Engineering Report Amendment

Date: May 22, 2025

Project: Central Waterfront Combined Sewer Overflow Control Project (Vine Street CSO)

To: Karstin Jacobson, PE
SPU

From: Makenzie Hofer
Consor

Reviewed By: Drew Henson, PE, PMP
Adam Schuyler, PE, PMP
Consor

Re: Vine Street CSO Engineering Report Amendment

Purpose of Amendment

Seattle Public Utilities (SPU) is submitting this amendment to the 2019 Central Waterfront Basin (Basin 69) Combined Sewer Overflow Control Project Engineering Report (2019 Report), submitted to the Department of Ecology (Ecology) on December 20th, 2019. The 2019 Report, included as **Appendix B**, outlined the recommended alternative and selection process for bringing Basin 69 into compliance. The final 2019 Report was submitted to and accepted by the King County Wastewater Treatment Division (KCWTD), and later to the Ecology. Since 2019, KCWTD built a new system model, which was a more accurate representation of their system. This model produced new boundary conditions, increasing the hydraulic grade line (HGL) in the Elliott Bay Interceptor (EBI). The higher HGL has decreased the effectiveness of the 2019 recommended alternative and the model shows that the 2019 recommended alternative no longer brings Basin 69 into compliance with the Consent Decree. As a result, further modeling was conducted to modify the recommended alternative to bring Basin 69 back into simulated compliance. The modeling analysis and results are documented in a technical memorandum, included as **Appendix A**. As the intent of this amendment is to update the completed 2019 Report given changes since it was finalized, this memo discusses the new boundary conditions used in analysis, the modifications to the recommended alternative, and the updated opinion of probable construction costs (OPCC) and project schedule.

Certification

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Date May 22, 2025

Project Overview and Update

SPU owns, operates, and maintains a combined sewer collection system within the City of Seattle. Stormwater runoff and sanitary flow are collected from this system and conveyed to the KCWTD system for treatment. SPU infrastructure connects directly to KCWTD interceptors at two locations, the Denny Way/Lake Union Tunnel and the EBI, which then convey flows to the West Point Treatment Plant. During large storm events and intense wet weather periods, the combined system can overflow at designated locations, resulting in combined sewer overflows (CSOs) of raw sewage and untreated stormwater. During a CSO event, excess combined sewer flow is discharged into SPU's surrounding receiving water bodies rather than conveyed to a wastewater treatment plant. Basin 69 is located at the north end of the City's downtown waterfront, adjacent to Elliott Bay. The Basin contains a single CSO outfall, Outfall 69, which discharges through the seawall into Elliott Bay. The Basin averaged 2.3 CSOs per year from 1998-2017. SPU is required to bring Basin 69 into compliance by reducing overflows to once per year, on a 20-year rolling average.

A brainstorming workshop was conducted to identify potential concepts or ideas that could reduce the frequency of CSOs within Basin 69. The team identified several potential alternatives to achieve the CSO reduction goals. After additional preliminary modeling was conducted to establish hydraulic feasibility, the alternatives were narrowed down to three selected for detailed development. The top alternatives considered for reducing CSO event frequency within Basin 69 require sending additional flow to KCWTD for conveyance and treatment. KCWTD modeled these alternatives and found that they are feasible. The top alternatives were developed to approximately ten percent design. A Multi Objective Decision Analysis (MODA) selection process was implemented to identify the recommended alternative that best achieves the project goals, SPU goals, and economic feasibility. The Elliott Avenue New Flow Transfer Alternative was selected as the recommended alternative.

The 2019 Report was submitted to Ecology in December 2019 to document the options analysis and the selected alternative to bring Basin 69 into compliance. Ecology approved the 2019 Report in February 2020. At that time, SPU paused the Vine Street CSO project as KCWTD was in the process of identifying improvements to the wastewater system downstream of Basin 69, which would potentially influence the

Vine Street CSO project. In 2024, KCWTD submitted their draft engineering report for the Elliott West Wet Weather Treatment Station, which identified the selected alternative for wastewater system improvements downstream of Basin 69. In addition to this, SPU received new Consent Decree dates for Basin 69: submit an Engineering Report by 6/30/2025 and complete construction for Basin 69 improvements by 12/31/2031. With the Ecology and KCWTD updates, the Vine Street CSO project revisited the 2019 Report to confirm the selected alternative including updated modeling, project costs, and project schedule.

New King County Boundary Condition

A hydraulic and hydrologic (H/H) model of Basin 69 was developed and calibrated as part of the 2019 Report to evaluate CSO performance of project alternatives. The H/H model relies on a boundary condition, provided by KCWTD's system model, representing simulated water levels in the EBI. This boundary condition is the downstream end of the Vine Street Model and impacts HGLs along Alaskan Way, including performance of the CSO structure. Since the completion of the 2019 Report, KCWTD built a new system model, which was a more accurate representation of their system. This model produced a new boundary condition representing the HGL in the EBI. Utilizing the new boundary condition provided by KCWTD, the H/H model of Basin 69 resulted in generally increased water surface elevations along Alaskan Way and at the CSO structure. The HGL represented in the new boundary condition increased by approximately 13 percent on average and increased for all but the highest return periods as compared to the older boundary condition file. The greatest increases in the EBI HGL boundary condition occur between one and two-year return periods. The higher EBI HGL has decreased the effectiveness of the recommended alternative, and the model shows that the recommended alternative would no longer bring Basin 69 into compliance with the Consent Decree. See Appendix A for further details regarding the H/H modeling analysis in the Modeling Technical Memorandum.

Modified Recommended Alternative Changes Description

2019 Report Recommended Alternative

The recommended alternative from the 2019 Report for controlling Basin 69 is the Elliott Avenue Flow Transfer that relies on conveying excess flow to KCWTD for further conveyance and treatment. KCWTD concurs that the recommended alternative was feasible. The proposed sewer alignment is within the paved right of way (ROW) of Elliott Avenue between Vine Street and Bay Street. The proposed sewer alignment aims to minimize conflicts with other utilities, limit changes in angles that require maintenance holes (MH), and minimize impacts to the roadway.

Key features of the 2019 recommended alternative include:

- Approximately 1,800 linear feet of 24-inch diameter gravity combined sewer pipe
- New connection to the EBI
- New sewer diversion vault and weir where the existing sewer crosses the intersection of Vine Street and Elliott Avenue
- No active outlet controls (meaning no real time controls such as valves or gates)

The gravity sewer will discharge to the EBI near the intersection of Bay Street and Elliott Avenue. The MH and connected pipes in Elliott Avenue will need to be constructed to direct flow north along Elliott Avenue to the EBI and prevent sewage from flowing west to the Vine Street sewer. A diversion vault will be installed on the existing Vine Street sewer and will direct sewage through the proposed Elliott Avenue Sewer. The vault will include an overflow weir to enable high flows to proceed to the Vine Street sewers, continuing to the existing CSO Control Vault. This will help prevent flooding of side sewers that can lead to sanitary sewer overflows (SSO).

The utility and aerial plans of the 2019 recommended sewer alignment are provided as Figures 11-2A, 11-2B, and 11-2C in the 2019 Report, which is included as **Appendix B**.

Modified Recommended Alternative

Updated Basin 69 H/H model results, including the updated KCWTD boundary condition, necessitated diverting additional flow beyond the 2019 Report recommended alternative to the EBI to bring Basin 69 into control. Updated alternative scenarios were evaluated to bring the basin into compliance with the additional goal of improving CSO performance as much as realistically possible.

- 24-inch diameter flow transfer alignment with Broad Street and Cedar Street flow
- 36-inch diameter flow transfer alignment with Broad Street and Cedar Street (Modified Recommended Alternative)
- 36-inch diameter flow transfer alignment with Cedar Street flow

Detailed descriptions of these scenarios and summaries of CSO performance are described further in the modeling technical memorandum, included as **Appendix A**.

Changes to the diversions on Western Avenue were considered but did not provide significant improvements to CSO performance while maintaining system HGLs at or below the baseline condition. Ultimately, the updated alternatives focused on improving performance of the recommended alternative through a combination of upsizing the proposed alignment and intercepting flows at Broad Street and Cedar Street. The modified recommended alternative utilizes an upsized alignment along Elliott Avenue capturing additional flows at Broad Street and Cedar Street. This increases conveyance capacity to KCWTD and decreases instances of flows over the high-flow weir in the proposed diversion structure at Vine Street and Elliott Avenue, which decreases flows conveyed to the CSO structure. The flows at Broad Street and Cedar Street that are intercepted further decrease flows to the CSO control structure. The increased capacity and decreased flows to the CSO structure, in addition to the intercepted flows, greatly improves CSO performance of this modified recommended alternative over the recommended alternative and the baseline condition. KCWTD officially approved the modified recommended alternative in a letter which is included in **Appendix C.**

The HGL was evaluated immediately upstream of the proposed connections at Broad Street (MH 039-017 and MH 039-021), Cedar Street (MH 039-045), and the proposed diversion at Vine Street and Elliot Avenue (MH 039-062) to gauge whether the proposed flow transfer alignment would potentially increase HGLs above the baseline condition. These locations are mapped and described in greater detail in **Appendix A**. The elevation of surrounding plumbing fixtures is unknown at this time, therefore an elevated HGL over the baseline scenario could increase the risk of an SSO. Elevations of nearby plumbing fixtures may be evaluated during project design. At the Cedar Street location, the HGL is below the baseline condition for all events. Upstream of the proposed diversion and at both locations upstream of the Broad Street connection, the HGLs are at or below the baseline condition for flows of approximately 6-month recurrence and greater. The increased HGL for relatively small events represents small increases in water levels of roughly one foot or less and is not expected to cause SSO as the baseline condition experiences significantly higher HGLs (approximately 2-4 feet higher) for flows with 6-month to 1-year recurrence, which occur relatively frequently. The Modeling TM (**Appendix A**) presents plots of HGL versus recurrence for each location and additional discussion of the HGL analysis.

The CSO performance of the baseline, recommended alternative, and modified recommended alternative scenarios are compared below in **Table 1**. This is for 2035 rainfall and the updated boundary conditions.

Table 1 | CSO Performance of Baseline, Recommended Alternative, & Modified Recommended Alternative*

Scenario	Total CSO Events**	Total CSO Volume (MG)	Maximum 20-Year CSO Event Count	Maximum 20-Year Control Volume (MG)
Baseline	84	25.217	51	0.240
Recommended Alternative	32	6.882	24	0.006
Modified Recommended Alternative	5	0.468	3	N/A

Note:
*Modeling utilized 2035 climate perturbed rainfall and the updated boundary conditions
** Total CSO Events is based on results from long-term simulations, spanning 1978 through 2017

The modified recommended alternative alignment is similar in length to the 2019 Report recommended alternative alignment. The modified recommended alignment satisfies the goals to minimize utility conflicts and road impacts. The modified recommended alignment remains within the paved ROW of Elliott Avenue between Vine Street and Bay Street. Elliott Avenue restoration is consistent with the restoration for the 2019 recommended alternative. There are no changes to the expected operations and maintenance (O&M) activities.

The updates to the 2019 Report recommended alternative include:

- Upsizing the sewer pipe diameter from 24 to 36 inches in diameter
- New connection to the existing sewer at Broad Street
- New connection to the existing sewer at Cedar Street
- EBI connection moved further down Bay Street
- The length of the proposed sewer pipe is nominally similar.

The increased pipe size to 36-inch diameter increases the construction trench limits from 5 feet to 6 feet. The connection to the existing sewer at Broad Street will require three new MHs and approximately 60 linear feet of sewer abandonment. The connection at Cedar Street will require two new MHs and approximately 10 linear feet of sewer abandonment. The EBI connection shifted to connect further down Bay Street, approximately 50 feet southwest of the original recommendation. At the EBI connection, the invert elevation increased from 4.0 feet to 9.0 feet, with the rim elevation remaining the same. The invert at the proposed diversion is 11.61 feet and the weir crest elevation is 20.00 feet. The existing influent and effluent pipes remain at their existing elevations. The inverts are listed in **Figure 3** below.

The utility and aerial plans of the modified recommended alternative sewer alignment are shown below in **Figure 1**, **Figure 2**, and **Figure 3**.

Figure 1 | Elliot Avenue Modified Recommended Alternative Alignment, Sheet 1 of 3

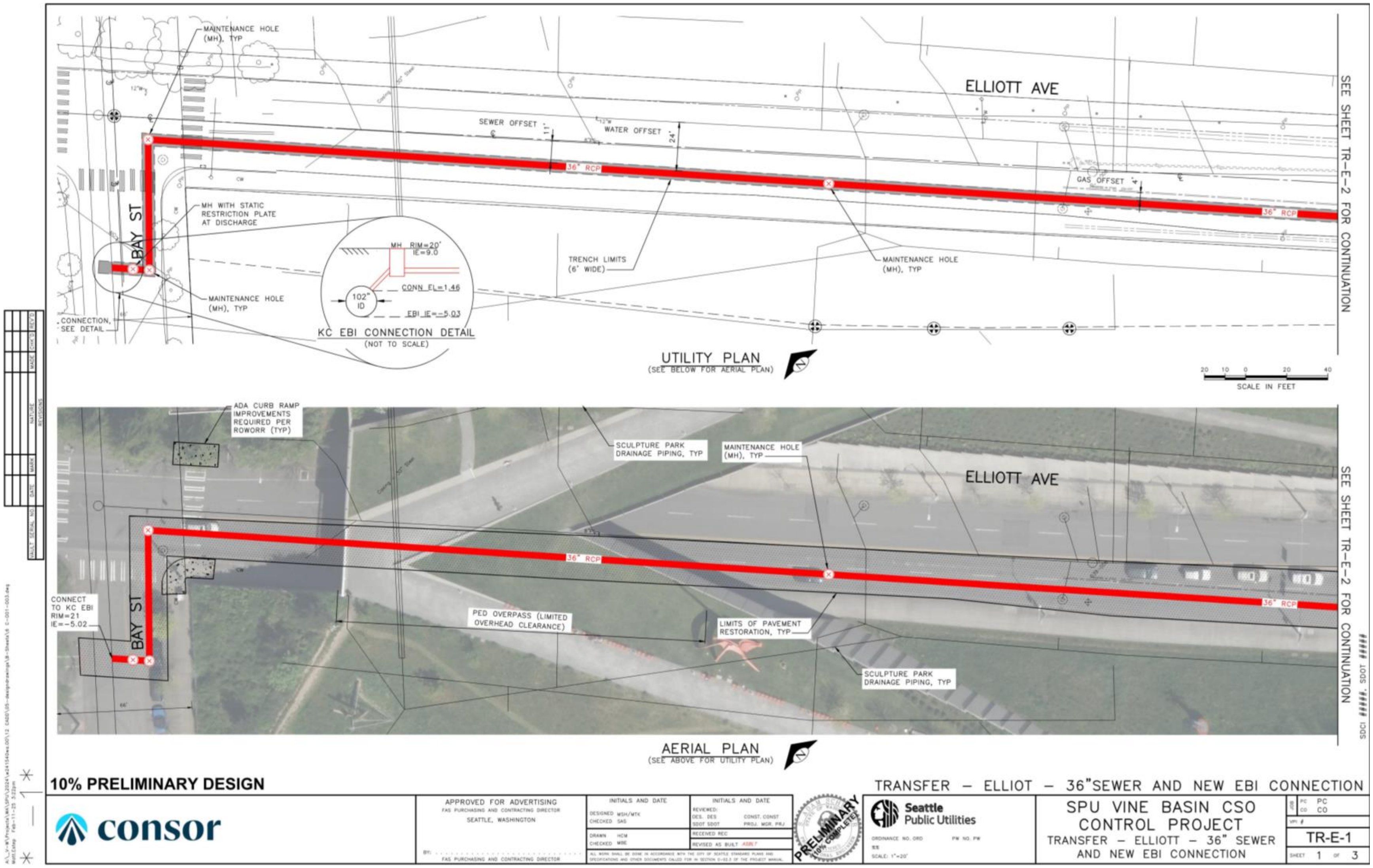


Figure 2 | Elliot Avenue Modified Recommended Alternative Alignment, Sheet 2 of 3

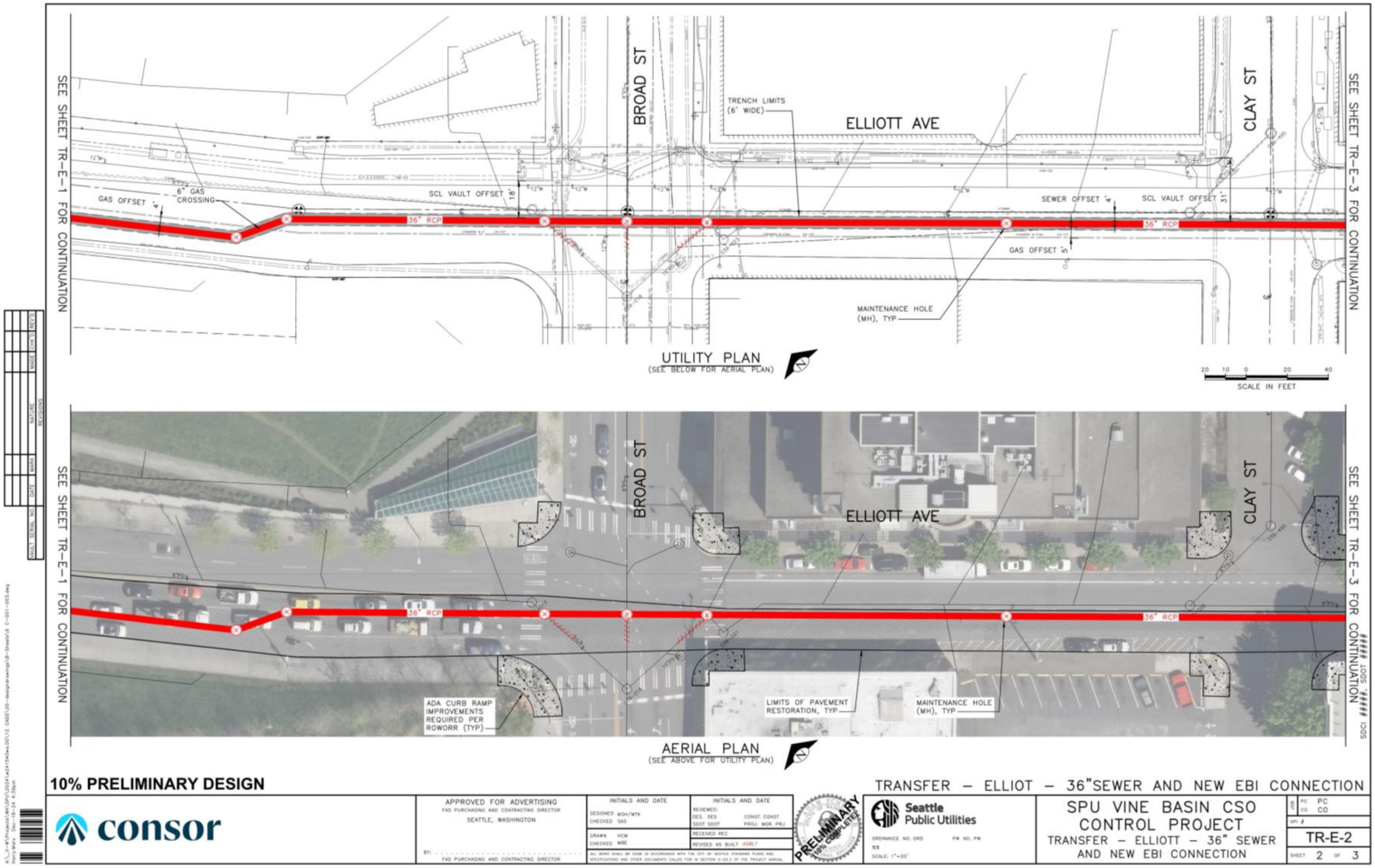
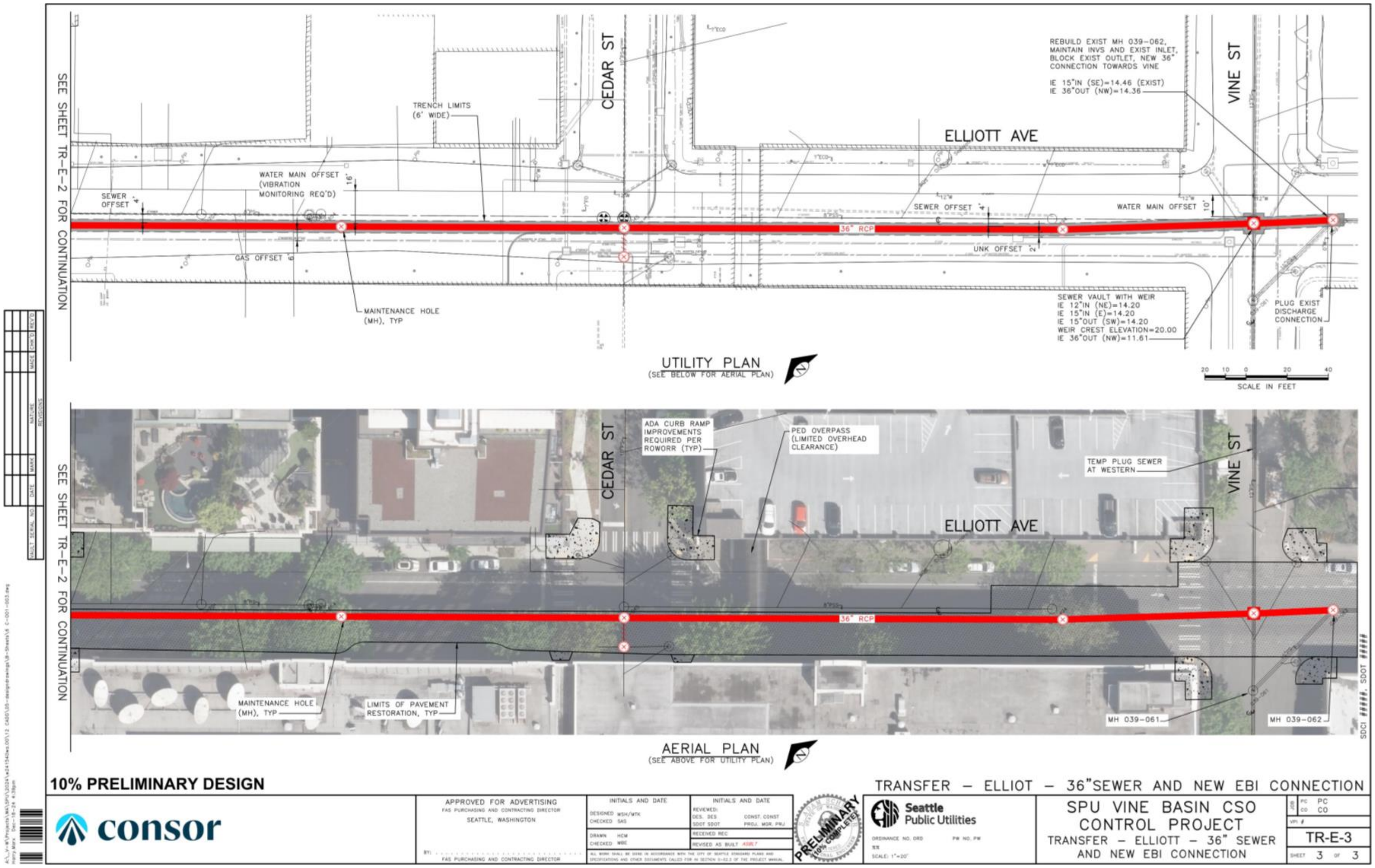


Figure 3 | Elliot Avenue Modified Recommended Alternative Alignment, Sheet 3 of 3



Update to the Financial Analysis

The anticipated project cost opinions presented in the 2019 Report were developed in accordance with SPU's 2017 Cost Estimating Guide and Template. These costs were updated for the modified recommended alternative. The updated costs were developed in accordance with SPU's 2023 Cost Estimating Guide. The cost estimating classification system defined in the Association for the Advancement of Cost Engineering International was used to define the level of accuracy for the OPCC. The changes to the recommended alternative described in the previous section resulted in cost changes, with most of the price increase due to rising construction costs from 2017 to 2023. The resulting OPCC for the updated Elliott Avenue modified recommended alternative is summarized in **Table 2**. The detailed OPCC is included as **Appendix D**.

Opinion of Probable Construction Costs

Table 2 | Elliott Avenue Modified Recommended Alternative Class 4 OPCC

Description	Updated Amount
OPCC	
Base Construction Cost	$8,770,000
Sales Tax (10.35%)	$910,000
Allowance for Indeterminates (35%)	$3,070,000
Other Hard Costs	$350,000
Subtotal OPCC	$13,100,000
Range of Possible Construction Costs	
Upper End of Class 4 OPCC (+30%)	$17,000,000
Lower End of Class 4 OPCC (-20%)	$10,500,000

The original Subtotal OPCC from the 2019 Report was $8,084,000. The changes to the OPCC were driven by increases in the base construction cost and sales tax. The design changes for the modified recommended alternative caused an increase in the base construction cost, which included a larger trench, additional MHs, and abandoning portions of the existing sewer. The unit costs for these items have also increased since the original 2019 Report was published. From the original design to the modified design, the trench width increased from 5 feet to 6 feet, there were five additional MHs, and approximately 70 linear feet of existing sewer will be abandoned. The Other Hard Costs category captures estimated costs for SPU crew costs, contracting fees, and miscellaneous permitting fees.

Opinion of Probable Project Costs

The OPPC for the project includes construction costs, hard costs, soft costs, contingency, inflation, and escalation. The original Total OPPC cost from the 2019 Report was $18,444,000. The updated OPPC for the Elliott Avenue modified recommended alternative is presented in **Table 3**. Soft costs were developed as a percentage of hard costs (OPCC) as outlined in SPU's Cost Estimating Guide.

Table 3 | Elliott Avenue Modified Recommended Alternative Anticipated OPPC

Description	Updated Amount
Subtotal OPCC	$13,100,000
Other Project Costs	
Soft Costs*	$6,700,000
Base Cost Total (Subtotal OPCC + Other Project Costs	$19,800,000
Contingency (25%)	$4,650,000
Inflation	$3,850,000
Escalation	$1,900,000
Total OPPC	$30,200,000

Note:
*Soft costs include project actual costs from Initiation and Options Analysis

The changes to the total project cost estimate were driven by the increased OPCC. Inflation and escalation were estimated per SPU's Cost Estimating Guide inflation/escalation Q4 2024 guidance based on an estimated project cost plan with an assumed construction complete date of 2030.

The O&M costs are based on historical cost information for SPU's typical maintenance, cleaning, and inspection activities. **Table 4** presents the anticipated annual O&M costs for the Elliott Avenue modified recommended alternative. The costs include the 2019 Report anticipated costs updated to 2024 dollars calculated using the Engineering News-Record Construction Cost Index.

Table 4 | Anticipated Annual O&M Costs

O&M Activity	Frequency	Updated Cost
CCTV	10 years	$2,000
Pipe Maintenance, Cleaning	Annual	$6,000
EBI Discharge Visual Inspection	Annual	$1,000
New Weir Vault Maintenance, Cleaning	Annual	$2,000
Flow Level Monitoring	Annual	$10,000

The Elliott Avenue modified recommended alternative is planned to be implemented based on the following schedule:

1. Final design is to be completed by May 2027.
2. Project to bid by August 2027.
3. Construction is to be initiated by December 2027.
4. Construction is to be completed by December 2030.
5. One year of commissioning and documentation to achieve controlled status is to be completed by December 2031.

APPENDIX A

Technical Memorandum

Date: May 22, 2025

Project: Vine Basin CSO Engineering Report Update

To: Karstin Jacobson
SPU

From: Marshall Kosaka, PE
Consor

Reviewed By: Drew Henson, PE, PMP
Adam Schuyler, PE, PMP
Consor

Re: Vine Basin CSO Engineering Report Update – Modeling Technical Memorandum

Introduction

The Vine Street Basin (Basin), located in the Central Waterfront area of Downton Seattle, features a combined sewer (CS) collection system owned and operated by Seattle Public Utilities (SPU). This system collects sanitary flow and stormwater runoff and conveys it to the King County Wastewater Treatment Division's (KCWTD) system for treatment via KCWTD's Elliott Bay Interceptor (EBI) and Lake Union Tunnel. The SPU system can become capacity constrained during wet weather periods which can cause CS overflows (CSOs) into Puget Sound via an overflow weir at the National Pollutant Discharge Elimination System (NPDES) 69 control structure. The hydraulic grade line (HGL) in SPU's system is also sensitive to the HGL in the EBI. SPU is required under its Consent Decree to bring this basin into compliance by reducing overflows to once per year, on a 20-year rolling average.

The 2019 Central Waterfront Basin (Basin 69) Combined Sewer Overflow Control Project Engineering Report (Aqualyze, 2019) (Report) describes the development and selection of a recommended alternative intended to bring the Basin into compliance (Murraysmith, 2019). A hydraulic and hydrologic (H/H) model of the Basin was developed with the United States Environmental Protection Agency's (EPA) Stormwater Management Model Version 5.1.012 (SWMM5) to analyze the alternatives. This H/H model relies on a boundary condition (BC), provided by KCWTD, representing the HGL in the EBI. The boundary condition was generated by KCWTD using their West Core 8A H/H model of the EBI. The CSO performance of the recommended alternative is influenced by the HGL in the EBI.

SPU has requested that Consor update the Report to reflect current conditions prior to the design of the recommended alternative. Since the completion of the Report, KCWTD has updated their system model and, as a result, has updated the boundary condition representing the HGL in the EBI. Utilizing the revised boundary condition, the recommended alternative does not bring the Basin into compliance. Therefore, additional modeling was conducted to develop a modified recommended alternative that would improve CSO performance and bring the Basin into compliance.

This technical memorandum (TM) describes the H/H model used for this analysis, a comparison of EBI HGL boundary conditions used in previous and current analyses, model results and scenarios representing modified alternatives, and projected flows to KCWTD.

H/H Model

The H/H model used for this analysis was last calibrated in 2018 under the Central Waterfront Basin 69 Calibration and Control Volume Project. The model hydraulics were updated based on SPU's geographic information system (GIS) data as part of the Report.

The model utilizes rainfall collected at SPU's Rain Gauge 11. Additionally, perturbed rainfall representing future climate conditions in the year 2035 was also considered in the analysis. The future rainfall was scaled up by an additional 1.4 percent, according to SPU's Uncertainty Analysis methodology. The Uncertainty Analysis scaling factor was determined during the Central Waterfront Basin 69 Calibration and Control Volume Project. SPU's perturbed rainfall timeseries and the Vine Basin Uncertainty Analysis are described in greater detail in previously developed TMs (Aqualyze, 2018; CH2M, 2017).

The model also utilizes a timeseries characterizing evapotranspiration with data collected by Washington State University (WSU) at the Puyallup, WA campus through 6/1/2017, and from the WSU Seattle gauge afterwards. SPU provided the original timeseries data which was supplemented with data from the Washington Agricultural Weather Network Version 2.0 downloaded from the WSU website.

The model relies on two water level boundary conditions: one at the CSO outfall representing the tide in Elliott Bay and the other representing the HGL in KCWTD's EBI. Tidal data were obtained from the National Oceanic and Atmospheric Administration National Ocean Service's gauge station 9447130. A saltwater correction was applied to the tidal boundary condition. The timeseries representing the HGL in the EBI was provided by KCWTD and is described in greater detail in the following section.

Elliott Bay Interceptor Boundary Condition Comparison

An updated timeseries representing the HGL in the EBI was provided by KCWTD in 2024. The SPU system downstream of the Vine Basin CSO control structure is sensitive to the water level in the EBI and relatively minor changes in the EBI water level boundary condition can impact the simulated CSOs. This boundary condition was developed by KCWTD from their most recent system model and differed from the boundary condition used in the previous Basin 69 modeling analysis. Changes to the EBI HGL in the latest model are attributed to differences between KCWTD models used to develop the EBI level timeseries.

The original boundary condition was developed using the KCWTD's in-house hydraulic model, referred to as the Unsteady Model. In the Unsteady Model, operations at West Point and the Interbay Pump Station were based on system operation controls from around the year 1990. The updated boundary condition was developed using the County's West Core 8A model on the Mike Urban platform; controls at West Point and the Interbay Pump Station have been updated to better reflect current operations. Additional modifications to the model were included to capture recent updates to the system such as changes to the CSO structures in the Central Waterfront Area (NPDES 070, 071, and 072) and the Georgetown Wet Weather Treatment Facility.

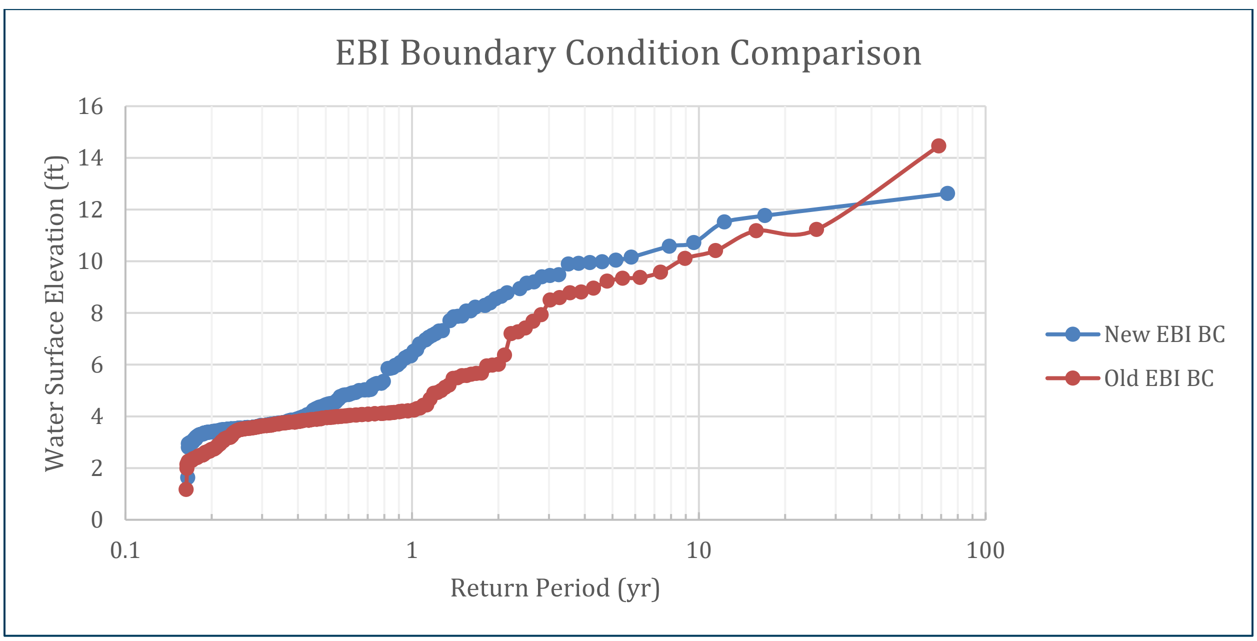
The Interbay Pump Station is throttled during larger storm events using model controls implemented by the County. The County's modeling team indicated that operators typically throttle the pump station less than what is reflected in the model. The County indicated that the West Core 8A model calibration is slightly conservative for the overall system. This biased calibration likely results in additional throttling at the Interbay Pump Station resulting in higher EBI HGLs. The slight conservativeness in basin models contributing to the EBI are cumulative and results in higher simulated EBI flows.

The West Core 8A model also includes some near-future modifications that were included to reflect the future conditions of the system. One modification that was included in the model but has not been constructed is a passive weir system installed between the emergency bypass channel and the influent control structure at the KCWTD West Point Treatment Plant which is scheduled to be completed in 2025. This passive weir system will result in the throttling of the Interbay Pump Station at a lower influent control threshold at West Point. The modeled set point was adjusted to the expected level once the weir is installed. This additional throttling further increases the EBI HGL.

Water surface elevation versus return period for the original EBI boundary condition (maintenance hole (MH) 034-016, invert elevation -5.2 feet) used in the Report and the revised EBI boundary condition (MH 039W-005 invert elevation -5.1 feet) are shown in Figure 1. The return period is calculated by determining the peak HGL values for high flow events through the simulation period and ranking those events. The return period is determined using the Cunnane formula.

The water surface level in the new boundary condition is higher for all but the highest return periods and is approximately 13 percent higher on average. The greatest increases in water surface elevation for the new boundary condition occur between return periods of roughly one to two years with a maximum increase of approximately 57 percent. An HGL of around 6 feet had a return period of approximately two years in the old boundary condition (annual exceedance probability of 50 percent) but has an approximate one-year return period (annual exceedance probability of 100 percent) in the new boundary condition.

Figure 1 | EBI Boundary Condition Comparison



Scenarios and Results

Baseline Scenario and Recommended Alternative

The baseline and recommended alternative model scenarios were run using the updated boundary condition to assess its impact on CSO performance in the basin as compared to the previous results documented in the Report. The baseline scenario represents the basin as it was in 2018, when the model was last calibrated. The model was not recalibrated under this project because there was no new monitoring data to calibrate against; therefore, there was no basis to make any hydrologic revisions to the model. The recommended alternative featured a proposed diversion at Elliott Avenue and Vine Street which directed flow to a proposed 24-inch diameter pipe running north along Elliott Avenue connecting to the EBI via a proposed connection at Bay Street and Elliott Avenue. In the recommended alternative the proposed alignment along Elliott Avenue would be the primary flow path with high flows conveyed in the existing alignment on Vine Street to the CSO control structure. The recommended alternative is shown below in Figure 2. The baseline scenario and recommended alternative are described in more detail in the Report.

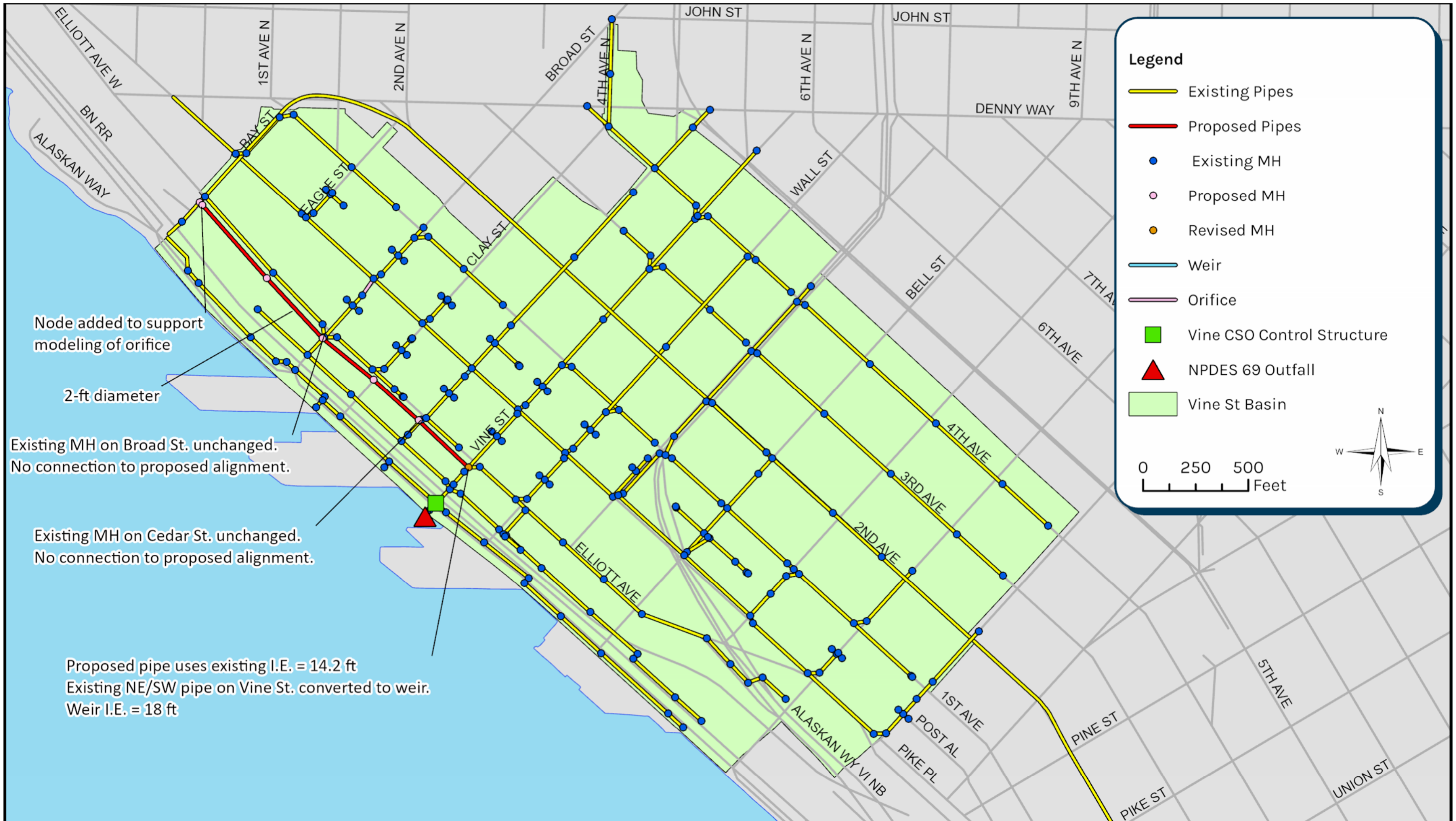
Long-term simulations (LTS), spanning 1976 through 2017 (includes two years of antecedent rainfall), for the baseline scenario and recommended alternative were evaluated for existing and 2035 perturbed rainfall. The baseline scenario's CSO performance with existing conditions rainfall and the recommended alternative's CSO performance with scaled 2035 rainfall for the new EBI BC compared to the old EBI BC are summarized below, in Table 1.

The simulated CSOs for the old and new boundary conditions were compared to observed CSO events. There were 20 observed CSOs during 2010 through 2017, which was the validation period for the modeling for the 2019 Report. The model using the old boundary condition resulted in 22 simulated CSOs for this period while the model with the new boundary condition simulated 28 CSOs. Simulated CSO volumes were increased as well with the new boundary condition. For the recommended alternative, there is an increase in CSO events so that the recommended alternative no longer brings the Basin into compliance. Note that the CSOs are relatively low in volume and the resultant control volume (CV) is small.

Table 1 | Baseline and Recommended Alternative CSO Performance Comparison

Scenario	Rainfall	Boundary Condition	Total CSO Events	Total CSO Volume (MG)	Maximum 20-Year CSO Event Count	Maximum 20-Year Control Volume (MG)
Baseline	Existing	Old	62	17.241	39	0.182
Baseline	Existing	New	72	19.921	46	0.215
Recommended Alternative	2035	Old	27	5.148	19	N/A
Recommended Alternative	2035	New	33	6.882	24	0.006

Figure 2 | Recommended Alternative Configuration – Elliott Avenue Flow Transfer



Data Sources: Seattle Public Utilities
Disclaimer: Consor and Seattle Public Utilities make no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Seattle Public Utilities

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Vine Basin CSO Engineering Report Update
Options Analysis Recommended Alternative

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Modified Alternatives

Several alternatives based on the recommended alternative were developed and analyzed to improve CSO performance and bring the basin into compliance, considering the updated EBI boundary condition. The CV with the new boundary condition is approximately 6,000 gallons which implies that modifications to the recommended alternative can bring the basin into compliance. The modified alternatives considered changes to the high flow weirs along Western Avenue, transferring flow to KCWTD on Elliott Avenue, and a combination of the changes to the high flow weirs and flow transfer on Elliott. Note that the scenarios that considered raising the existing weirs along Western Avenue were eliminated from consideration due to the limited improvement to CSO performance it provided without increasing HGLs in the upstream system. See the Engineering Report Amendment (Consor, 2025) for more discussion on why the Elliot alternative is still the preferred of the three options originally considered in the Report. The high-flow weirs and upper and lower basin extents are shown in Figure 3.

The updated scenarios focused on transferring flow to KCWTD along Elliott Avenue. SPU directed the team to improve CSO performance as much as possible with the modified alternative. Intercepting flow traveling along Broad Street and Cedar Street at Elliott Avenue were included in the scenarios to improve CSO performance over the previous recommended alternative with the intention to intercept flows and bypass the CSO control structure. These added connections are in line with the “Ability to Expand” section of the Report.

An increased diameter flow transfer alignment was also analyzed. Three alternatives were ultimately analyzed with long-term simulations to characterize CSO performance.

- 24-inch diameter flow transfer alignment with Broad Street and Cedar Street flow
- 36-inch diameter flow transfer alignment with Broad Street and Cedar Street
- 36-inch diameter flow transfer alignment with Cedar Street flow

Detailed descriptions of these scenarios and summaries of CSO performance are described below.

24-inch Diameter Flow Transfer Alignment with Diverted Broad and Cedar Street Flow

This scenario is similar to the previously recommended alternative with a proposed 24-inch diameter pipe along Elliott Avenue and flow diversion structure located at Elliott Avenue and Vine Street. The primary flow path through the diversion conveys flow to Elliott Avenue and a weir allows high flows to continue along Vine Street to the CSO control structure. The high-flow weir in the diversion structure was raised from an invert elevation of 18 feet in the recommended alternative to 20 feet to improve CSO performance.

This alternative adds diverting flows into the proposed 24-inch diameter pipe in Elliott Avenue at Broad Street and Cedar Street at the intersection of the respective streets at Elliott Avenue. The proposed connection at Cedar Street has a drop of approximately 9.5 feet to the proposed alignment which maintains HGLs at the connection and upstream system at or below baseline scenario. The connection at Broad Street for the proposed flow transfer alignment is at approximately the same elevation as the existing pipes. The invert immediately upstream of the proposed connection to the EBI was lowered 1 foot to make the connection at Broad Street. This alternative is not expected to significantly impact HGLs in the existing collection system. The HGL analysis is described in greater detail below. This alternative is shown below in Figure 4.

36-inch Diameter Flow Transfer Alignment with Broad and Cedar Street Flow

This alternative has the same configuration as the 24-inch diameter flow transfer alignment alternative with the piping upsized to a 36-inch diameter pipe. The manhole, pipe, and weir inverts remain unchanged from the prior alternative. The upsized 36-inch diameter alternative provides additional flow transfer capacity over the 24-inch diameter pipe, further improving CSO performance. This alternative is not expected to significantly impact HGLs in the existing collection system. The HGL analysis is described in greater detail below. The 36-inch diameter Elliott flow transfer alignment with Broad and Cedar Street flow is shown below in Figure 5.

36-inch Diameter Flow Transfer Alignment with Cedar Street Flow

This alternative consists of a 36-inch diameter flow transfer alignment along Elliott Avenue. The proposed alignment intercepts flow at Cedar Street in the same manner as the other updated alternatives described above. This alternative does not intercept flow at Broad Street. The proposed diversion structure on Vine Street at Elliott Avenue and the proposed connection to the EBI have the same configuration as the other updated alternatives. This alternative improves CSO performance by picking up flow at Cedar Street while limiting the scope of construction by leaving the pipes on Broad Street unchanged. It is not expected to significantly impact HGLs in the existing collection system. The HGL analysis is described in greater detail in later sections. The 36-inch diameter Elliott flow transfer alignment with Cedar Street flow is shown below in Figure 6. The differences between the updated alternatives alignments at the intersection of Broad Street and Elliot Avenue are shown in Figure 7.

Figure 3 | High-Flow Weirs and Upper and Lower Basin Extents

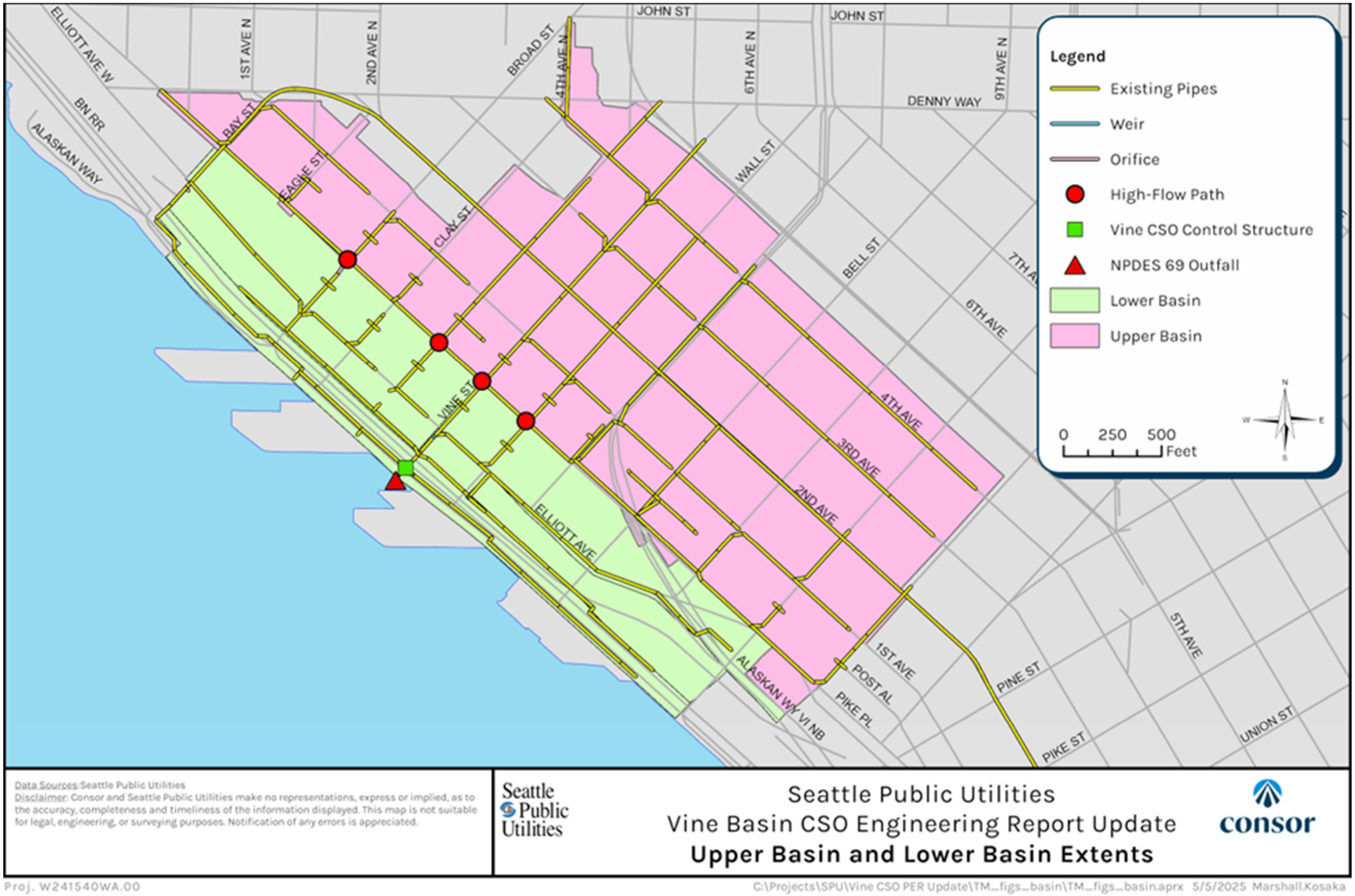
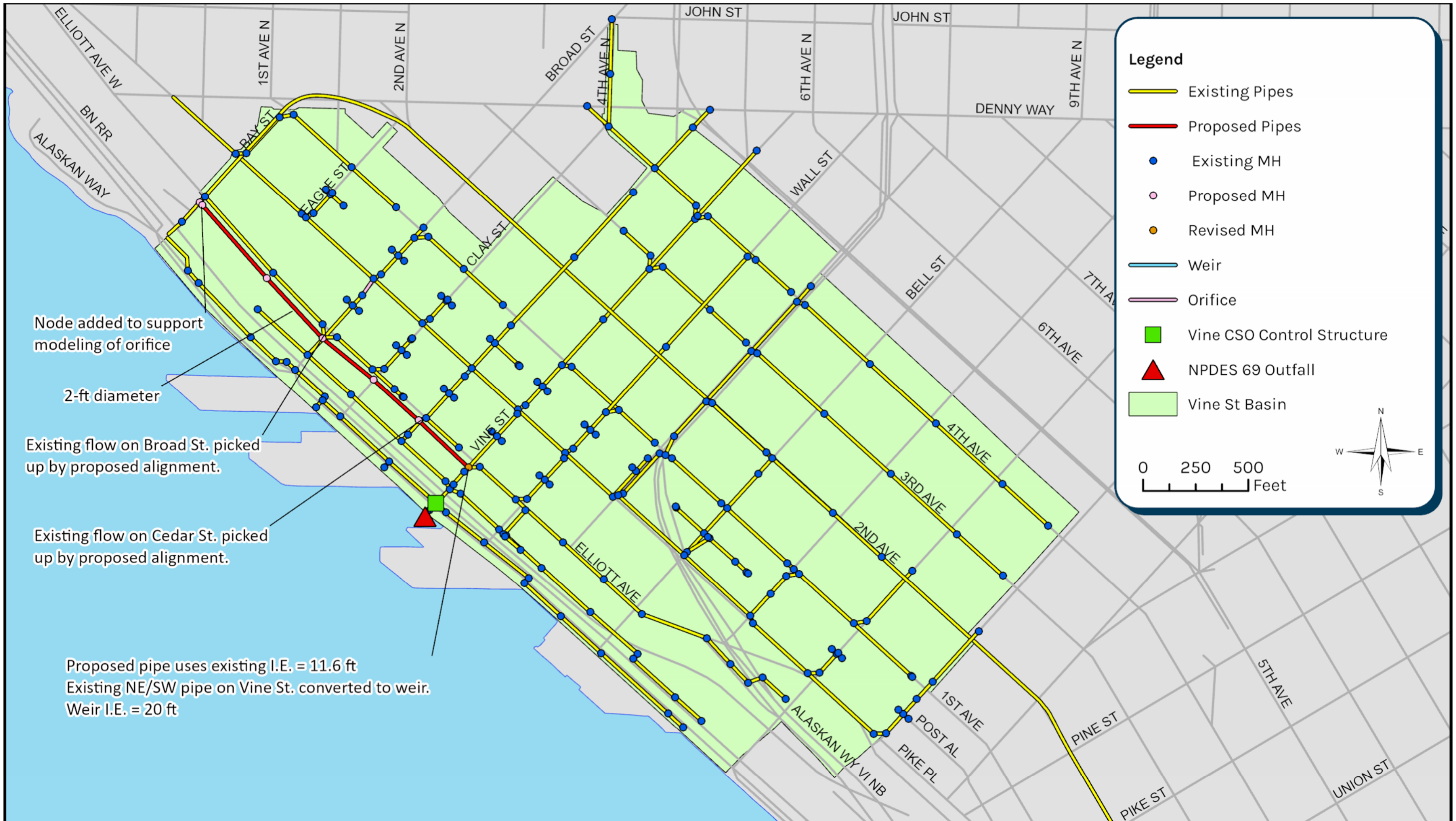


Figure 4 | 24-inch Diameter Elliott Flow Transfer with Broad and Cedar Street Flow Configuration



Data Sources: Seattle Public Utilities
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Vine Basin CSO Engineering Report Update
24-inch Diameter Elliot Flow Transfer With Broad and Cedar Flow

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Figure 5 | 36-inch Diameter Elliott Flow Transfer with Broad and Cedar Street Flow Configuration

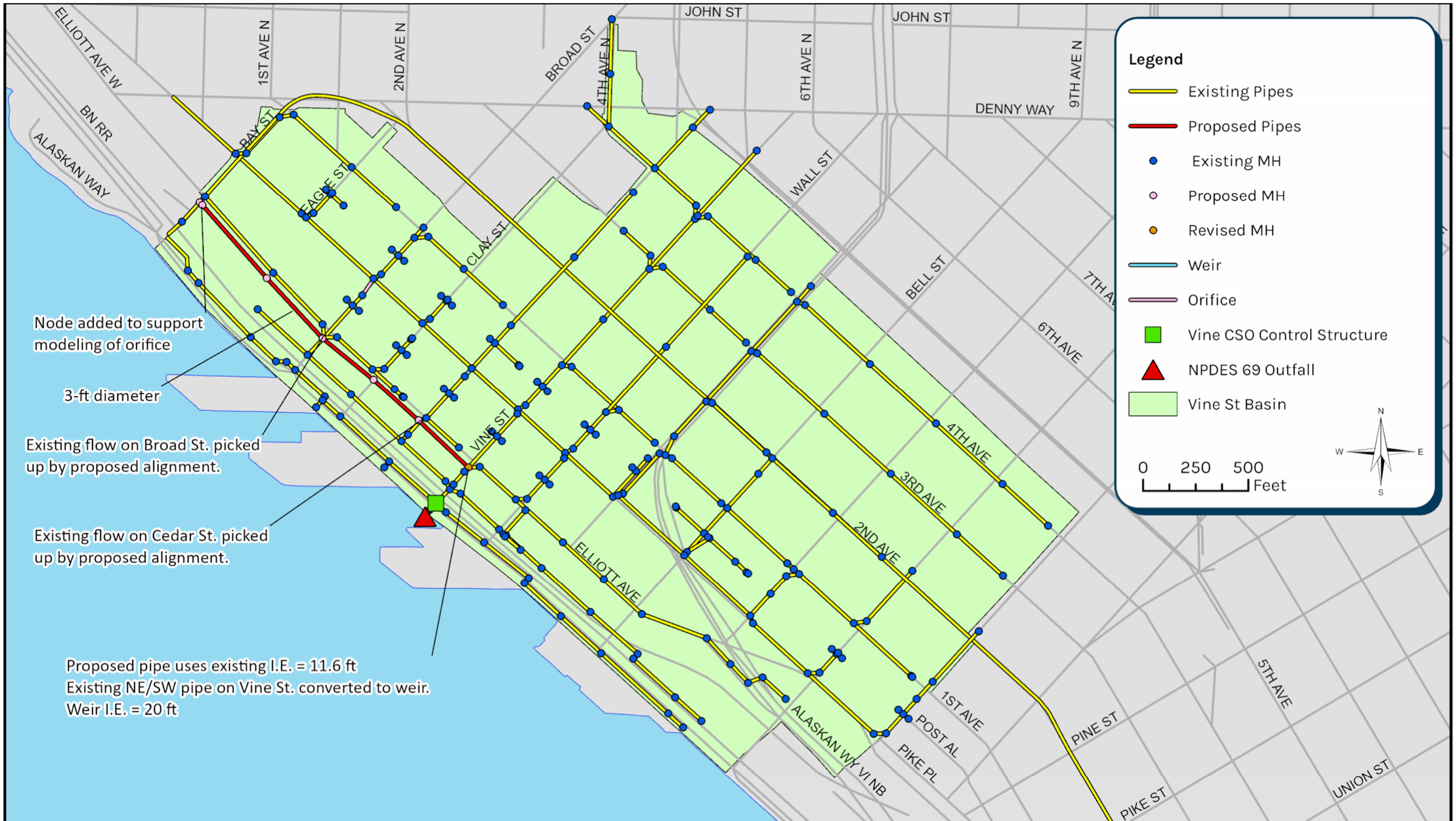

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Figure 6 | 36-inch Diameter Elliott Flow Transfer with Cedar Street Flow Configuration

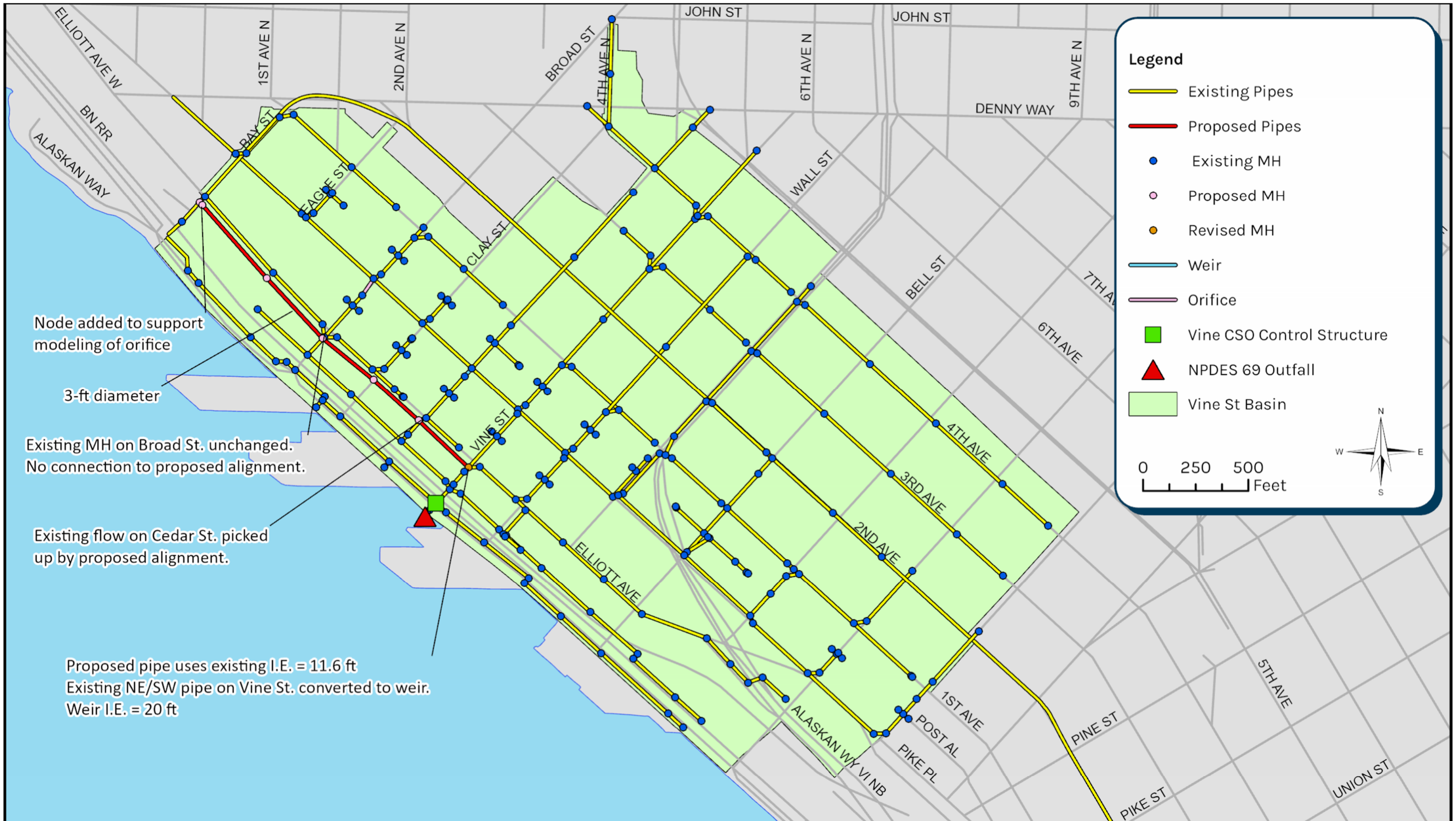

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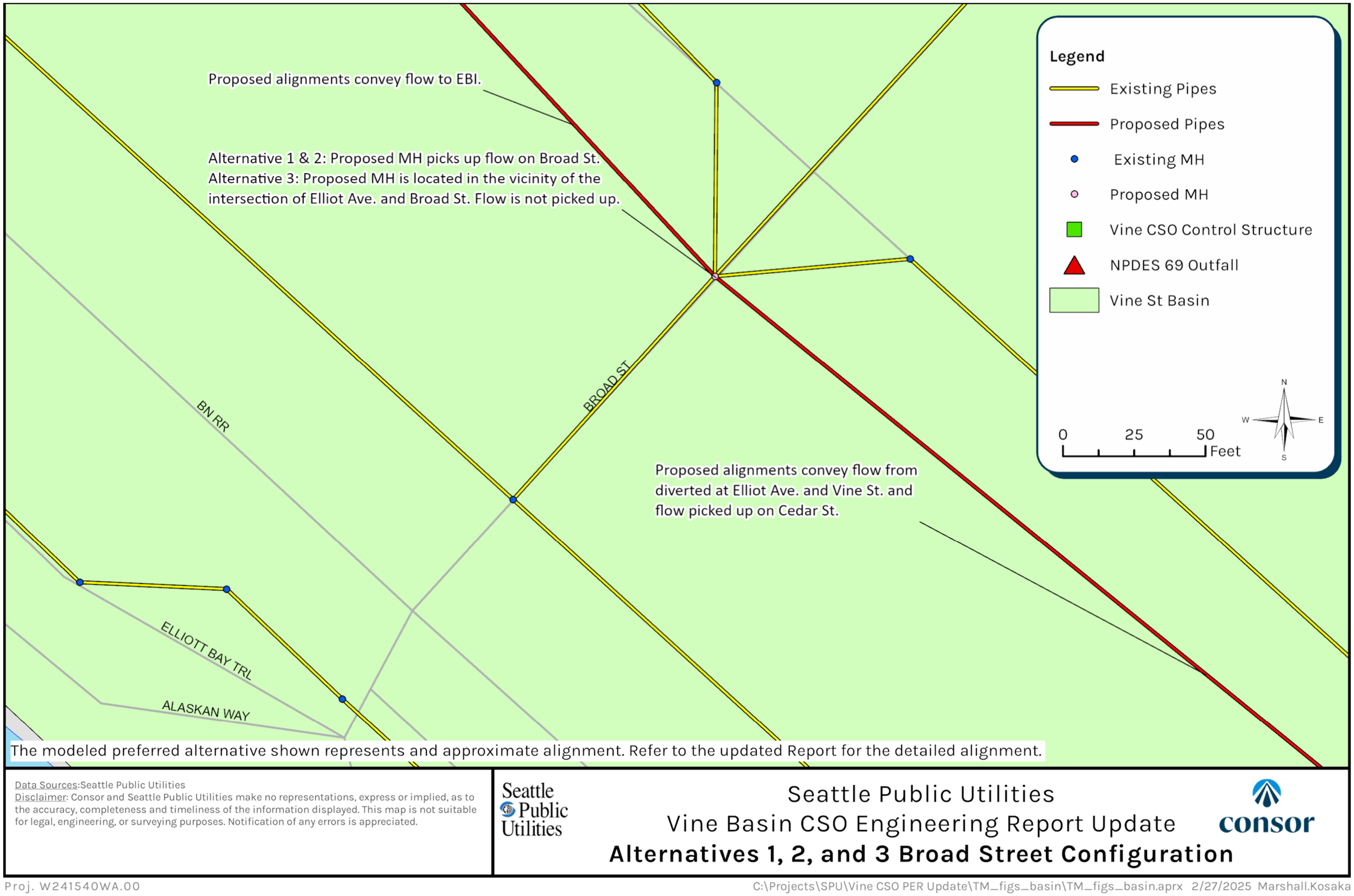
Figure 7 | Modified Alternatives Broad Street Connection Detail



CSO Performance

Long-term simulations, spanning 1978 through 2017, for the updated alternatives were evaluated using 2035 scaled rainfall and the new boundary condition provided by KCWTD. CSO performance for the updated alternatives are summarized below in Table 2.

Table 2 | Updated Alternatives CSO Performance

Scenario	Total CSO Events	Total CSO Volume (MG)	Maximum 20-Year CSO Event Count
24-inch Diameter with Broad and Cedar Diversions	22	2.968	16
36-inch Diameter with Broad and Cedar Diversions	5	0.468	3
36-inch Diameter with Cedar Diversion	9	1.101	5

All three updated alternatives brought the basin into compliance with a maximum 20-year CSO count of 16 for the 24-inch diameter flow transfer alternative. Total CSO volume also decreased for all updated alternatives compared to the baseline scenario and the previously recommended alternative.

Of the three alternatives, the 36-inch diameter flow transfer alignment with the Broad Street and Cedar Street connections resulted in the greatest CSO reduction in terms of number of events and total CSO volume. The 36-inch diameter flow transfer alignment, with only Cedar Street flow intercepted, performed better than the 24-inch diameter flow transfer alignment with both Broad and Cedar Street flows intercepted.

Both the 36-inch diameter flow transfer alignment with the Broad Street and Cedar Street connections and the 36-inch diameter flow transfer alignment with only the Cedar Street connection intercepted flows that flows that overtopped the Western Avenue high-flow weirs from the upper basin. This interception reduced the flow to the CSO structure. The decreased flow to the CSO structure significantly improved CSO performance, as the existing infrastructure (particularly along Alaskan Way) has limited capacity to convey baseline flows to KCWTD's EBI, resulting in simulated CSOs. The 24-inch diameter flow transfer alignment with both Broad and Cedar Street flow intercepted surcharged such that flows frequently traveled over the high-flow weir at the proposed diversion structure and contributed to simulated CSOs.

An analysis was conducted to evaluate the sensitivity of the CSO performance of the 36-inch diameter flow transfer alignment with the Broad Street and Cedar Street connections to changes in the water level in the EBI. The 21st largest simulated CSO event for this alignment with 2035 rainfall was evaluated using a boundary condition artificially raised between 1 and 6 feet. The boundary condition level was increased incrementally until a CSO was simulated for this storm event. The increased capacity in the flow transfer alignment and the elevated high flow weir in this alternative significantly decreases flows and water levels on Alaskan Way compared to the baseline. Due to the lower flows on Alaskan Way, the HGL between where the boundary condition is applied and the CSO structure is less sensitive to increases to the EBI boundary condition. An increase of approximately 5.85 feet to the EBI boundary condition was required to simulate a CSO for this event.

Hydraulic Grade Line Evaluation

The HGL upstream of the proposed flow transfer alignment was evaluated to gauge whether the updated alternatives would potentially increase HGLs above the baseline condition. HGL was evaluated at the nodes listed below which are shown in Figure 8. The elevation of surrounding plumbing fixtures is unknown at this time therefore elevated HGL over the baseline scenario could increase risk of a sanitary sewer overflow (SSO). Elevations of nearby plumbing fixtures may be evaluated during project design.

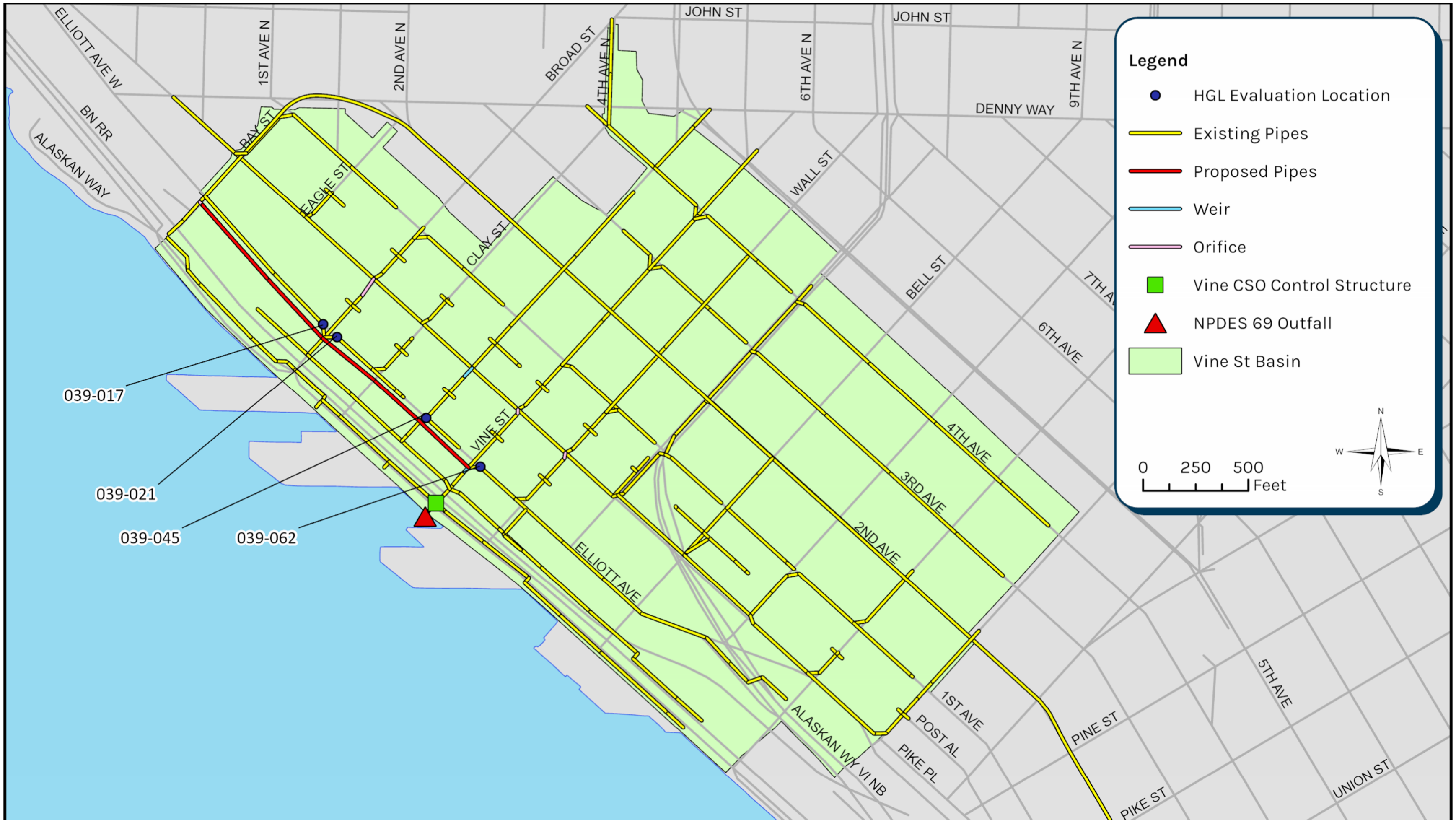
- MH 039-017 – upstream of the proposed connection to the flow transfer alignment at Broad Street
- MH 039-021 – upstream of the proposed connection to the flow transfer alignment at Broad Street
- MH 039-045 – upstream of the proposed connection to the flow transfer alignment at Cedar Street
- MH 039-062 – upstream of the proposed diversion at Vine Street and Elliott Avenue to the east.

The area upstream of the proposed diversion at Vine Street and Elliott Avenue, to the northeast (MH 039-063), was not included as the invert elevation at this location is approximately 30 feet higher than the invert elevation at the proposed diversion.

The HGL evaluation was limited to these points as impacts to HGLs are expected to be greatest at these points with less impact expected further upstream. HGL versus return period is plotted for each location in Figure 9 through Figure 12.

The HGL impact on the upstream system was confirmed based on an analysis of simulated HGLs in the 24-inch diameter flow transfer alignment versus the baseline condition at the following locations upstream of the proposed diversion on Elliot Avenue and Vine Street: MH 039-062, 039-080, 039-120, 039-126, 039-081, 039-082, and 039-063. These locations were selected because the greatest increases in simulated HGLs over the baseline condition occurred for the 24-inch diameter flow transfer alignment at MH 039-062. The differences between simulated HGLs were compared over a range of return periods. Generally, the further upstream from the proposed diversion, the fewer events with simulated HGLs higher than the baseline occurred. Additionally, the return period of events where simulated HGLs exceeded the baseline condition decreased with distance upstream from the proposed diversion, indicating HGL performance for large events improves with distance from the proposed diversion. This analysis confirmed that the curves shown in the following figures represent a conservative estimate of the HGL impacts in the upstream system.

Figure 8 | Hydraulic Grade Line Evaluation Locations



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Vine Basin CSO Engineering Report Update
Hydraulic Grade Line Evaluation Locations

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Figure 9 | HGL Evaluation – MH 039-017

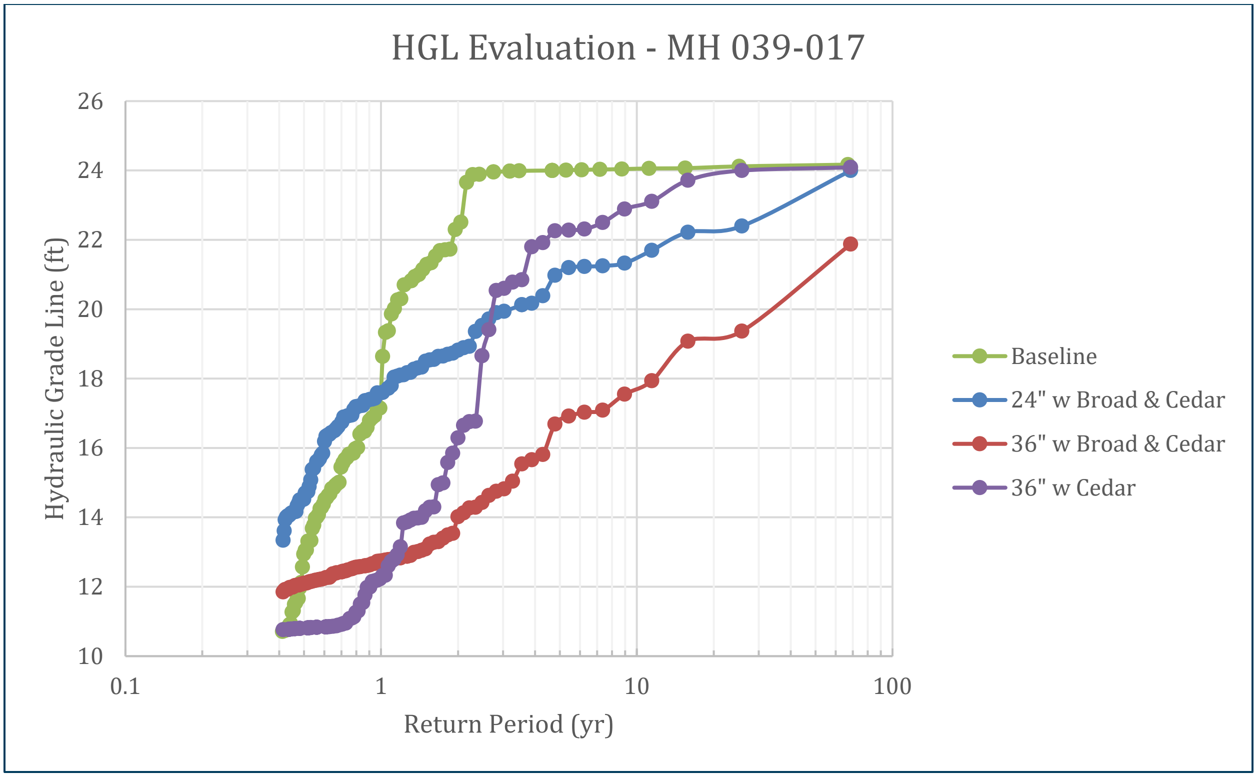


Figure 10 | HGL Evaluation – MH 039-021

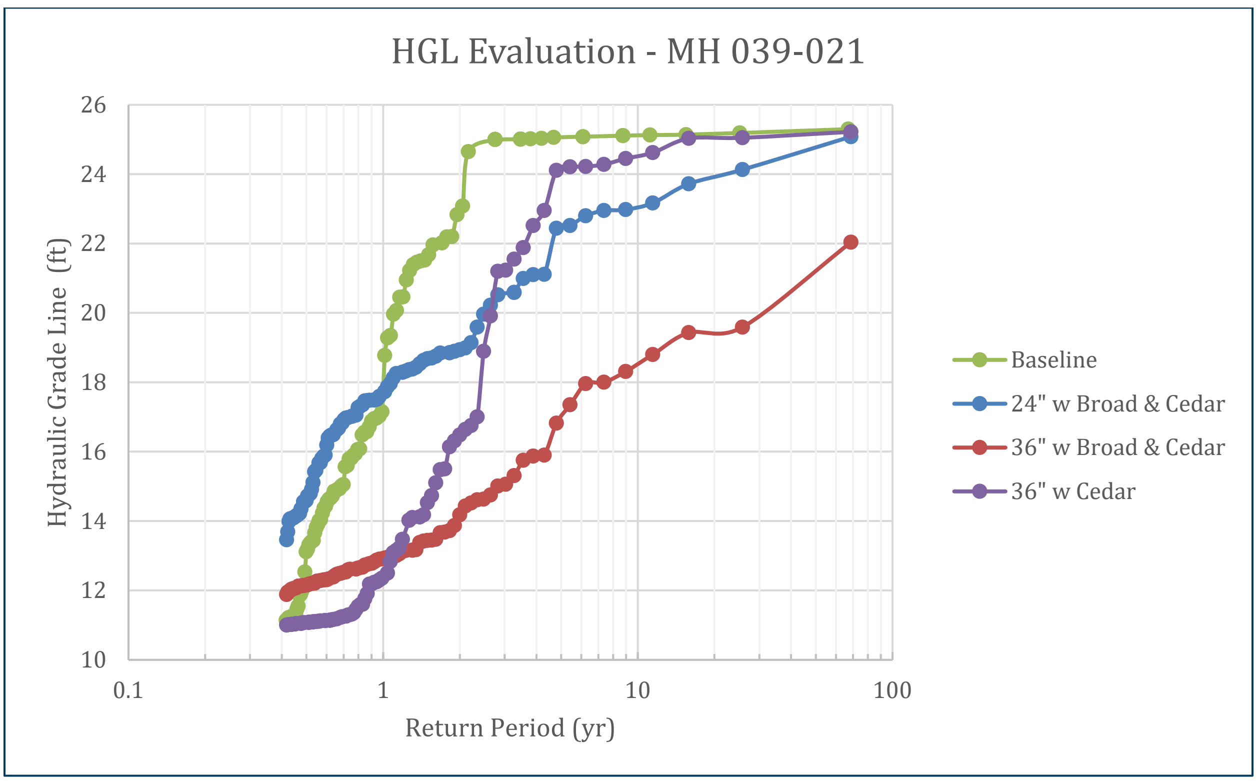


Figure 11 | HGL Evaluation – MH 039-045

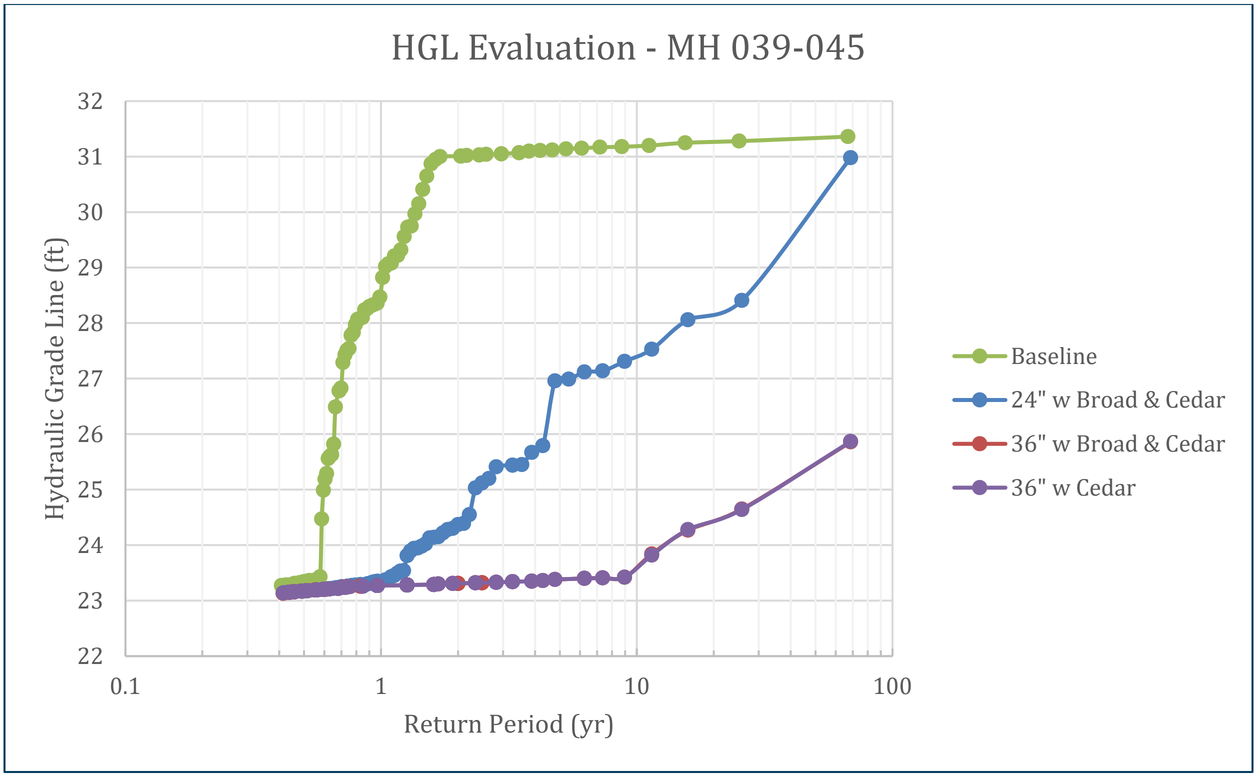
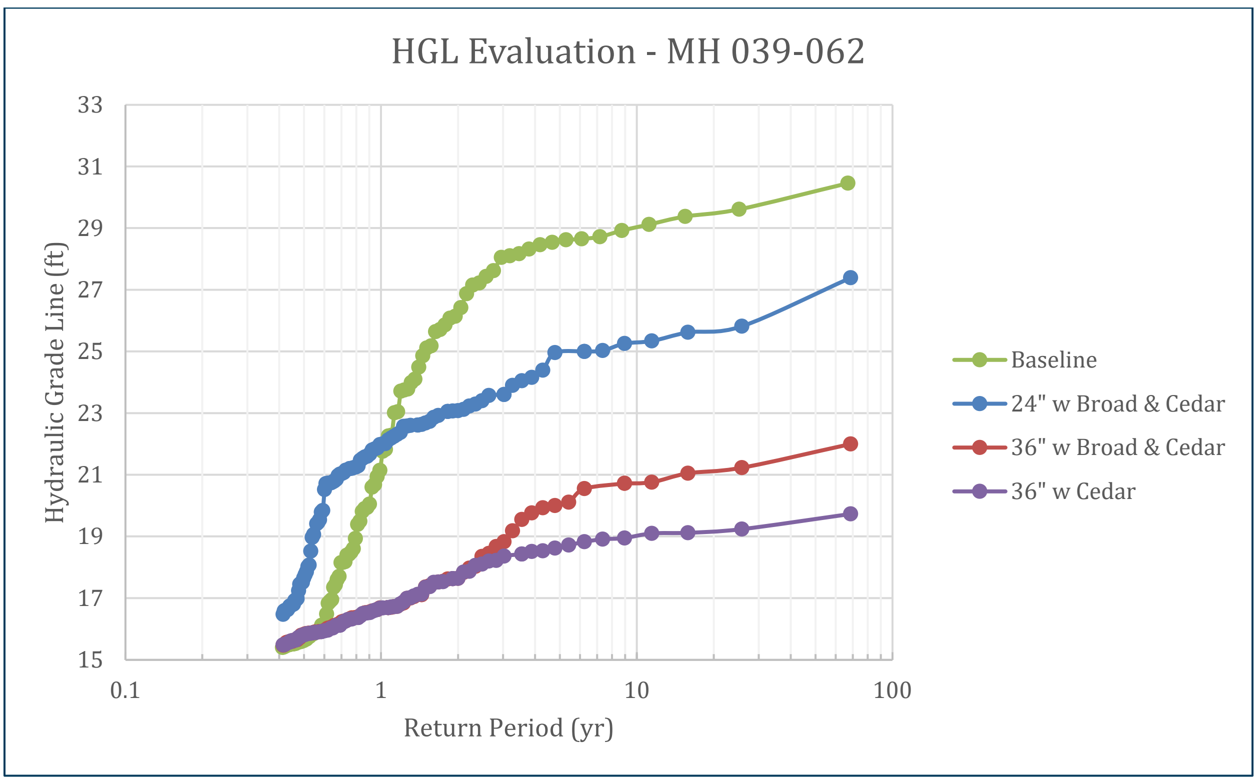


Figure 12 | HGL Evaluation – MH 039-062



At Broad Street (MH 039-017 and 039-021), the HGL in the 24-inch diameter flow transfer option is equal to or below the baseline condition for events with approximately one-year recurrence and greater. The HGL in the 36-inch diameter flow transfer alignments are equal to or below the baseline condition for events with approximately 6-month recurrence and greater. The increased HGL for relatively small events is not expected to cause SSOs as the baseline condition experiences significantly higher HGLs for 2-year events which occur relatively frequently. Consor and SPU are unaware of any recent reported SSOs in the project area. For the largest event, the 24-inch diameter flow transfer alignment and the 36-inch diameter flow transfer alignment with Cedar Street flow show a very minor decrease in HGL. The 36-inch diameter flow transfer alignment with Broad and Cedar Street flow shows a decrease of approximately two feet at MH 039-017 and approximately three feet at MH 039-021.

At Cedar Street (MH 039-045), HGLs are below the baseline condition for all alternatives. For the largest event, HGL decreases approximately 0.75 feet for the 24-inch diameter flow transfer alignment and approximately 5 feet for the 36-inch diameter flow transfer alignments. HGL performance between the two 36-inch diameter flow transfer alternatives is nearly identical.

Upstream of the proposed diversion on Vine Street and Elliott Avenue to the east (MH 039-062), the HGL in the 24-inch diameter flow transfer option is equal to or below the baseline condition for events with approximately one-year recurrence and greater. The increased HGL is a result of surcharge in the proposed alignment which is alleviated when enough flow can travel over the high flow weir at the proposed diversion. The HGL in the 36-inch diameter flow transfer alignments are equal to or below the baseline condition for events with approximately 6-month recurrence and greater with a maximum increase of approximately 2 inches over the baseline condition. The increased HGL for relatively small events is not expected to cause SSOs as the baseline condition experiences significantly higher HGLs for 2-year events which occur relatively frequently.

All modified alternatives show significant decreases in HGL for the largest event. HGLs decrease approximately 3 feet, 8 feet, and 10 feet over the baseline condition in the 24-inch diameter flow transfer alignment, the 36-inch diameter flow transfer alignment with Cedar Street flow, and the 36-inch diameter flow transfer alignment with Broad and Cedar Street flow, respectively. The increases seen for smaller events are generally due to increased flows in the flow transfer alignment created by diverting additional flow at the proposed connections. As flows increase for larger events, HGLs increase in the baseline conditions faster than HGLs in the flow transfer alignments for the proposed alternatives.

Projected Flows to King County

Flows in the Vine Basin are ultimately conveyed to the KCWTD's collection system for treatment and performance of the updated alternatives relies on transferring increased flows to the County. To assist coordination with KCWTD, CV and annual peak and total flow are summarized for the baseline condition, with the modified recommended alternative (36-inch diameter flow transfer alignment with Broad and Cedar Street flow) for existing rainfall in Table 3 below.

Table 3 | Projected Flows to KCWTD

	Baseline Condition Existing Rainfall	SPU Upgrades Existing Rainfall
Control Volume (gal)	215,000	<21 events
Average Annual CSO Volume (gal/yr)	498,025	10,717
Average Annual Volume to KCWTD (MG/yr)		
Proposed EBI Connection, Elliot Ave (039W-007C_039W-007B)	-	63
Existing EBI Connection, Alaskan Way (039W-006.1)	125.876	63.982
Lake Union Tunnel Connection, Western Ave (039W-001_034-272)	368.320	368.315
Total	**494.193**	**494.863**
Average Annual Peak Flow to KCWTD (mgd)		
Proposed EBI Connection, Elliot Ave (039W-007C_039W-007B)	-	17.764
Existing EBI Connection, Alaskan Way (039W-006.1)	9.525	4.954
Lake Union Tunnel Connection, Western Ave (039W-001_034-272)	17.638	17.582

Conclusions

Since the Basin 69 options analysis, completed in 2019, KCWTD has updated their model and provided a new boundary condition of simulated water surface elevation in the EBI. Basin 69 discharges to the EBI and the Lake Union Tunnel and CSO performance in the basin is sensitive to the water level in the EBI. The Basin's H/H model relies on this boundary condition to simulate water levels at the end of the modeled conveyance. CSO performance of the recommended alternative, described in the Engineering Report, that included flow transfer along Elliott Avenue, was evaluated using this updated boundary condition. The initial evaluation showed it no longer brought the basin into compliance. Updated alternative scenarios were evaluated to bring the basin into compliance with the additional goal of improving CSO performance as much as realistically possible.

Changes to the high-flow diversions on Western Avenue were considered but did not provide significant improvements to CSO performance while maintaining system HGLs at or below the baseline condition. Ultimately, the updated alternatives focused on improving performance of the recommended alternative through a combination of upsizing the proposed alignment and intercepting flows at Broad Street and Cedar Street.

The modified recommended alternative includes an upsized alignment along Elliott Avenue capturing additional flows at Broad Street and Cedar Street. The upsized flow transfer alignment increases conveyance capacity to KCWTD and decreases instances of flows over the high-flow weir in the proposed diversion structure at Vine Street and Elliott Avenue, decreasing flows that are conveyed to the CSO structure. The intercepted flows at Broad Street and Cedar Street further decrease flows to the CSO control structure. The combination of increased capacity and decreased flows to the CSO structure with the intercepted flows significantly improves CSO performance of this modified recommended alternative over the recommended alternative and the baseline condition.

The HGL was evaluated at four locations upstream of the updated alternatives using plots of water surface elevation versus recurrence to ensure HGLs remained at or below the baseline condition. HGLs in the modified recommended alternative at the proposed Cedar Street connection are at or below the baseline for the LTS. HGLs in the modified recommended alternative at Broad Street and the proposed diversion at Vine Street and Elliot Avenue were at or below the baseline condition for events with approximately 6-

month recurrence and greater. The relatively small increase seen is not expected to cause SSOs as the baseline condition experiences significantly higher HGLs for relatively frequent events.

Flow to KCWTD for the baseline condition and for baseline and future conditions with the most effective alternative were summarized to characterize the projected increase in flows from upgrades to SPU's system. The total average annual volume transferred to KCWTD from all connection points is expected to increase by approximately one million gallons per year. The average annual peak flow from the Vine Basin to KCWTD is expected to remain roughly the same at the existing connection point on Western Avenue. The average annual peak flow to KCWTD at the existing EBI connection on Alaskan Way is expected to decrease from 9.525 mgd to 4.954 mgd. The simulated average annual peak flow to KCWTD at the proposed EBI connection point near Elliot Avenue is 17.764 mgd. KCWTD has approved this increase in flow.

Limitations and Uncertainty

No additional calibration was completed as part of this effort. No considerations were made for changes in population and employment or changes to the conveyance system outside of the updated alternatives. It was assumed that the calibration sufficiently represents wastewater flows in the basin and that any changes to wastewater generation or hydrology occurring since calibration are minor and would not significantly impact results. SPU is currently monitoring sanitary sewer flows upstream of the two existing KCWTD connection points. SPU will use this collected monitoring data to review calibration with the new boundary condition during the design phase.

Care was taken to review impacts to HGL in the portions of the system upstream of the updated alternatives to limit the risk that the modified recommended alternative would contribute to unintended SSOs. It was outside of the scope of this task to review impacts to basement connections (if any). This should be considered in future phases of design.

References

Murraysmith. 2019. “The 2019 Central Waterfront Basin (Basin 69) Combined Sewer Overflow Control Project Engineering Report”

Aqualyze Inc. 2019. " Basin 69 Modeling Technical Memorandum."

Aqualyze Inc. 2018. "Central Waterfront Basin 69 Calibration and Control Volume Modeling Technical Memorandum."

CH2M. 2017. “Combined Sewer Overflow Sizing Approach Implementation: Perturbing Precipitation Timeseries to Future Climate Conditions.” Technical Memorandum, Seattle Public Utilities.

APPENDIX B

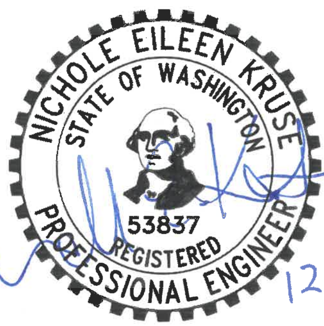
Central Waterfront Basin (Basin 69) Combined Sewer Overflow Control Project

Engineering Report

Seattle Public Utilities
City of Seattle

December 2019

Prepared By: Murraysmith
250 Pike Street, Suite 1350
Seattle, WA 98101



12/20/2019

Nichole Kruse, PE

I hereby certify that the Engineering Report was prepared by me or under my direct supervision and that I am a duly registered Engineer under the laws of the State of Washington.

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Appendix D - Basis of Esitmate and OPCC for Elliott Avenue New Flow Transfer Alternative

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Appendix F - Basin 69 Hydraulic Modeling Technical Memoradum

Appendix G - SEPA Determination and Checklist

Appendix H – King County Letter of Flow Transfer Collaboration

Acronyms & Definition of Terms

A	
AACE	Association for the Advancement of Cost Engineering
ADA	Americans with Disabilities Act
AFI	Allowance for Indeterminates
AQI	Air Quality Index
B	
BGS	Below Ground Surface
BMP	Best Management Practice
Basin 69	Central Waterfront Basin 69
C	
CAD	Computer-Aided Design
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program
CIPP	Cured in Place Pipe
City	City of Seattle
Consent Decree	Civil Action No. 2:13-cv-678 which addresses the control of CSOs and sewer overflows; negotiated among the U.S. EPA, Ecology, DOJ, and the City and entered in U.S. District Court for the Western District of Washington on July 3, 2013.
CSS	Combined Sewer System Definition: A wastewater collection and conveyance system designed to collect and convey both sewage and stormwater through a single-pipe system
CSO	Combined Sewer Overflow Definition: Occurs when flow rates in the combined sewer system exceed the conveyance and storage capacity of the system as a result of precipitation, and excess flow (mixture of untreated sewage and stormwater) backs up in the pipe, crests an overflow weir, and discharges through a permitted outfall into a water body.
CV	Control Volume Definition: Used as a first approximation of the amount of excess combined sewage which must be stored, transferred, diverted, or removed to limit the combined sewer basin to a long-term average of no more than one CSO event per year per outfall.
CWA	Clean Water Act
CWF	Central Waterfront
D	
DIP	Ductile Iron Pipe
DIA	Diameter of a Pipe
DNRP	King County Department of Natural Resources and Parks
DOJ	United States Department of Justice
E	

ECA	Environmentally Critical Area
Ecology	Washington State Department of Ecology
EL	Elevation
ENR	Environment & Natural Resource
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
F	
FEMA	Federal Emergency Management Agency
FT	Feet
G	
GIS	Geographic Information System
GMA	Growth Management Act
GSI	Green Stormwater Infrastructure
H	
HGL	Hydraulic Grade Line
I	
I&I	Inflow and Infiltration
IE	Invert Elevation
IN	Inches
Inline Storage	A storage vessel which is also a conveyance pipe that has normal flow (e.g., oversized pipe)
Infiltration	Groundwater introduced into a sanitary or combined sewer through defects below groundwater level.
Inflow	Stormwater introduced into a sanitary or combined sewer from direct connections.
K	
KC	King County
L	
LOS	Level of Service
M	
MG	Million Gallons
MGD	Million Gallons per Day
MH	Maintenance Hole
MODA	Multi-Objective Decision Analysis
N	
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
O	
O&M	Operations and Maintenance
Offline Storage	A storage vessel which does not convey normal (dry weather) flow. The storage is only utilized during occasional precipitation events.
OHWM	Ordinary High-Water Mark

OPCC	Opinion of Probable Construction Cost
Outfall 69	CSO Outfall 69 for Central Waterfront Basin 69
P	
PSCAA	Puget Sound Clean Air Authority
R	
RCP	Reinforced Concrete Pipe
RCW	Revised Code of Washington
REC	Recognized Environmental Condition
RII	Rainfall-Induced Infiltration
ROV	Remotely Operated Vehicle
ROW	Right-of-Way
ROWORR	Right-of-Way Opening and Restoration Rule
RTC	Real-Time Control
S	
Sanitary Sewage	The mixture of domestic, commercial, and industrial wastewaters.
SCADA	Supervisory Control and Data Acquisition
SDCI	Seattle Department of Construction and Inspections
SDOT	Seattle Department of Transportation
SEPA	State Environmental Policy Act
Separated sewer systems	Collection systems that convey only sanitary sewage. Stormwater is conveyed separately.
SERP	State Environmental Review Process
Sewer Overflow	Any overflow or release of wastewater from the City's wastewater collection system, with the exception of discharges from permitted CSO outfalls.
SFZ	Seattle Fault Zone
SMC	Seattle Municipal Code
SMH	Stormwater Maintenance Hole
SPU	Seattle Public Utilities
SPU-LTCRDI	Seattle Public Utilities—Long-term Continuous Rainfall Dependent Infiltration Method
SRF	State Water Pollution Control Revolving Loan Fund
SSO	Sanitary Overflow (either from a sanitary sewer or combined sewer)
State	Washington State
Storage Volume	Definition: The volume predicted necessary to meet the performance standard for controlled CSOs. Usually equal to or larger than the CV because of system hydraulics, physical location of storage, means of control, timing of the release compared to storm frequency, and downstream conditions.
SWMM	Stormwater Management Model
SWPPP	Stormwater Pollution Prevention Plan
T	
TBL	Triple Bottom Line
TESC	Temporary Erosion and Sediment Control
TVSP	Tree, Vegetation, and Soil Protection (TVSP) Plan
U	

UA	Uncertainty Analysis
U.S.C.	United States Code
UFD	Utility Flow Diagram
USACE	United States Army Corps of Engineers
V	
VCP	Vitrified Clay Pipe
W	
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WPTP	West Point Treatment Plant

Section 1

Executive Summary

This Engineering Report outlines the recommended alternative and selection process for controlling Central Waterfront Basin 69 (herein referred to as Basin 69) to the State CSO performance standard of an average of no more than one combined sewer overflow (CSO) event per year. This Engineering Report is intended to fulfill the requirements of the Washington Administrative Code (WAC) 173-240-060 (Engineering Reports).

1.1 Problem Identification

Seattle Public Utilities (SPU) operates and maintains a combined sewer system within the City of Seattle. During large storm events, the combined system can overflow at designated locations, resulting in combined sewer overflows (CSOs) of raw sewage and untreated stormwater. In 2013, the City of Seattle entered into a Consent Decree with the U.S. Environmental Protection Agency (EPA), U.S. Department of Justice (DOJ), and the Washington State Department of Ecology (Ecology), requiring the City to control each combined sewer outfall to the State CSO performance standard. Per the Consent Decree and SPU's wastewater NPDES permit (Permit No. WA 0031682 included as Appendix A) control is assessed based on a 20 year moving average. During the period 1999-2018, Basin 69 averaged 1.8 CSOs per year. The alternatives identified and documented in this report were developed with the intent of planning system improvements to control the Basin 69.

1.2 Basin Description

Basin 69 is located at the north end of the City's downtown waterfront, adjacent to Elliott Bay. The Basin is highly developed and densely populated. Sanitary flows and stormwater runoff are collected in a combined sewer system that discharges to King County infrastructure, to be treated at the King County West Point Treatment Plant (WPTP). During heavy precipitation events, stormwater runoff can overwhelm the sewer system within the Basin and trigger a CSO event, discharging excess flows into Elliott Bay at Outfall 69.

1.3 Brainstorming and Selection Process

Twenty-eight alternatives were explored through an extensive brainstorming and screening process. Four primary methods for controlling Basin 69 were discussed, including transferring excess flows to King County (KC), storing excess flows, treating and discharging excess flows, or reducing stormwater inflow into the combined sewer system. Preliminary alternatives were screened based on downstream flow rate limitations, constructability and construction risks, operations and maintenance considerations, property acquisition requirements, and general feasibility. Preliminary hydraulic modeling was also used to screen alternatives. Three alternatives were selected for further consideration:

- **Alternative 1**: Transfer excess flows to King County's Elliott Bay Interceptor via a parallel alignment to the existing sewer in Alaskan Way,
- **Alternative 2**: Transfer excess flows to King County's Elliott Bay Interceptor via a new sewer in Elliott Avenue, and
- **Alternative 3**: Store excess flow in a large diameter, inline storage pipe in the existing sewer alignment in Alaskan Way.

The top alternatives were evaluated using a Multi-Objective Decision Analysis (MODA) which considered ability of the alternative to meet project and City goals using nine criteria. The ranking outcome of the alternatives were considered along with the anticipated project costs and life-cycle costs to identify the recommended alternative. Based on the MODA and cost analysis, the top alternatives ranked in the following order:

- **Highest Ranked Alternative**: Elliott Avenue New Flow Transfer alternative (Alternative 2),
- **Second Ranked Alternative**: Alaskan Way Parallel Flow Transfer alternative (Alternative 1),
- **Lowest Ranked Alternative**: Alaskan Way Inline Storage alternative (Alternative 3).

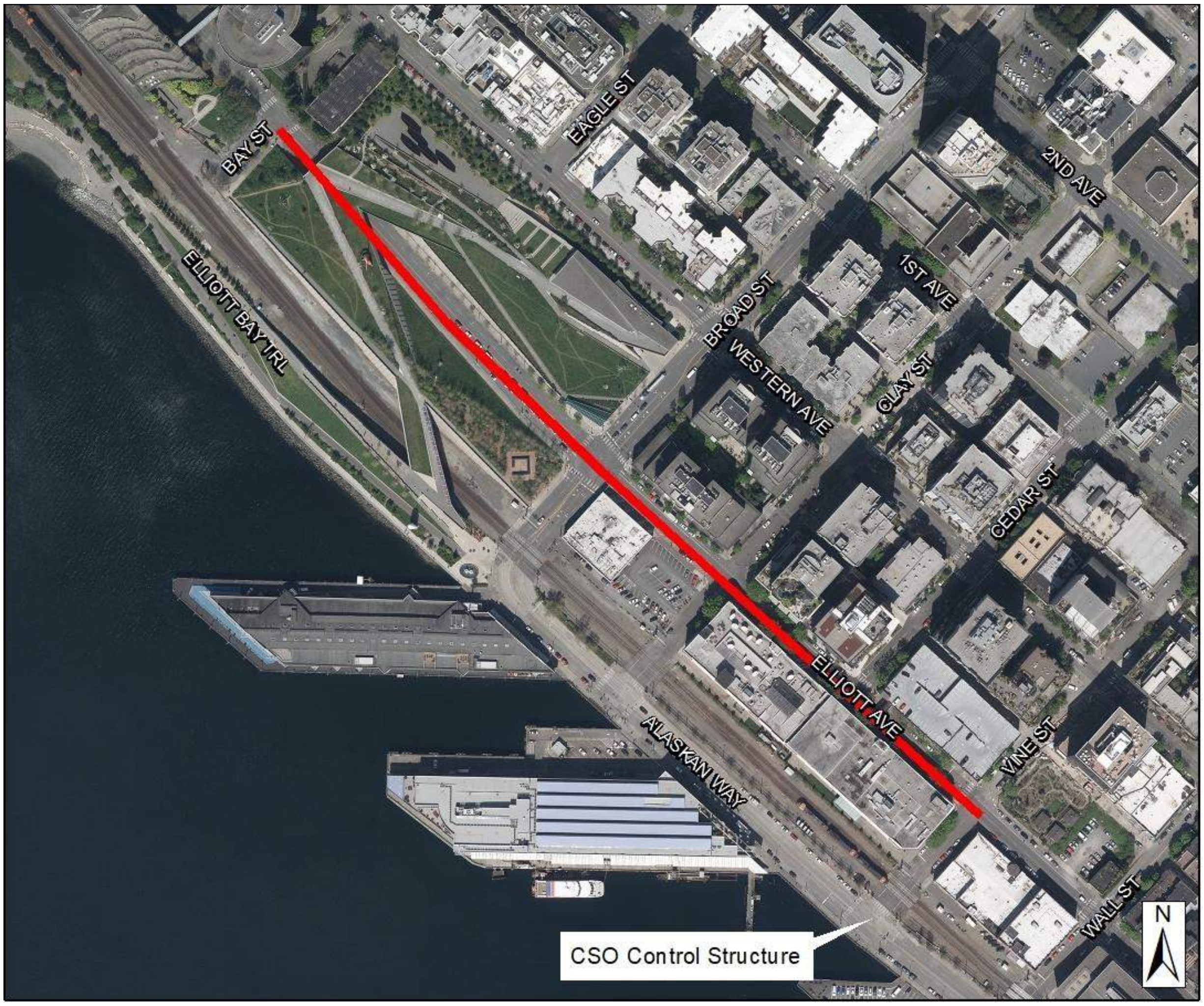
1.4 Recommended Alternative

The recommended alternative for controlling Basin 69 is the Elliott Avenue New Flow Transfer alternative (Alternative 2). This alternative relies on conveying excess flow to KC for further conveyance and treatment, and KC concurs that this alternative is feasible. Key features of this alternative include. Key features of this alternative include:

- Approximately 1,800 linear feet of 24 inch diameter gravity combined sewer pipe,
- New connection to KC’s Elliott Bay Interceptor,
- New sewer diversion vault and weir where the existing sewer crosses the intersection of Vine Street and Elliott Avenue, and
- No active outlet controls (meaning no real time controls such as valves or gates).

Figure 1-1 shows in red the general location and layout of the recommended alternative.

Figure 1-1
Elliott Avenue New Flow Transfer Alternative (Alternative 2) General Location



Long-term hydraulic modeling simulations were completed to provide confidence that the proposed modifications will control Basin 69 to the State CSO performance standard; the Basin is expected to experience 20 CSOs within the worst 20 years of historical precipitation data, including additional factors to account for climate change.

The total project cost of this alternative is approximately $18.5 million in 2019 dollars, including various allowances, contingencies, and inflation. A Class 4 opinion of probable construction cost (OPCC) was developed as the basis for the total anticipated project cost. Construction of this alternative is expected to require 12 to 16 months.

The recommended alternative is currently scheduled to be implemented based on the following schedule:

1. Final design is to be completed by December 2021.

2. Construction is to be initiated by July 2022.
3. Construction is to be completed by September 2025.
4. One year of commissioning and documentation to achieve controlled status is to be completed by September 2026.

This implementation schedule is consistent with the milestones in SPU's *Plan to Protect Seattle's Waterways*, which include a construction completion milestone of September 30, 2025.

Section 2

Owner Information

The owner of this project is the City of Seattle (City). The owner's representative is listed below.

Andrew Lee, Deputy Director
Seattle Public Utilities
Drainage and Wastewater Line of Business
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Section 3

Project Overview and Background

This section includes problem identification and background information for Basin 69.

3.1 Problem Identification

Seattle Public Utilities (SPU) operates and maintains combined sewer systems within the City of Seattle. Combined sewer systems convey both stormwater and sanitary flows. During heavy precipitation events, the volume of stormwater and sanitary flows in the combined sewer system can exceed the system's capacity, and a combined sewer overflow (CSO) can occur. During a CSO event, excess combined sewer flow is discharged into the City's surrounding receiving water bodies rather than conveyed to a wastewater treatment plant.

SPU is required to reduce CSOs in order to comply with their National Pollutant Discharge Elimination System (NPDES) permit administered by the Department of Ecology. Washington state law RCW 90.48.480 requires local governments to achieve the greatest reasonable reduction of CSOs at the earliest possible date, where "greatest reasonable reduction" is defined under WAC 173-245-020 as a long-term average of no more than one untreated discharge per year per permitted CSO outfall. Per SPU's NPDES Permit and the City's Consent Decree, CSO performance is assessed based on a 20 year moving average.

In 2013, a Consent Decree to address the control of CSOs and sewer overflows was negotiated among the United States Department of Justice (DOJ), the United States Environmental Protection Agency (EPA), Ecology, and the City and was entered into U.S. District Court for the Western District of Washington on July 3, 2013 (Civil Action No. 2:13-cv-678). The Consent Decree sets a schedule for the City to meet the State CSO performance standard. In May 2015, SPU submitted the *Plan to Protect Seattle's Waterways*, describing the planned approach for meeting the Consent Decree schedule.

Basin 69 is one of the combined sewer basins addressed in the Plan. Using the 20 year moving average, the current estimated CSO frequency for Basin 69 is 1.8 CSOs per year[1], which exceeds the State CSO performance standard. Control actions such as storing, transferring, or reducing flows are necessary to reduce the CSO event frequency to the State standard. This Engineering Report documents the process used to identify and evaluate alternatives and select the recommended CSO control project for Basin 69. This report also provides a description of the evaluated alternatives, the recommended project, and supporting information to facilitate

[1] Based on CSO flow monitoring and supplemented modeled data, Aqualyze, 2019.

implementation. This Engineering Report meets the requirements of WAC 173-240-060 (Engineering Reports).

3.2 Basin Overview

Basin 69 is located at the north end of the City's downtown waterfront. Vine Basin includes an area of approximately 150 acres and is generally bounded by Denny Way to the north, Bay Street to the northwest, 5th Avenue and 4th Avenue to the north and east, and Alaskan Way to the south and west; a map of the Vine Basin location is provided as **Figure 3-1** .

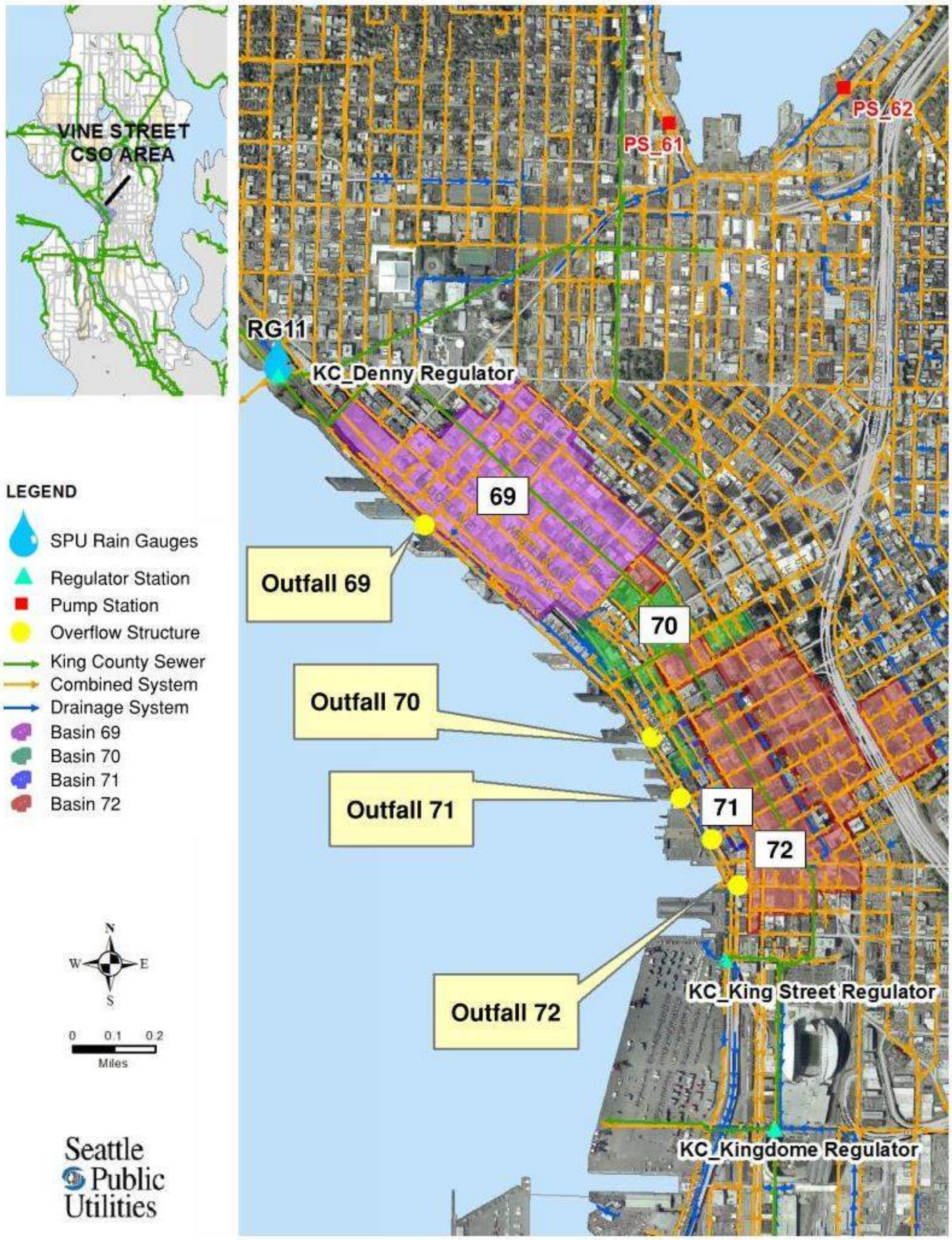
Sanitary flows and stormwater runoff are collected in a combined sewer system that discharges to the King County at two locations; the Denny Way/Lake Union Tunnel near the intersection of Western Avenue and West Denny Street, and the Elliott Bay Interceptor (EBI) at the intersection of Alaskan Way and Bay Street. During heavy precipitation events, stormwater runoff can overwhelm the sewer system within the Basin and trigger a CSO event at the CSO Control Structure, located within the intersection of Alaskan Way and Vine Street. The Basin 69 Outfall (Outfall 69) discharges overflows through the seawall into Elliott Bay, just west of the Alaskan Way and Vine Street intersection. **Table 3-1** provides basic information about Basin 69; more detailed information is included in **Section 5**.

Table 3-1
Basin 69 Information

Category	Description
Basin Name	Central Waterfront Basin, Basin 69, Vine Basin
CSO Outfall Number	69
Receiving Waterbody	Elliott Bay
Basin Acreage	150
Neighborhood	Belltown (Central Waterfront)
Downstream Facilities	KC Denny Way/Lake Union Tunnel (72 inch diameter) KC Elliott Bay Interceptor (102 inch diameter) KC Denny Way Regulator Station KC West Point Treatment Plant (WPTP)
Existing Basin CSO Facilities	CSO Control Structure (Alaskan Way and Vine Street) CSO Outfall (Outfall 69)
Outfall Coordinates	Latitude: 47.61321° Longitude: -122.35232° [2]

[2] National Pollutant Discharge Elimination System Waste Discharge Permit No. WA0031682, Issued March 30, 2016, Effective May 1, 2016, Modified September 28, 2017, Expires April 30, 2021.

Figure 3-1
Basin 69 Location Map[3]



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[3] Protecting Seattle's Waterways, Volume 2, Long-Term Control Plan, May 29,2015, Figure 2.8, Page 2-25.

3.3 Sewer Classification and Related CSO Impacts

Within the SPU collection system, there are three classes of sewers: separated, combined, and a hybrid of the two called partially separated. Older Seattle neighborhoods are more likely to have combined sewers than newer neighborhoods. Combined and separated sewer types are present in Basin 69, but the Basin is primarily served by combined sewers.

3.3.1 Separated Sewers

In separated parts of the system, sewer and stormwater flows are collected in separate collection systems. Sanitary flows are conveyed to a treatment plant, while stormwater runoff is discharged to local water bodies (in some cases following on-site treatment). In properly functioning separated systems, stormwater runoff has little to no effect on sewer flows.

3.3.2 Combined Sewers

Where there are combined sewers, storm drainage and sanitary flows are collected in the same pipes. During dry weather, the flows are primarily sewage and are routed to the treatment plant. During wet weather, flows are a combination of sewage and stormwater. Flows are conveyed to the treatment plant as long as there is adequate sewer capacity. If the flow exceeds the combined sewer capacity, a combined sewer overflow (CSO) occurs, discharging both stormwater runoff and raw sewage into a water body.

3.4 Citywide CSO Reduction Efforts

The City began reducing CSOs in the 1960s, by installing storm drains to convey stormwater from public property in areas of the collection system served by combined sewers. In the 1980s, SPU began constructing storage facilities to provide additional storage during wet weather events. Seattle has since constructed 38 storage facilities for overflow control. Later, emphasis was placed on retrofit projects to optimize existing infrastructure. As of 2015, the City had expended over $524 million (2009 dollars) on CSO reduction and control efforts.[4]

The following are key milestones in the City's CSO reduction efforts:

- **1980 Facility Plan (201 Facilities Planning).** This plan focused on CSOs in high-priority areas (Longfellow Creek, Lake Washington, and Puget Sound beaches) based on human contact potential and environmental protection. Storage facilities were recommended for 50 CSO outfalls.

[4] Protecting Seattle's Waterways, Volume 2 LTPC, Chapter 1, May 29, 2015.

- **1988 CSO Reduction Plan**. This plan addressed CSO reduction in Portage Bay, Lake Union, the Ship Canal, Elliott Bay, and the Duwamish River, recommending storage facilities for 30 uncontrolled CSO outfalls.

- **Began Monitoring CSO Control Structures**. Beginning in the 1990s the City began installing overflow monitors at the CSO outfalls discharging to Portage Bay, Lake Union, the Ship Canal, Elliott Bay, and the Duwamish River.

- **2001 CSO Reduction Plan Amendment**. This plan identified six additional high-priority areas for CSO reduction. This plan also emphasized the "Nine Minimum Controls" established by the EPA and identified other system improvements necessary to limit CSOs to a long-term average of no more than one untreated discharge per year per outfall. Finally, this plan included Best Management Practices (BMP) recommendations for implementing CSO storage facilities.

- **2005 CSO Reduction Plan Amendment Update**. Evaluated BMP/retrofit projects identified by the 2001 CSO Reduction Plan Amendment. Cost estimates and schedules for remaining, uncompleted projects were updated.

- **2010 CSO Reduction Plan Amendment**. This plan was required by WAC 173-245-090(2) and focused on efforts through 2015 to reduce CSOs at the most critical sites through a cost-effective blend of traditional and sustainable infrastructure in a four-part approach: 1) optimize existing CSO infrastructure through low-cost retrofits, 2) construct large CSO infrastructure projects to reduce overflows to Lake Washington, 3) construct "green" solutions to reduce CSOs throughout the City, and 4) develop a long-term plan to control all remaining CSOs and achieve water quality goals.

- **2015 Plan to Protect Seattle's Waterways**. Volume 2 of this plan, also referred to as the Long-Term Control Plan (LTCP), presented a comprehensive strategy to reduce CSOs through various projects and actions with a completion milestone of 2025 (consistent with the Consent Decree deadline). It also identified opportunities for partnering with King County to jointly resolve system capacity issues. Volume 3 of the 2015 Plan, also referred to as the Integrated Plan, presented a strategy to address both combined sewer overflows and stormwater pollution jointly.

Several projects have already been implemented including projects in the Windermere, Leschi, Genesee, Henderson, Ballard and Delridge Basins, in addition to extensive sewer system improvements. SPU is actively pursuing CSO reduction measure with the Ship Canal Water Quality Project, Pearl Street Drainage and Wastewater Improvements, Broadview Sewer and Drainage Improvements, and Magnolia Basin 60 Pump Station Upgrades. SPU anticipates continued investments and efforts to reduce annual CSO frequency and volume.

3.5 Regulatory Framework

Various regulatory policies apply to the CSO reduction efforts in Basin 69.

3.5.1 Clean Water Act and NPDES Permits

The Clean Water Act (33 U.S.C. § 1251 et seq.) requires authorization prior to discharge of any pollutant from a point source into navigable waters of the United States. The term "point source" is defined to include any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit or other materials from which pollutants are or may be released[5]. The term "pollutant" is also broadly defined to include dredged spoil, solid waste, sewage, garbage, sewage sludge, chemical wastes, biological materials, heat, rock, sand, and other materials[6].

The CWA established the National Pollutant Discharge Elimination System (NPDES) program to meet the discharge authorization requirement. The program's intent is to limit the discharge of pollutants to meet specific water quality criteria. In the State of Washington, the NPDES program is administered through the Department of Ecology (Ecology). Ecology's regulations in Chapter 173-220 WAC govern individual NPDES permits, including SPU's CSO permit.

3.5.2 EPA CSO Control Policy of 1994

The CWA described in 33 U.S.C. § 1342(q) (1) requires that any permit authorizing discharges from a CSO Outfall must conform to the EPA CSO Control Policy of April 19, 1994.

The EPA CSO Control Policy provides guidance on how communities with combined sewer systems can meet CWA goals in as flexible and cost-effective a manner as possible. The Policy has three main elements:

1. Implementation of the Nine Minimum Controls,
2. Long-Term CSO Control Plans, and
3. Requirement to meet State Water Quality Standards.

The Nine Minimum Controls are measures that can reduce the frequency and impacts of CSOs and are not expected to require extensive engineering studies or major construction. These controls are:

1. Properly operate and maintain the sewer system and its CSO outfalls,
2. Maximize use of the collection system for storage,
3. Review and modification of pretreatment requirements to ensure CSO impacts are minimized,

[5] 33 U.S.C. § 1362(14)
[6] 33 U.S.C. § 1362(6).

4. Maximize flow to the publicly owned treatment works for treatment,
5. Prevent dry weather CSOs,
6. Control solids and floatable materials in CSOs,
7. Implement a pollution prevention program,
8. Provide public notification to ensure that the public receives adequate notification of CSO occurrences and impacts, and
9. Monitor to effectively characterize CSO impacts and the efficacy of CSO controls.

Long-Term Control Plans are tools to assist in adherence with the CWA and include the following elements:

1. Characterization, monitoring, and modeling of the combined sewer system,
2. Public participation,
3. Consideration of sensitive areas,
4. Evaluation of alternatives to meet CWA requirements using either the "presumption approach" or the "demonstration approach",
5. Cost/performance considerations,
6. Operational plan,
7. Maximizing treatment at the existing treatment plant,
8. Implementation schedule, and
9. Post-construction compliance monitoring program.

3.5.3 Washington State Law and NDPES Permit

The CWA at 33 U.S.C. §1370 allows for states to adopt pollution control standards and requirements so long as they are at least as strict as the standards and requirements in that chapter. Washington state law (RCW 90.48.480) requires local governments to create reasonable plans and compliance schedules to achieve the “greatest reasonable reduction” of CSOs at the earliest possible date. Ecology has interpreted “the greatest reasonable reduction” to mean no more than one untreated discharge event may happen per year per CSO outfall[7]. SPU’s NPDES

[7] WAC 173-245-020 (22).

permit and the City's Consent Decree each allow compliance to be determined based on up to 20 years of monitoring and modeling data.

At a minimum, CSO reduction plans must include documentation of CSO activity, analysis of control/treatment alternatives, analysis of selected treatment/control projects, priority rankings, and a schedule. An annual CSO report is required, detailing the frequency and volume of CSO discharges, accomplishments, and planned projects. With each application for NPDES permit renewal, permittees must submit an amendment to their CSO plans.

Ecology first issued the City of Seattle an NPDES permit for CSO discharges in 1975. The permit is reissued periodically and was most recently issued on March 30, 2016. The current permit, NPDES Permit WA0031682, went into effect on May 1, 2016, was modified on September 28, 2017, and is effective through April 30, 2021. The permit defines monitoring requirements, establishes requirements for detailed reporting, authorizes discharges only as a result of precipitation events, and requires implementation of the Nine Minimum Controls.

3.5.4 EPA Consent Decree and the Long-Term Control Plan

In 2013, the City of Seattle entered into a Consent Decree with the United States Department of Justice, EPA, and Ecology. The Consent Decree was issued in response to a complaint filed against the City which alleged that the City violated Sections 301 and 402 of the CWA, 33 U.S.C. §§ 1311 and 1342, and the conditions and limitations of its NPDES permit, as authorized by EPA under Section 402(b) of the CWA, 33 U.S.C. § 1342(b).

The Consent Decree mandates that SPU complete certain CSO-control related activities. Several high-priority basins were identified for early action projects. The Consent Decree also mandates the preparation of the LTCP with an associated Capital Improvement Plan; this requirement has been satisfied. While Basin 69 was not named in the Consent Decree as a high priority basin, Basin 69 is identified in the LTCP for control by 2025. The LTCP has set the following milestones to achieve CSO control in Basin 69:

- Submit Draft Engineering Report to Ecology by June 30, 2019.
- Submit Final Engineering Report to Ecology by December 31, 2019.
- Complete Draft Plans and Specifications by June 30, 2021.
- Complete Final Plans and Specifications by December 31, 2021.
- Begin Construction by July 1, 2022.
- Complete Construction by September 30, 2025.
- Achieve Controlled Status by September 30, 2026.

Section 4

Existing Environmental Conditions

This section describes the existing environmental conditions in Basin 69 based on findings from other recent efforts in the area and information made available by the City of Seattle, Ecology, and other regional and state agencies.

4.1 Water

4.1.1 Groundwater

Groundwater in Basin 69 is bounded by Elliott Bay along the western edge of the Basin. Groundwater levels close to Elliott Bay are expected to be in hydraulic continuity with the tidally influenced Bay.

Existing geotechnical boring data available from other projects in the Basin has been reviewed to inform the preliminary development and considerations for alternatives; most of the data available was gathered between 1966 and 1995. No geotechnical evaluations or investigations have been conducted that are specific to Basin 69 CSO reduction efforts. Given the likelihood of variability of geotechnical conditions specific to project siting, geotechnical investigations are expected to be conducted as part of the final design of the selected CSO control alternative.

Along the Elliott Bay waterfront, groundwater levels are expected to be approximately five feet below the ground surface during high tide and during precipitation events. During the dry months of the year, the groundwater level may be lower, however additional investigations are recommended.

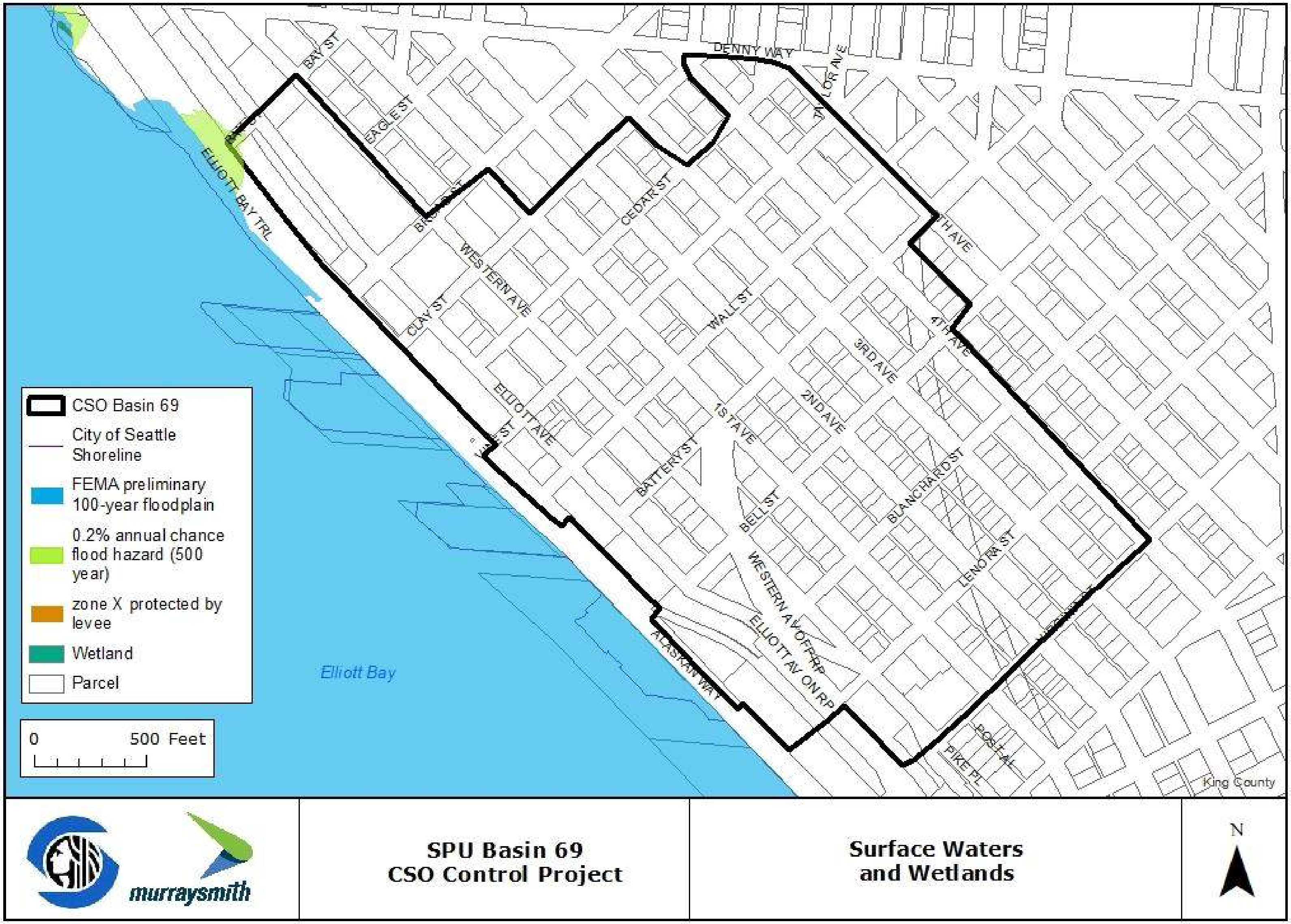
Portions of the Basin further away from the waterfront and with higher ground elevations are anticipated to have groundwater levels at greater depths than along the waterfront, however groundwater is still expected to be encountered for excavations greater than 10 feet deep.

Groundwater levels are anticipated to be high enough within the Basin to influence the design and affect construction of any alternatives.

4.1.2 Surface Water

Elliott Bay is the only surface water feature in or directly adjacent to Basin 69 as shown in **Figure 4-1**. Elliott Bay is a tidally influenced body of saltwater partially enclosed in coastline that borders on the north, east, and south sides of the Bay. The coastline consists of urbanized areas

Figure 4-1
Surface Waters Near Basin 69



of Seattle. The eastern shoreline borders the Downtown neighborhoods of Seattle and has been heavily modified by historical development; the waterfront land was created by filling in what was once intertidal habitat by constructing bulkheads (seawalls). As a result, the shoreline along Elliott Bay is much steeper than a natural shoreline.[8] Elliott Bay is influenced by the Puget Sound (marine water) and the Duwamish River (freshwater). The ordinary high-water mark (OHWM) is at elevation eight feet.[9]

Ecology has categorized major water bodies of the state according to their water quality standards, which are based on "designated uses" that are to be protected, such as aquatic life and recreation. Designations for marine waters are defined in WAC 173-201A-610, and their associated water quality standards are specified in WAC 173-201A. Elliott Bay is designated as a marine water "excellent for aquatic life use", "primary contact recreational use" and "harvest use for all."[10]

The water quality in Elliott Bay at Outfall 69 is considered Category 2 by Ecology, defined as "waters of concern." Elliott Bay is noted as exceeding water quality standards for Endosulfan (a compound previously used as an insecticide) and bacteria, and is listed as a Category 4B for sediment for samples collected in 1985.[11] Ecology's *Puget Sound Nutrient Source Reduction Project* is a collaborative project focused on reducing human sources of excess nutrients (such as nitrogen and organic carbon) present in the Puget Sound which will have a direct impact on that water quality within Elliott Bay.[12]

Coordinates for Outfall 69 are provided in **Section 3**, **Table 3-1**. The outfall discharges flow through the seawall into Elliott Bay near the intersection of Vine Street and Alaskan Way within downtown Seattle.

4.2 Land

4.2.1 Topography

Basin 69 is located within the Puget Sound Lowland. The Puget Sound Lowland is flanked by the Cascade Mountain Range to the east and the Olympic Mountain Range to the west.

The topography of Basin 69 varies from flat "Upper Basin" that generally slopes towards the waterfront, and a flat area directly adjacent to the seawall as shown in **Figure 4-2**. The Basin generally slopes from northeast to northwest, with the steepest slopes located between Western Avenue and Alaskan Way.

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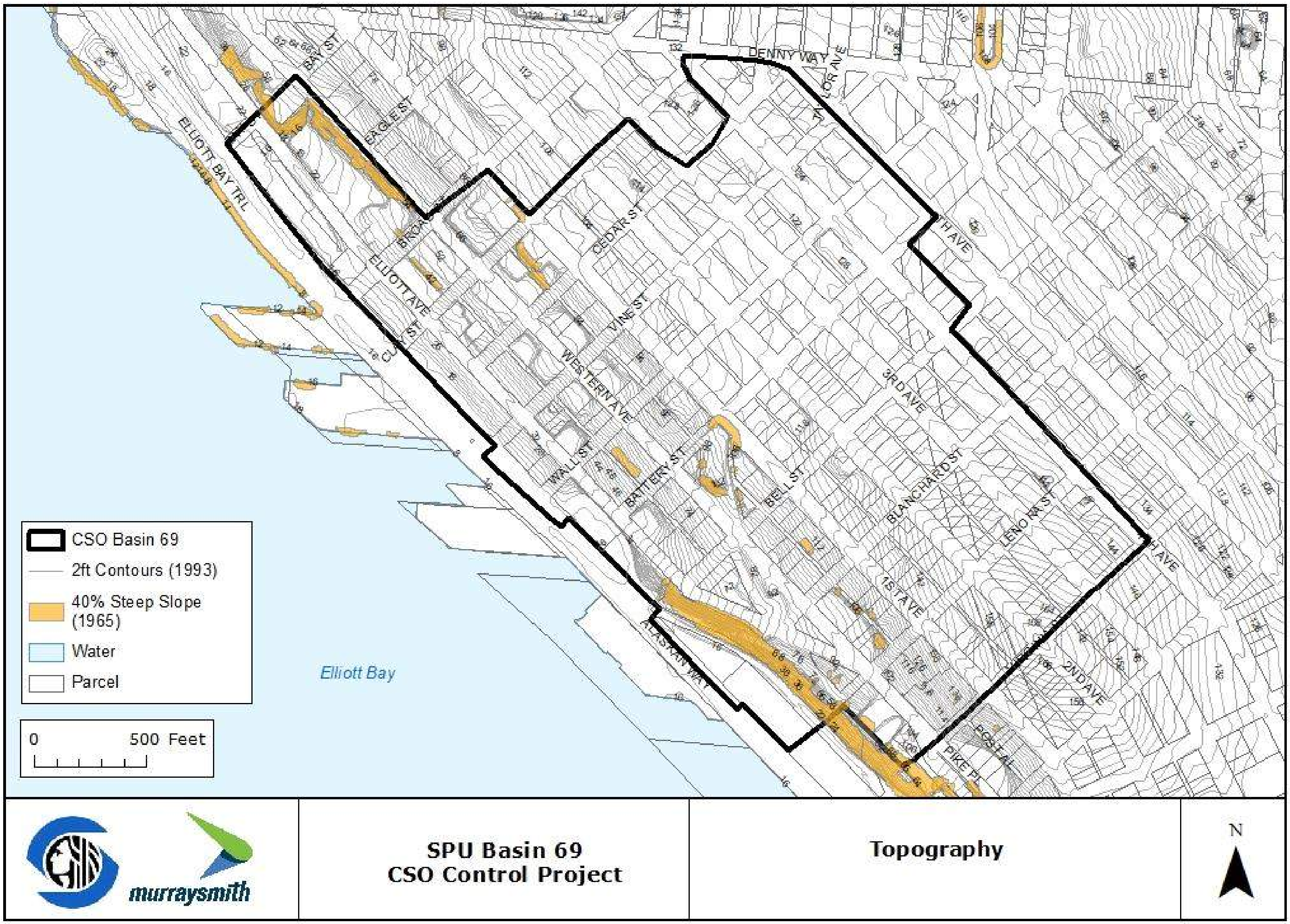
[8] Protecting Seattle's Waterways, Volume 3 Integrated Plan, May 29, 2015, Page 2-3.
[9] Based on City of Seattle GIS data; NAVD 88 Datum.
[10] WAC 173-201A-612.
[11] Washington State Water Quality Atlas, Listing ID 15801 for Endosulfan, Listing ID 60182 for Bacteria, Listing ID 605265 for Sediment on May 13, 2019.
[12] https://ecology.wa.gov/Water-Shorelines/Puget-Sound/Helping-Puget-Sound/Reducing-Puget-Sound-nutrients

Figure 4-2
Basin 69 Topography



4.2.2 Geology, Soils, and Geologic Hazards

Geologic conditions vary greatly throughout the City of Seattle and affect the design and construction techniques that may be feasible for a given project, making it critical to obtain site specific geotechnical data to inform the structural design criteria for a facility. Existing geotechnical boring data available from other projects in the Basin has been compiled and reviewed; most of the data available was gathered between 1966 and 1995. No geotechnical evaluations or investigations have been conducted that are specific to Basin 69 CSO reduction efforts. Given the likelihood of variability of geotechnical conditions specific to project siting, geotechnical investigations are recommended to be conducted prior to final design of the recommended CSO control project.

Geology for Basin 69 presented herein is derived from the Geologic Map of Seattle created in 2005 for the Washington Hydrology Symposium. The Geologic Map of Seattle was created from the compilation of subsurface geologic data from across the City. [13] The upper layer of soils within Basin 69 are anticipated to consist of artificial fill that was regraded from upper portions of the Basin that had higher elevations; these soils are anticipated to be less dense since they have not been glacially consolidated and can be more prone to geologic hazards and geotechnical engineering challenges. Primary soil types in the Basin include Tide Flat Deposits and Pre-Fraser Glaciation Age Deposits. As noted on the City of Seattle's Environmentally Critical Areas map, the area between Elliott Avenue and the seawall is listed as a liquefaction prone area.[14] Basin 69 is located north of the Seattle Fault Zone.

4.2.3 Soil and Groundwater Contamination

Anecdotal evidence suggests the potential for soil contamination, and thereby groundwater contamination, at several sites within Basin 69.

- The site of Olympic Sculpture Park, located along the waterfront at the northern edge of the Basin, was once the site of the Union Oil Company of California (UNOCAL) fuel storage and transfer station. Industrial operations contaminated the soil and groundwater with petroleum products. Beginning in the 1990s, 120,000 tons of petroleum contaminated soil were removed from the site, and an asphalt parking lot was left in place and covered to act as a cap and limit contaminant leaching.[15]

- BNSF operates using railroad tracks located along the Elliott Bay waterfront; the tracks are generally located along Alaskan Way within the Basin. The railroad tracks are a potential source of various types of contamination from heavy metals to diesel fuel.

[13] Troost et al., 2005, http://pubs.usgs.gov/of/2005/1252/
[14] City of Seattle, Liquefiable Soils, http://seattlecitygis.maps.arcgis.com/apps/webappviewer/index.html?id=f822b2c6498c4163b0cf908e2241e9c2.
[15] https://www.landscapeperformance.org/case-study-briefs/olympic-sculpture-park#/sustainable-features

- Old fill material from the seawall construction along the waterfront may also be contaminated, often with creosoted lumber.

A high-level review of geotechnical reports from projects was performed. Between Broad and Bay Streets along Alaskan Way, several reports indicated the presence of hydrocarbon odor in various concentrations (from slight to strong) and the presence of creosote odor. Along Elliott Avenue more than 50 percent of the boreholes/monitoring wells indicated the presence of hydrocarbons.

Prior to design of the selected CSO control project, a Phase 1 site assessment is planned to be completed to evaluate the presence and possible sources of contamination. SPU is prepared for the possibility of encountering contaminated soils or groundwater during construction efforts within Basin 69. The project costs developed for the alternatives considered have included allowances for addressing soil and groundwater contamination.

4.3 Rainfall

Rainfall frequency, duration, and intensity influences the capacity of the combined sewer system and may also impact partially separated and separated sewer collection systems through inflow and infiltration. Total annual rainfall within the City of Seattle typically ranges between 30 and 45 inches and varies within the City limit boundaries. [16] In general, the occurrence of precipitation tends to be lighter and less frequent in the summer months, increases in the fall, peaks during winter, and decreases in spring. Approximately half of the precipitation accumulated during a year falls from October through January, and 75 percent occurs from October through March. Rainfall for July and August is less than five percent of the annual total.

Most of the rainfall in the Seattle region comes from long-duration, moderate-intensity storms covering large areas. Short-duration, high-intensity thunderstorms covering small areas are less frequent. Intensities and total accumulation of precipitation generally are greater at higher elevations. In any given storm, there may be substantial variance in intensity and accumulation at various locations in the City. On average, approximately 160 rainfall events occur yearly. Seattle maintains 17 active rain gauges; Rain Gauge 45-S011, named "Metro-KC Denny Regulating" is located nearest to Basin 69[17]. Having data dating back to 1976, Rain Gauge 11 served as the historical rainfall source for all modeling efforts on this project.[18]

4.4 Air

The EPA has set federal standards for the following six criteria air pollutants: fine and coarse particulate matter, ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead. In the

[16] http://www.seattleweatherblog.com/rain-stats/
[17] http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p2358283.pdf
[18] http://climatechange.seattle.gov/wp-content/uploads/2018/01/Seattle-IDF-Curve-Update-TM_12-29-2017.pdf

Puget Sound area, the Puget Sound Clean Air Agency (PSCAA), along with Ecology, monitors and regulates levels of criteria air pollutants.

The PSCAA releases a periodic report documenting and analyzing air quality data. The most recent report was published in July 2018 and covers data for 2017.[19] One of the key sets of data in the report is the Air Quality Index (AQI), which is a nationwide reporting standard developed by the EPA for the criteria air pollutants. The AQI is used to report daily air quality and categorizes days as good, moderate, unhealthy for sensitive groups, or unhealthy. The 2017 AQI ratings for King County rated 73 percent of the days as good, 22 percent of the days as moderate, 3 percent of the days as unhealthy for sensitive groups, and 2 percent of the days as unhealthy.[20]

4.5 Sensitive Areas

This section describes the existing environment related to sensitive areas within Basin 69.

4.5.1 Wetlands

There are no wetlands located within Basin 69, as shown in **Figure 4-1**. A 0.04-acre area within Myrtle Edwards Park, approximately 800 feet north of Basin 69 delineation, is classified as a PEM1A area (Palustrine, Emergent, Persistent, and Temporary Flooded). This area is not anticipated to be impacted by any alternatives considered for Basin 69 CSO reduction.

4.5.2 Streams

There are no streams within Basin 69.

4.5.3 Shorelines

Elliott Bay forms the western boundary of Basin 69. Alternatives located along Alaskan Way are located within 200 feet of the shoreline of Elliott Bay.

4.5.4 Floodplains

Basin 69 is located entirely above the 100 year FEMA floodplain. The end of Bay Street located within the Basin, between the railroad tracks and Elliott Avenue, is located within the 500 year floodplain. Portions of Alaskan Way and Myrtle Edwards Park are located within the 100 year and 500 year floodplains and may impact some alternatives in this area. These areas are shown in **Figure 4-1**.

[19] https://www.pscleanair.org/DocumentCenter/View/3337/Air-Quality-Data-Summary-2017
[20] https://www.pscleanair.org/DocumentCenter/View/3337/Air-Quality-Data-Summary-2017

4.6 Endangered Species

Elliott Bay is listed as having critical habitat for proposed, threatened, and endangered species occurring within Puget Sound adjacent to Seattle, including various types of salmon, groundfish, and Killer Whales.[21] No in water work is anticipated, work is not expected to be within the critical habitat of these species.

4.7 Public Health

CSOs are a public health concern because they allow unregulated pollutants and untreated sewage into open water bodies. Pollutants include fecal coliforms and bacteria, as well as chemicals and toxins found in stormwater runoff. These pollutants pose a risk to both aquatic life and human health, as Elliott Bay is used for recreation and harvesting of fish and shellfish for consumption. CSO reduction to within the regulatory requirements for Basin 69 will benefit the aquatic life present in Elliott Bay and public health.

4.8 Demographics and Land Use

Basin 69 is zoned as a Downtown area, as shown in **Figure 4-3.** The zoning is further delineated into the following uses:

- Downtown Mixed Residential and Commercial Use
- Downtown Harbor Front, and
- Pike Market Mixed in the southeast corner of the Basin.

The existing population estimate for the Belltown Neighborhood (approximately Basin 69) is 8,455 people as of 2013.[22]

[21] Seattle Biological Evaluation; Prepared by Seattle Public Utilities; Revised May 2015; http://www.seattle.gov/utilities/documents/reports/seattle-biological-evaluation/sbe-document.

[22] SPU Belltown Resident Information, 2009-2013 Census Information.

Figure 4-3
Basin 69 Zoning

Section 5

Existing Sewer System Conditions

This section describes the existing sewer system conditions within Basin 69.

5.1 Infrastructure Overview

Basin 69 includes the following features, as shown in **Figure 5-1**:

- Approximately 31,000 linear feet of sewers ranging from 8 inches to 48 inches in diameter,
- Four high flow paths along Western Avenue, connecting the "Upper" sub-basin to the "Lower" sub-basin,
- One BNSF Railroad Track Crossing to convey sewer flows to the CSO Control Structure,
- Two discharge connections to KC-owned interceptors:
  - The first connection is located near the intersection of Western Avenue and Denny Way and discharges combined sewer flows to the KC Deny Way/Lake Union Tunnel (72 inch diameter),
  - The second connection is located near where Alaskan Way and Bay Street would intersect and discharges to the KC Elliott Bay Interceptor (102 inch diameter),
- One CSO Control Structure with an overflow weir at the intersection of Vine Street and Alaskan Way, and
- CSO Outfall 69 that discharges flow through the seawall into Elliott Bay.

Figure 5-1
SPU and King County Basin Infrastructure

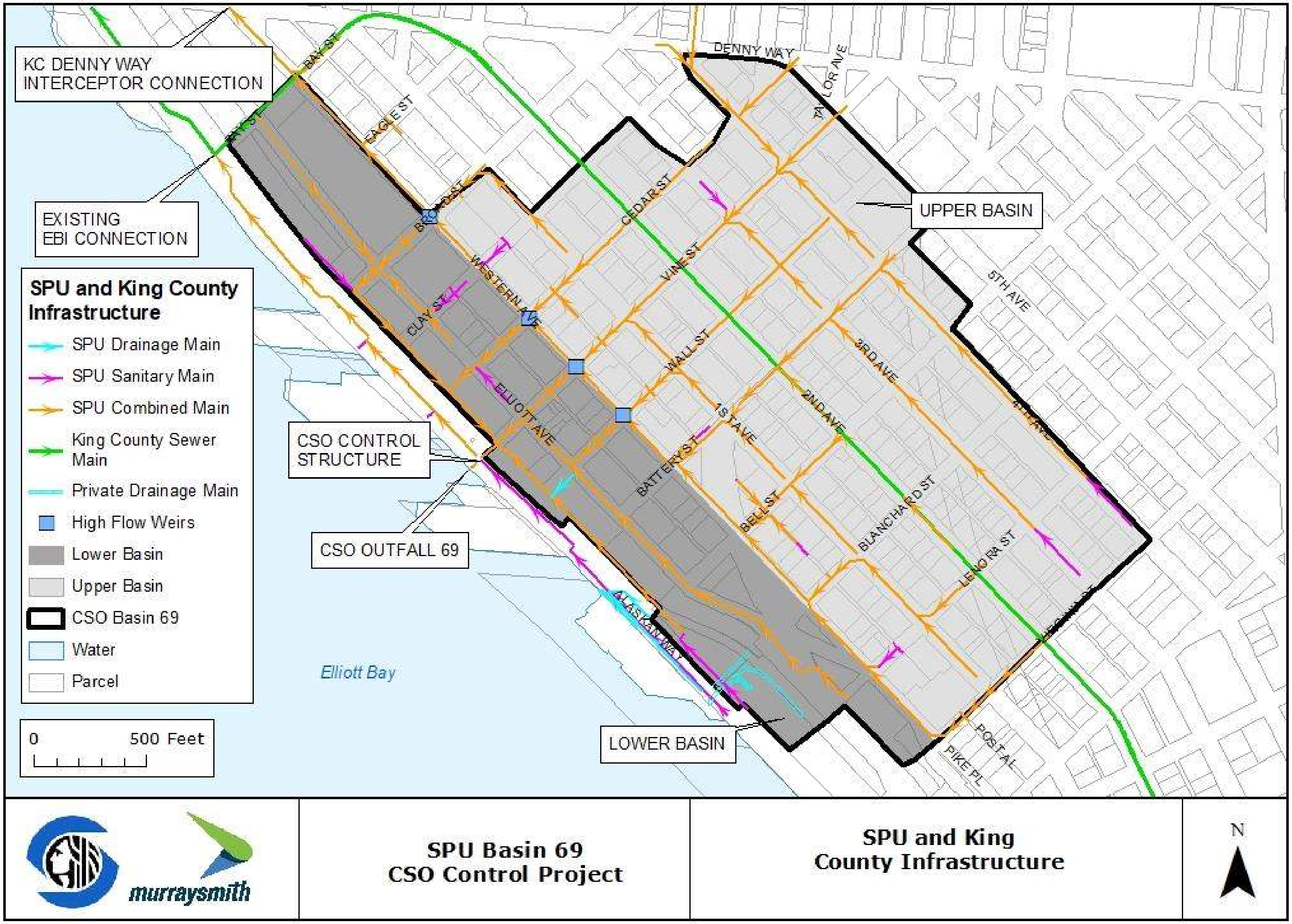
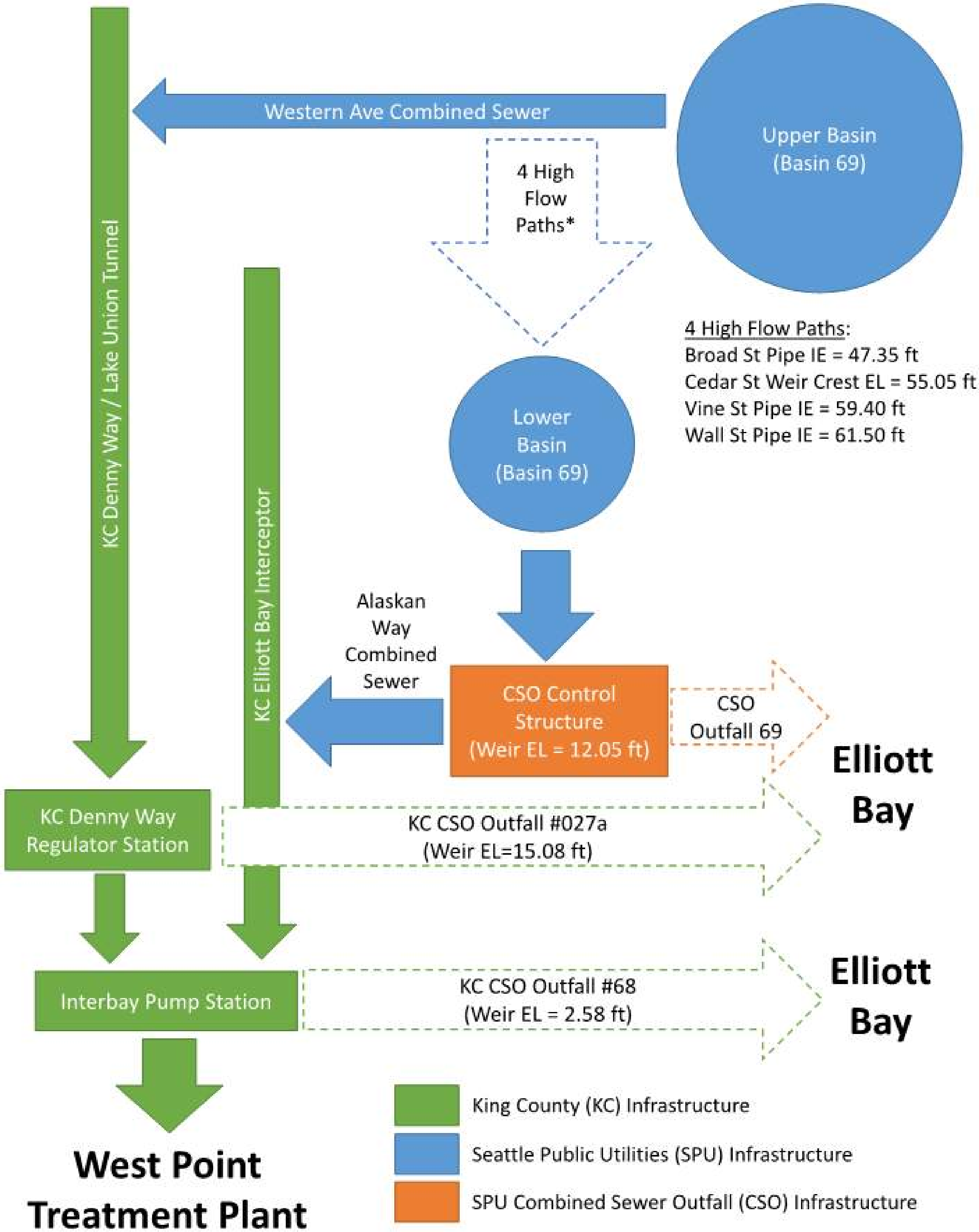


Figure 5-2
Basin 69 Flow Schematic



Note: Solid outlines represent nominal flow paths. Dashed outlines represent high flow paths, only active when flow through normal pathways is limited such as during heavy wet weather events. All elevations are presented in NAVD88 Datum.

5.2 Basin and Flow Routes

During dry weather flows, Basin 69 is divided into two separate sub-basins: the "Lower Basin" located to the west of Western Avenue and the "Upper Basin" located to the east of Western Avenue as shown in **Figures 5-1 and 5-2**. Dry weather flows collected in the "Upper Basin" are collected in a 24 inch/30 inch combined sewer within Western Avenue that conveys flows north and discharges to the KC Denny Way/Lake Union Tunnel at the intersection of Western Avenue and Denny Way. The KC Denny Way/Lake Union Tunnel conveys flows to the KC Denny Way Regulator Station. The "Lower Basin" collects dry weather flows from the "Lower Basin" and conveys them through a 48 inch diameter sewer that crosses beneath the BNSF Railroad Tracks along Alaskan Way. Flows then pass through the CSO Control Structure to the combined sewer in Alaskan Way, which flows north and ultimately discharges to the KC Elliott Bay Interceptor. The KC Elliott Bay Interceptor also conveys flows to the KC Interbay Pump Station. The KC Denny Way Regulator Station and Interbay Pump Station both ultimately pump flows to the KC West Point Treatment Plant (WPTP).

During wet weather events, the sewer levels in Western Avenue rise. As the sewer levels rise, four high flow paths along the Western Avenue allow excess flow to pass from the "Upper Basin" into sewer infrastructure in the "Lower Basin." The four high flow paths are located at the intersections of Western Avenue and Bell Street, Vine Street, Cedar Street, and Broad Street. These high flows paths are elevated sewer connections or weirs. The elevations for the high flow paths are higher in elevation than the dry weather flow HGL by approximately 22-inches on average and are used infrequently, amounting to an average of seven times per year.

As the sewer level in the Alaskan Way sewer rises, the level within the CSO Control Structure also rises. If the level rises above the elevation of the CSO weir located in the CSO Control Structure, a CSO event is triggered and flows discharge to Elliott Bay via CSO Outfall 69. Refer to **Figure 5-2** for a graphic depiction of the Basin sewer flows and critical elevations.

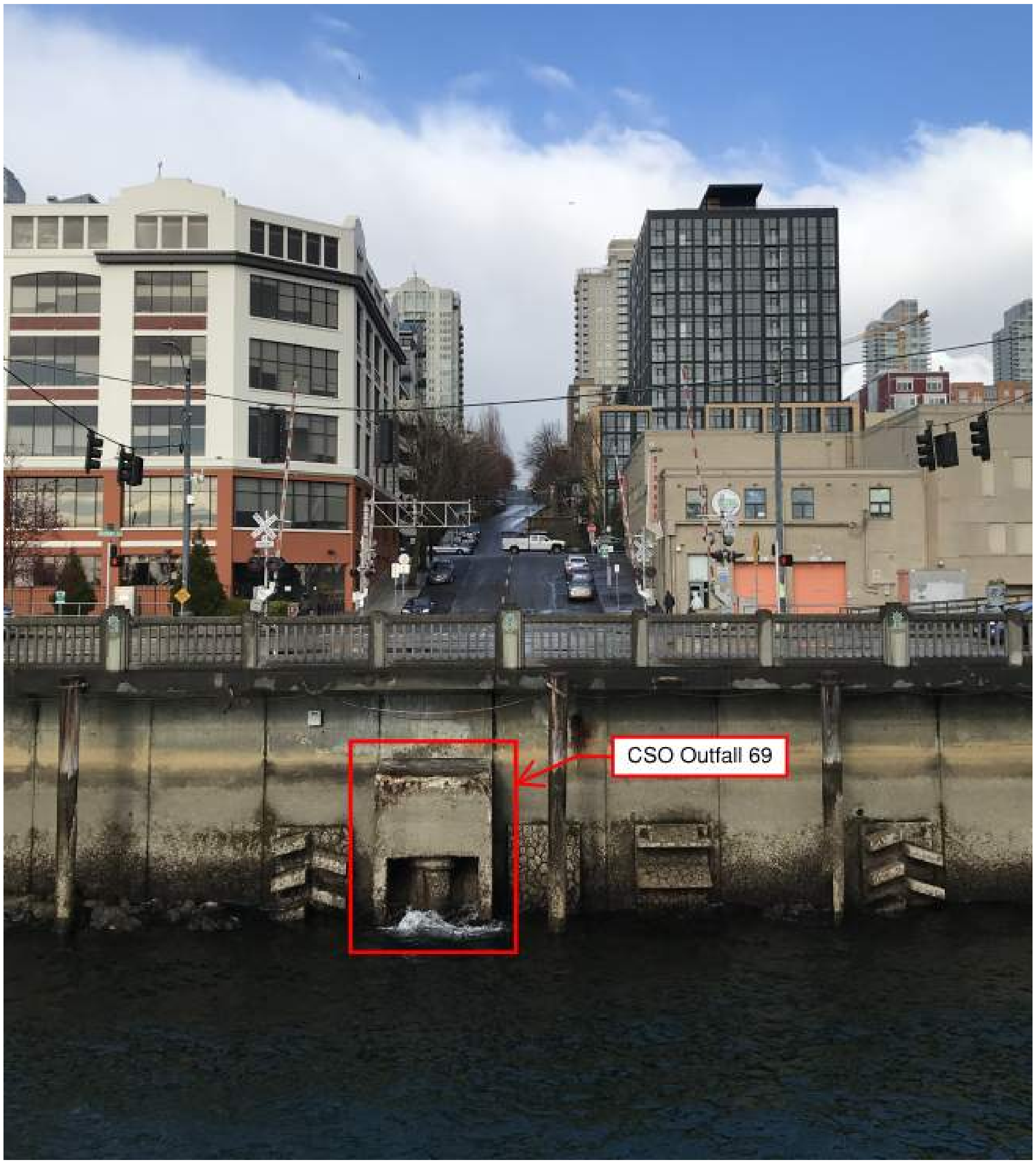
5.3 CSO Facilities

The only CSO facilities located within Basin 69 are the CSO Control Structure that houses the CSO Overflow Weir and the CSO Outfall located at the Intersection of Vine Street and Alaskan Way.

5.4 CSO Outfalls

Basin 69 contains a single CSO outfall, discharging into Elliott Bay. Details for the outfall location are included in **Section 3, Table 3-1**. Outfall 69 is a 24 inch diameter RCP pipe that discharges flows directly through the seawall and is pictured in **Figure 5-3**. There is not currently a flap gate or tide gate to prevent tidal influence on the CSO outfall. However, the weir elevation is located at an elevation of 12.05 feet (NAVD88 Datum), which is 3.04 feet above the mean high water mark (MHWM). Based on recorded CSO events and correlation with precipitation events, it does not appear that tidal changes have resulted in saltwater intrusion (saltwater passing over the CSO weir). Additional analysis will be conducted during final design to identify reasonable measures to protect the system against irregularly high sea-levels or swells.

Figure 5-3
CSO Outfall 69



5.5 Pump Stations

There are no sewage pump stations located within Basin 69.

5.6 Sewer Classification and Pipeline Information

Most sewers in Basin 69 are classified as combined (see **Figure 5-1**). Upstream of Vine Street along Alaskan Way, the sewers are separated, and stormwater is discharged directly into Elliott Bay. Across the Basin, stormwater from downspouts is typically discharged into the combined system.

Sewer mains (both combined and separated) range in diameter from 8 to 48 inches and are typically Vitrified Clay (VC) or Reinforced Concrete (RCP). Approximately 48 percent of the sewers in the Basin are VC and 47 percent are concrete or RCP. Stormwater mains, where they exist, range in diameter from 6 to 12 inches and are also typically VC or RCP.

Table 5-1
Summary of SPU Sewer Infrastructure Age

Installation Date (Year)	Linear Feet of Sewer Piping (LF)	Percent of Basin Sewer Infrastructure (%)
Post 2000	1,700	4
1980-2000	2,532	5
1960-1980	9,600	20
1934-1963	No Data Available	-
Pre 1935	21,964	47
Unknown	11,287	24
TOTAL	47,083	100

Note: Information presented is from SPU 2018 GIS data.

SPU has an ongoing condition assessment program that conducts closed-circuit television (CCTV) inspections of sewers and identifies locations in need or rehabilitation or replacement. The goal of the program is to inspect sewers a minimum of once every ten years. More than 95 percent of the sewers within Basin 69 have been inspected within the last ten years. Through this program, approximately 2,000 linear feet of cured in-place pipe (CIPP) lining rehabilitation work is planned for sewers within Basin 69, over half of which is of VC pipe.

SPU prioritizes the repair work based on the overall risk assessment score (calculated using likelihood of failure and consequence of failure). SPU is taking active measures to rehabilitate and replace aging infrastructure when deterioration is identified. Overall, based on the visual inspection data collected from a large majority of the Basin, infiltration is not anticipated to be a significant relative to other Basins.

5.7 King County Facilities

City infrastructure connects directly to King County (KC) interceptors at two locations that convey flows to the West Point Treatment Plant. The KC Elliott Bay Interceptor is a 102 inch diameter, RCP pipe while the KC Denny Way/Lake Union Tunnel is a 72 inch diameter RCP pipe. The “Upper Basin” connects to the Denny Way/Lake Union Tunnel at Denny Way and Western Avenue, and the "Lower Basin" connects to the KC Elliott Bay Interceptor near the Elliott Bay Trail and Bay Street. The KC Denny Way/Lake Union Tunnel and Elliott Bay Interceptor ultimately send flow to the KC West Point Treatment Plant.

Some of the top alternatives considered for reducing CSO event frequency within Basin 69 require sending additional flow to KC for conveyance and treatment. KC Wastewater Treatment Division modeled these alternatives and found that they are feasible. The collaboration of the two agencies (SPU and KC) on this matter and the anticipated impact on King County-owned downstream facilities is documented in a letter attached as **Appendix H**.

5.8 Wastewater Treatment

West Point Treatment Plant treats wastewater from the Seattle region, including areas as far north as Kenmore and as far south as Allentown. It is one of three regional Treatment Plants owned and operated by King County, including South Plant in Renton and Brightwater Plant near Woodinville.

West Point Treatment Plant treats approximately 90 million gallons per day (MGD) in the dry season and provides secondary treatment for flows up to 300 MGD. The plant also provides primary treatment and disinfection for flows exceeding 300 MGD and up to 440 MGD.[23] The West Point Treatment Plant effluent is discharged through a diffuser located offshore in central Puget Sound.

5.9 Stormwater Drainage System

Basin 69 has limited stormwater drainage infrastructure, primarily located within the Olympic Sculpture Park, Myrtle Edwards Park, and along the bay side of Alaskan Way (east of the BNSF Railroad tracks) as shown in **Figure 5-1**. All other areas discharge stormwater to the combined sewer system. There are cisterns and green infrastructure within the Basin, but they ultimately discharge to the combined sewer system as well.

5.10 Water Quality and Combined Sewer Overflows

The biological and chemical characteristics of effluent from SPU CSOs are summarized in this section. Information is based on the 2007 sediment characterization study and the 2010 CSO supplemental characterization study.

[23] King County, https://www.kingcounty.gov/depts/dnrp/wtd/system/west.aspx

5.10.1 Sediment Characterization Study

SPU's 2005 NPDES permit required preparation of a sediment survey to gather sediment quality data for locations in the vicinity of CSO outfalls. The sediment survey was completed 2007.

Sediment chemistry data are relatively abundant from waters adjacent to commercial and industrial land uses. Although concentrations of some chemicals were higher near CSO outfalls, there were also many other current and historical sources of these chemicals. The 2000 CSO Characterization Study identified no obvious trend linking sediment contamination with a particular CSO. This finding was confirmed in the 2007 Sediment Survey. Ultimately, the 2007 Sediment Survey concluded that no clear cause-and-effect relationship could be inferred relating CSO outfalls to effects on surface sediment quality.

Sediment monitoring must be conducted in the Central Waterfront (CSO Outfall 71) by December 31, 2035. No sediment monitoring near CSO Outfall 69 is planned or required prior to that time.

5.10.2 CSO Characterization Study

Seattle has completed two CSO characterization studies. The first was completed in 2000 for 73 of the 113 permitted CSO outfalls in existence at that time. The study ultimately led the City to abandon, remove, or eliminate CSOs where feasible.

The second CSO characterization study was completed in 2010 and included sampling overflow events from eight CSO outfalls collectively representing greater than 75 percent of the volume of SPU's CSO discharges. Samples were collected between December 2007 and January 2010 and were tested for contaminants. The contaminants were grouped into four classes: conventional, metals, semi-volatile organic compounds, and volatile organic compounds (VOCs). The study conclusions were as follows:

- Concentrations of fecal coliform and ammonia nitrogen (considered as conventional contaminants) were higher at sites that tended to overflow frequently.
- Concentrations of ammonia, fecal coliform, total copper, total zinc were lower when compared to a King County regional characterization study.
- Concentrations of dissolved copper, dissolved zinc, and bis(2-ethylhexl) phthalate were lower than those from the King County study.
- Concentrations of dissolved copper and zinc (classified as metals) were consistent across sampling sites.

- Fluoranthene and phenanthrene were identified as specific parameters to test for but were not detected in samples.[24]

No further CSO characterization studies have been required or conducted.

5.11 Receiving Water Quality

The receiving water quality of Elliott Bay is discussed in **Section 4**.

5.12 Infiltration and Inflow Studies

Flows in the sewer system in Basin 69 consist primarily of four components:

- **Sanitary Sewage:** A mixture of domestic, commercial, and industrial wastewater.
- **Inflow:** Stormwater introduced into a sanitary or combined sewer from roof drains, yard drains, basement drains, street catch basins, or other direct connections.
- **Infiltration:** Groundwater introduced into a sanitary or combined sewer through joints, the pipe material, cracks, and other defects below groundwater level. "Base infiltration" is the term used to denote the rate of infiltration, which may fluctuate very slowly with the seasons.
- **Rain-induced Infiltration:** Groundwater introduced into a sanitary or combined sewer as a result of a recent storm event. The points of entry into the sewer system may be the same as for infiltration, but rain-induced infiltration may include flow contributions from constructed improvements such as foundation drains that are not considered systems defects. The points of entry of rain-induced infiltration may be located above the normal groundwater table and are activated by localized accumulations of rainwater at or near the ground surface during a storm event.

SPU has not performed studies to identify sources of infiltration and inflow for Basin 69 to date. Additionally, Infiltration and Inflow control measures were not recommended in the 2015 *Plan to Protect Seattle's Waterways* (LTCP) because they were not cost-effective. Alternatives that consider eliminating inflow and reducing infiltration are discussed further in **Section 8**.

5.13 Sanitary Surveys for Unsewered Areas

There are no unsewered areas located within Basin 69.

[24] Fact Sheet for NPDES Permit WA-003168-2, City of Seattle's Combined Sewer Overflow System, February 18, 2016.

Section 6

Historical Combined Sewer System Flows

This section summarizes historical combined sewer flows in Basin 69.

6.1 Hydraulic Model Calibration

In 2018, Aqualyze, Inc. (Aqualyze) updated the EPA Storm Water Management Model version 5.1.012 (SWMM5) for Basin 69. The update involved calibration of the model using precipitation and CSO flow monitoring data generally between October 1, 2017 and April 1, 2018. Flow and level monitoring data collected in the field and computer simulated data using the calibrated hydraulic modeling software were utilized to formulate the information presented in this section and Section 7.

6.2 Monitored Basin Flows

SPU has conducted flow monitoring at each of its CSO outfalls since the 1990s. However, the flow monitoring configuration used at Outfall 69 prior to 2008 cannot be confirmed and the pre-2008 flow monitoring data accuracy is questionable.

For the purposes of this Engineering Report, SPU used the recorded Outfall 69 CSO counts for the period 2006 through 2017 and the recorded Outfall 69 CSO volumes for the period 2008 through 2017. From 2006 through 2017 there were 31 recorded CSO events, which results in an average of 2.6 CSO events per year from Outfall 69. For the period from 2008 through 2017, a total CSO volume of 2.2 million gallons (MG) was observed over 25 events resulting in an average of 0.089 MG per CSO event. A summary of recorded CSO events for the Vine Basin is presented in Table 6-1.

Table 6-1
Summary of Observed CSO Events at Outfall 69 – From 2006-2017

Year	Event Start Dates	Annual Count	Annual Volume
2006	Not Available	4	Not Available
2007	Not Available	2	Not Available
2008	6/3	1	68,000 gallons
2009	5/5, 5/19, and 10/16	3	304,000 gallons
2010	9/17	1	215,000 gallons

Year	Event Start Dates	Annual Count	Annual Volume
2011	3/9 and 5/21	2	58,000 gallons
2012	5/21 and 11/19	2	278,000 gallons
2013	8/29, 9/5, and 9/28	3	440,000 gallons
2014	1/11, 3/5, and 9/2	3	207,000 gallons
2015	1/18, 3/15, 8/14, and 9/5	4	436,000 gallons
2016	2/12, 5/19, 10/26, and 11/15	4	66,000 gallons
2017	2/9 and 5/4	2	147,000 gallons

Aqualyze analyzed observed data collected from seven flow meters located throughout Basin 69 to determine average dry weather flows for the Basin. The dry weather flows represent the sanitary sewer portion of the total flow. The average dry weather flow rate for Basin 69 is 1.125 MGD.

Based on monitoring data from 2008 to 2017 (10 year period) the 11th largest overflow event was 68,000 gallons. This value represents a good indicator of the size of the CSO problem in this Basin by looking at historical monitoring data.

6.3 Modeled Basin Flows

An EPA SWMM5 model was developed and calibrated to model system flows in Basin 69 and predict the frequency and volume of CSO events. A long-term simulation using historical rainfall from 1978 to 2018 was performed to evaluate existing conditions. Note that the simulated overflow volumes were generally higher than the observed overflow event volumes; for more detail refer to **Appendix F**.

Section 7

Future Conditions

This section describes the future conditions anticipated in Basin 69 that would impact sewer flows.

7.1 Future Demographics, Land Use and Population Projections

Basin 69 is in the downtown urban center of Seattle where mixed-use commercial and residential redevelopment is allowed and expected. No land use or zoning changes are expected for the Basin area. Redevelopment may result in minor increases to impervious area, but overall, redevelopment will likely result in reduced stormwater inflows to the combined sewer system as construction will trigger stormwater peak runoff controls and/or detention as required by the City of Seattle Stormwater Code.

While zoning is not expected to change, population growth is expected alongside redevelopment of Basin 69. Population growth projections are based on data from the 2017 Puget Sound Regional Council (PSRC) Land Use Vision version 2 dataset. The 2015 total population is used as a baseline with the projected 2040 population used to determine average projected population growth across the Basin. The population data is reported by census tracts; Basin 69 is comprised of five separate census tracts. The projected population growth for the Basin is presented as an area-weighted average of the projected population growth in each census tract. For Basin 69 the average population growth across the Basin is estimated to be 78 percent by the year 2040.

7.2 Projected Dry Weather Flows

Dry weather flows represent the sanitary sewer flows collected within the Basin. Future dry weather flows are anticipated to increase, as population and land use are also expected to change. Future industrial wastewater sources are not anticipated, as the Basin is not zoned for industrial development. Dry weather flows account for a small fraction of the sewer flows during wet weather events in the Basin. Therefore, changes to existing dry weather flows are not anticipated to have a significant impact on modeled system flows for wet weather events or the sizing of the CSO control measures. Additionally, as the current Stormwater Code requirements for stormwater runoff peak flow reduction are implemented, the potential impact to CSO event volume and frequency is expected to be mitigated.

Future average daily dry weather flows for Basin 69 are anticipated to be:

- KC Elliott Bay Interceptor Connection (Alaskan Way): approximately 0.289 MGD
- KC Denny Way/Lake Union Tunnel Connection (Western Ave): approximately 1.371 MGD

7.3 CSO Control Volumes

In 2018, Aqualyze performed preliminary hydraulic modeling for potential CSO reduction projects in Basin 69. SPU and Aqualyze performed an uncertainty analysis using an ACU-SWMM software package developed by MGS Consultants and Aqualyze to consider uncertainty in historical precipitation, predictions from watershed modeling, and residual uncertainties. The uncertainty analysis accounted for climate change through a set of historic and perturbed rainfall timeseries that represent three different climate epochs – year 2015 (also referred to as "current climate"), year 2035, and year 2100. The perturbed 2035 and 2100 rainfall timeseries were developed by altering historic rainfall data to account for climate change by incorporating monthly and intense rainfall scaling factors to project future climate conditions. The resulting time series have increased total rainfall and storm events with increased rainfall intensities.

Based on this analysis SPU selected a control volume of 182,000 gallons for storage and flow reduction alternatives analyzed as part of this Engineering Report; the storm event that produces this control volume is categorized as an 11 year, 7 hour precipitation event for the City of Seattle. This control volume was deemed reasonable by SPU to address the existing and estimated future CSO issue in this Basin. The rational for this decision is based on understanding that the model does a good job of predicting system flows in the Basin but it over predicts overflow volumes when compared to observed events. Flow transfers to KC were instead sized to deliver a peak flowrate for a slightly larger control volume (233,000 gallons); the storm event that produces this control volume is categorized as a 13 year, 7 hour precipitation event for the City of Seattle. The rational for this decision is based on the understanding that incremental cost to deliver a slightly larger flowrate is low and thereby a more conservative flowrate should be used during alternatives analysis.

SPU is confident that the selected control volumes described above will bring the Basin into control (now and in the future). SPU makes this determination based on both observed overflow data from recent years as well as simulated overflow data for the last 40 years. For observed overflow data, as described in **Section 6.2**, the volume required to control the Basin to no more than one overflow per year is approximately 68,000 gallons (matching the volume of the 11th largest overflow in a 10 year period). For simulated overflow data, per information contained in Table 5.2 of **Appendix F**, the volume required to control the Basin to no more than overflow per year is 99,350 gallons for the most recent 20 year period (1998-2017) or 181,900 gallons for the worst 20 year period on record (1996-2015). Both the observed and simulated overflows are smaller than the control volumes of the proposed alternatives herein.

Alternatives discussed in **Section 8** and **Section 9** were preliminarily sized based on these selected control volumes. Additional long-term hydraulic modeling simulations were completed for the top alternatives to verify anticipated control and sizing.

7.4 Future Flow Reduction Options

The City of Seattle currently has requirements for development within capacity constrained basins (like Basin 69) to reduce peak stormwater runoff from private parcels. Overtime, these code requirements are intended to help address the capacity issues within capacity constrained basins. Other concepts for reducing stormwater inflow to the combined sewer are considered as part of the alternative's analysis discussed in Section 8 and Section 9.

7.5 Future Environment Without the Project

Without implementing CSO reduction and control measures, CSO event frequency and volumes are anticipated to continue to increase given predications regarding climate change and variability. CSO events would continue to impact the water quality of Elliott Bay and the Puget Sound; the extent of the impacts is assumed to be similar or greater than the existing conditions due to the predicted increase to CSO frequency and volume.

Section 8

Alternatives Development and Screening

This section describes the approach used to develop and screen alternatives for reducing CSOs in Basin 69.

8.1 Approach

The approach used to identify, develop and select a recommended alternative for reducing CSO events in Basin 69 included a series of meetings, discussions, and technical development conducted from September 2018 through May of 2019. A diverse project team coordinated during all stages of this process. Representatives within SPU from engineering, operations and maintenance, finance, environmental, water quality, green infrastructure, permitting, and public relations and consultant experts in pipe/water engineering, hydraulic modeling, green infrastructure, public involvement, structural engineering, geotechnical engineering, and permitting were involved at all levels of the alternatives identification, development and selection process.

In October 2018, a Brainstorming Workshop was conducted to identify any potential concepts or ideas that could reduce the frequency of CSOs within Basin 69. The team identified several potential alternatives to achieve the CSO reduction goals.

These potential alternatives next went through a screening process, including a Pre-Screening Workshop, a Screening Workshop, and a Public Open House to identify hydraulic feasibility, select criteria important to SPU and the community, and score and rank alternatives. After additional preliminary modeling was conducted to establish hydraulic feasibility, the alternatives were narrowed down to three alternatives selected for detailed development.

A stormwater control focused alternative that considered a multi-pronged approach to achieve control over time was developed with extensive input from GSI experts and its own screening process. This is further detailed in **Section 8.5**.

The final "top" alternatives were developed to approximately ten percent design, including site specific layouts, community impacts, operation and maintenance needs, project costs, and lifecycle costs. A Multi Objective Decision Analysis (MODA) selection process was implemented to identify the recommended alternative that best achieves the project goals, City goals and economic feasibility.

8.2 Alternative Categories

In October 2018, a Brainstorming Workshop was conducted with the purpose of identifying any potential concepts or ideas that could reduce the frequency of CSOs within Basin 69. The team identified potential alternatives to achieve the CSO reduction goals. Alternative solutions were generally grouped into the following categories:

- **Transfer Alternatives:** These alternatives identified ways of conveying excess flows to KC for conveyance to the treatment plant to prevent CSO events. This type of alternative requires either larger or additional connections to KC's existing infrastructure, as well as coordination and approval from KC to receive, convey and treat the additional flows.

- **Storage Alternatives:** These alternatives identified ways of capturing and storing excess flows within the Basin to prevent CSO events. This type of alternative included inline storage, offline storage and storage tank configurations, with a preference for inline storage if it is hydraulically feasible due to fewer equipment requirements and lower operation and maintenance requirements. Potential storage locations were identified based on sewer slopes, topography, City-owned property locations and planning level utility information.

- **Stormwater Infrastructure and Program Improvements:** These alternatives identified ways for reducing or removing stormwater inflow from the combined sewer system. Green stormwater infrastructure (GSI) best management practices (BMPs) such as cisterns and roadway bioretention were considered in additional to programmatic changes to the City's Stormwater Code for capacity constrained basins, and incentive programs that encourage private property owners and developers to reduce peak stormwater discharge rates into the combined sewer system.

- **Treatment Alternatives:** These alternatives identified opportunities to treat excess flows prior to discharge into Elliott Bay. These alternatives would require construction of a wet-weather treatment facility rather than having excess flows conveyed to KC's existing Treatment Plant for treatment.

- **Inflow and Infiltration Reduction Alternatives:** These alternatives identified opportunities to eliminate inflow and reduce infiltration into the sewer system, resulting in less flow to be conveyed during wet-weather events.

8.3 Preliminary Alternatives Screening

After the potential alternatives were captured in the Brainstorming Workshop, all alternatives were vetted at a high level for overall feasibility. **Figure 8-1** shows the complete list of potential alternatives that were brainstormed in the Brainstorming Workshop; alternatives shaded red were eliminated from further consideration for various reasons as summarized in **Table 8-1**. Alternatives were preliminarily screened based on the following general criteria:

- King County Peak Flow Rate Limitations (applicable for the transfer concepts),
- Shallow or deep infiltration (applicable for stormwater management concepts),
- Inability to Achieve CSO Control Within the Basin as a Stand-Alone Option,
- Constructability and Construction Risks,
- Operations and Maintenance Safety and Access,
- Property Acquisition Requirements, and
- Inline Storage Being Preferred to Minimize Equipment, Operation and Maintenance, and Odor Control Requirements.

It was determined that primary CSO control by GSI BMPs was infeasible due to many of the constraints listed above and the inability to infiltrate in the Basin. SPU made the decision that Basin 69 would not be suitable infiltration due to the complex subsurface environment and inability to cost effectively qualify or quantify potential risk to subsurface infrastructure and private property. Basin 69 is a dense urban environment with over a hundred years of significant regrading and redevelopment, making the soils a poor candidate for infiltration. This determination has strong implications for the feasibility of typical GSI BMPs. As a result, GSI BMPs were eliminated as stand-alone concepts. However, SPU felt it was important to pursue alternative solutions so additional concepts incorporating Stormwater Code Changes and Stormwater Management Incentive Programs for private property with GSI BMPs were pursued separately and are discussed in **Section 8.5.**

CSO treatment was eliminated from further consideration for multiple reasons, including:

1. Siting a treatment facility would require property acquisition which is not financially viable for SPU for this CSO control project

2. Treatment facilities typically require odor control, solids handling, water quality monitoring, extensive aesthetic screening, operations staff, a modified or new NPDES permit, and potentially a new outfall. This would be an extensive project and a large undertaking to make work in this Basin that is located within a densely populated urban corridor.

3. CSO and wastewater treatment is not a service category currently provide by SPU and would not maximize the use of existing treatment facilities within the Seattle area.

The I/I reduction alternatives were eliminated from further consideration for the following reasons:

1. To eliminate inflow from the system, a separate storm drain system would need to be constructed. Based on preliminary analysis, to achieve CSO control in the Basin, approximately 30 acres of impervious area (roughly 22 percent of the Basin area) would

need to be separated and discharged to a new storm drain outfall. This would require extensive coordination with private property owners to disconnect roof drains, a new permitted storm drain outfall, new water quality control and monitoring infrastructure, and construction of a new separated storm drain collection system causing disruption to several surface streets within the Basin.

2. To reduce infiltration within the system, two alternatives were identified: in-situ rehabilitation using cured-in place pipe (CIPP) technology or replacement of aging sewer infrastructure. For either alternative, preliminary analysis was conducted to determine if eliminating infiltration would be effective at achieving CSO control in the Basin. Short-term modeling simulations were conducted using the control volume event (11/18/2003 CSO event). When simulations were run eliminating all infiltration, CSO control was not achieved (approximately 31,000 gallons of overflow still occurred for 11/18/2003 event). Additionally, it is not feasible to assume that all infiltration could be eliminated, therefore addressing infiltration would be less effective than the model simulation. Therefore, infiltration reduction was eliminated as a stand-alone alternative. Instead, infiltration reduction measures could be used as an adaptive management measure in the future to obtain further CSO reductions if necessary. Additionally, infiltration reduction measures may be considered during final design if transfer volumes or storage volumes of the selected alternative needed to be reduced due to unforeseen circumstances.

Of the original concepts identified during the Brainstorming Workshop, more than half were eliminated from further consideration as part of the pre-screening process. The remaining alternatives included transfer and storage alternatives and were further evaluated and vetted in a Screening Workshop.

Figure 8-1
Summary of Brainstormed CSO Reduction Concepts

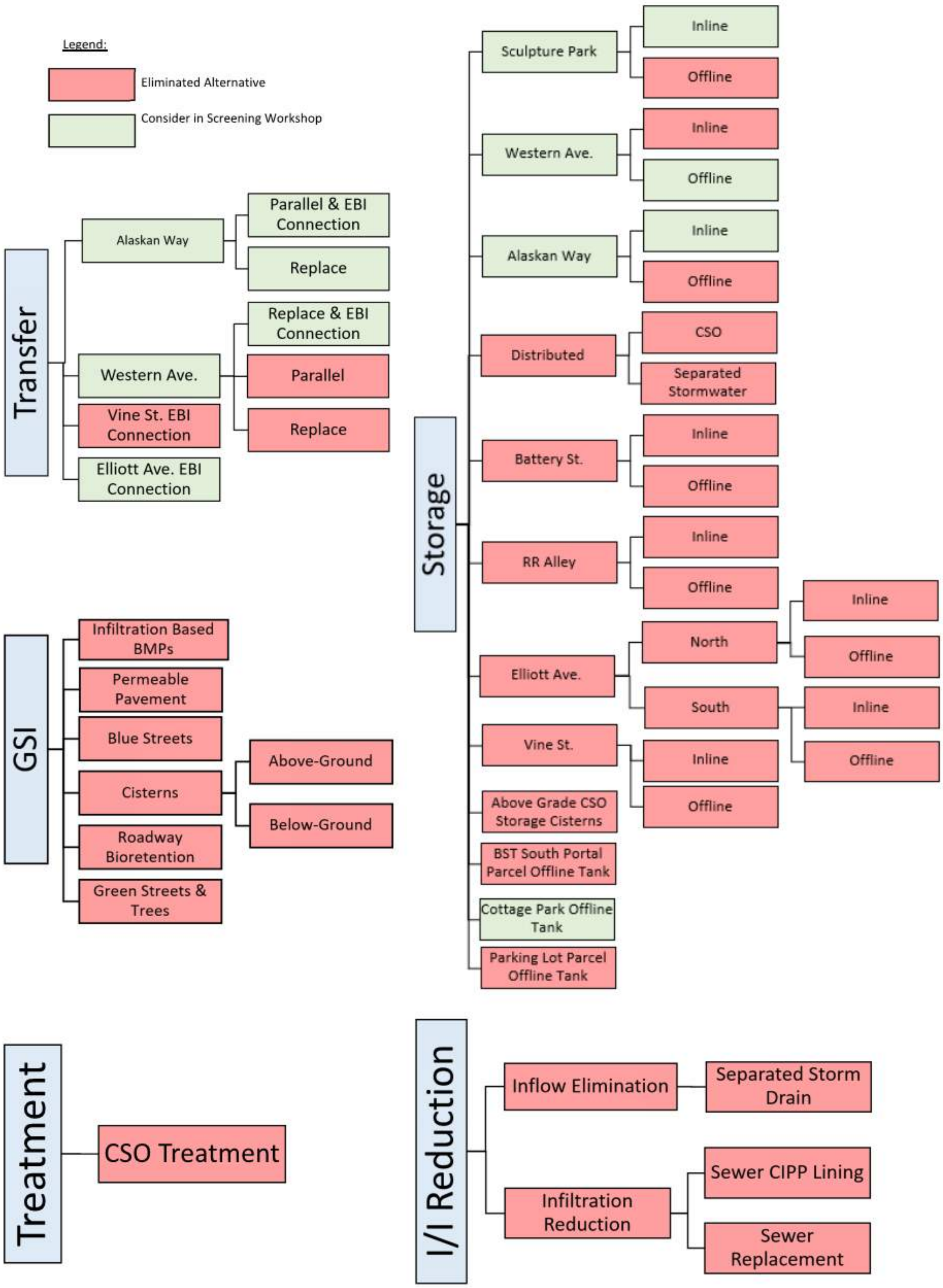


Table 8-1
Summary of Screened Concepts and Reasoning

Concept Category	Concept Description	Reason for Eliminating
Transfer	Western Avenue – Parallel	Results in increased peak flows to KC Denny Way Tunnel which is not acceptable per discussion between KC and SPU.
	Western Avenue - Replace	Will result in increased peak flows to KC Denny Way Tunnel which is not acceptable per discussion between KC and SPU.
	Vine Street – EBI Connection	Requires approx. 100 foot deep drop connection. Concerns with constructability, construction risks, and future access/maintenance.
Storage	Sculpture Park - Offline	Inline storage at this location is hydraulically feasible and preferred to offline storage.
	Western Avenue - Inline	Not hydraulically feasible due to risk of flooding side sewer elevations.
	Alaskan Way - Offline	Inline storage at this location is hydraulically feasible and preferred to offline storage.
	Distributed Storage	Distributed storage would require at least 4 times more linear feet of piping than a 6 foot diameter storage pipe, would require more ROW restoration and larger construction footprint than localized storage.
	Battery Street - Inline	Not compliant with SPU Standards for maximum MH depth.
	Battery Street - Offline	Not compliant with SPU Standards for maximum MH depth.
	Railroad Alley - Inline	Not hydraulically feasible due to risk of flooding side sewer elevations.
	Railroad Alley - Offline	Pump station, odor control and flushing systems would be required to support the storage facility; space limitations between buildings and railroad tracks may be unfeasible.
	Elliott Avenue North - Inline	Not hydraulically feasible due to risk of flooding side sewer elevations.
	Elliott Avenue North - Offline	Pump station, odor control and flushing systems would be required so support the storage facility; ROW space limitations and extensive utility relocations required.
	Elliott Avenue South - Inline	Not hydraulically feasible due to risk of flooding side sewer elevations.
	Elliott Avenue South - Offline	Pump station, odor control and flushing systems would be required so support the storage facility; ROW space limitations and extensive utility relocations required.
	Vine Street – Inline	Not hydraulically feasible due to insufficient capture potential.
	Vine Street - Offline	Not hydraulically feasible due to insufficient capture potential.
	Above Grade Sewer Cisterns	Requires exposed sewer piping, flushing and odor control, and would be difficult to site in a densely populated area. Also has concerns regarding public perception.
	BST South Portal Tank	Not hydraulically feasible due to insufficient capture potential.
	Parking Lot Parcel - Offline Tank	Requires property acquisition that is not financially feasible for SPU for this project.

8.3.1 Consideration of Trenchless Construction Methods

Trenchless construction methods for the installation of new pipelines generally consist of advancing a pipeline through drilling, boring, tunneling, or ramming from one point to another, wherein excavation of the overlying ground in between the two end points is not required. Trenchless methods generally considered for this project, subject to site specific soil conditions, site constraints, and acceptable risk, are as follows: microtunneling, open shield pipe jacking, auger boring, pipe ramming, and horizontal directional drilling.

Site specific soil conditions are directly related to the achievable diameter, length, and feasibility for a given trenchless method. The limited available geotechnical information for Basin 69 indicates that the general soil conditions in the project area consist of relatively loose fill soils underlain by glacial till and lacustrine soils. The general groundwater table was considered to have the potential to be perched upon dense, lower permeability soils at depth based upon historical borings and experience in similar soils. The geotechnical information evaluated during pre-design was historical in nature and not considered project specific.

Horizontal directional drilling (HDD) is typically a surface to surface method, which was not initially considered compatible with the requisite alignments for storage or transfer. Further, the required pipeline diameter would require the use of a maxi-sized drilling rig, with limited flexibility in geometry given the relatively short length of pipe required (600 feet). The result would be that the surface to surface nature of HDD would be negated by the need to drill from pits or shafts excavated at the entrance and exit locations. HDD was not considered a candidate for further consideration.

Microtunneling, open shield pipe jacking, auger boring, and pipe ramming consist of either thrusting or hammering a pipeline into the ground from a pit or shaft. For the purposes of storage, the pits were anticipated to be near the volume required for the storage facility, therefore the methods were not further evaluated for the purposes of storage. The required drive length to realize the benefits of the trenchless installation by eliminating excavation between the entry and exit was approximately 600 feet. This length is beyond typical installation lengths for auger boring and pipe ramming based upon the installations that have been achieved in the past.

Microtunneling and open shield pipe jacking consist of advancing steel casing behind a tunneling tool which excavates at the face of the tunnel, either with a remote, pressure balanced face (microtunneling) or with manual workers operating machinery at the face of an open shield (open shield pipe jacking). The approximate transition between very soft fill soils and dense glacial and non-glacial material was anticipated to be at a depth approximately equal to the depth required for a transfer alignment to take advantage of a gravity fed system. Microtunneling has historically had challenges in mixed face conditions, wherein the upper portion of the microtunnel boring machine (MTBM) encounters soft soil with little resistance and the lower portion of the MTBM encounters very dense soil with a high resistance. Historically, the result has been loss of grade and potential over-excavation over the pipeline, placing overlying utilities and features at risk.

Therefore, microtunneling was not considered for further evaluation given the geotechnical conditions at the required pipeline elevation.

Open shield pipe jacking is not typically used beneath the groundwater table, and dewatering is challenging when potential contaminated groundwater is present and overlying features may be subject to dewatering induced settlement. Based upon historical borings, the groundwater was anticipated to be above the required pipeline elevation. There is the potential to use open shield pipe jacking within an aquitard or aquiclude soil layer which does not readily transmit water. However, the potential layers with such characteristics (dense glacial soils) were anticipated to be below the minimum system elevation required to take advantage of a gravity system, therefore open shield pipe jacking was not considered for further evaluation.

Based on this preliminary analysis, alternatives were evaluated assuming open trench construction, as trenchless construction methods would not be feasible or financially beneficial to consider for this project within Basin 69.

8.4 Further Screening

Of the original concepts identified during the Brainstorming Workshop, four transfer concepts and four storage concepts remained for further consideration. The alternatives considered during the Screening Workshop included:

Transfer Alternatives:

1. **Alaskan Way Parallel Flow Transfer**: Requires installation of a new sewer from the CSO Control Structure to KC's Elliott Bay Interceptor.

2. **Alaskan Way Replace Flow Transfer**: Requires replacement and upsizing of the existing sewer from the CSO Control Structure to KC's Elliott Bay Interceptor.

3. **Western Avenue Replace Flow Transfer**: Requires replacement and upsizing of the existing sewer in Western Ave to KC's Denny Way/Lake Union Tunnel.

4. **Elliott Avenue New Flow Transfer**: Requires installation of a new sewer to convey flows to KC's Elliott Bay Interceptor.

Storage Alternatives:

1. **Sculpture Park Inline Storage**: Requires replacement of an existing segment of sewer pipe with a large diameter section intended for storage. The segment to be replaced is in the ROW near Sculpture Park.

2. **Western Avenue Offline Storage**: Requires location of a large diameter storage pipe adjacent to the existing sewer. The storage segment to be installed is in the ROW of Western Avenue.

3. **Alaskan Way Inline Storage**: Requires replacement of an existing segment of sewer pipe with a large diameter section intended for storage. The segment to be replaced is in the ROW of Alaskan Way.

4. **Cottage Park Tank Storage**: Requires construction of an offline storage tank on a parcel owned by the City of Seattle. The parcel is used as a public park called Belltown Cottage Park.

These remaining concepts were vetted in a Screening Workshop held on November 16, 2018 to narrow the concepts down to four alternatives that would be considered in greater detail.

At the Screening Workshop, each alternative was presented, and project implications were discussed. Alternatives were then scored and ranked based on a set list of criteria. Transfer and storage alternatives were considered separately but scored on the same criteria. The criteria used to evaluate the remaining alternatives and their weighting (relative importance, with a larger weighting factor indicating greater importance) are summarized in **Table 8-2**.

Table 8-2
Summary of Screening Criteria used for Alternatives Selection

Criteria	Criteria Objective	Impact	Weight
Drainage Area Managed	Capture potential efficacy for reducing CSO events to ≤1 event/year based on the drainage area managed.	Long-Term	3
Constructability and Construction Risk	Capture how complex the alternative construction is anticipated to be and degree of anticipated risks.	Short-Term	2
Construction Impact Area	Capture how extensive the construction footprint is anticipated to be, which also correlates to traffic and parking impacts.	Short-Term	2
Adverse Community Impacts	Capture how the alternative will adversely impact the community, e.g. businesses, residences, service providers, park access, and parking garage access.	Short-Term	2
Community Benefits	Capture the potential for community benefit beyond CSO reduction, e.g. alignment with SPU mission, new green space, street greening, and water quality improvements, public safety improvements, alignment with rehabilitation, etc.	Long-Term	3
Compatibility with GSI and/or Greening	Capture how compatible the alternative is with incorporating GSI or "Greening" improvements.	Long-Term	1
Operation and Maintenance Complexity	Capture the degree of complexity anticipated for system operation and maintenance.	Long-Term	2
Operation and Maintenance Safety	Capture the degree of safety anticipated for operation and maintenance staff.	Long-Term	3

Criteria	Criteria Objective	Impact	Weight
Utility and Agency Coordination	Capture the degree of difficulty anticipate for coordination with other utilities, such as crossings or relocations.	Short-Term	2
King County Approval Required	Capture the requirement for King County to accept additional flow volume.	Short-Term	1

8.4.1 Alternative Scoring and Ranking

The goal of the Screening Workshop was to select two transfer and two storage alternatives for further development and consideration. Transfer and storage alternatives were scored separately based on the same criteria. Multiple project team members representing different subject matters were present for the screening workshop and all had a say in the final scoring and ranking that was assigned to each alternative.

8.4.1.1 Transfer Alternatives Scoring and Ranking

Scores for transfer alternatives are provided in **Table 8-3**. The highest scoring transfer alternative was Elliott Avenue alternative for both weighted and unweighted scores. The Western Avenue alternative scored the lowest for both weighted and unweighted scores. Both flow transfer alternatives in Alaskan Way scored the same for weighted and unweighted scores. The Alaskan Way parallel alternative was selected to move forward, as opposed to the replacement alternative, for three main reasons:

1. The existing sewer within Alaskan Way was recently inspected and was in good condition,
2. Most of the Basin sewer flow travels through the Alaskan Way sewer; replacement would require extensive sewer bypassing throughout construction whereas a new parallel sewer would not have this requirement, and
3. The existing sewer is within close proximity to a cast iron water main that would likely need to be replaced if the sewer is replaced, due to minimum separation requirements between new water mains and sewers.

Table 8-3
Transfer Alternatives Scoring Results

Screening Criteria	Criteria Weighting	Alaskan - Parallel	Alaskan - Replace	Western - Replace	Elliott - New
Drainage Area Managed	3	3	3	3	3
Constructability and Construction Risk	2	2	2	1	3
Construction Impact Area	2	2	2	1	2
Adverse Community Impacts	2	2	2	1	2
Community Benefits	3	2	2	1	3
Compatibility with GSI and/or Greening	1	2	2	1	3

Screening Criteria	Criteria Weighting	Alaskan - Parallel	Alaskan - Replace	Western - Replace	Elliott - New
Operation and Maintenance Complexity	2	3	3	3	3
Operation and Maintenance Safety	3	2	2	1	2
Utility and Agency Coordination	2	2	2	1	2
King County Approval Required	1	1	1	1	1
UNWEIGHTED SCORE		**21**	**21**	**14**	**24**
WEIGHTED SCORE		**46**	**46**	**31**	**52**

Based on the outcome of the scoring results presented in **Table 8-3**, the two transfer alternatives that were selected for additional evaluation were:

1. **Elliott Avenue New Flow Transfer**: Requires installation of a new sewer to convey flows to KC's Elliott Bay Interceptor.

2. **Alaskan Way Parallel Flow Transfer**: Requires installation of a new sewer from the CSO Control Structure to KC's Elliott Bay Interceptor.

8.4.1.2 Storage Alternatives Scoring and Ranking

Scores for storage alternatives are provided in **Table 8-4**. The highest scoring storage alternative was the Sculpture Park Inline Storage alternative for the weighted scores. The Sculpture Park Inline and Alaskan Way Inline storage alternatives tied with the highest unweighted scores. The Sculpture Park Inline Storage alternative ranked one point higher than the Alaskan Way Inline Storage alternative for weighted scores. The Western Avenue Offline storage alternative scored the lowest out of all the alternatives for unweighted and weighted scores.

Table 8-4
Storage Alternatives Scoring Results

Screening Criteria	Criteria Weighting	Sculpture Park - Inline	Western Avenue - Offline	Alaskan Way - Inline	Cottage Park - Offline
Drainage Area Managed	3	3	3	3	2
Constructability and Construction Risk	2	2	2	2	2
Construction Impact Area	2	3	1	2	3
Adverse Community Impacts	2	2	2	2	2
Community Benefits	3	1	1	2	1
Compatibility with GSI and/or Greening	1	1	2	2	3
Operation and Maintenance Complexity	2	3	1	3	1
Operation and Maintenance Safety	3	3	1	2	2
Utility and Agency Coordination	2	2	1	2	2
King County Approval Required	1	3	3	3	3
UNWEIGHTED SCORE		**23**	**17**	**23**	**21**
WEIGHTED SCORE		**49**	**34**	**48**	**41**

Based on the outcome of the scoring results presented in **Table 8-4**, the two storage alternatives that were selected for additional evaluation were:

1. **Sculpture Park Inline**: Requires replacement of an existing segment of sewer pipe with a large diameter section intended for storage. The segment to be replaced is in the ROW near Sculpture Park.

2. **Alaskan Way Inline**: Requires replacement of an existing segment of sewer pipe with a large diameter section intended for storage. The segment to be replaced is in the ROW of Alaskan Way.

After additional hydraulic modeling efforts were conducted, it was determined that the Sculpture Park Inline Storage alternative was not feasible without upsizing the entire sewer from the CSO Control Structure to the storage facility. Because of this change to the alternative definition, this alternative was now very similar to the Alaskan Way Transfer alternative that required removal and replacement of the existing sewer in Alaskan Way, which was eliminated from consideration. As a result, this alternative was eliminated from further consideration, leaving two transfer alternatives and one storage alternative for evaluation. Once the Sculpture Park Option was eliminated, SPU held further discussions to determine if another storage option should be moved forward for consideration. The next highest ranking storage alternative was the Cottage Park Offline Storage Option. Due to the significant difference in community impact, infrastructure requirements, department approvals and coordination, and long-term maintenance that would be required by the Cottage Park Offline Storage Option, it was universally agreed upon that it would not have any likelihood of being selected as the recommended option if any of the other three "top alternatives" were feasible. Therefore, it was decided not to move this alternative forward for further development and consideration.

8.5 Stormwater Control Focused Alternative Development

As discussed previously in **Section 8**, individual GSI BMPs were not considered as stand-alone alternatives for controlling CSO events in Basin 69. However, SPU is a community-centered utility and is committed to seeking solutions that achieve multiple City goals to provide the highest value possible to rate-payers. For these reasons, SPU chose to pursue development of additional concepts targeted at stormwater control. This section discusses the development of the stormwater control focused alternative.

8.5.1 Desktop Analysis and Site Walk

Initially, a desktop analysis was performed using available geographic information system (GIS) and open source data to subjectively determine areas with the greatest potential for implementing localized stormwater control. Half blocks within Basin 69 were rated and ranked on attributes such as parking impacts, utility conflicts, existing trees, street slopes, driveways, and existing planter strips. Areas that rated highly were prioritized for a site walk for visual inspection. During the site walk, it became clear that a desktop analysis in this type of urban environment, with data that was approximately three years old and at varying levels of detail and accuracy, would not sufficiently identify effective GSI locations.

8.5.2 Stormwater Control Implementation Concepts

Early in concept development, it became clear that stormwater control measures implemented within Basin 69 would need to be significant to meet the CSO event reductions needed within the Basin. So significant, that stormwater control measures seemed infeasible given the constraints posed by the dense urban setting of the Basin and the extensive amount of utility relocations, mass transit coordination, and street parking that would need to be eliminated to accommodate typical GSI BMPs. Rather than focus on locating individual GSI BMPs, such as bioretention cells, SPU considered larger programmatic ways of implementing change. The following concepts were identified as potential methods for meeting the Basin CSO reduction goals:

1. **Stormwater Code Change**: Modify the current City of Seattle Stormwater Code requirements for combined sewer basins that are capacity constrained to require more effective control of stormwater runoff. Construction activities on private parcels (referred to as site development or redevelopment) would trigger these requirements. This type of programmatic change would result in control of stormwater inflow (to the combined sewer system) over time; impacts to CSO events would depend on the rate of private parcel redevelopment.

2. **ROW Incentive Program**: Create an incentive program that encourages private parcel owners to control stormwater runoff from the ROW adjacent to their property. The incentive would be for stormwater control that goes beyond what is required in the City of Seattle Stormwater Code. Through the incentive program, funding support would be provided by SPU to property owners to offset some of the construction costs of installing stormwater controls (such as bioretention cells). It is most likely that these ROW stormwater runoff controls would pair with private parcel redevelopment. Since the stormwater controls would be located within the ROW, the City would assume ownership and maintenance responsibility after they are constructed and commissioned.

    a. **SPU Pilot Program**: SPU would fund and install a limited number of ROW stormwater controls upfront to help initiate the incentive program and demonstrate implementation and control expectations.

3. **Alley Retrofit and Revitalization Incentive Program**: Create an incentive program that encourages private parcel owners to control stormwater runoff from their property and adjacent ROW by installing stormwater storage within the alley adjacent to their property. The downtown community has identified alley improvements as a desired benefit. The alley retrofit and revitalization incentive program would give the adjacent property owners the opportunity to make aesthetic improvements to the alley, add more usable space, and add other features for their properties and the community. Through the incentive program, funding support would be provided to the property owner by SPU

to offset construction costs of installing some or all the stormwater storage. As the stormwater storage would be located within the ROW, the City would assume ownership and maintenance responsibility after construction and commission.

   a. **SPU Pilot Program**: SPU would fund and install a limited number of alley retrofits with stormwater storage upfront to help initiate the incentive program and demonstrate implementation and control expectations.

4. **GSI Retrofit Incentive Program**: Create an incentive program that encourages private parcel owners to control stormwater runoff from their property by adding GSI BMPs to their property. The GSI BMPs could be on-site lined (non-infiltrating) bioretention, green roofs, and/or rainwater harvesting systems. Through the incentive program, funding support would be provided to the property owner by SPU to offset construction costs of installing the stormwater control measures. As the stormwater control measures would be located on the private parcel, the property owner would be responsible for maintenance of the infrastructure.

CSO reduction for all concepts discussed in this section would happen gradually, likely over a period of over 80 years. It would be unlikely these concepts would result in CSO control within the timeline required by the Consent Decree.

8.5.3 Hydraulic Modeling

Hydraulic modeling for several stormwater control measures was performed.

First, EPA SWMM modeling was conducted to better understand the correlation of stormwater runoff to area managed. In theory, if stormwater runoff from a precipitation event that results in a CSO event could be controlled, then the CSO event would be eliminated. However, not all the stormwater from the entire Basin would be managed by GSI. Therefore, this modeling helped determine how much area, and thereby stormwater, would need to be managed to effectively reduce the frequency of CSO events. To supplement this effort, MGS Flood modeling was conducted to create a baseline of possible stormwater control achieved by individual BMPs, such as ROW bioretention cells and alley stormwater storage facilities.

A spreadsheet tool was developed using this modeling analysis to identify the anticipated control volume reduction that could potentially be achieved by stormwater code and control programs. The tool allowed for multiple assumptions, including the anticipated rate of redevelopment, the anticipated rate of participation in the incentive programs, the capacity of bioretention cells, the capture area of bioretention cells, the capacity of alley stormwater storage facilities, and the capture area of alley stormwater storage facilities.

Next, the team conducted long-term EPA SWMM modeling simulations. By comparing results from the EPA SWMM long term simulation and the spreadsheet analysis tool, it was found that the spreadsheet analysis tool over-predicted the anticipated control volume reduction by approximately 10 percent. Therefore, the stormwater management alternatives were adjusted to make up the difference.

8.5.4 Stormwater Control Alternatives

Based on the modeling results of the various stormwater code changes and control programs, the following two alternatives were identified to control CSO events:

1. Green/Grey Alternative: This alternative includes stormwater control measure and combined sewage storage measures. The alternative includes the following components:

    a. **Initial Construction Effort (by SPU):** These measures would be constructed prior to 2026.

        i. Installation of two stormwater storage facilities in alleys to pilot the Alley Retrofit and Revitalization Incentive Program.

        ii. Installation of 16 bioretention cells to pilot the ROW Incentive Program.

        iii. Installation of a combined sewage storage facility in Alaskan Way (similar to the Alaskan Way Inline Storage alternative, but smaller volume).

    b. **Programmatic Implementation:** These measures would result in CSO control over time, achieving a 20 year moving average of no more than one CSO event per year by the year 2100.

        i. Stormwater Code Change (required of all private parcel development within Basin 69 and other combined sewer basins that are capacity constrained).

2. Green Alternative: This alternative includes stormwater control measures only. The alternative includes the following components:

    a. **Initial Construction Effort (by SPU):** These measures would be constructed prior to 2026.

        i. Installation of two stormwater storage facilities in alleys to pilot the Alley Retrofit and Revitalization Incentive Program.

        ii. Installation of 16 bioretention cells to pilot the ROW Incentive Program.

    b. **Programmatic Implementation:** These measures would result in implementation over time, resulting in CSO reduction to a 20 year moving average of no more than one event per year by the year 2100.

        i. Stormwater Code Change (required of all private parcel development within Basin 69 and other combined sewer basins that are capacity constrained).

ii. Alley Retrofit and Revitalization Incentive Program, assuming participation resulting in nine alley stormwater storage facilities.

iii. ROW Incentive Program, assuming participation resulting in 32 bioretention cells.

8.5.5 Alternative Screening

SPU chose to not pursue either of the stormwater control alternatives identified above for the following main reasons:

1. There were several layers of assumptions made to develop these alternatives. As a result, there is significant uncertainty in the overall timeline and potential efficacy of the programs and changes identified.

2. Both alternatives would require a long-range view for meeting CSO reduction goals. This is not consistent with the Consent Decree requirements.

While these specific alternatives were not selected for further evaluation as part of Basin 69 CSO reduction efforts, SPU and the City of Seattle will continue to look for ways to incorporate stormwater control measures within this Basin and other combined sewer basins throughout the City. Some of the concepts developed may also be considered in the future as adaptive management solutions to improve long-term control in the Basin.

8.6 Section Summary

Following the screening process, three alternatives remained for consideration: Alaskan Way Parallel Flow Transfer, Elliott Avenue New Flow Transfer, and Alaskan Way Inline Storage. These alternatives are evaluated in more detail in the **Section 9**.

Section 9

Description of Top Alternatives

This section describes the top alternatives that were selected for further evaluation and consideration. The recommended alternative is selected from these remaining top alternatives. The selected recommended alternative is described in greater detail in Section 10.

9.1 List of Top Alternatives

The top alternatives identified by through the screening process are summarized in Table 9-1. A base case scenario is included and represents a "No Action Alternative". Alternatives are described in more detail in the following subsections herein.

Table 9-1
Summary of Top Alternatives for Basin 69 CSO Reduction

Alternative	Description
Base Case	Existing conditions model; establishes results of "No Action Alternative" where no improvements are made to reduce CSO event frequency.
Alaskan Way Parallel Flow Transfer	Installation of approximately 1,800 linear feet of 24 inch diameter gravity sewer pipe within the ROW of Alaskan Way from the existing CSO Control Structure at its intersection with Vine Street to the KC Elliott Bay Interceptor near the end of Bay Street. This alternative requires approval from King County, a new connection to the KC Elliott Bay Interceptor, CSO Control Structure modifications and work along the shoreline in an area of ROW utilized as a public park space. Discharges to KC's Elliott Bay Interceptor are controlled passively.
Elliott Avenue New Flow Transfer	Installation of approximately 1,800 linear feet of 24 inch diameter gravity sewer pipe within the ROW of Elliott Avenue from its intersection with Vine Street to the KC Elliott Bay Interceptor near Bay Street. This alternative requires approval from King County, a new connection to the KC Elliott Bay Interceptor, and a new diversion vault and weir structure at the intersection of Vine Street and Elliott Avenue. Discharges to KC's Elliott Bay Interceptor are controlled passively.
Alaskan Way Inline Storage	Installation of approximately 700 linear feet of 8 foot diameter storage pipe installed inline downstream of the CSO Control Structure, providing approximately 263,000 gallons of combined sewage storage. This alternative requires CSO Control Structure modifications, removal of the existing sewer, extensive sewer bypassing, and replacement of the adjacent cast iron water main. Storage and discharge of stored flows are controlled passively.

9.2 Base Case Existing Condition (No Action Alternative)

The No Action Alternative maintains the existing status of Basin 69 combined sewer infrastructure. If this alternative is selected, CSOs will likely continue to occur at the same frequency as is current condition (a 20 year moving average that consistently exceeds one CSO event per year). Therefore, this alternative is unacceptable and eliminated from further discussion.

9.3 Alternative 1 – Alaskan Way Parallel Flow Transfer

9.3.1 Description

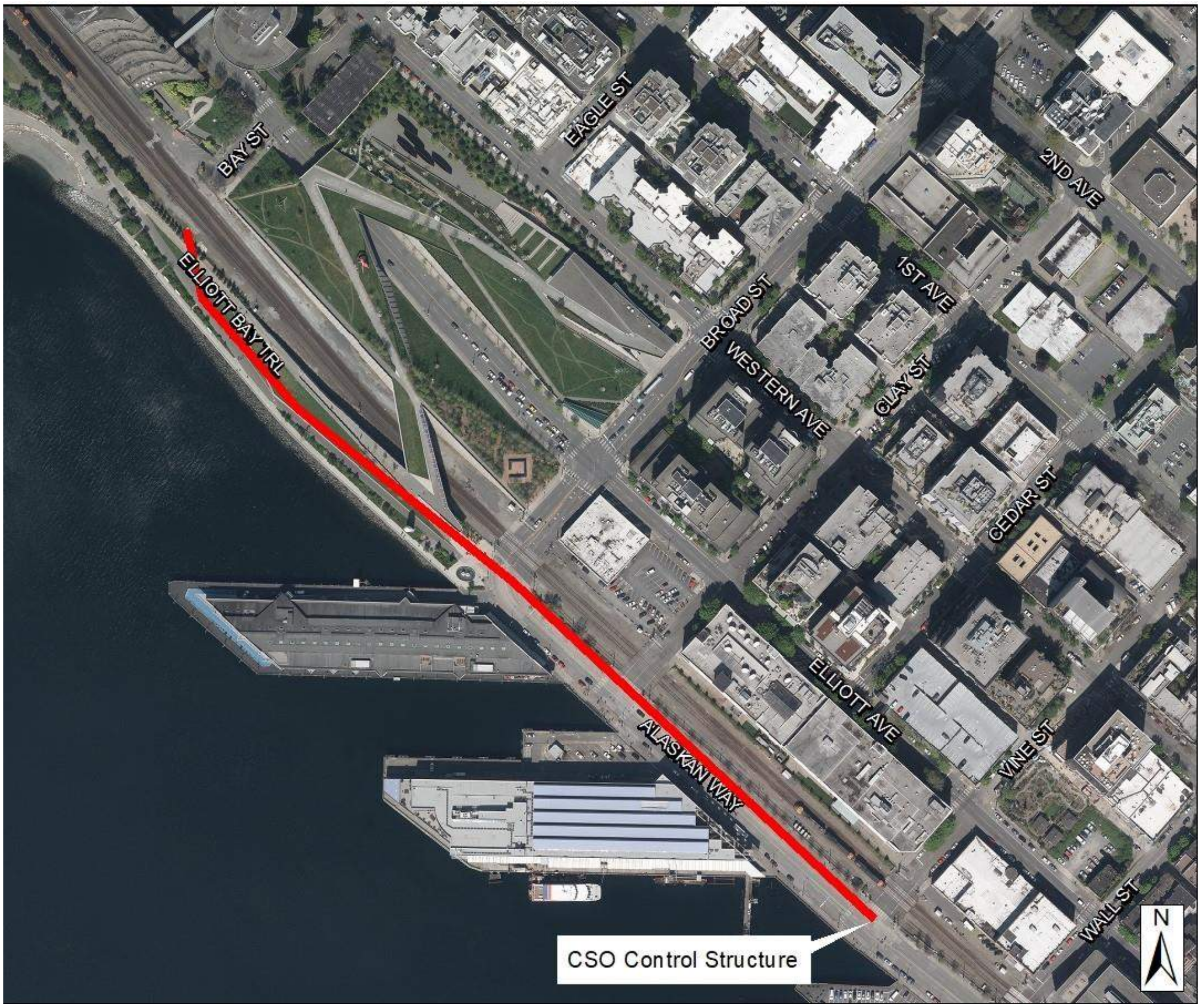
This alternative reduces CSO event frequency by increasing combined sewer system conveyance capacity downstream of the existing CSO Control Structure. This alternative increases peak flows and total discharged flows to KC's Elliott Bay Interceptor. The combined sewer system currently experiences a CSO event when the hydraulic grade line (HGL) in the existing Alaskan Way sewer and CSO Control Structure is elevated above the crest of the CSO overflow weir. This alternative provides additional conveyance capacity, which delays the HGL from rising above the CSO weir, resulting in a reduction in CSO event frequency.

Key features of this alternative include:

- Installation of approximately 1,800 linear feet of 24 inch diameter gravity sewer pipe,
- A new connection to KC's Elliott Bay Interceptor,
- CSO Control Structure modifications to split flows between the existing sewer and the parallel overflow pipe, and
- Orifice restriction at the downstream end of the sewer (and no active or real-time controls such as valves or gates).

Figure 9-1 shows the general location and layout of this alternative.

Figure 9-1
Alaskan Way Parallel Flow Transfer Alternative General Location



Figures 9-2A 9-2B and 9-2C show the utility plans and the aerial plans of the proposed sewer alignment starting from the downstream connection to KC's Elliott Bay Interceptor.

Figure 9-2A

Alaskan Way Parallel Flow Transfer Alternative - Utility Plan and Aerial Plan, Sheet 1 of 3

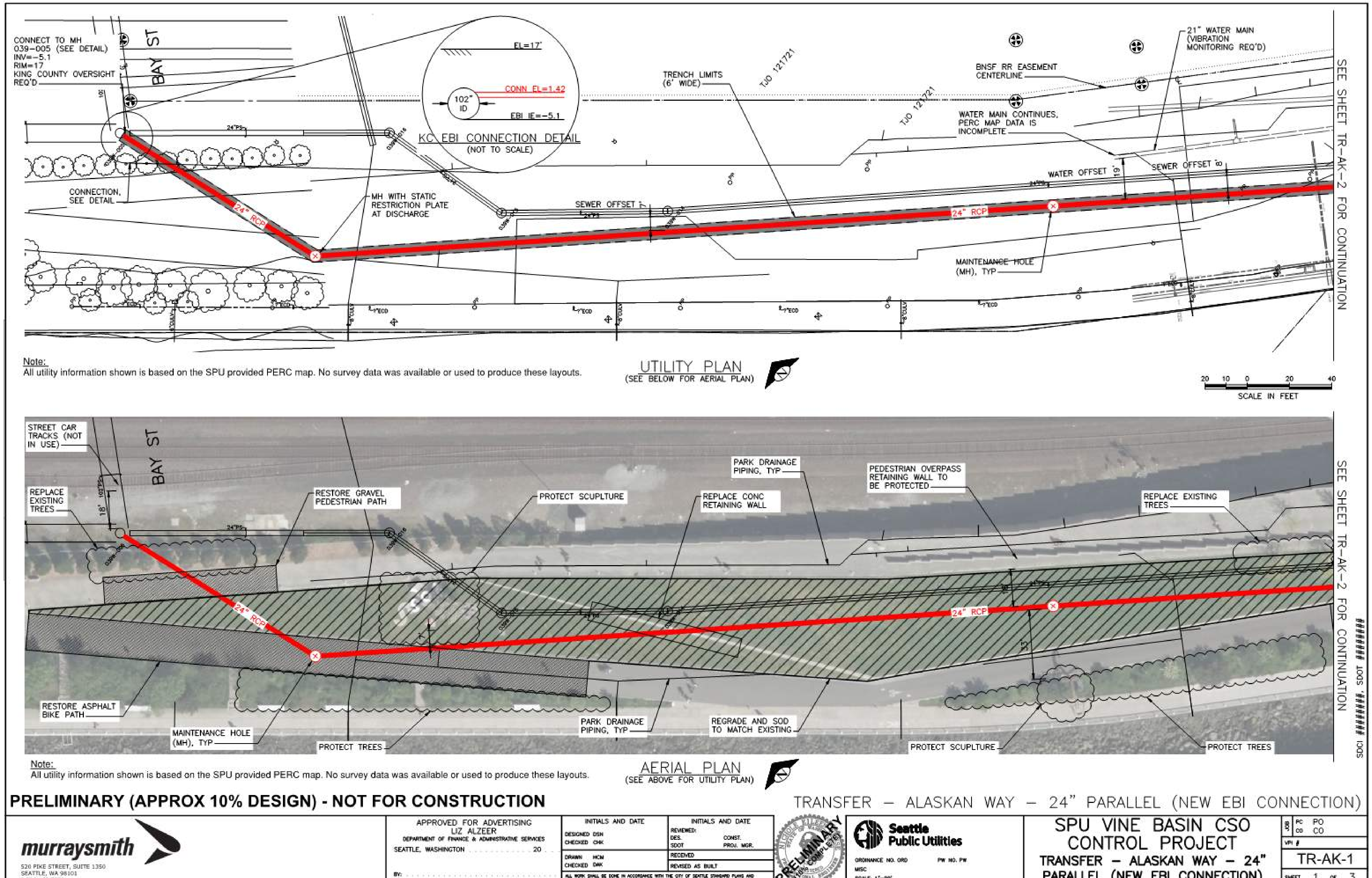


Figure 9-2B

Alaskan Way Parallel Flow Transfer Alternative - Utility Plan and Aerial Plan, Sheet 2 of 3

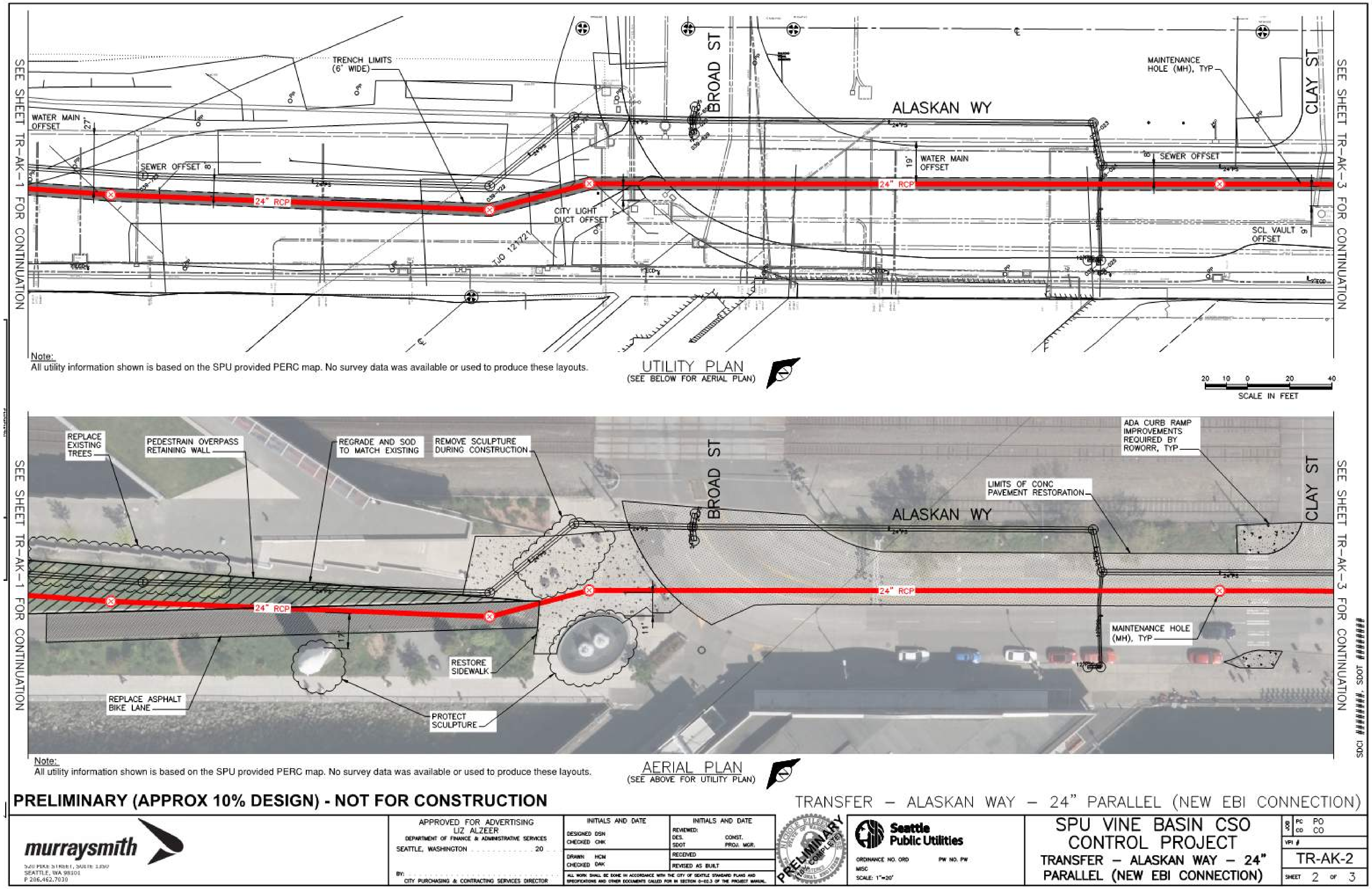
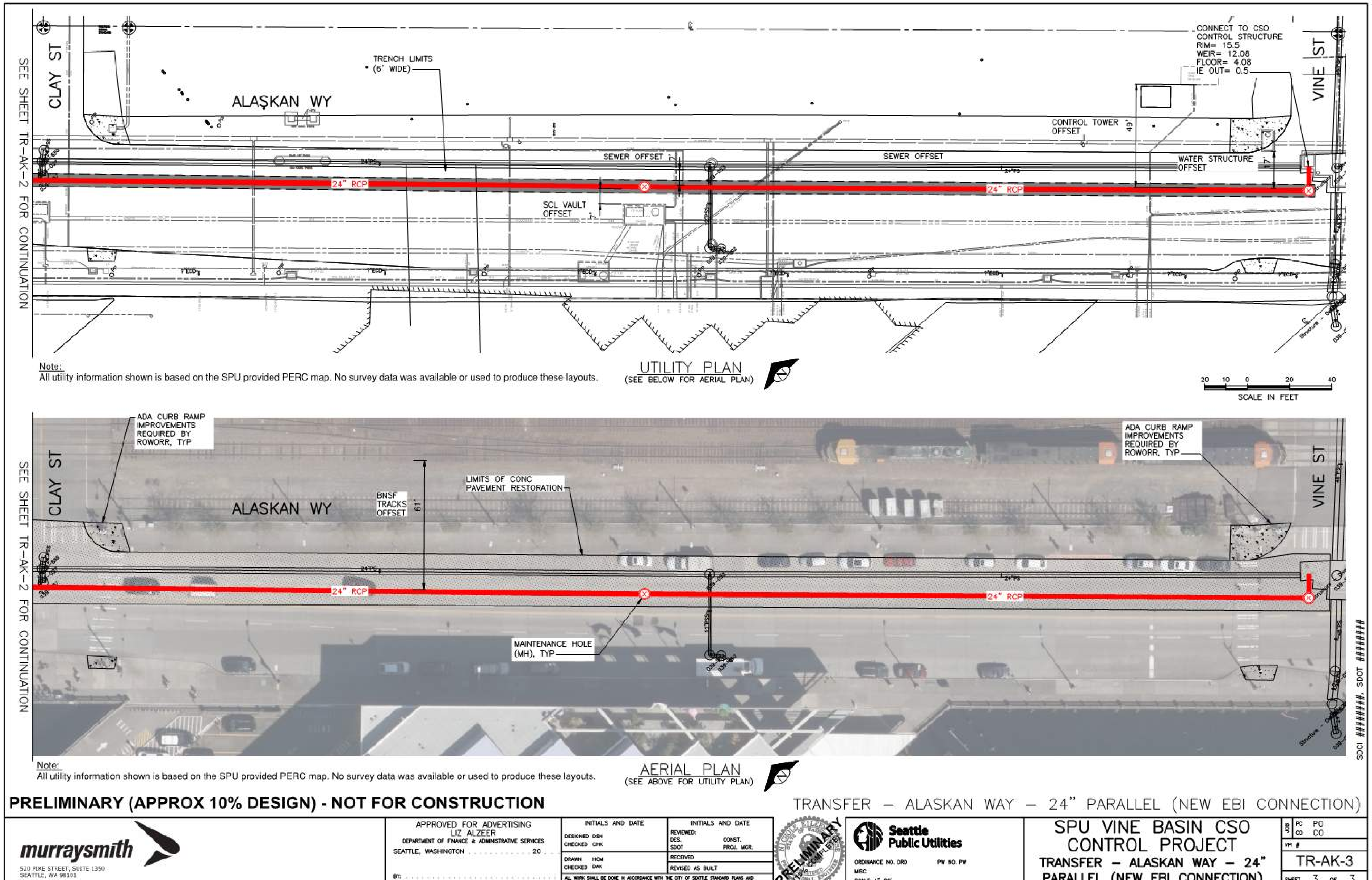


Figure 9-2C

Alaskan Way Parallel Flow Transfer Alternative - Utility Plan and Aerial Plan, Sheet 3 of 3



9.3.1.1 Construction Impacts

Construction of this alternative is anticipated to require 12 to 16 months and is expected to occur in one block intervals, to minimize impacts to traffic and the community. The proposed sewer is anticipated to be installed approximately 15 feet below grade using open-trench construction methods. A total of three intersections will be impacted: Alaskan Way and Broad Street, Clay Street, and Vine Street. It is anticipated that a safety peace officer will be required to be present while work is being conducted within intersections. It is anticipated that a minimum of two traffic lanes will be closed in the block with active construction, in addition to the sidewalk along the east side of Alaskan Way and street parking located on both sides of the street. Seattle Department of Transportation (SDOT) is unlikely to approve plans that require full street closure, as Alaskan Way is an arterial street that has an average annual weekday traffic count of approximately 8,800 vehicles per day.[25] It is likely that the construction work hours will also be reduced to limit traffic impacts.

While construction activities are conducted within the park area located adjacent to the Elliott Bay Trail (to the north of the Alaskan Way street end), the Elliott Bay Trail is expected to be closed. Bicycle traffic will need to be rerouted. Pedestrian traffic along the sidewalk directly adjacent to the shoreline is expected to remain open throughout construction. Access to the pedestrian overpass may be limited or temporarily closed when the Elliott Bay Interceptor connection is constructed.

There are two piers along the western side of Alaskan Way; access to the piers will be maintained throughout construction. Construction activities adjacent to the piers should be scheduled to minimize the potential for conflicts with the elevated number of tourists that visit the waterfront area during this busiest summer months.

9.3.1.2 Risks and Constraints

The following risks and constraints apply to the Alaskan Way Parallel Flow Transfer Alternative:

- Active BNSF railroad tracks parallel the proposed sewer alignment and will require additional coordination and safety measures when working near the tracks.
- The proposed sewer alignment is within close proximity to the Elliott Bay shoreline and seawall. Future reconstruction of the seawall (unscheduled at this time) may have future impacts to the sewer alignment. It is anticipated that utilities within 40 feet of the seawall may need to be relocated; the proposed alignment general falls outside of this envelope (approximately 50 feet from the seawall), except for a portion within the park area at the northern end of the alignment.

[25] Seattle Department of Transportation, 2018 Traffic Report, 2017 Seattle Traffic Flow Map.

- Construction access will be very limited within the park area to the north of the Alaskan Way street end. This will complicate site access and material deliveries for the work located within the northern portion of the proposed alignment.

- Alaskan Way is identified as a liquefaction prone area that is particularly susceptible in the event of a seismic event. The soils are not anticipated to be suitable backfill for the sewer. The sewer backfill and design will need to take this into consideration.

- Existing art sculptures located within the park area to the north of the Alaskan Way street end will need to be protected or temporarily removed during construction. Some of the art sculptures are built in-place using cast in-place concrete and cannot be removed. The sculptures on display are owned by the Seattle Art Museum (SAM).

- High groundwater levels are anticipated due to the proximity to the shoreline. Extensive groundwater management strategies may need to be implemented that could include:

    - Water-tight shoring systems,
    - Dewatering wells, and/or
    - Trench dewatering systems.

- There is potential for encountering soil contamination and groundwater contamination within the proposed limits of construction, especially to the north end of the alignment where preliminary information indicates a buried asphalt parking lot was used to cap contaminated soils. Since no geotechnical investigations have been completed for this project to date, it is difficult to estimate how much contaminated soil to expect and quantify the potential project costs related to contaminated soils disposal or remediation.

- Given the combined sewer capacity limitations, stormwater and groundwater from the construction area may need to be treated and discharged to Elliott Bay rather than the combined sewer system to avoid causing additional CSO events.

- There is potential for encountering abandoned creosote treated piles during excavation that remain from the original seawall construction. Abandoned piles were encountered as part of the Seattle Seawall Replacement Project that was recently completed to the south of the proposed project site.

- Since the normal dry weather flows will be split between the existing sewer and the new sewer, there is potential for build-up of solids within the sewers and elevated odor levels due to reduced flow velocities.

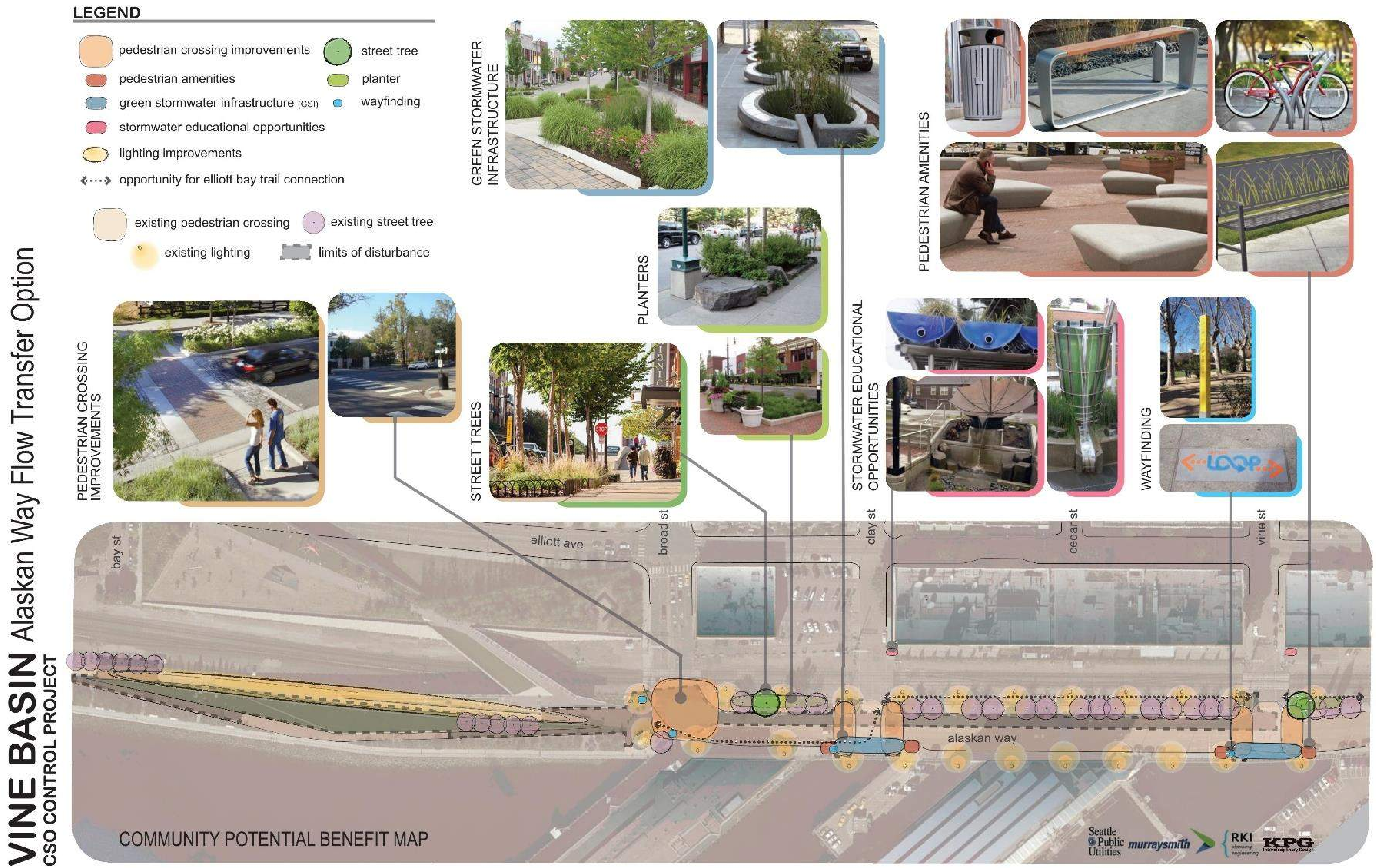
- No survey data or utility locating investigations (i.e. potholing) have been completed to date. There is a risk of encountering vertical or horizontal spacing conflicts with other utilities. Utility relocations not previously identified may be required if there are conflicts identified during detailed design.

9.3.1.3 Public Acceptability

The greatest perceived drawback to the community resulting from this alternative is the temporary closure of the Elliott Bay Trail (half of the proposed alignment), as this is a major pathway used by a significant number of bicycle commuters to access downtown Seattle. Long-term community benefits have not been narrowly defined for this alternative, but various ideas are shown in **Figure 9-3**. The benefits may include educational features about stormwater, pedestrian improvements, and most notably, the potential for connecting the Elliott Bay Trail from the park area to the continued section to the south of the construction area.

A public in-person open house meeting was held on February 6, 2019 where general project information, as well as information about potential construction impact areas, was made available. An online open house with the same information was also held from January 24, 2019 through February 13, 2019. Common themes of feedback received from participants included an interest in additional greenery within Basin 69, pedestrian safety improvements (lighting and crosswalks), and a priority to maintain existing parking and car/bike lanes. A summary report of the public outreach conducted as part of the alternatives analysis for this project is provided as **Appendix B**.

Figure 9-3
Potential Community Benefits for the Alaskan Way Parallel Flow Transfer Alternative



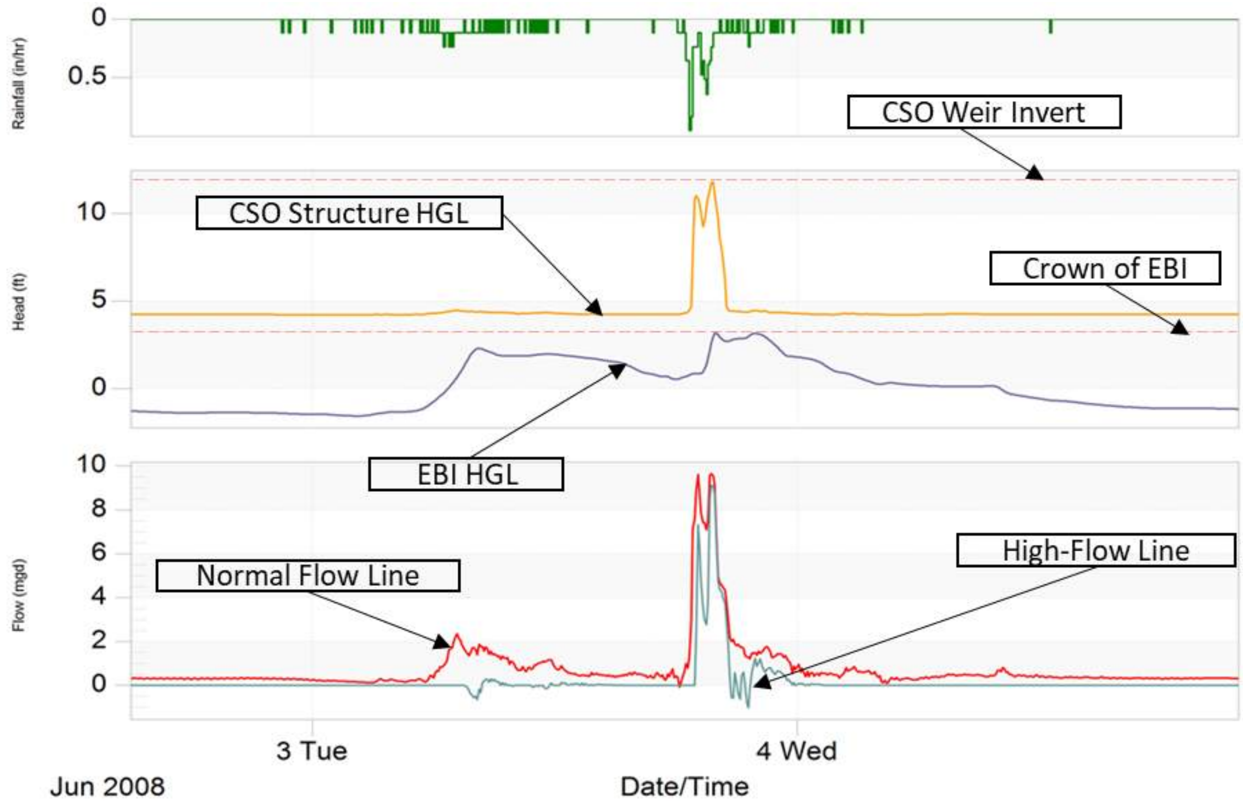
9.3.2 Long-Term Hydraulic Modeling

A long-term hydraulic modeling simulation was performed for this alternative to assess system sizing, configuration and anticipated performance for reducing CSO events. The simulation was run using 2035 climate perturbed rainfall. Boundary conditions consistent with all model runs were used to simulate downstream water surface elevations.

The alternative relies on increasing the flow to downstream KC facilities (KC's Elliott Bay Interceptor) to reduce CSO event frequency within Basin 69. Added conveyance capacity achieves this goal and effectively reduces the HGL in the SPU combined sewer system at the CSO Control Structure where the CSO overflow weir is located. As a result, this alternative is projected to meet the performance standard of no more than one CSO event per year in a 20 year moving average after the project is constructed and effectively provides the selected control volume of 233,000 gallons as discussed in **Section 7.3**.

One challenge of this alternative was optimizing the proposed sewer layout to limit the increase in peak flows to the KC Elliott Bay Interceptor while still meeting the performance standard required by the Consent Decree and NPDES permit. **Figure 9-4** shows the operation of the Alaskan Way Parallel Flow Transfer alternative for the 6/3/2008 CSO event (the control volume event identified in **Section 7**). The "normal flow line" is the existing sewer while the "high flow line" is the proposed parallel sewer.

Figure 9-4
Alaskan Way Parallel Flow Transfer Alternative Operation – 6/3/2008 CSO Event



A comparison of flows to the KC Elliott Bay Interceptor (EBI) for the baseline configuration (do nothing alternative) and the Alaskan Way Parallel Flow Transfer configuration is given in **Table 9-2**.

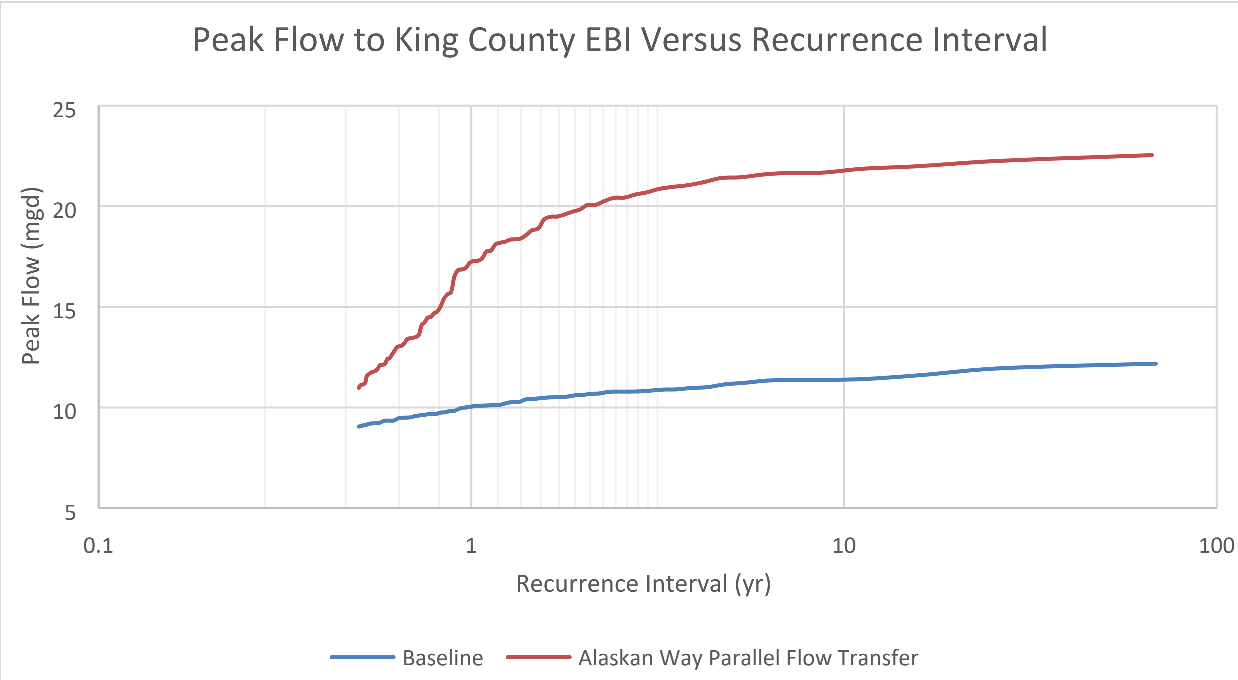
Table 9-2
Alaskan Way Parallel Flow Transfer Alternative Downstream Impact Comparison

	Average Annual Peak Flow Rate (MGD)			Average Annual Flow Volume (MG)	
	Alaskan Way Existing Sewer	Alaskan Way Proposed Parallel Sewer	Western Ave Existing Sewer	Alaskan Way Sewer(s)	Western Ave Existing Sewer
Baseline	10.06	N/A	18.13	127.2	371.1
Alternative 1	9.63	7.86	18.13	127.6[1]	371.1

Notes:
1. The value presented for Alternative 1 is representative of the sum of total flow through the existing and proposed parallel sewers.

Peak flows conveyed to the KC EBI are plotted against their corresponding recurrence interval for the baseline and Alaskan Way Parallel Flow Transfer configurations in **Figure 9-5**. The sum of the flow series for the two connection points in the Alaskan Way Parallel Flow Transfer alternative were used to develop the recurrence interval curve for this alternative.

Figure 9-5
Peak Flow Versus Recurrence Interval for the Alaskan Way Parallel Flow Transfer and Baseline Configurations at Alaskan Way Connection



9.3.3 Operation and Maintenance

Operations and maintenance (O&M) of the Alaskan Way Parallel Flow Transfer alternative is assumed to be consistent with SPU's existing gravity sewer infrastructure. Flow splitting between the existing sewer and proposed parallel sewer will be passively controlled. Control of the discharges to KC's infrastructure will also be passively controlled. No additional training of SPU field crews is expected to be required to perform the necessary O&M activities. No solids handling is anticipated to be required, as the solids will be conveyed to the West Point Treatment Plant with the sewer flows.

Anticipated O&M activities for this alternative are listed in **Table 9-3**, along with the anticipated maintenance frequency and cost. Costs presented in the table are based on historical cost information from SPU's O&M staff as presented in the 2017 SPU Cost Estimating Guide and Template.

Table 9-3
Summary of Anticipated O&M Activities, Frequency and Cost

O&M Activity	Frequency	Cost
CCTV Inspection	10 years	$1,260
Pipe Maintenance and Cleaning	Annual	$4,500
EBI Discharge Visual Inspection	Annual	$500
Level Monitoring	Annual	$7,000

9.3.4 Anticipated Project Costs

Opinions of probable construction costs (OPCCs) and other related and potential costs for the Alaskan Way Parallel Flow Transfer alternative are presented in **Table 9-4**. The developed project costs include assumptions, allowances and contingencies as described in greater detail in **Section 11**. The OPCC for this alternative was developed at the Association for the Advancement of Cost Engineering (AACE) Class 4 Level (-20% to +30% accuracy range). Material quantities used to develop the OPCC were taken from the design layouts presented in **Figures 9-2A**, **9-2B** and **9-2C**. The complete basis of estimate and OPCC for this alternative are provided in **Appendix C**.

Table 9-4
Summary of the Alaskan Way Parallel Flow Transfer Alternative Anticipated Project Costs

Description	Amount
Opinion of Probable Construction Cost (OPCC)	
Base Construction Cost	$6,007,000
Sales Tax (10.1%)	$607,000
Allowance for Indeterminates (30%)	$1,803,000
Other Hard Costs	$185,000
Subtotal OPCC	**$8,602,000**
Range of Possible Construction Costs	
Upper End of Class 4 OPCC (+30%)	$11,183,000
Lower End of Class 4 OPCC (-20%)	$6,882,000
Other Project Costs	
Property Acquisition	$0
Soft Costs (49%)	$4,215,000
Base Cost Total (Subtotal OPCC + Other Project Costs)	**$12,817,000**
Contingency (25%)	$3,205,000
Management Reserve for Risk (20%)	$2,564,000
Total Project Cost (2017 Dollars)	**$18,586,000**
Inflation Assumption (2.3% per year)	$865,000
Escalation Adjustment Assumption (1% per year)	$173,000
Total Project Cost (2019 Dollars)	**$19,624,000**

Notes:

1. All values have been rounded up to the nearest $1,000.
2. Costs are presented in 2017 dollars, as the APWA and CSI bid item costs available in SPU's Cost Estimating Guide and Template are from 2017. Costs are presented in 2017 dollars, as the APWA and CSI bid item costs available in SPU's Cost Estimating Guide and Template are from 2017.
3. Inflation and escalation adjustments are added to present costs in 2019 dollars. Inflation is applied to the total project cost; escalation is only applied to construction costs.

9.3.5 Permits and Approvals

Table 9-5 provides a list of permits and approvals that are anticipated to be required for the Alaskan Way Parallel Flow Transfer alternative.

Table 9-5
Anticipated Permits and Approvals for Alaskan Way Parallel Flow Transfer Alternative

Jurisdiction	Anticipated Permit or Approval	Trigger and Notes	Anticipated Time to Obtain following Application Submittal
Local			
SPU	State Environmental Policy Act (SEPA) Review and Threshold Determination *(expected to be a SEPA checklist and Determination of Non-Significance)*	A threshold determination is required for any project or non-project action that exceeds or does not meet the City of Seattle's criteria for categorical exemption.	3 months.
SDOT	Street Improvement Permit (SIP)	Installation of major new permanent improvements within the City of Seattle ROW.	6 to 7 months, generally concurrent with the SDOT SIP design review process. Review times are expected to vary depending on project complexity.
SDOT	Construction Street Use Permit (includes review and permitting for the contractor's temporary ROW use, traffic control plan, pedestrian mobility plan, shoring, tree removal, etc.)	Required when performing construction activities that impact public access to the ROW. When work will last longer than 6 months in duration, a project notification is required, which must be posted on-site at each closure location and visible to the public.	2 to 3 months.
SDCI	Noise Variance *(potential based on construction plan and equipment)*	Required if construction activities are outside of the normal hours identified in Seattle Municipal Code 25.08- typically, 10 PM to 7:00 AM. Also required if construction activities exceed 85 dB(A), measured at the property line of adjacent receiving properties.	Approximately 4 months for major projects.
SDCI	Land Use/Master Use Permit – Shoreline	Project work located within 200 feet of a water body regulated by the City of Seattle's Shoreline Master Program.	4 to 8 months depending on project scale and complexity.
SDCI/King County	SDCI Side Sewer Permit for Temporary Dewatering, including an Industrial Waste Program Wastewater Discharge Authorization from King County.	Required when discharging construction site water to a public combined or sanitary sewer system. Also required for deep excavations (greater than 12 feet), an acre or more of land disturbance, or if surface/subsurface water is encountered during construction. A temporary dewatering plan, subject to review and approval by SPU, will be required.	2 to 3 months. Dependent on project complexity.
Seattle Parks and Recreation	Revocable Use Permit (RUP) and/or Partial Transfer of Jurisdiction (PTOJ)	Temporary construction and staging within Alaskan Way ROW managed by City of Seattle Parks (Broad to Bay, along Alaskan Way). The area is not owned by Parks, but it is anticipated that one or both of these permits may be required to facilitate coordination and approval.	4 to 8 months.
State			
Department of Archaeology and Historic Preservation (DAHP)	DAHP Concurrence	Although ground disturbance is not expected to reach native soils and earlier cultural resources surveys in the area suggest that fill has a very low potential for significant cultural materials, DAHP may require a cultural resources survey, which would be submitted for their review and approval. If ground disturbance would extend into native soils, early consultation with DAHP is highly recommended.	Typically, 2 months depending on DAHP staff availability.
Washington State Department of Ecology (Ecology)	National Pollutant Discharge Elimination System Construction Stormwater General Permit	Required for land-disturbing activities exceeding 1 acre and with construction stormwater or groundwater discharge to waters of the state.	2 to 3 months.
Private			
BNSF	Pipeline or wire line permit	Installation of an underground utility line within BNSF ROW. BNSF ROW varies from 25 to 50 feet from the center line of the tracks. If the BNSF ROW extends to 50 feet along this alignment, this permit would apply to this alternative.	1 month; however, durations can extend up to 6 months.

9.3.6 Environmental Impacts

Most construction work is expected to be within the paved right-of-way, thus limiting environmental impacts. This alternative is not anticipated to require any in-water work. Unpaved areas expected to be disturbed within the park area at the north end of the proposed sewer alignment will be replaced in-kind as part of the restoration phase of the construction activities.

The project site is located within 100 feet of the Elliott Bay shoreline. As such, site runoff will need to be closely controlled. The selected general contractor will be required to have and comply with a Stormwater Pollution Prevention Plan (SWPPP) and a Tree, Vegetation, and Soil Protection (TVSP) Plan. Due to the limited capacity of the combined sewer system, water collected from site dewatering activities is expected to be treated and discharged to Elliott Bay via an existing stormwater discharge point. Regular testing or maintenance of the dewatering treatment system will be required to minimize the impacts of the discharge to the Elliott Bay environment.

Dust control measures during earthwork activities will be required, including, but not limited to, street sweeping, watering exposed soil surfaces and covering soil stockpiles to minimize fugitive dust and particulate matter pollution in the surrounding area.

Air pollution engine exhaust could increase during periods of heavy construction, however provisions to limit the idling of mechanical equipment are typically included in City of Seattle projects.

No significant long-term environmental impacts are expected for this alternative after construction has been completed, other than the improvements to Elliott Bay as a result of reducing CSO event frequency.

9.4 Alternative 2 – Elliott Avenue New Flow Transfer

9.4.1 Description

This alternative reduces CSO event frequency by increasing combined sewer system conveyance capacity upstream of CSO Control Structure with a new discharge connection to KC's Elliott Bay Interceptor. This alternative increases peak flows and total discharged flows to KC's Elliott Bay Interceptor. The combined sewer system currently experiences a CSO event when the HGL in the existing Alaskan Way sewer and CSO Control Structure is elevated above the CSO overflow weir elevation. This alternative provides additional conveyance capacity by adding a new sewer in Elliott Avenue and diversion structure upstream of the CSO Control Structure to divert flows away from the CSO Control Structure. This delays the HGL from rising above the CSO weir elevation, resulting in a reduction in CSO event frequency.

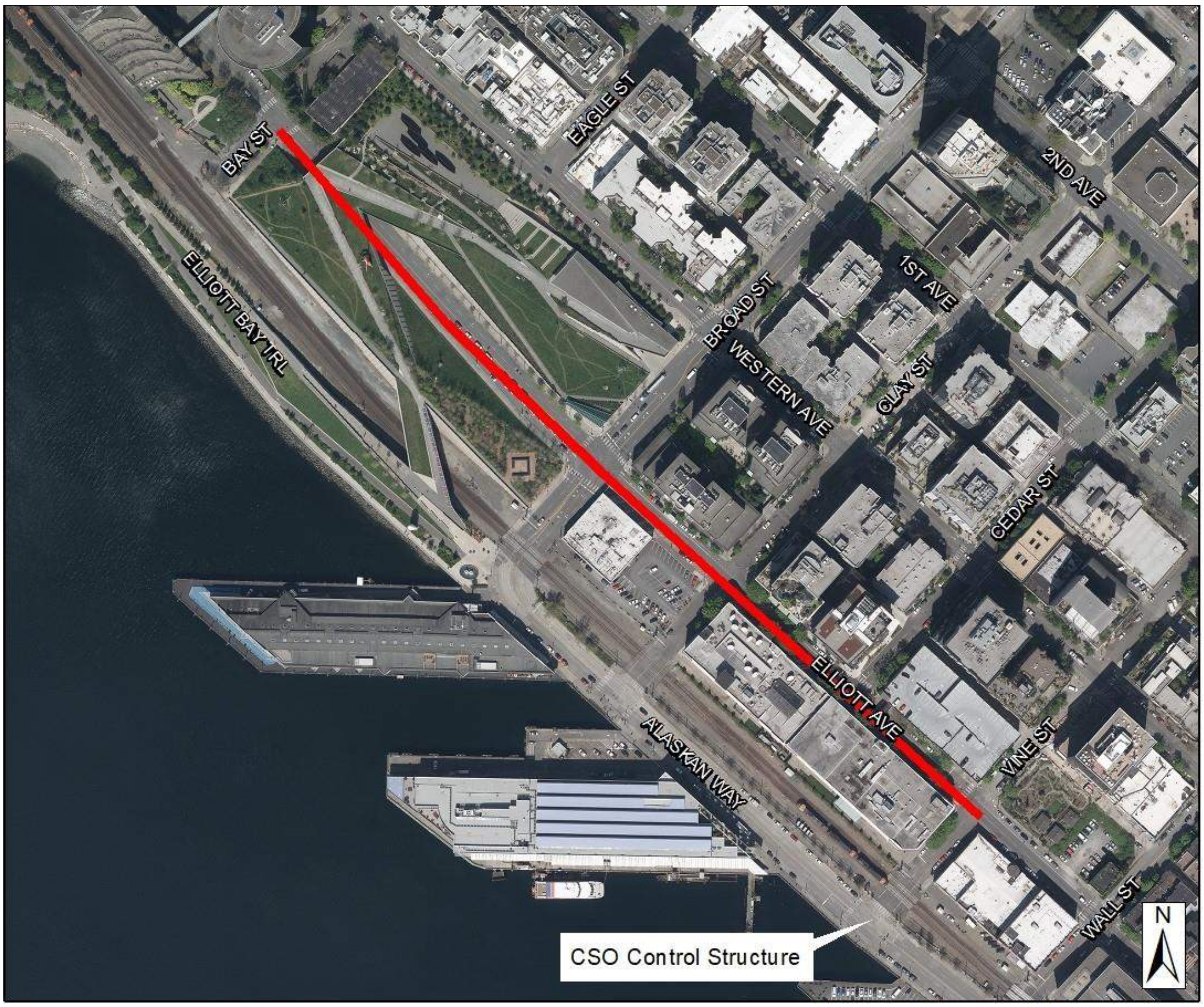
Key features of this alternative include:

- Installation of approximately 1,800 linear feet of 24 inch diameter gravity sewer pipe,

- A new connection to KC's Elliott Bay Interceptor,
- A new sewer diversion vault and weir where the existing sewer crosses the intersection of Vine Street and Elliott Avenue, and
- No active outlet controls (meaning no real time controls such as valves or gates).

Figure 9-6 shows the general location and layout of this alternative.

Figure 9-6
Elliott Avenue New Flow Transfer Alternative General Location



Figures 9-7A 9-7B and 9-7C show the utility plans and the aerial plans of the proposed sewer alignment starting from the downstream connection to KC's Elliott Bay Interceptor.

Figure 9-7A
Elliott Avenue New Flow Transfer Alternative - Utility Plan and Aerial Plan, Sheet 1 of 3

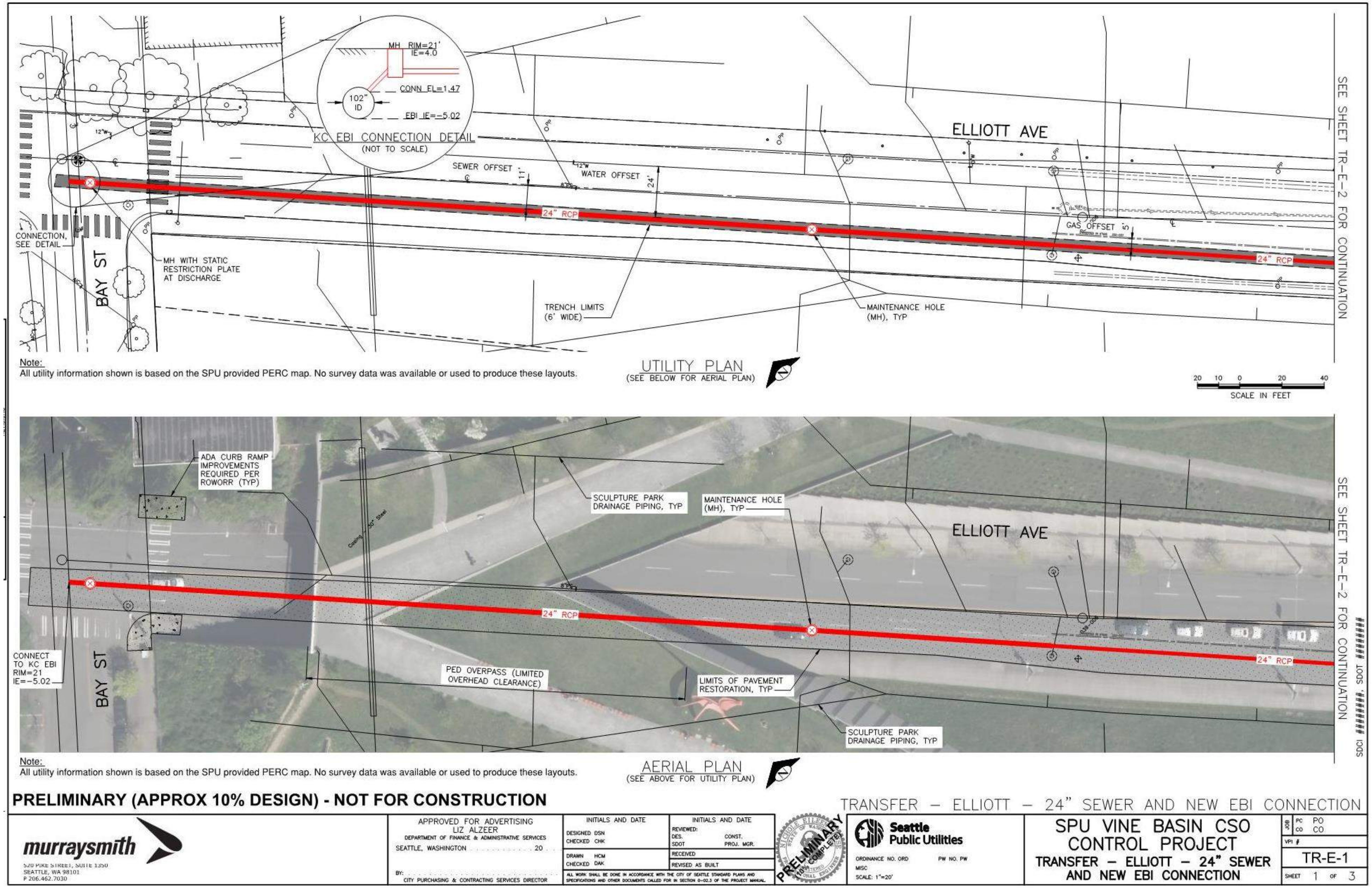


Figure 9-7B
Elliott Avenue New Flow Transfer Alternative - Utility Plan and Aerial Plan, Sheet 2 of 3

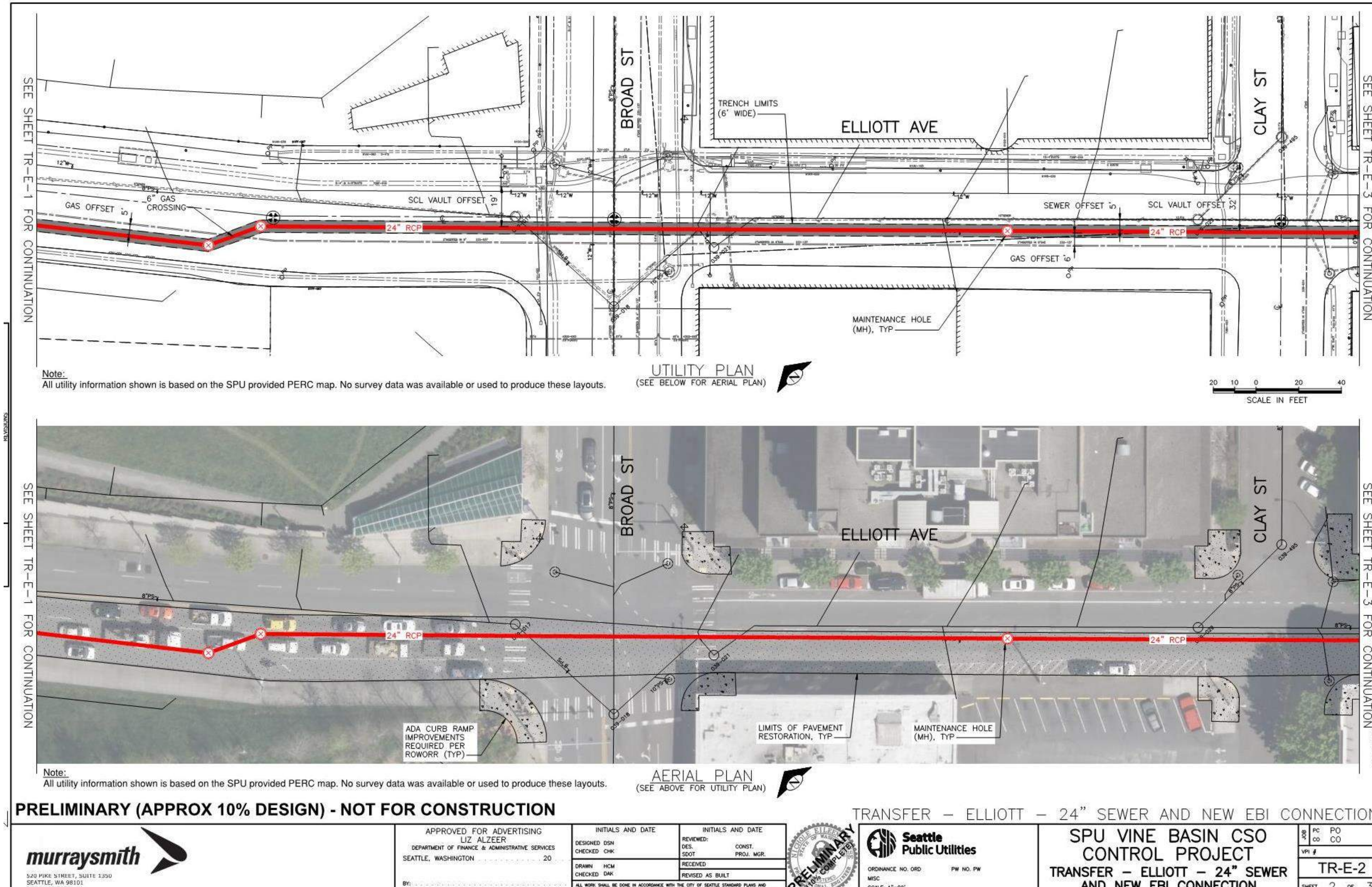
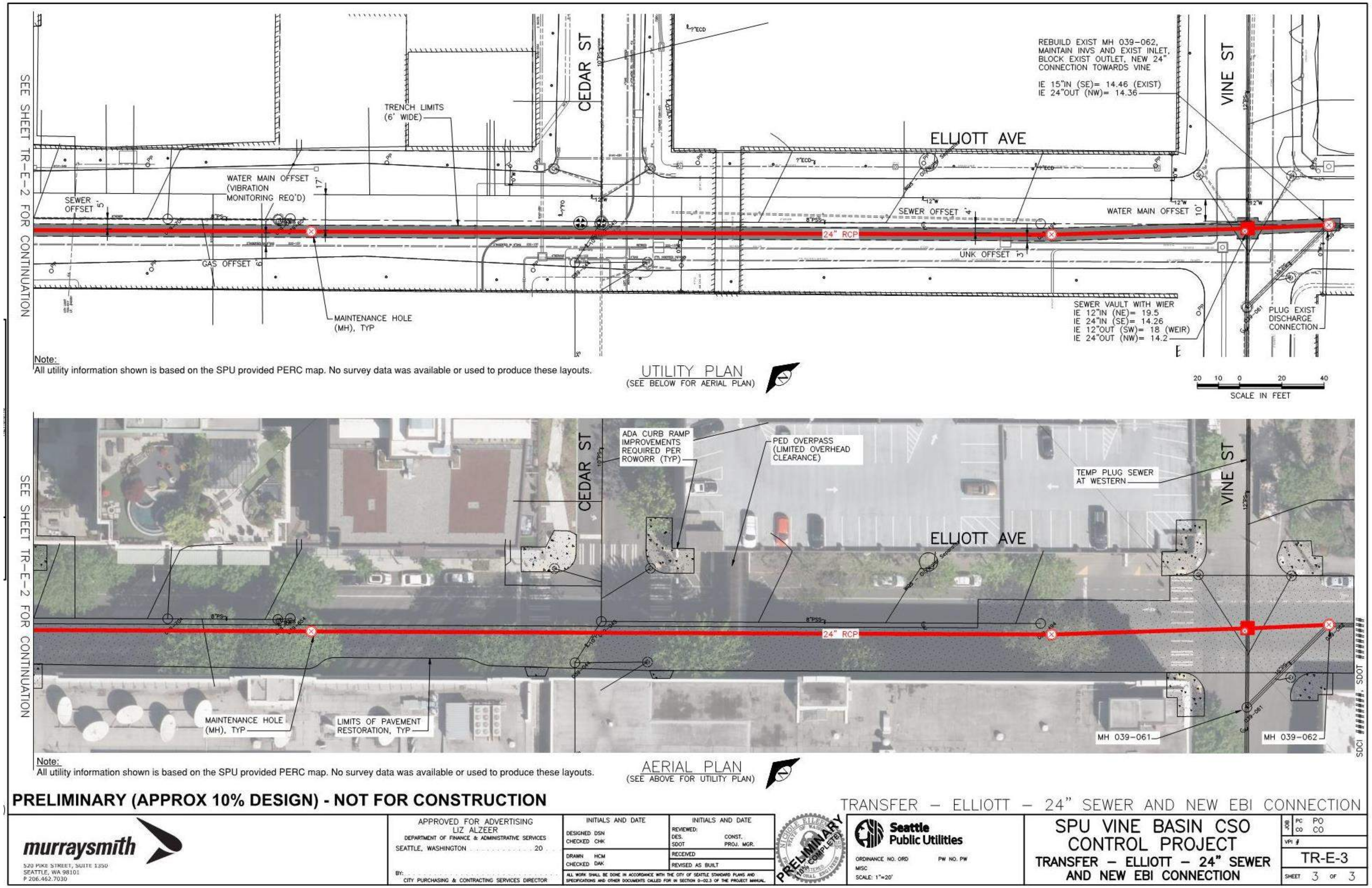


Figure 9-7C
Elliott Avenue New Flow Transfer Alternative - Utility Plan and Aerial Plan, Sheet 3 of 3



9.4.1.1 Construction Impacts

Construction of this alternative is anticipated to require 12 to 16 months and is expected to occur in one block intervals, to minimize community and traffic impacts. The proposed sewer is anticipated to be installed approximately 15 feet below grade using open-trench construction methods. A total of five intersections will be impacted along Elliott Avenue, including Bay Street, Broad Street, Clay Street, Cedar Street, and Vine Street. It is anticipated that a safety peace officer will be required to be present while work is being conducted within intersections. It is anticipated that a minimum of two traffic lanes will be closed in the block with active construction, in addition to the sidewalk along the west side of Elliott Avenue, street parking located on both sides of the street, and the bicycle lane located on the east side of Elliott Avenue. It is expected that Elliott Avenue will be required to remain open to a minimum of one lane of traffic; SDOT is unlikely to approve plans that require full street closures, as Elliott Avenue is an arterial street that has an average annual weekday traffic count of approximately 15,000 to 19,000 vehicles per day.[26] It is likely that the construction work hours will also be reduced to limit traffic impacts.

There are multiple business and multi-use building entrances located along Elliott Avenue. Construction activity coordination will be required to maintain accessibility for buildings and businesses.

9.4.1.2 Risks and Constraints

The following risks and constraints apply to the Elliott Avenue New Flow Transfer Alternative:

- Groundwater is anticipated to be encountered based on the planned depth of excavation. Groundwater management strategies may need to be implemented that could include:
  - Water-tight shoring systems,
  - Dewatering wells, and/or
  - Trench dewatering systems.
- Elliott Avenue has mature trees lining both sides of the street and proposed sewer alignment. Tree roots may be encountered during excavation which will require coordination with the Seattle Department of Urban Forestry to minimize harm to the health of the trees.
- There are two locations along the proposed alignment that have overhead obstructions. Alternative construction techniques may be required in these locations to manage the risk of damaging the overhead structures (pedestrian overpasses and skywalks).
- Tall buildings line both sides of the proposed sewer alignment. As a result, construction noises may be exacerbated. Alternative construction techniques may need to be

[26] Seattle Department of Transportation, 2018 Traffic Report, 2017 Seattle Traffic Flow Map.

implemented to manage the noise produced by construction activities and limit the impact to adjacent businesses and residences.

- Traffic control and pedestrian routing will be more complex for this alternative, as there are many business accesses, included parking garage accesses along the proposed alignment, specifically between Vine Street and Broad Street.

- There is potential for encountering soil contamination and groundwater contamination within the proposed limits of construction. Since no geotechnical investigations have been completed for this project to date, it is difficult to estimate how much contaminated soil to expect and quantify the potential project costs related to contaminated soils disposal or remediation.

- No survey data or utility locating investigations (i.e. potholing) have been completed to date. There is a risk of encountering vertical or horizontal spacing conflicts with other utilities. Utility relocations not previously identified may be required if there are conflicts identified during detailed design.

9.4.1.3 Public Acceptability

The greatest perceived drawback to the community resulting from this alternative is the potential impact to business and residence accessibility, as there are several entrances located along Elliott Avenue between Vine Street and Broad Street (half of the proposed alignment). Long-term community benefits have not been narrowly defined for this alternative, but various ideas are shown in **Figure 9-8**. The benefits may include green stormwater infrastructure, pedestrian improvements, or lighting improvements.

A public in-person open house meeting was held on February 6, 2019 where general project information, as well as information about potential construction impact areas, was made available. An online open house with the same information was also held from January 24, 2019 through February 13, 2019. Common themes of feedback received from participants included an interest in additional greenery within Basin 69, pedestrian safety improvements (lighting and crosswalks), and a priority to maintain existing parking and car/bike lanes. A summary report of the public outreach conducted as part of the alternatives analysis for this project is provided as **Appendix B**.

Figure 9-8
Potential Community Benefits for Elliott Avenue New Flow Transfer Alternative

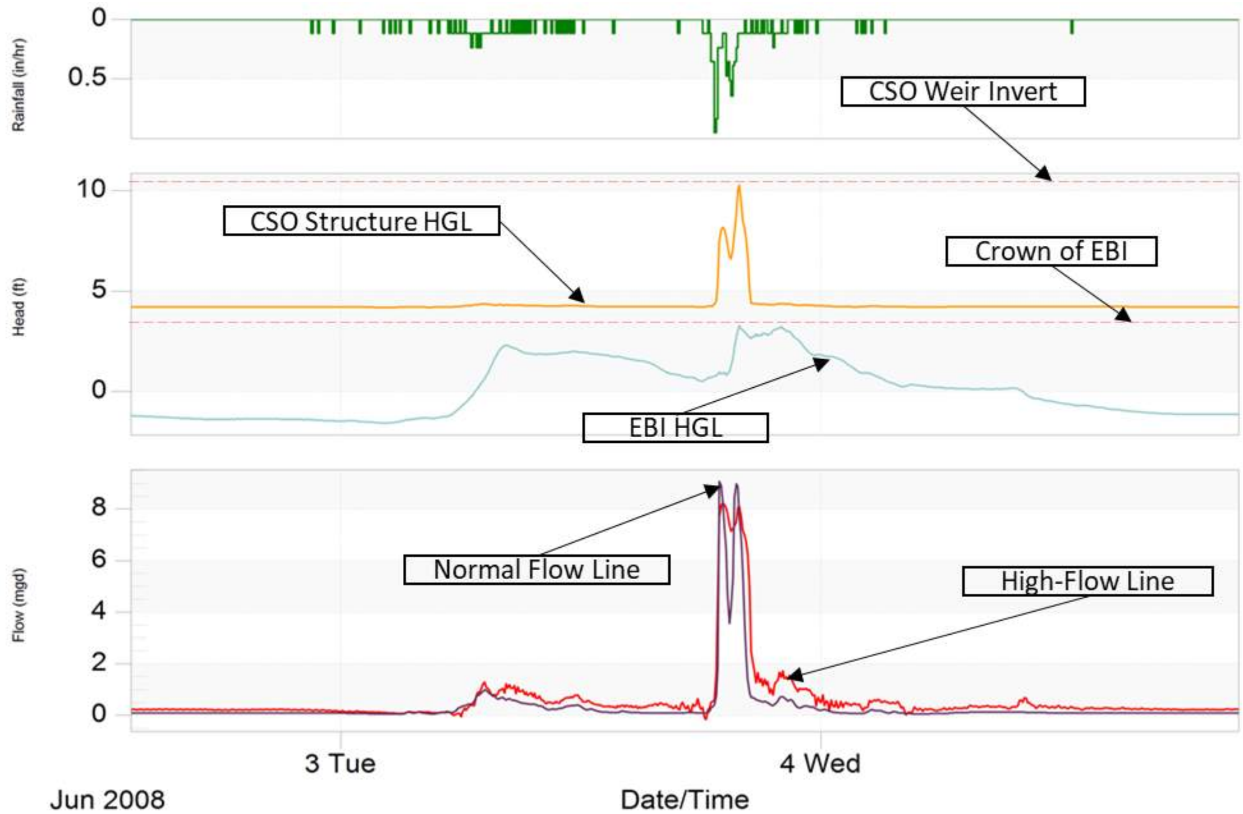
9.4.2 Long-Term Hydraulic Modeling

A long-term hydraulic modeling simulation was performed for this alternative to assess system sizing, configuration and anticipated performance for reducing CSO events. The simulation was run using 2035 climate perturbed rainfall. Boundary conditions consistent with all model runs were used to simulate downstream water surface elevations.

The alternative relies on increasing the flow to downstream KC facilities (KC's Elliott Bay Interceptor) to reduce CSO events within Basin 69. Added conveyance capacity achieves this goal and effectively reduces the HGL at the CSO Control Structure where the CSO overflow weir is located. As a result, this alternative is projected to meet the performance standard of no more than one CSO event per year in a 20 year moving average after the project is constructed and effectively provides the selected control volume of 233,000 gallons as discussed in **Section 7.3**.

A new diversion structure and weir located upstream of the existing CSO Control Structure was optimized to limit peak flows to KC's Elliott Bay Interceptor, while still meeting the performance standard required by the Consent Decree and NPDES permit. However, by diverting the flows through the proposed diversion structure, sewers upstream of the structure can be impacted, in particular, the existing sewer along Elliott Avenue to the south of Vine Street. The diversion structure was configured during the hydraulic modeling such that flow in the existing sewer south of Vine Street would not surcharge and result in an unintended Sewer Overflow (SSO). **Figure 9-9** shows the operation of the Elliott Avenue New Flow Transfer alternative for the 6/3/2008 CSO event (the control volume event identified in **Section 7**). The "normal flow line" is the existing sewer in Alaskan Way while the "high flow line" is the proposed sewer in Elliott Avenue.

Figure 9-9
Elliott Avenue New Flow Transfer Alternative Operation – 6/3/2008 CSO Event



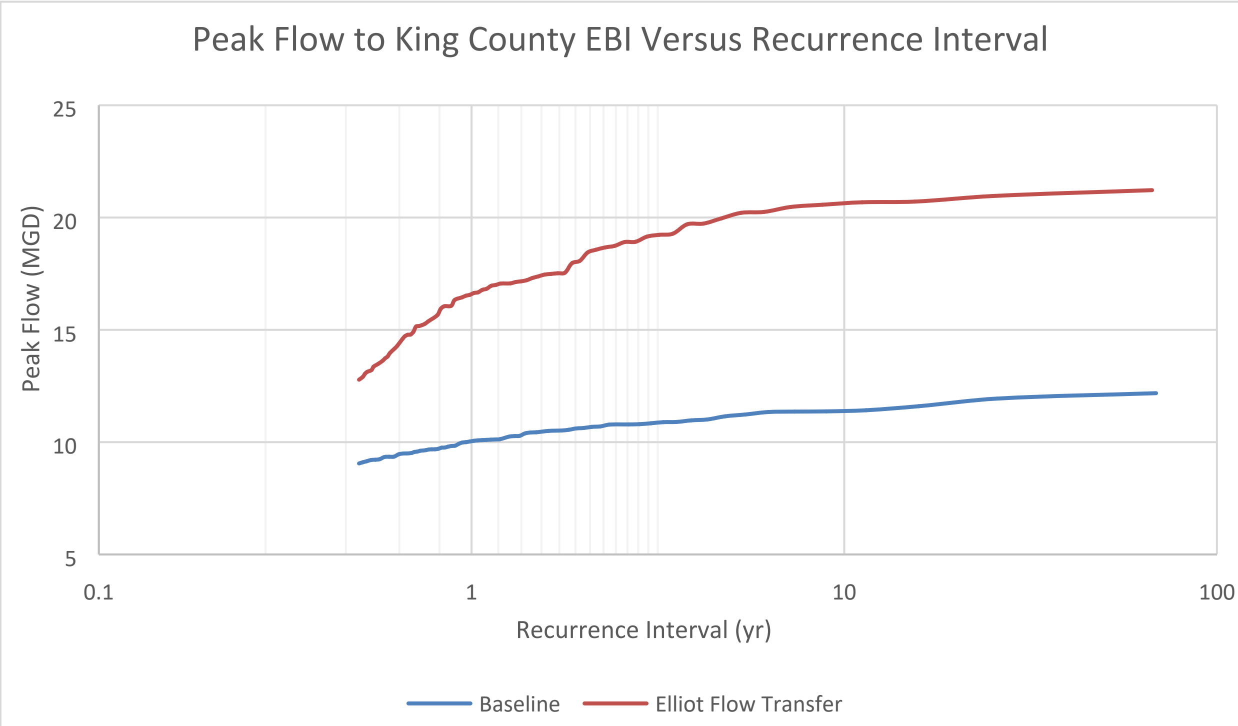
A comparison of flows to KC Elliott Bay Interceptor (EBI) for the baseline configuration (do nothing alternative) and the Elliott Avenue New Flow Transfer configuration is given in **Table 9-6.**

Table 9-6
Elliott Avenue New Flow Transfer Alternative Downstream Impact Comparison

	Average Annual Peak Flow Rate (MGD)			Average Annual Flow Volume (MG)		
	Alaskan Way Existing Sewer	Elliott Avenue Proposed Sewer	Western Avenue Existing Sewer	Alaskan Way Existing Sewer	Elliott Avenue Proposed Sewer	Western Avenue Existing Sewer
Baseline	10.06	N/A	18.13	127.2	N/A	371.1
Alternative 2	8.76	8.12	18.13	89.0	38.5	371.1

Peak flows conveyed to the KC EBI are plotted against their corresponding recurrence interval for the baseline and Elliott Avenue New Flow Transfer configurations in **Figure 9-10**. The sum of the flow series for the connection points at Alaskan Way and Elliott Avenue for the Elliott Avenue New Flow Transfer alternative were used to develop the recurrence interval curve for this alternative.

Figure 9-10
Peak Flow Versus Recurrence Interval for the Elliott Avenue New Flow Transfer and Baseline Configurations at Alaskan Way and Elliott Connection Points



9.4.3 Operation and Maintenance

Operations and maintenance (O&M) of the Elliott Avenue New Flow Transfer alternative is assumed to be consistent with SPU's existing gravity sewer infrastructure. Diversion of flows into the proposed Elliott Avenue sewer will be passively controlled. Control of the new discharge connection to KC's infrastructure will also be passively controlled using an orifice plate or similar. No additional training of SPU field crews is expected to be required to perform the necessary O&M activities. No solids handling is anticipated to be required, as the solids will be conveyed to the West Point Treatment Plant with the sewer flows.

The anticipated O&M activities for this alternative are listed in **Table 9-7**, along with the anticipated maintenance frequency and cost. Costs presented in the table are based on historical cost information from SPU's O&M staff as presented in the 2017 SPU Cost Estimating Guide and Template.

Table 9-7
Summary of Anticipated O&M Activities, Frequency and Cost

O&M Activity	Frequency	Cost
CCTV	10 years	$1,260
Pipe Maintenance, Cleaning	Annual	$4,500
EBI Discharge Orifice Visual Inspections	Annual	$500
New Weir Vault Maintenance, Cleaning	Annual	$1,000
Flow Level Monitoring	Annual	$7,000

9.4.4 Project Costs

Opinions of probable construction costs (OPCCs), and other related and potential costs for the Elliott Avenue New Flow Transfer alternative are presented in **Table 9-8**. The developed project costs include assumptions, allowances and contingencies as described in greater detail in **Section 11**. The OPCC for this alternative was developed at the AACE Class 4 Level (-20% to +30% accuracy range). Material quantities used to develop the OPCC were taken from the design layouts presented in **Figures 9-7A**, **9-7B** and **9-7C**. The complete basis of estimate and OPCC for this alternative are provided in **Appendix D**.

Table 9-8
Summary of the Elliott Avenue New Flow Transfer Alternative Anticipated Project Costs

Description		Amount
Opinion of Probable Construction Cost (OPCC)		
Base Construction Cost		$5,637,000
Sales Tax (10.1%)		$570,000
Allowance for Indeterminates (30%)		$1,692,000
Other Hard Costs		$185,000
	Subtotal OPCC	**$8,084,000**
Range of Possible Construction Costs		
Upper End of Class 4 OPCC (+30%)		$10,510,000
Lower End of Class 4 OPCC (-20%)		$6,468,000
Other Project Costs		
Property Acquisition		$0
Soft Costs (49%)		$3,962,000
	Base Cost Total (Subtotal OPCC + Other Project Costs)	**$12,046,000**
Contingency (25%)		$3,012,000
Management Reserve for Risk (20%)		$2,410,000
	Total Project Cost (2017 Dollars)	**$17,468,000**
Inflation Assumption (2.3% per year)		$813,000
Escalation Adjustment Assumption (1% per year)		$163,000
	Total Project Cost (2019 Dollars)	**$18,444,000**

Notes:

1. All values have been rounded up to the nearest $1,000.
2. Costs are presented in 2017 dollars, as the APWA and CSI bid item costs available in SPU's Cost Estimating Guide and Template are from 2017. Costs are presented in 2017 dollars, as the APWA and CSI bid item costs available in SPU's Cost Estimating Guide and Template are from 2017.
3. Inflation and escalation adjustments are added to present costs in 2019 dollars. Inflation is applied to the total project cost; escalation is only applied to construction costs.

9.4.5 Permits and Approvals

Table 9-9 provides a list of permits and approvals that are anticipated to be required for the Elliott Avenue New Flow Transfer alternative.

Table 9-9
Anticipated Permits and Approvals for Elliott Avenue New Flow Transfer Alternative

Jurisdiction	Anticipated Permit or Approval	Trigger and Notes	Anticipated Time to Obtain following Application Submittal
Local			
SPU	State Environmental Policy Act (SEPA) Review and Threshold Determination *(expected to be a SEPA checklist and Determination of Non-Significance)*	A threshold determination is required for any project or non-project action that exceeds or does not meet the City of Seattle's criteria for categorical exemption.	3 months.
SDOT	Street Improvement Permit (SIP)	Installation of major new permanent improvements within the City of Seattle ROW.	6 to 7 months, generally concurrent with the SDOT SIP design review process. Review times are expected to vary depending on project complexity.
SDOT	Construction Street Use Permit (includes review and permitting for the contractor's temporary ROW use, traffic control plan, pedestrian mobility plan, shoring, tree removal, etc.)	Required when performing construction activities that impact public access to the ROW. When work will last longer than 6 months in duration, a project notification is required, which must be posted on-site at each closure location and visible to the public.	2 to 3 months.
SDCI	Noise Variance *(potential based on construction plan and equipment)*	Required if construction activities are outside of the normal hours identified in Seattle Municipal Code 25.08 - typically, 10 PM to 7:00 AM. Also required if construction activities exceed 85 dB(A), measured at the property line of adjacent receiving properties.	Approximately 4 months for major projects.
SDCI/King County	SDCI Side Sewer Permit for Temporary Dewatering, including an Industrial Waste Program Wastewater Discharge Authorization from King County.	Required when discharging construction site water to a public combined or sanitary sewer system. Also required for deep excavations (greater than 12 feet), an acre or more of land disturbance, or if surface/subsurface water is encountered during construction. A temporary dewatering plan, subject to review and approval by SPU, will be required.	2 to 3 months. Dependent on project complexity.
State			
Department of Archaeology and Historic Preservation (DAHP)	DAHP Concurrence	Although ground disturbance is not expected to reach native soils and earlier cultural resources surveys in the area suggest that fill has a very low potential for significant cultural materials, DAHP may require a cultural resources survey, which would be submitted for their review and approval. If ground disturbance would extend into native soils, early consultation with DAHP is highly recommended.	Typically, 2 months depending on DAHP staff availability.
Washington State Department of Ecology (Ecology)	National Pollutant Discharge Elimination System Construction Stormwater General Permit	Required for land-disturbing activities exceeding 1 acre and with construction stormwater or groundwater discharge to waters of the state.	2 to 3 months.

9.4.6 Environmental Impacts

The proposed project is expected to have limited environmental impacts. There are no environmentally critical areas (ECAs) located within the anticipated project limits and the proposed alignment is located more than 100 feet from the shoreline of Elliott Bay. This alternative is not anticipated to require any in-water work.

All construction work is expected to be within the paved right-of-way for this alternative, thus limiting environmental impacts. The selected general contractor will be required to have and comply with a Stormwater Pollution Prevention Plan (SWPPP) and a Tree, Vegetation, and Soil Protection (TVSP) Plan.

Dust control measures during earthwork activities will be required, including, but not limited to, street sweeping, watering exposed soil surfaces and covering soil stockpiles to minimize fugitive dust and particulate matter pollution in the surrounding area.

Air pollution engine exhaust could increase during periods of heavy construction, however provision to limit the idling of mechanical equipment are typically included in City of Seattle projects.

No significant long-term environmental impacts are expected for this alternative after construction has been completed, other than the improvements to Elliott Bay as a result of reducing CSO event frequency.

9.5 Alternative 3 – Alaskan Way Inline Storage

9.5.1 Description

This alternative reduces CSO event frequency by increasing combined sewer system storage capacity downstream of the existing CSO Control Structure. The combined sewer system currently experiences a CSO event when the HGL in the existing Alaskan Way sewer and CSO Control Structure is elevated above the crest of the CSO overflow weir. This alternative provides additional storage capacity for excess flows directly downstream of the CSO Control Structure, which delays the HGL from rising above the CSO weir, resulting in a reduction in CSO event frequency. Flows to KC's system are controlled by a static orifice plate at the downstream end of the storage pipe.

Key features of this alternative include:

- Removal and replacement of the existing sewer in Alaskan Way with 700 linear feet of 8 foot diameter RCP storage pipe (approximately 263,000 gallons of storage),
- Modifications to the interior of the existing CSO Control Structure,

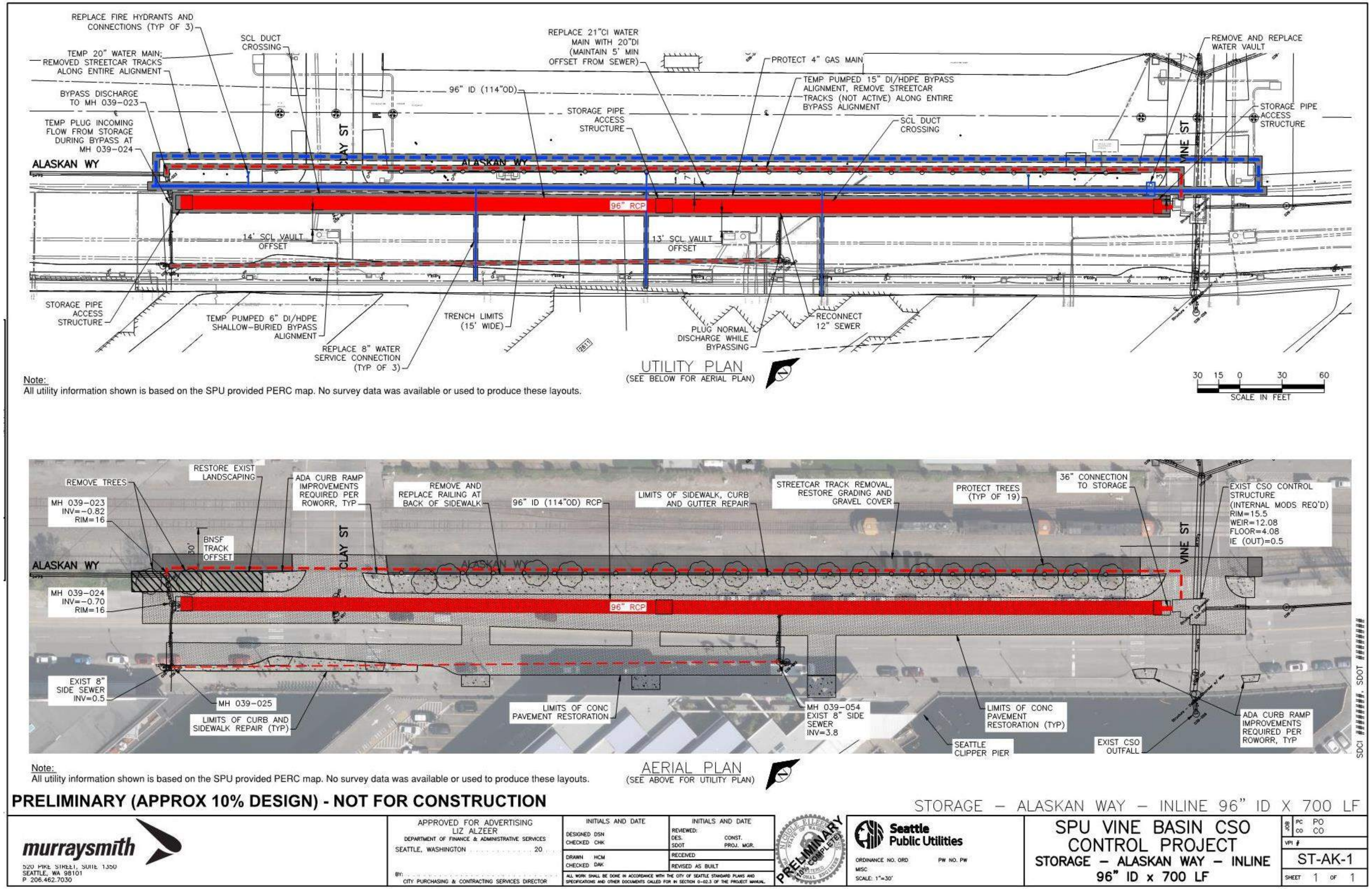
- Installation of three access structures, providing access for inspection and maintenance of the storage pipe,
- Orifice restriction at the downstream end of the storage pipe (no active or real-time controls such as valves or gates),
- Removal and replacement of the existing parallel 20 inch diameter water main, service connections and hydrants, and
- Removal of the existing streetcar tracks to accommodate temporary water and sewer bypassing.

Figure 9-11 shows the general location and layout of this alternative.

Figure 9-11
Alaskan Way Inline Storage Alternative General Location

Figure 9-12 shows the utility plan and the aerial plan of the proposed inline storage pipe.

Figure 9-12
Alaskan Way Inline Storage Alternative - Utility Plan and Aerial Plan, Sheet 1 of 1



9.5.1.1 Construction Impacts

Construction of this alternative is anticipated to require 12 to 16 months and is expected to occur in one block intervals, to minimize impacts to traffic and the community. The proposed storage pipe is anticipated to be installed approximately 15 feet below grade using open-trench construction methods. The trench to install the sewer is anticipated to be approximately 15 feet wide; covering the trench at night for site safety will be difficult, so additional site security will be required. A total of two intersections will be impacted: Alaskan Way and Clay Street, and Vine Street. It is anticipated that a safety peace officer will be required to be present while work is being conducted within intersections. It is anticipated that a minimum of two traffic lanes will be closed in the block with active construction, in addition to the sidewalk along the east side of Alaskan Way and street parking located on both sides of the street. SDOT is unlikely to approve plans that require full street closure, as Alaskan Way is an arterial street that has an average annual weekday traffic count of approximately 8,800 vehicles per day.[27] It is likely that the construction work hours will also be reduced to limit traffic impacts.

As captured previously, the 20 inch diameter water main adjacent to the storage pipe will need to be replaced, and construction phasing and coordination will be required to minimize service outages and to maintain required fire flows. Coordination with individual services being upgraded will also be required.

To accommodate sewer and water main bypassing, the inactive Seattle streetcar tracks are planned to be removed. Additional worker safety and coordination with BNSF will be required when removing the streetcar tracks and installing or removing the bypassing systems and piping.

There are two piers along the western side of Alaskan Way; access to the piers will be maintained throughout construction. Construction activities adjacent to the piers should be scheduled to minimize the potential for conflicts with the elevated number of tourists that visit the waterfront area during the busiest summer months.

9.5.1.2 Risks and Constraints

The following risks and constraints apply to the Inline Alaskan Way Inline Storage Alternative:

- Active BNSF railroad tracks parallel the proposed storage pipe and bypassing alignments and will require additional coordination and safety measures when working near the tracks.
- No survey data or utility locating investigations (i.e. potholing) have been completed to date. Since the proposed storage pipe is significantly larger in diameter than the existing sewer, there is a risk of encountering vertical or horizontal spacing conflicts with other

[27] Seattle Department of Transportation, 2018 Traffic Report, 2017 Seattle Traffic Flow Map.

utilities. Utility relocations not previously identified may be required if there are conflicts identified during detailed design.

- Extensive sewer bypassing will be required since the existing sewer is being removed and replaced. As a result, the sewer capacity during construction will be reduced. This could increase the frequency and/or volume of CSOs during construction. Additionally, the bypassing system will need to be managed to prevent SSOs.

- The proposed storage alignment is close to the Elliott Bay shoreline and seawall. Future reconstruction of the seawall (unscheduled at this time) may have future impacts to the sewer alignment. It is anticipated that utilities within 40 feet of the seawall may need to be relocated; the proposed storage pipe general falls outside of this envelope (approximately 60 feet from the seawall).

- Internal modifications to the existing CSO Control Structure are required to allow enough flow through the structure into the storage pipe. External modifications to the CSO Control Structure are not anticipated to be required, however additional engineering analysis will be needed during design to verify this assumption.

- Alaskan Way is identified as a liquefaction prone area that is particularly susceptible in the event of a seismic event. The soils are not anticipated to be suitable backfill for the sewer. The sewer backfill and design will need to take this into consideration.

- High groundwater levels are anticipated due to the proximity to the shoreline. Extensive groundwater management strategies may need to be implemented that could include:

    - Water-tight shoring systems,
    - Dewatering wells, and/or
    - Trench dewatering systems.

- There is potential for encountering soil contamination and groundwater contamination within the proposed limits of construction. Since no geotechnical investigations have been completed for this project to date, it is difficult to estimate how much contaminated soil is expected and quantify the potential project costs related to contaminated soils disposal or remediation.

- Given the combined sewer capacity limitations, stormwater and groundwater from the construction area may need to be treated and discharged to Elliott Bay rather than the combined sewer system to avoid causing additional CSOs.

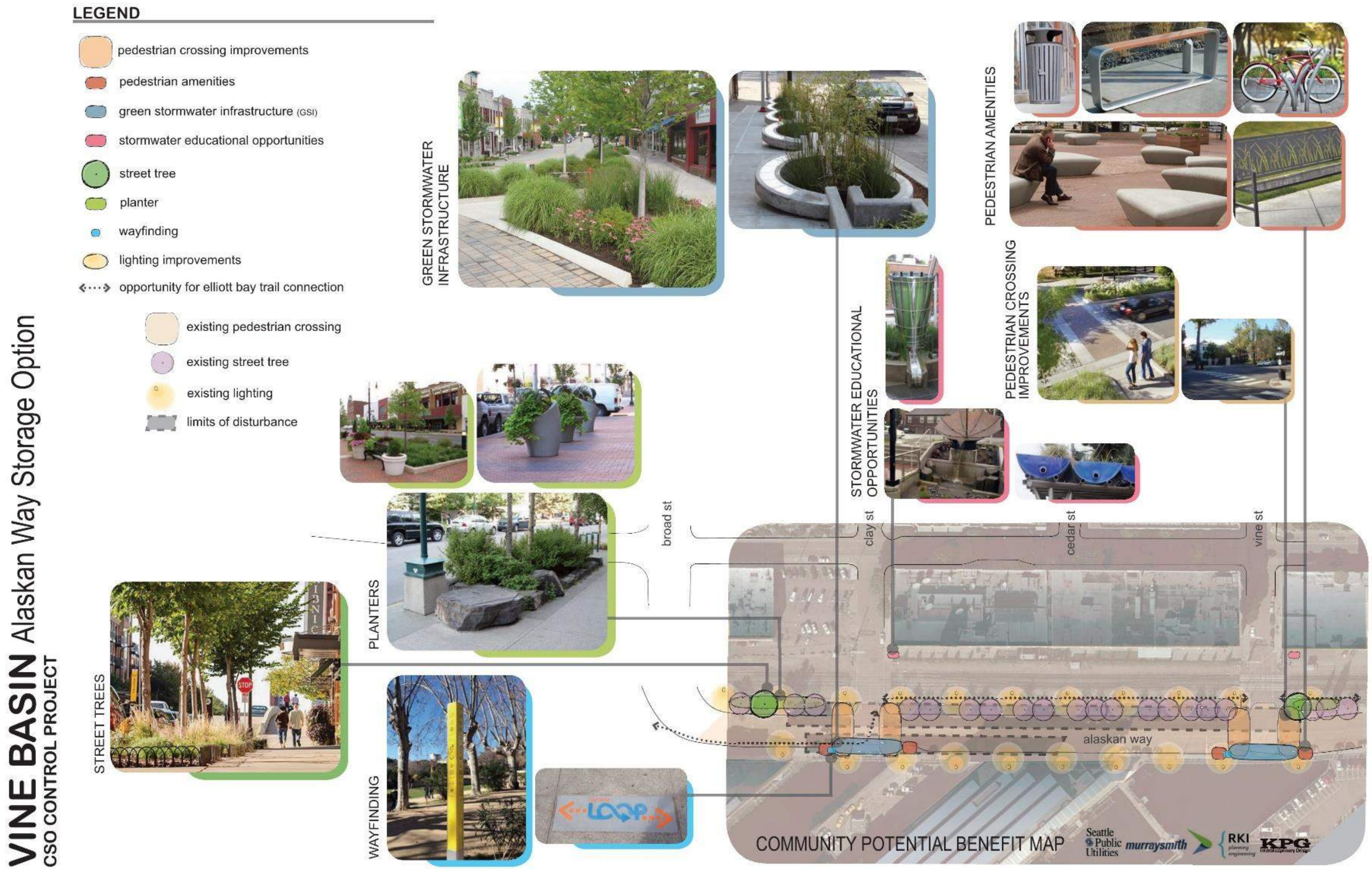
- There is potential for encountering abandoned creosote piles during excavation that remain from the original seawall construction. Abandoned piles were encountered as part of the Seattle Seawall Replacement Project that was recently completed to the south of the proposed project site.

9.5.1.3 Public Acceptability

The greatest perceived drawback to the community resulting from this alternative is the duration of impacts to street parking and vehicle traffic along the waterfront. Due to the anticipated width of the excavation, intersection closures are anticipated to take longer than the other alternatives and the excavation cannot be easily covered with steel plates at night for site safety. Long-term community benefits have not been narrowly defined for this alternative, but various ideas are shown in **Figure 9-13**. The benefits may include educational features about stormwater, pedestrian improvements, and most notably, the potential for connecting the Elliott Bay Trail from the park area to the continued section to the south of the construction area.

A public in-person open house meeting was held on February 6, 2019 where general project information, as well as information about potential construction impact areas, was made available. An online open house with the same information was also held from January 24, 2019 through February 13, 2019. Common themes of feedback received from participants included an interest in additional greenery within Basin 69, pedestrian safety improvements (lighting and crosswalks), and a priority to maintain existing parking and car/bike lanes. A summary report of the public outreach conducted as part of the alternatives analysis for this project is provided as **Appendix B**.

Figure 9-13
Potential Community Benefits for the Alaskan Way Inline Storage Alternative



9.5.2 Long-Term Hydraulic Modeling

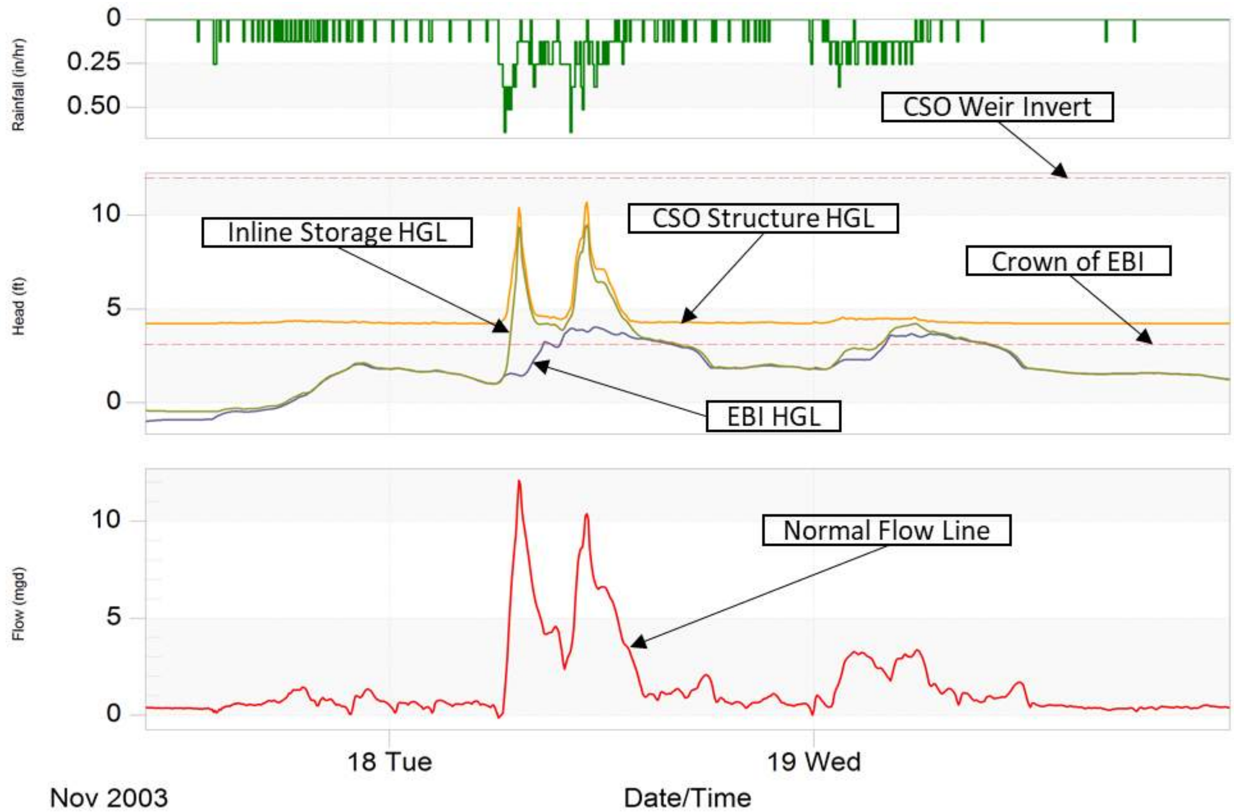
A long-term hydraulic modeling simulation was performed for this alternative to assess system sizing, configuration and anticipated performance in reducing CSO events. The simulation was run using 2035 climate perturbed rainfall. Boundary conditions consistent with all model runs were used to simulate downstream water surface elevations.

This alternative relies on storing excess sewer flows downstream of the CSO Control Structure to reduce the frequency of CSOs from Basin 69. The CSO Control Structure is modified so that flows exit through an enlarged orifice and are conveyed through an upsized pipe to the inline storage pipe. Enlarging the orifice and upsizing the sewer between the CSO Control Structure and the inline storage pipe reduces the HGL in the CSO Control Structure. As a result, this alternative is projected to meet the CSO performance standard of no more than one CSO event per year in a 20 year moving average after the project is constructed.

The control volume for the storage alternative was originally expected to be 182,000 gallons, however the proposed storage is sized at 263,000 gallons. The proposed volume exceeds the anticipated control volume because the storage had to be located downstream of the CSO Control Structure, and as a result, additional storage was required to mitigate the effects of the downstream HGL of KC's Elliott Bay Interceptor.

Additionally, the alternative was configured to limit an increase of peak flows conveyed to KC's system. This was accomplished with the use of two orifices used to limit the flow out of the storage pipe. The first orifice is two feet in diameter and located at the invert of the storage pipe. This orifice is surcharged for most large precipitation events. A second 2 foot diameter orifice is located approximately three feet higher to provide a path for flows to exit outside the peak of the storm events. During the peak period of large precipitation events this orifice is often surcharged as well. Finally, a high-flow weir 2 feet tall and 10 feet long is located at the top of the inline storage to allow flow to escape when the storage is at capacity. This combination of weirs and orifices allows for the level in the CSO Control Structure to be sufficiently low to prevent CSO events, but also attempts to restrict flow such that peak flows to KC are not significantly increased. **Figure 9-14** shows the Alaskan Way Inline Storage operations for the 11/18/2003 CSO event (control volume event identified in **Section 7**).

Figure 9-14
Alaskan Way Inline Storage Alternative Operation – 11/18/2003 CSO Event



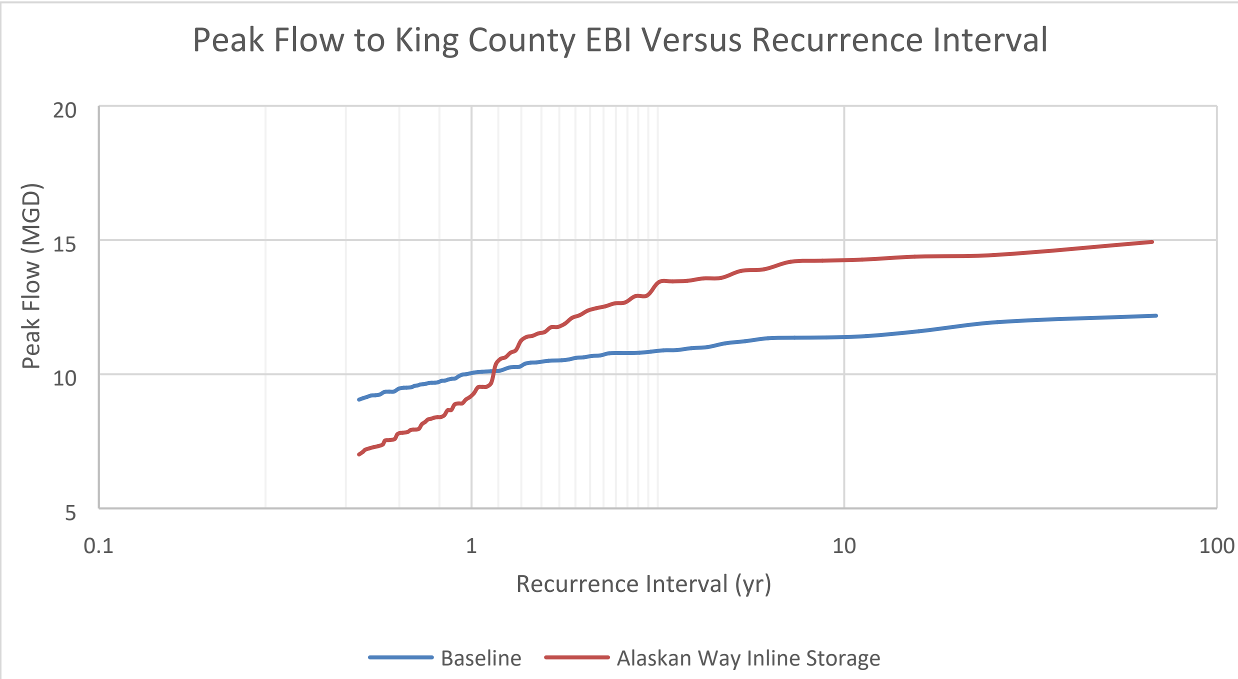
A comparison of flows to KC Elliott Bay Interceptor (EBI) for the baseline configuration (do nothing alternative) and the Alaskan Way Inline Storage configuration is given in **Table 9-10**.

Table 9-10
Alaskan Way Inline Storage Downstream Impact Comparison

	Average Annual Peak Flow Rate (MGD)		Average Annual Flow Volume (MG)	
	Alaskan Way Sewer	Western Avenue Existing Sewer	Alaskan Way Sewer	Western Avenue Existing Sewer
Baseline	10.06	18.13	127.2	371.1
Alternative 3	10.59	18.13	128.6	371.1

Peak flows conveyed to the KC EBI are plotted against their corresponding recurrence interval for the baseline and Alaskan Way Inline Storage configurations in **Figure 9-15**. For this alternative, the configuration was optimized for precipitation events similar in size to the 11/18/2003 event (shown in **Figure 9-14**). The peak flow to the KC system increases for larger events when the storage fills up and flow is discharged from the storage pipe via an overflow weir which prevents the storage pipe from overfilling. This happens for precipitation events that have a 1.2 year return period as the storage pipe is generally sized to store precipitation events below that return period.

Figure 9-13
Peak Flow Versus Recurrence Interval for the Alaskan Way Inline Storage and Baseline Configurations at the Alaskan Way Connection



9.5.3 Operation and Maintenance

Operations and maintenance (O&M) of the Alaskan Way Inline Storage alternative is assumed to be consistent with SPU's existing inline storage infrastructure. Discharges to KC's infrastructure will also be passively controlled. No additional training of SPU field crews is expected to be required to perform the necessary O&M activities. No solids handling is anticipated to be required, as the solids will be conveyed to the West Point Treatment Plant with the sewer flows.

The anticipated O&M activities for this alternative are listed in **Table 9-11**, along with the anticipated maintenance frequency and cost. Costs presented in the table are based on historical cost information from SPU's O&M staff as presented in the 2017 SPU Cost Estimating Guide and Template.

Table 9-11
Summary of Anticipated O&M Activities, Frequency and Cost

O&M Activity	Frequency	Cost
CCTV	10 years	$490
Structural Inspection	10 years	$3,500
Pipe Maintenance, Cleaning	Annual	$21,000
Flow Level Monitoring	Annual	$7,000

9.5.4 Project Costs

Opinions of probable construction costs (OPCCs) and other related and potential costs for the Alaskan Way Inline Storage alternative are presented in **Table 9-12**. The developed project costs include assumptions, allowances and contingencies as described in greater detail in **Section 11**. The OPCC for this alternative was developed at the AACE Class 4 Level (-20% to +30% accuracy range). Material quantities used to develop the OPCC were taken from the design layout presented in **Figure 9-12**. The complete basis of estimate and OPCC for this alternative is provided in **Appendix E**.

Table 9-12
Summary of the Alaskan Way Inline Storage Alternative Anticipated Project Costs

Description	Amount
Opinion of Probable Construction Cost (OPCC)	
Base Construction Cost	$8,125,000
Sales Tax (10.1%)	$821,000
Allowance for Indeterminates (30%)	$2,438,000
Other Hard Costs	$175,000
Subtotal OPCC	**$11,559,000**
Range of Possible Construction Cost	
Upper End of Class 4 OPCC (+30%)	$15,027,000
Lower End of Class 4 OPCC (-20%)	$9,248,000
Other Project Costs	
Property Acquisition	$0
Soft Costs (49%)	$5,664,000
Base Cost Total (Subtotal OPCC + Other Project Costs)	**$17,223,000**
Contingency (25%)	$4,306,000
Management Reserve for Risk (20%)	$3,445,000
Total Project Cost (2017 Dollars)	**$24,974,000**
Inflation Cost Adjustment Assumption (2.3% per year)	$1,162,000
Escalation Cost Adjustment Assumption (1% per year)	$233,000
Total Project Cost (2019 Dollars)	**$26,369,000**

Notes:
1. All values have been rounded up to the nearest $1,000.
2. Costs are presented in 2017 dollars, as the APWA and CSI bid item costs available in SPU's Cost Estimating Guide and Template are from 2017. Costs are presented in 2017 dollars, as the APWA and CSI bid item costs available in SPU's Cost Estimating Guide and Template are from 2017.
3. Inflation and escalation adjustments are added to present costs in 2019 dollars. Inflation is applied to the total project cost; escalation is only applied to construction costs.

9.5.5 Permits and Approvals

Table 9-13 provides a list of permits and approvals that are anticipated to be required for the Alaskan Way Inline Storage alternative.

Table 9-13

Anticipated Permits and Approvals for Alaskan Way Inline Storage Alternative

Jurisdiction	Anticipated Permit or Approval	Trigger and Notes	Anticipated Time to Obtain following Application Submittal
Local			
SPU	State Environmental Policy Act (SEPA) Review and Threshold Determination *(expected to be a SEPA checklist and Determination of Non-Significance)*	A threshold determination is required for any project or non-project action that exceeds or does not meet the City of Seattle's criteria for categorical exemption.	3 months.
SDOT	Street Improvement Permit (SIP)	Installation of major new permanent improvements within the City of Seattle ROW.	6 to 7 months, generally concurrent with the SDOT SIP design review process. Review times are expected to vary depending on project complexity.
SDOT	Construction Street Use Permit (includes review and permitting for the contractor's temporary ROW use, traffic control plan, pedestrian mobility plan, shoring, tree removal, etc.)	Required when performing construction activities that impact public access to the ROW. When work will last longer than 6 months in duration, a project notification is required, which must be posted on-site at each closure location and visible to the public.	2 to 3 months.
SDCI	Noise Variance *(potential based on construction plan and equipment)*	Required if construction activities are outside of the normal hours identified in Seattle Municipal Code 25.08 - typically, 10 PM to 7:00 AM. Also required if construction activities exceed 85 dB(A), measured at the property line of adjacent receiving properties.	Approximately 4 months for major projects.
SDCI	Land Use/Master Use Permit – Shoreline	Non-exempt work located within 200 feet of a water body regulated by the City's Shoreline Master Program.	4 to 8 months depending on project complexity.
SDCI/King County	SDCI Side Sewer Permit for Temporary Dewatering, including an Industrial Waste Program Wastewater Discharge Authorization from King County.	Required when discharging construction site water to a public combined or sanitary sewer system. Also required for deep excavations (greater than 12 feet), an acre or more of land disturbance, or if surface/subsurface water is encountered during construction. A temporary dewatering plan, subject to review and approval by SPU will be required.	2 to 3 months. Dependent on project complexity.
State			
Department of Archaeology and Historic Preservation (DAHP)	DAHP Concurrence	Although ground disturbance is not expected to reach native soils and earlier cultural resources surveys in the area suggest that fill has a very low potential for significant cultural materials, DAHP may require a cultural resources survey, which would be submitted for their review and approval. If ground disturbance would extend into native soils, early consultation with DAHP is highly recommended.	Typically, 2 months depending on DAHP staff availability.
Washington State Department of Ecology (Ecology)	National Pollutant Discharge Elimination System Construction Stormwater General Permit	Land-disturbing activities exceeding 1 acre and with construction stormwater or groundwater discharge to waters of the state.	2 to 3 months.
Private			
BNSF Railway (BNSF)	Pipeline or wire line permit	Installation of an underground utility line within BNSF ROW. BNSF ROW varies from 25 to 50 feet from the center line of the tracks.	1 month; however, durations can extend up to 6 months.

9.5.6 Environmental Impacts

All construction work is expected to be within the paved right-of-way for this alternative, thus limiting environmental impacts. This alternative is not anticipated to require any in-water work. The selected general contractor will be required to have and comply with a Stormwater Pollution Prevention Plan (SWPPP) and a Tree, Vegetation, and Soil Protection (TVSP) Plan. Due to the limited capacity of the combined sewer system, water collected from site dewatering activities is expected to be treated and discharged to Elliott Bay via an existing stormwater discharge point. Regular testing or maintenance of the dewatering treatment system will be required to minimize the impacts of the discharge to the Elliott Bay environment.

Dust control measures during earthwork activities will be required, including, but not limited to, street sweeping, watering exposed soil surfaces and covering soil stockpiles to minimize fugitive dust and particulate matter pollution in the surrounding area.

Air pollution engine exhaust could increase during periods of heavy construction, however provisions to limit the idling of mechanical equipment are typically included in City of Seattle projects.

No significant long-term environmental impacts are expected for this alternative after construction has been completed, other than the improvements to Elliott Bay as a result of reducing CSO event frequency.

Section 10

Evaluation of Top Alternatives

This section summarizes the process used to evaluate the top alternatives and select a recommended alternative that best meets the project goals of reducing CSO event frequency in Basin 69 and other City goals.

10.1 Life-Cycle Cost Comparisons

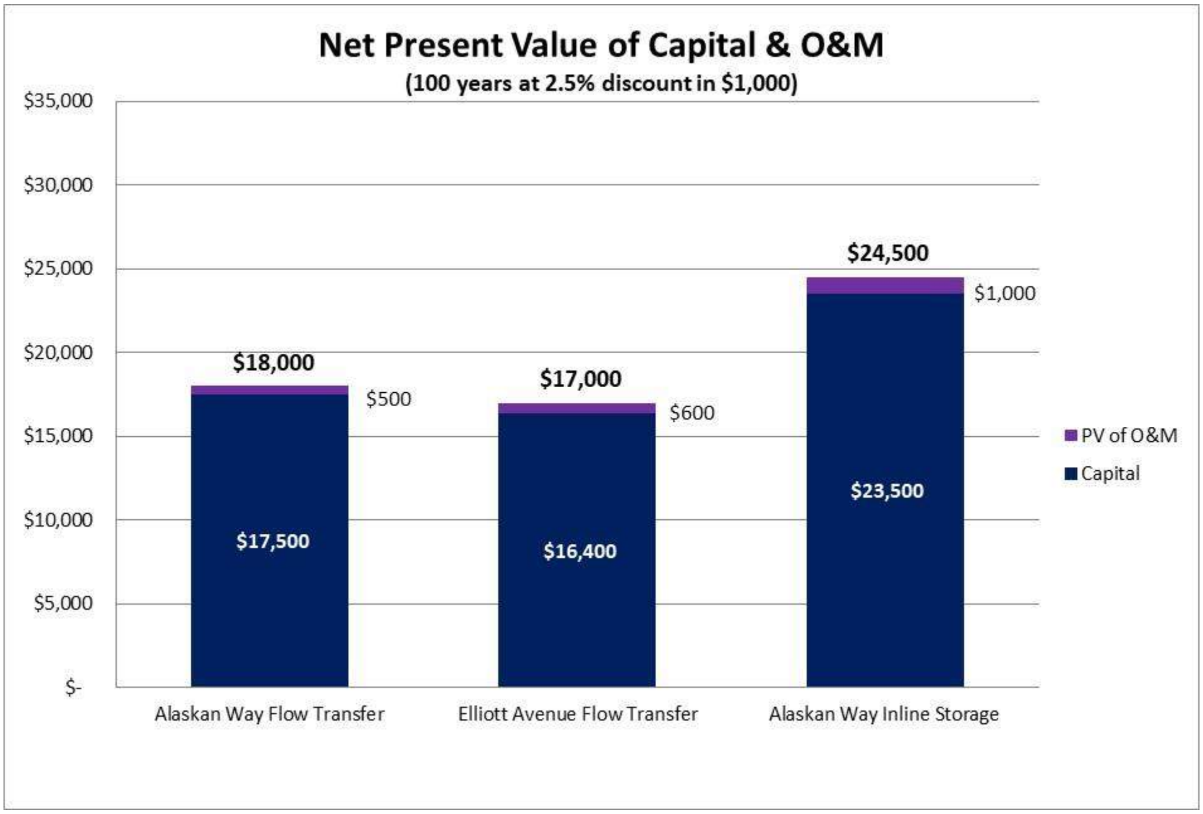
To best compare the top alternatives, the net present value (NPV) of each alternative was calculated for the total project cost and anticipated O&M costs using a 100 year period at 2.5 percent discount rate. **Table 10-1** provides a summary of the NPV for each top alternative. The least expensive alternative is Alternative 2 (Elliott Avenue New Flow Transfer). Alternative 1 (Alaskan Way Parallel Flow Transfer) is anticipated to be $1,000,000 more costly than Alternative 1. Alternative 3 is the most expensive alternative, with an anticipated NPV of $24,500,000. Costs are presented in 2017 dollars.

Table 10-1
Summary of Net Present Value of Top Alternatives

Project Cost Components	Alternative 1 - Alaskan Way Transfer	Alternative 2 – Elliott Avenue Transfer	Alternative 3 – Alaskan Way Inline Storage
Hard Costs	$8,100,000	$7,600,000	$10,900,000
Soft Costs	$4,000,000	$3,700,000	$5,300,000
Reserves	$5,400,000	$5,100,000	$7,300,000
O&M Costs	$500,000	$600,000	$1,000,000
Anticipated Project Total NPV	**$18,000,000**	**$17,000,000**	**$24,500,000**

Figure 10-1 provides a graphical representation of the NPV for each top alternative, delineated by capital costs (including hard costs, soft costs and reserves) and O&M costs.

Figure 10-1
Net Present Value of Capital and O&M



10.2 Multi-Objective Decision Analysis

A Multi-Objective Decision Analysis (MODA) was performed on the top alternatives to identify the alternative that would best meet the project goals of reducing CSO event frequency within Basin 69 and other overarching City goals. Over the course of several meetings, SPU led a process to identify evaluation criteria, develop performance scales, assign weights to the criteria, and score the top alternatives. After the top alternatives were scored, the results were compared to the project NPVs using a value versus cost graph. The recommended alternative would be the alternative that best balances life-cycle costs and meet the evaluation criteria. While possible, it was not automatic that the alternative with the highest value resulting from the evaluation criteria scoring would also be the least expensive.

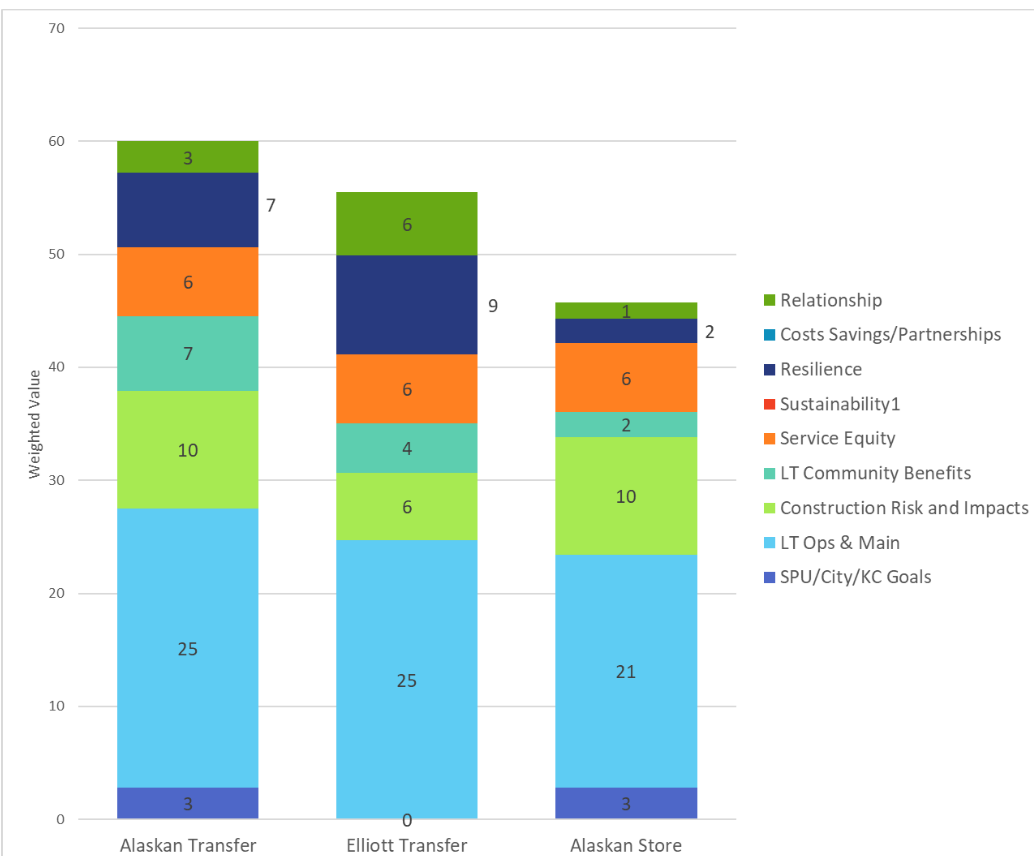
The evaluation criterion and assigned weighting used to score the top alternatives are provided in **Table 10-2. Figure 10-2** provides a graphical representation of the value scores for the top alternatives.

Alternative 1 (Alaskan Way Parallel Flow Transfer) received the highest valued score of 61 points. Alternative 2 (Elliott Avenue New Flow Transfer) had the second highest value score of 56 points. Alternative 3 (Alaskan Way Inline Storage) received the lowest value score of 45 points.

Table 10-2
Criteria, Weighting, and Scoring for the Top Alternatives

Criteria	Weight (%)	Weighted Value Scores		
		Alaskan Way Parallel Flow Transfer	Elliott Avenue New Flow Transfer	Alaskan Way Inline Storage
Expanded Outcomes – SPU/City/KC Goals	9	3	0	3
Long-term Operations and Maintenance	26	25	25	21
Construction Risks and Impacts	15	10	6	10
Long-term Community Benefits and Impacts	10	7	4	2
Social Equity	10	6	6	6
Sustainability	6	0	0	0
Resilience	11	7	9	2
Costs Savings and Partnerships	6	0	0	0
Relationship to Existing and Planned System Improvements	7	3	6	1
Total Weighted Score		61	56	45

Figure 10-2
Value Scores for the MODA Analysis

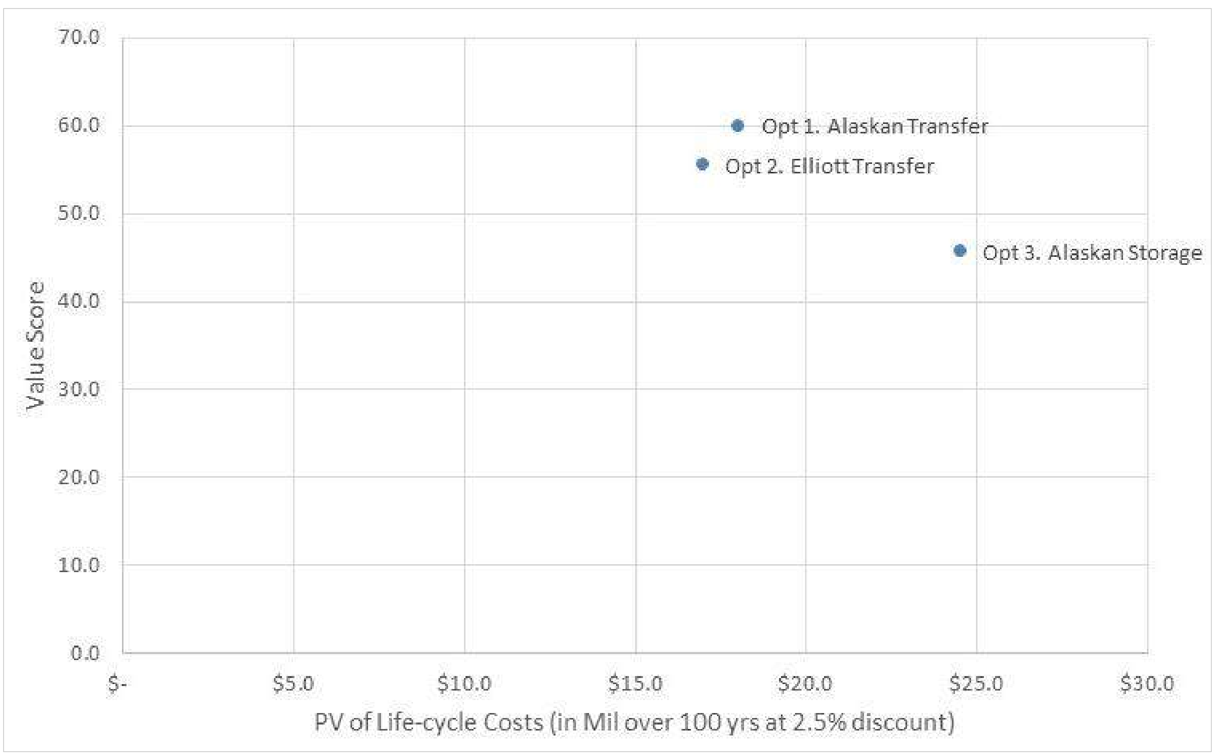


10.3 Recommended Alternative

Figure 10-3 is a graph comparing value scores and NPV costs for each of the top alternatives. The highest value alternative is Alternative 1 (Alaskan Way Parallel Flow Transfer), while the lowest cost alternative is Alternative 2 (Elliott Avenue New Flow Transfer). Both transfer alternatives scored significantly better on both value and NPV cost than Alternative 3 (Alaskan Way Inline Storage).

Based on the results of the MODA analysis and cost versus value comparison, the recommended alternative is Alternative 2 – Elliott Avenue New Flow Transfer. This alternative was the least costly alternative and scored a high value for the evaluation criteria considered. The Elliott Avenue New Flow Transfer is believed to provide the best value to SPU ratepayers for the anticipated expenditure.

Figure 10-3
Cost Versus Value Comparison of Top Alternatives



Section 11

Recommended Alternative

The Elliott Avenue New Flow Transfer alternative is the recommended alternative for reducing CSO event frequency in Basin 69. This section provides additional information about this alternative, including design criteria.

11.1 Site Layout

11.1.1 Existing Site Conditions

The proposed sewer alignment is located within the paved ROW of Elliott Avenue. The ROW is managed by SDOT; any plans to install utilities within the ROW must be approved by SDOT. Elliott Avenue is anticipated to be concrete pavement overlain with asphalt, however further field investigations during the design phase are required to verify this assumption and the thickness of the existing roadway.

Elliott Avenue to the south of Broad Street is a one-way street with two lanes for vehicular traffic, a single bike lane, and parking on both sides of the street. Three to four story buildings front the entire length and are immediately adjacent to a narrow sidewalk. Several mature trees line the roadway, but there are no significant planter strips. A narrow pedestrian skybridge crosses Elliott Avenue just south of Cedar Street.

Elliott Avenue to the north of Broad Street has two lanes for vehicular traffic in each direction, and a turn lane. A grassy slope (part of Olympic Sculpture Park) is located to the west of Elliott Avenue and a steep concrete retaining wall runs along the east side of the street. Trees are planted within the sidewalk along the east side of the street. A pedestrian overpass extends across Elliott Avenue just south of Bay Street and is part of Olympic Sculpture Park.

11.1.2 Proposed Facilities

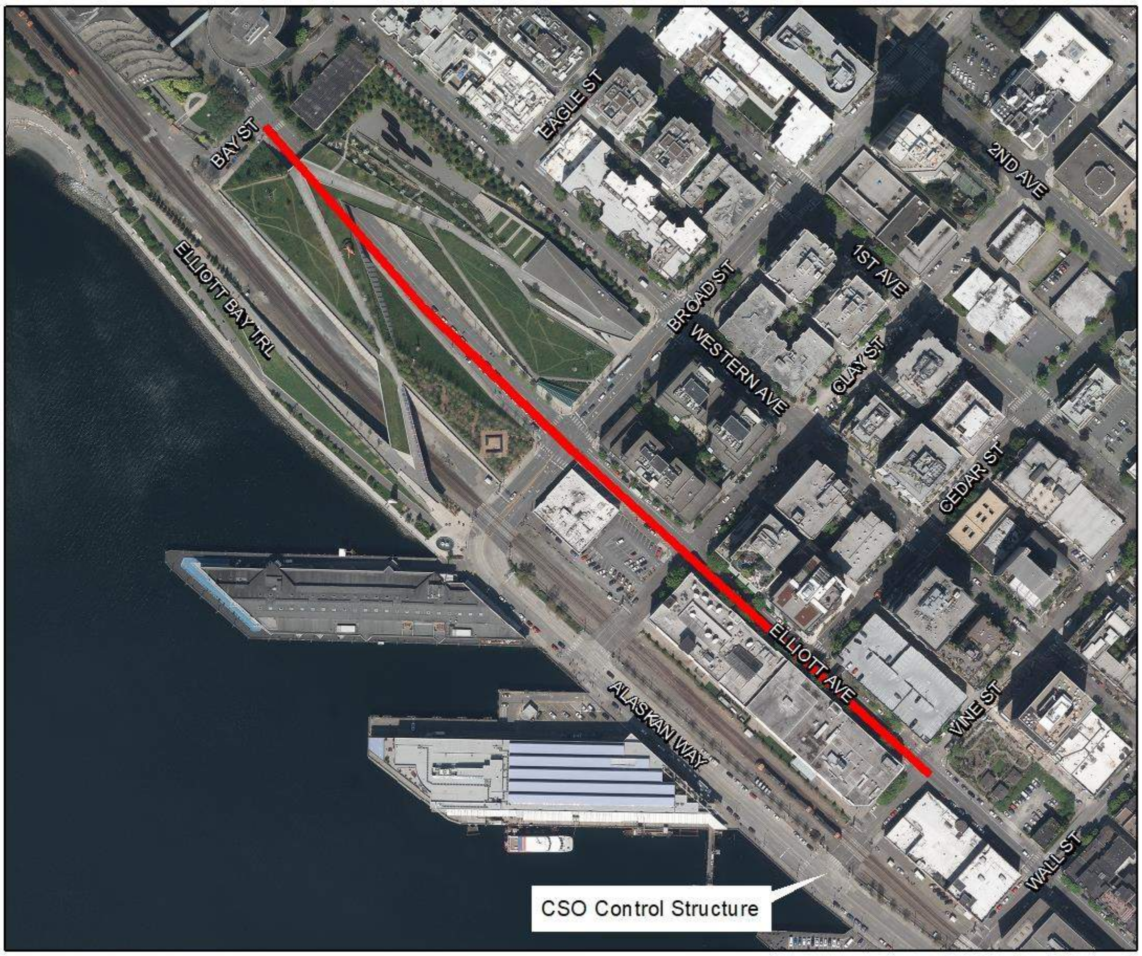
The recommended alternative primarily consists of approximately 1,800 linear feet of 24 inch diameter gravity sewer located within the ROW of Elliott Avenue between Vine Street and Bay Street. The gravity sewer will terminate at the intersection of Bay Street and Elliott Avenue, discharging to the KC Elliott Bay Interceptor. At this location, the Elliott Bay Interceptor is buried with approximately 20 feet of cover.

To direct sewer flows into the new sewer alignment, the maintenance hole (MH) and connecting pipes in Elliott Avenue just south of Vine Street will need to be reconstructed so that flows continue north along Elliott Avenue, rather than turning west and connecting to the sewer within

Vine Street. Flows from the Elliott Avenue sewer will pass through a diversion vault, installed on the existing Vine Street sewer running east/west. The proposed diversion vault will send normal dry weather flows through the proposed Elliott Avenue sewer. The diversion vault will also include an overflow weir to allow high flows to pass into the Vine Street sewers towards the existing CSO Control Vault (matching the existing flow path). This high flow path is necessary to prevent SSOs and flooding of side sewers upstream of the new diversion vault.

A general layout of the project site is provided in **Figure 11-1**.

Figure 11-1
Elliott Avenue New Flow Transfer Proposed Project - General Location



Figures 11-2A, 11-2B and 11-2C show the utility plans and the aerial plans of the proposed sewer alignment starting from the downstream connection to KC's Elliott Bay Interceptor. The connection to the KC Elliott Bay Interceptor will be made using a tapped connection at approximately 45-degrees above spring-line. The proposed diversion vault is shown in the intersection of Elliott Avenue and Vine Street on **Figure 11-2C**. The proposal alignment shown was selected to: 1) minimize conflicts with other utilities, 2) minimize changes in angle which require MHs, and 3) limit impacts to one-half of the roadway.

Figure 11-2A

Elliott Avenue New Flow Transfer Proposed Project - Utility Plan and Aerial Plan, Sheet 1 of 3

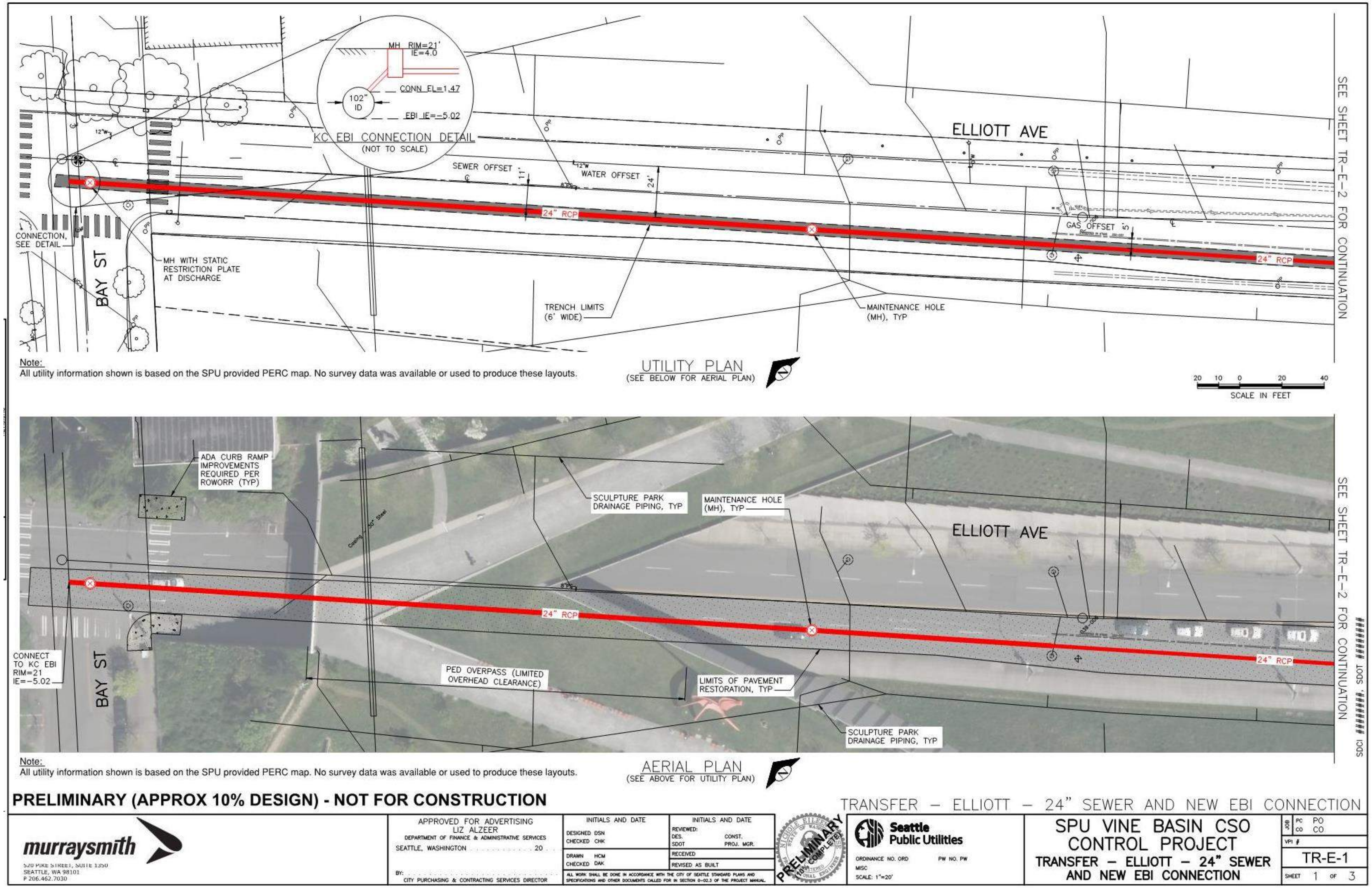


Figure 11-2B
Elliott Avenue New Flow Transfer Proposed Project - Utility Plan and Aerial Plan, Sheet 2 of 3

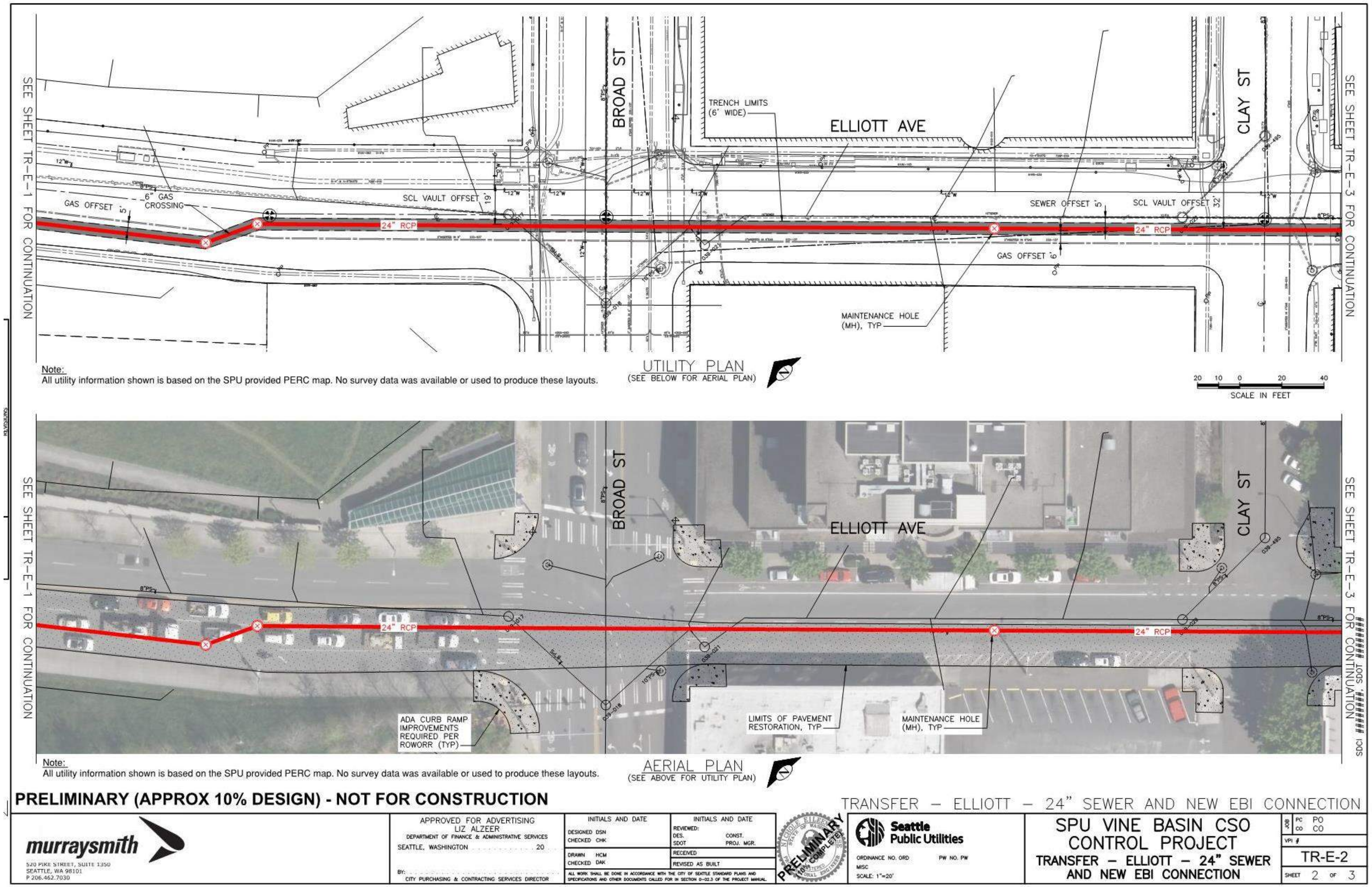
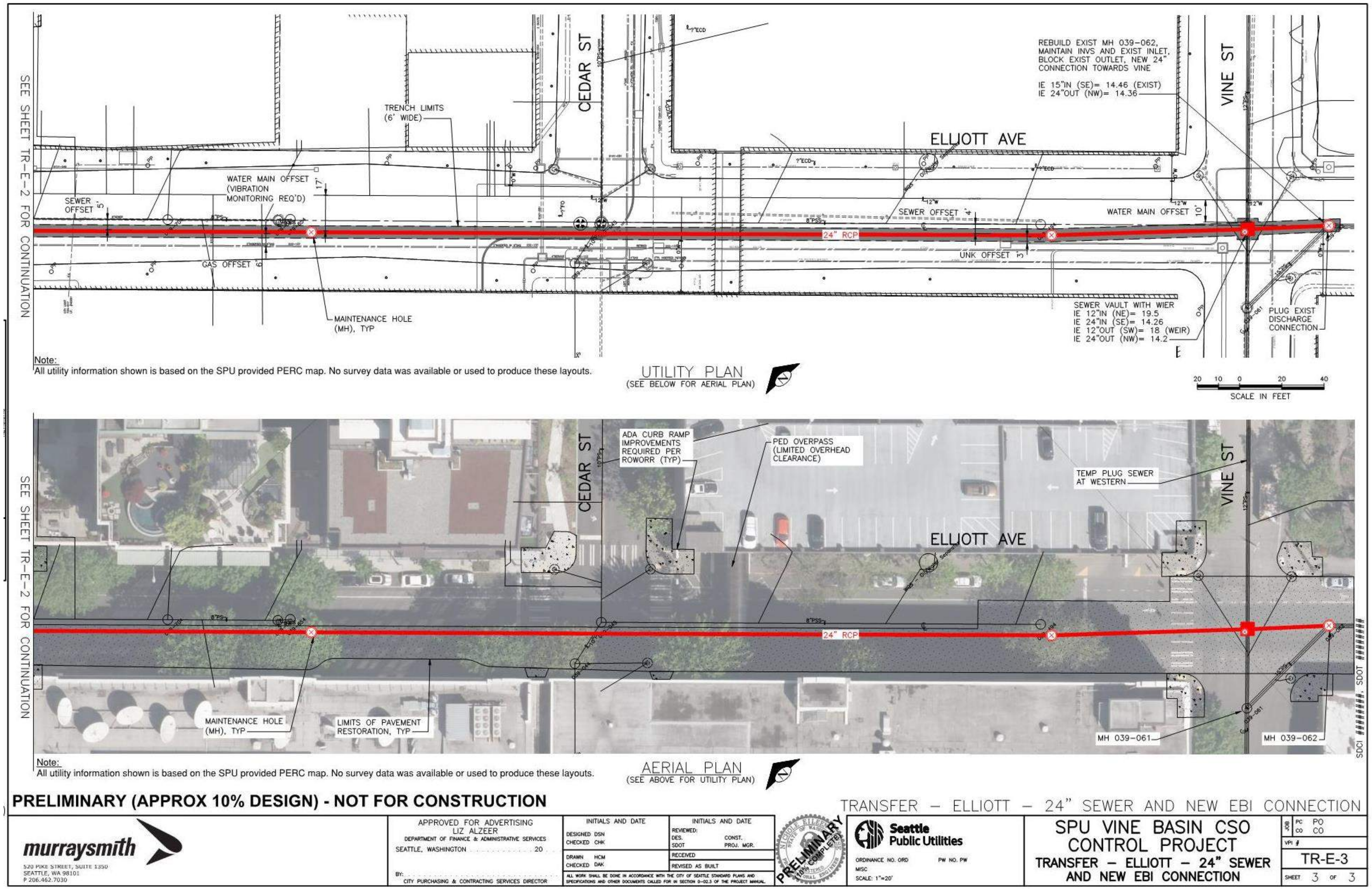


Figure 11-2C

Elliott Avenue New Flow Transfer Proposed Project - Utility Plan and Aerial Plan, Sheet 3 of 3



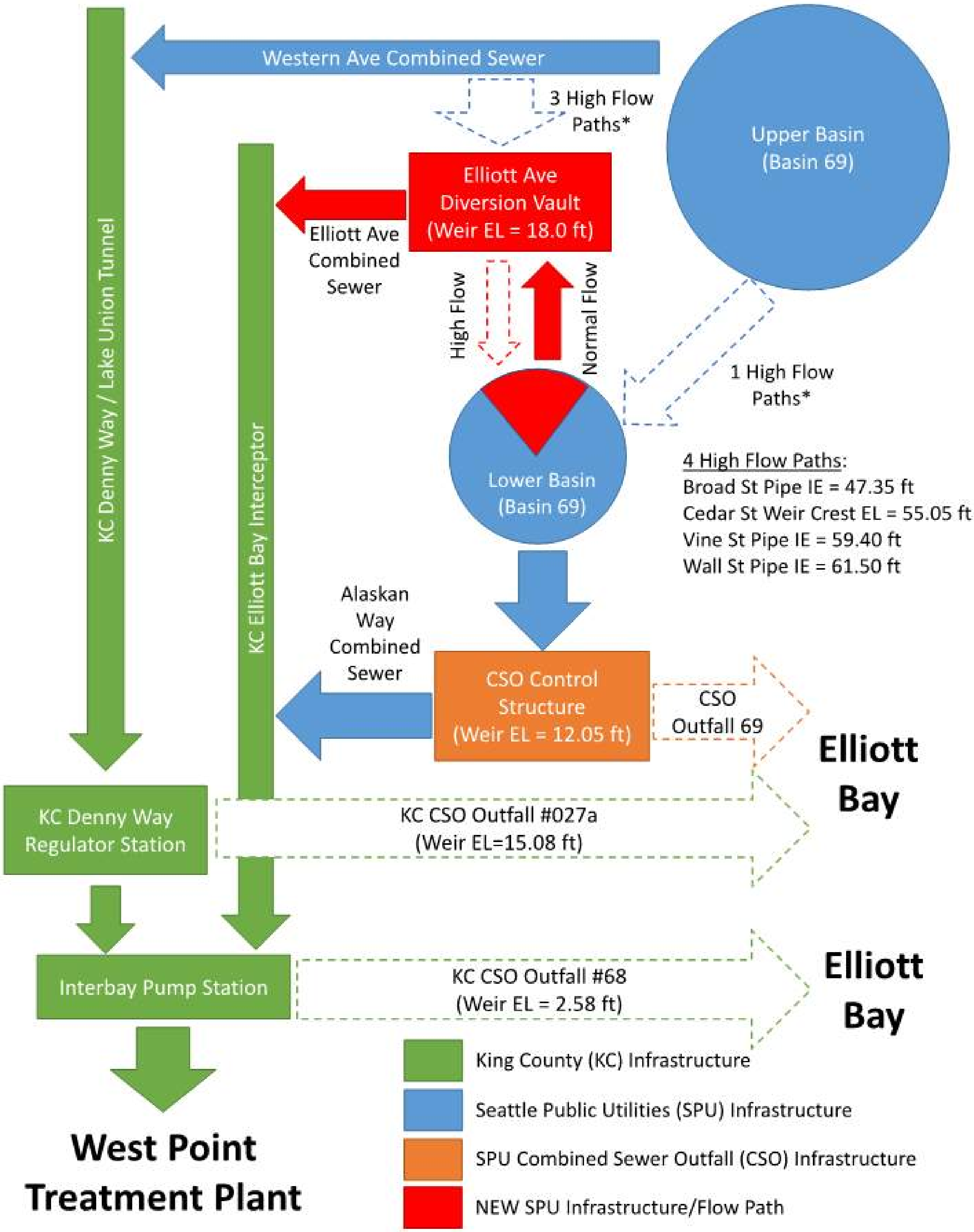
11.2 Flow Diagram

The proposed alternative introduces a new flow path for conveying flows to the KC Elliott Bay Interceptor. To successfully reduce the CSO event frequency in the Basin, this alternative relies on increasing the flow to the KC Elliott Bay Interceptor.

In the existing system, low flows from the “Upper Basin” (east of Western Avenue) are conveyed to the KC Denny Way/Lake Union Tunnel along a combined sewer main in Western Avenue. Flows from the “Lower Basin” are collected and pass through the CSO Control Structure prior to discharging through the combined sewer main in Alaskan Way to the KC Elliott Bay Interceptor. Under high flow conditions, excess flows are conveyed to the CSO Control Structure and KC Elliott Bay Interceptor via four high-flow paths along Western Avenue.

The selected alternative will change how flows from the “Upper Basin” and portions of the “Lower Basin” are conveyed to the KC Elliott Bay Interceptor. A revised flow schematic of Basin 69 is provided in **Figure 11-3;** the proposed modifications for the recommended alternative are presented in red. For the recommended alternative, normal flows in the Vine Street sewer (flowing from the east to the west) will be directed into the new Elliott Avenue sewer. Additionally, sewer flows in Elliott Avenue to the south of Vine Street will also be directed into the new Elliott Avenue sewer. A diversion vault will be located at the intersection of Vine Street and Elliott Avenue and will redirect flow from the two existing sewers into the new Elliott Avenue sewer. During a wet weather event, the HGL in the Vine Street sewer (east to west) and Elliott Avenue sewer (south to north) will rise. A weir in the diversion vault will allow high flows to continue down Vine Street sewer into the CSO Control Structure and the Alaskan Way sewer, matching the current flow path. Additional analysis is needed during final design to identify potential upgrades to the CSO Control Structure to protect the system from saltwater intrusion as a result of irregularly high sea-levels or swells. The rest of the Basin will continue to operate as before.

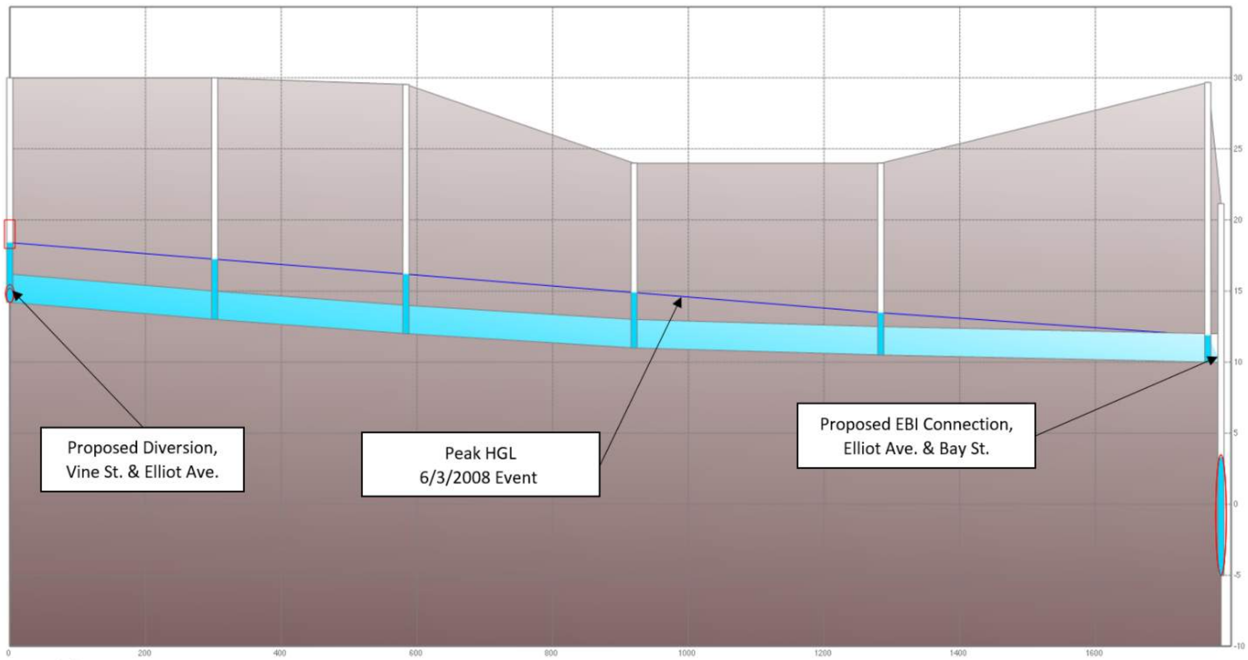
Figure 11-3
Basin 69 Flow Schematic with Modifications for Recommended Alternative



Note: Solid outlines represent normal flow paths. Dashed outlines represent high flow paths, only active when flow through normal pathways is limited such as during heavy wet weather events. All elevations are presented in NVAD88 Datum.

Figure 11-4 shows the HGL of the proposed Elliott Avenue sewer during the control volume wet-weather event (6/3/2008). The proposed diversion vault is shown at the left-hand side of the HGL, and the new connection to KC's Elliott Bay Interceptor is shown at the right-hand side of the HGL.

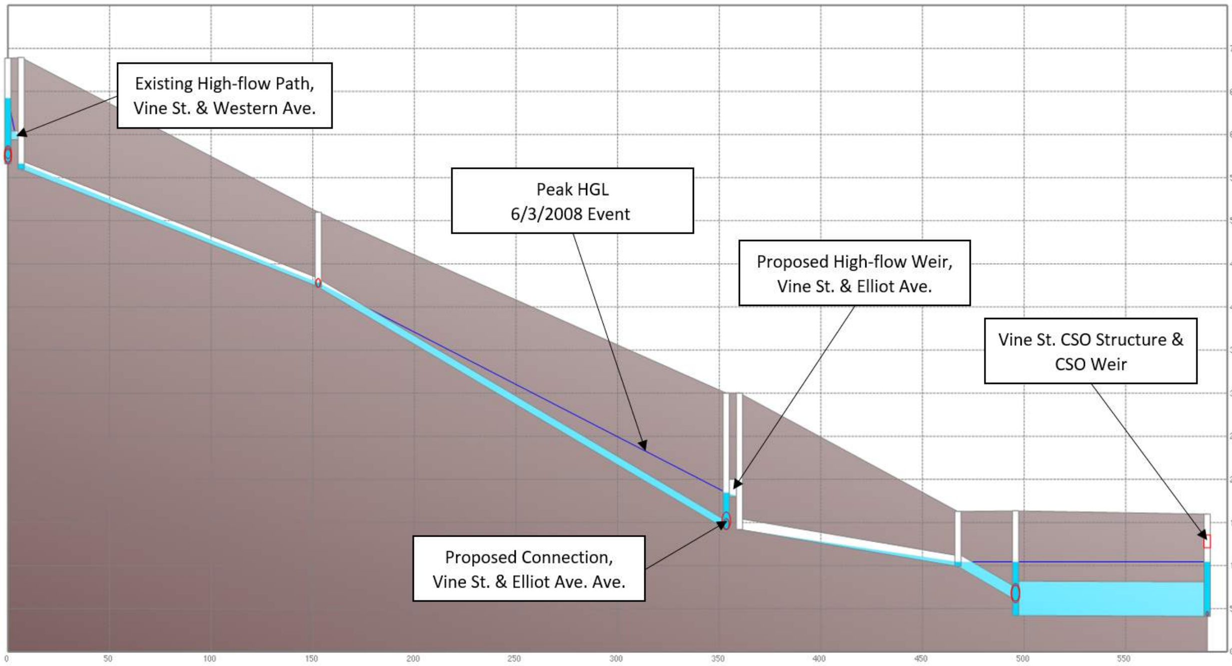
Figure 11-4
High Flow HGL for Proposed Elliott Avenue Sewer



The 6/3/2008 event, in the existing conditions configuration, generates a CSO volume approximately equivalent to the selected flow transfer CV.

Figure 11-5 shows the HGL of the existing Vine Street sewer (flowing from east to west towards Elliott Bay) with the proposed system modifications for the control volume wet-weather event (6/3/2008). The proposed diversion vault is shown at the left-hand side of the HGL, and the CSO Control Structure is shown at the right-hand side of the HGL. As can be seen in **Figure 11-5**, the peak flow for the control volume event results in an HGL below the elevation of the CSO weir in the CSO Control Structure.

Figure 11-5
High Flow HGL for Vine Street Sewer Between Western Avenue and Alaskan Way



The 6/3/2008 event, in the existing conditions configuration, generates a CSO volume approximately equivalent to the selected flow transfer CV.

11.3 Sizing

The new Elliott Avenue gravity sewer will be a 24 inch diameter sewer sized to convey peak wet weather flows to the KC Elliott Bay Interceptor. Added conveyance capacity achieves the project goal and effectively reduces the HGL at the CSO Control Structure where the CSO overflow weir is located. As a result, this alternative is projected to meet the performance standard of no more than one CSO event per year on a 20 year moving average after the project is constructed.

11.4 Environmental Impact

The proposed project is expected to have limited environmental impacts. There are no environmentally critical areas (ECAs) located within the anticipated project limits and the proposed alignment is located more than 100 feet from the shoreline of Elliott Bay. This alternative is not anticipated to require any in-water work.

All construction work is expected to be within the paved right-of-way for this alternative, thus limiting environmental impacts. The selected general contractor will be required to have and comply with a Stormwater Pollution Prevention Plan (SWPPP) and a Tree, Vegetation, and Soil Protection (TVSP) Plan.

Dust control measures during earthwork activities will be required, including, but not limited to, street sweeping, watering exposed soil surfaces and covering soil stockpiles to minimize fugitive dust and particulate matter pollution in the surrounding area.

Air pollution engine exhaust could increase during periods of heavy construction, however provisions to limit the idling of mechanical equipment are typically included in City of Seattle projects.

No significant long-term environmental impacts are expected for this alternative after construction has been completed, other than the improvements to Elliott Bay as a result of reducing CSO event frequency.

Additional information regarding environmental impacts will be available with the SEPA Checklist and a Determination of Non-Significance; these documents will be provided as **Appendix G** as part of the Final Engineering Report.

11.5 Design Life

The anticipated design life for the proposed alternative components are as follows:

- Concrete access structures: 50 years
- Pipelines: 100 years

These durations are consistent with 2017 SPU's Cost Estimating Guidelines. Under normal operations and regular maintenance, infrastructure lifespans are often longer than those listed in the Guidelines.

11.6 Sludge Management

Sludge management is expected to be minimal, since solids will be conveyed to the West Point Treatment Plant with the sewer flows. The slope of the sewer will be designed to maintain minimum slopes to prevent settlement of solids within the sewer. Solids may build-up in the proposed diversion vault, however the design configuration can minimize this potential.

The vault will be designed with access for annual inspection and other O&M needs. If solids or accumulated debris are present during an inspection, a Vactor™ truck can be used to remove and dispose of the solids that build-up in the vault, since the vault is expected to be less than 25 feet deep. Traffic control will be required any time access to the diversion vault is required. The diversion vault will be a confined space and will require provisions for confined space entry.

When a Vactor™ truck is used to remove debris and solids from other facilities in SPU's system, the solids are typically taken to an SPU operation center, decanted and the resulting solids are disposed of under contract by the City's solids waste contractor at an approved location.

11.7 Ability to Expand

The proposed sewer is 24 inch diameter piping, which is sized for a capacity that exceeds the required capacity needed to control CSO Outfall 69. Additional connections can be made to convey additional flow to KC's Elliott Bay Interceptor, if necessary, in the future. The cost of upsizing the pipe is minimal and greatly improves the long-term resilience and viability of this alternative.

The proposed alternative conveys flows from a single point at the intersection of Vine Street and Elliott Avenue. There are no other connections to the proposed sewer. If in the future it becomes necessary to send additional flow to KC, new connections can be created at the intersections of Cedar Street or Broad Street.

The proposed connection to the KC Elliott Bay Interceptor is via a pipe with a steep slope at the downstream end of the alignment; this is intended to minimize the backwater conditions in the proposed sewer and allow for the sewer to be installed at a shallower depth. Limiting the backwater effect from the KC Elliott Bay Interceptor also helps to increase the capacity of the proposed sewer.

Finally, the high-flow weir in the new diversion vault could potentially be raised to send more flow through the Elliott Avenue sewer.

Other alternatives that could be pursued as future adaptive management measures to improve long-term control in the Basin are:

- Mitigate infiltration through rehabilitation of aging sewers and MHs using CIPP
- Implement GSI BMPs and/or stormwater storage through SPU constructed infrastructure of incentive programs.

11.8 Operation and Maintenance

Operations and maintenance (O&M) activities anticipated for the recommended alternative are expected to be consistent with existing SPU procedures for gravity sewer infrastructure. It is expected that SPU has adequate staffing for the O&M requirements for this alternative. Table 11-1 presents a list of anticipated O&M activities that will be required for the proposed infrastructure and their frequency.

Table 11-1
Summary of Anticipated O&M Activities and Frequency

O&M Activity	Description	Frequency
CCTV	Camera Inspection of Sewer Pipe	10 years
Pipe Maintenance, Cleaning	Jet-spray cleaning to remove grease and solids build up from sewer and structures.	Annual
EBI Discharge Orifice Visual Inspections	Downstream MH access, visual inspection and jet-spray cleaning of the final segment of pipe connected to KC EBI.	Annual
New Weir Vault Maintenance, Cleaning	Visual inspection, jet-spray cleaning and Vactor™ truck removal of debris.	Annual
Flow Level Monitoring	A level monitoring device is anticipated to be installed in the new diversion vault. SPU currently contracts for the equipment, maintenance and reporting services with ADS.	Annual

11.9 Design Parameters

The proposed sewer is to be located within the ROW of Elliott Avenue between Vine Street and Bay Street. The sewer is to be a 24 inch diameter gravity sewer with a constant downward slope towards the discharge connection to the KC Elliott Bay Interceptors. MHs are to be located at all changes in sewer slope or direction (horizontal or vertical changes) and are to be spaced no further than 350 feet apart. The sewer alignment is to maintain a minimum of 10 feet of offset from existing cast iron water mains.

A site specific survey will be conducted as part of detailed design; the alignment will be finalized to minimize conflicts with existing utilities. All other design parameters, such as sewer pipe materials, slope, and bedding material are to be determined during detailed design.

11.10 Feasibility of Implementation

The recommended alternative is feasible for implementation. The alignment was selected to minimize utility impacts and the number of MHs required. Slight variations of this alignment will likely be explored during design once utility survey and potholing data is obtained.

The recommended alternative appears to be feasible and no major flaws have been identified as part of the preliminary design and evaluation.

Section 12

Financial Analysis

This section describes the financial information developed for the recommended alternative. This section also includes discussion about how capital projects are financed and SPU's financial and managerial capabilities for implementing the recommended project.

12.1 Costs

Anticipated project costs were developed in accordance with SPU's 2017 Cost Estimating Guide and Template. The cost estimating classification system defined in the Association for the Advancement of Cost Engineering (AACE) was used to define the level of accuracy for the opinions of probable construction cost (OPCC). The AACE system consists of five different levels of cost estimates ranging from Class 5 to Class 1, Class 5 being the least accurate class and Class 1 being the most accurate. **Table 12-1** summarizes the various classes of estimates and their accuracy ranges. The OPCCs developed for the top alternatives discussed in **Section 9** are Class 4 estimates presented in 2017 dollars, because the APWA and CSO bid item costs in the SPU Cost Estimating Guide and Template are from 2017. A one percent per year escalation adjustment and 2.3 percent per year inflation adjustment are added to the costs to present the overall cost in 2019 dollars.

Table 12-1
Summary of AACE Estimating Classification System

AACE Estimate Class	Project Phase	Typical Accuracy as a Range
Class 5	Project Development	-30% to +50%
Class 4	Preliminary Engineering	-20% to +30%
Class 3	30% Design	-15% to +20%
Class 2	60% Design	-10% to +15%
Class 1	90% Design and Final Design	-5% to +10%

12.1.1 Opinion of Probable Construction Costs

The OPCCs presented in **Section 9** and **Section 11** were developed for the purpose of evaluating and comparing the top alternatives, having developed the concepts to approximately 10 percent design based on the information and data available. No site survey data, geotechnical investigations, or utility locating efforts have been conducted to-date. Quantity take-offs were based on the preliminary layouts and design assumptions. An allowance for indeterminates (AFI) of 30 percent was included in the OPCCs to provide an estimated cost to address known construction scope that cannot yet be accurately quantified at this phase of the design development.

Project specific assumptions used to develop the OPCC for the Elliott Avenue New Flow Transfer alternative include the following:

- No in-water work will be performed.
- No replacement or relocation of other utilities unless specifically indicated on the layout.
- No odor control facilities, automation, instrumentation, or online monitoring is included.
- No rock excavation will be required.
- No vibration monitoring of adjacent structures is included.
- Vibration and settlement monitoring of the adjacent water main is included.
- No cost for additional/new art is included.
- Cultural resource monitoring of excavations will be performed.
- Complete street closures are not acceptable. At least one lane must always be kept open.
- Peace officers will be required during work within intersections.
- Open-cut construction will be utilized; no trenchless construction methods will be used.
- Right-of-way surface restoration will be completed in accordance with the Right-of-Way Opening and Restoration Rule (ROWORR) and per current City of Seattle Standards.
- Excavations will require interlocking steel sheet piles for groundwater management.
- At utility crossings, hand-digging will be required, and special shoring will be required.
- Trench dewatering will be required; assume sump pumps will be used. Discharge will be treated with Baker Tanks and oil absorbent filters prior to sewer discharge; KC approval required.
- Groundwater contamination sampling will be required.
- Construction schedule will overlap with wet season.
- Limited bypass pumping will be required when installing new bypass vault at the intersection of Vine Street and Elliott Avenue. Bypassing will be above grade and will not be trenched or require pavement restoration.

- Additional temporary power supply will be required during construction for dewatering pumps and bypass pumps.
- An allowance for renting a private parcel to be used as a construction staging and parking area has been included.
- Allowance has been included for excavated soils that may require disposal due to contamination; extent of contaminated soils is currently undefined.
- Roadway is assumed to be concrete pavement with asphalt overlay.
- Trees along the alignment will be protected.
- Construction duration will be approximately 16 months.
- Gravity sewer pipe will require approximately 1,800 linear feet of 24 inch diameter RCP.
- SPU will not perform any construction work or provide any owner furnished materials

The resulting OPCC for the Elliott Avenue New Flow Transfer alternative is summarized in **Table 12-2**.

Table 12-2
Summary of the Elliott Avenue New Flow Transfer Alternative Class 4 OPCC

Description	Amount
Opinion of Probable Construction Cost (OPCC)	
Base Construction Cost	$5,637,000
Sales Tax (10.1%)	$570,000
Allowance for Indeterminates (30%)	$1,692,000
Other Hard Costs	$185,000
Subtotal OPCC (2017 Dollars)	**$8,084,000**
Range of Possible Construction Costs	
Upper End of Class 4 OPCC (+30%)	$10,510,000
Lower End of Class 4 OPCC (-20%)	$6,468,000

12.1.2 Total Project Cost Estimates

The total cost for a project is developed to include the following:

- **Construction Costs**. These costs represent the anticipated construction contract value. This includes the base construction cost, sales tax, and allowance for indeterminants.
- **Other Hard Costs**. These are intended to capture additional construction costs that will be the responsibility of SPU rather than the contractor. These hard costs include permit fees, construction phase surveying, and construction materials testing.

- **Soft Costs**. These are non-construction labor costs such as the cost of SPU staff labor during design and construction and consultant engineering design fees. The estimated soft costs included in the project cost estimate is 49 percent of the OPCC value.

- **Property Acquisition Costs**. This is the amount require to purchase property required for the project. None of the top alternatives required property acquisition, so no amount was included in the project cost estimates.

- **Contingency**. This is an amount added to the OPCC to cover risk events that could occur the project, excluding changes in project scope. The contingency included in the project cost estimates is 25 percent of the OPCC value.

- **Management Reserve**. This is an amount added to the project cost to cover unidentified risk events that occur on the project, including minor changes in project scope. The management reserve included in the project cost estimates is 20 percent of the OPCC value.

- **Inflation.** This factor captures the persistent increase in consumer prices, or put differently, the persistent decline in the purchasing power of money. SPU currently sets the annual inflation rate to be used for cost projections at 2.3 percent.

- **Escalation.** This factor captures the change in price levels due to underlying economic conditions. Escalation is affected by changes in price-drivers such as productivity. Changes in market conditions, such as high demand, profit margins, and labor shortages, also impact escalation. SPU uses a one percent escalation adjustment rate to account for changing market prices.

The total project cost estimated for the Elliott Avenue New Flow Transfer alternative is presented in **Table 12-3**.

Table 12-3
Summary of the Elliott Avenue New Flow Transfer Alternative Anticipated Project Costs

Description	Amount
Subtotal OPCC	**$8,084,000**
Other Project Costs	
Property Acquisition	$0
Soft Costs (49%)	$3,962,000
Base Cost Total (Subtotal OPCC + Other Project Costs)	**$12,046,000**
Contingency (25%)	$3,012,000
Management Reserve for Risk (20%)	$2,410,000
Total Project Cost (2017 Dollars)	**$17,468,000**
Inflation Assumption (2.3% per year)	$813,000
Escalation Adjustment Assumption (1% per year)	$163,000
Total Project Cost (2019 Dollars)	**$18,444,000**

12.1.3 Operation and Maintenance Costs

Estimates of operation and maintenance (O&M) costs were based on historical cost information for SPU's typical maintenance, cleaning and inspection activities. Present value O&M and replacement costs for a 100 year service life were estimated using a discount rate of 2.5 percent; this resulted in an NPV of $600,000 for the O&M associated with the Elliott Avenue New Flow Transfer alternative. **Table 12-4** presents the annual O&M costs anticipated for the Elliott Avenue New Flow Transfer alternative.

Table 12-4
Summary of Anticipated O&M Activities and Costs

O&M Activity	Frequency	Cost
CCTV	10 years	$1,260
Pipe Maintenance, Cleaning	Annual	$4,500
EBI Discharge Visual Inspection	Annual	$500
New Weir Vault Maintenance, Cleaning	Annual	$1,000
Flow Level Monitoring	Annual	$7,000

12.2 Service Charges

SPU funds capital projects using bond proceeds, grants and reimbursements, and current revenues from user charges for wastewater and drainage service. SPU collects sewer charges based on metered water usage sent to customers in a combined utility bill (water, sewer and drainage).

The current sewer (wastewater) rate has two components:

1. The system component is to recover SPU costs and expenses and,

2. The treatment component is to recover payments to KC, whose facilities treat wastewater collected and conveyed by SPU's system.

SPU charges drainage (surface water management or stormwater) fees to property owners within City limits based on property characteristics that contribute to stormwater runoff. All rate increases are formally approved by the City Council. Drainage and wastewater rates were last increased on January 1, 2019.

12.2.1 Sewer Rates

Single-family residential customers are assessed sewer charges over a seasonal schedule. During winter months (November through April), sewer charges are assessed based on actual water usage. During summer months (May through October), sewer charges are assessed based on average water usage during the previous winter months. This approach focuses charges on the water that enters the wastewater system rather than the extra water typically used during the summer for outdoor activities such as irrigation and car washing, which does not enter the wastewater collection system.

Multi-family and commercial customers are charged based on actual water usage throughout the year unless they install sub-meters to measure actual use of the wastewater system. **Table 12-5** presents current wastewater billing rates for single-family residential customers. All properties (residential and commercial) pay the same 2019 sewer rate of $14.48 per 100 cubic feet of water used during November through April. The 2019 rates represent an increase of 7.5 percent.

Table 12-5
Wastewater Billing Rates Charged to Single-Family Residential Customers

	2018	2019
Typical Monthly Bill (430 cubic feet)	$57.88	$62.26
Rate per 100 cubic feet	$13.46	$14.48

12.2.2 Drainage Rates

The City of Seattle charges property owners a fee for stormwater management services based on each property's estimated impact on the City's drainage system. These fees are billed as a separate line item on King County property tax statements.

Starting January 1, 2008, the City of Seattle changed the drainage rate structure which underlies the calculation of the drainage fee. The new structure improves equity among customers by more accurately reflecting customers' impacts on the drainage system.

Drainage (stormwater) rates are assessed based on a property's estimated impact on the drainage system. Single-family and duplex properties of less than 10,000 square feet pay an annual flat fee based on the size of their property. Other properties, including single-family residences and duplexes on parcels of 10,000 square feet or greater, are charged based on the percent of impervious surface and billable property size. **Table 12-6** provides the current drainage rates charged by SPU.

Table 12-6
Drainage Billing Rates

	2018	2019
Small Residential - Annual Rate Per Parcel		
Under 2,000 square feet	$159.68	$169.81
2,000 – 2,999 square feet	$259.68	$276.51
3,000 – 4,999 square feet	$356.15	$383.43
5,000 – 6,999 square feet	$480.86	$516.72
7,000 – 9,999 square feet	$603.90	$652.61
All Other Properties - Annual Rate per 1,000 Square Feet		
Underdeveloped (0-15% Impervious)		
Regular	$38.78	$42.62
Low-Impact[3]	$23.06	$25.36
Light (16-35% Impervious)		
Regular	$59.24	$63.64
Low-Impact[3]	$46.74	$49.85
Medium (36-65% Impervious)		
Regular	$85.45	$90.58
Low-Impact[3]	$69.28	$73.31
Heavy (66-85% Impervious)	$114.57	$119.86
Very Heavy (86-100%) Impervious[4]	$134.85	$143.10

Notes:

1. Single Family Residential & Duplex parcels less than 10,000 square feet which are charged a flat rate per parcel rather than a fee based on the percent impervious. Rates for other properties are per 1,000 square feet based on the percent of impervious surface.
2. Beginning in 2016, the under 3,000 square feet tier was split into two tiers to minimize the variance between properties in each group in terms of lot size and percent impervious.
3. A customer in the Undeveloped, Light or Medium rate category with a significant amount of highly pervious (absorbent) surface may qualify for the Low Impact rate.
4. "Very heavy" does not necessarily mean heavily developed. A parking lot would be classified as "very heavy" since it is 100% impervious.

12.3 Financial and Managerial Capability

SPU is comprised of six executive branches: Finance, Office of Administration, Project Delivery and Engineering, Drainage and Wastewater Line of Business, Water Line of Business and Shared Services, and Solid Waste Line of Business. The General Manager and Chief Executive Officer, Mami Hara, manages SPU in accordance with policies established by the Mayor and the City Council.

Each Line of Business within SPU has an independent fund with project planning and budgets allocated to be consistent with the City of Seattle's Capital Improvement Program (CIP). The latest CIP projects spending from 2019 through 2024. SPU's Drainage and Wastewater Line of Business has a total CIP budget for this period of approximately $1.45 billion. These funds are further delineated for specific work, including CSO related work and include a line item for future CSO projects, including the recommended project for Basin 69. The future CSO projects line item has a budget of approximately $72 million to be allocated between 2019 and 2024.[28]

12.4 Capital Financing Plan

The recommended project to reduce CSO event frequency in Basin 69 will be financed by SPU from the Drainage and Wastewater Fund CIP, which is primarily supported through revenues from utility rates and issuance of revenue bonds. SPU has adopted financial policies that determine what share of the capital investments are funded through cash, and what share from debt. These policies are designed to balance the portion of current investments that are paid by today's ratepayers, versus future ratepayers who will also benefit from long-term capital investments. Bonds are typically issued every two years and were most recently issued in 2017.[29]

In June 2017, the Drainage Wastewater Fund issued approximately $234 million of revenue bonds with varying annual principal payments due beginning 2018 and ending in 2047, at interest rates ranging from 4.0 percent and 5.0 percent. A portion of the proceeds were used to fully refund remaining 2006 bonds. As a result, the total debt service requirements were reduced by $7.5 million resulting in an economic gain of $5.5 million. SPU's Drainage and Wastewater Fund is financially strong and has some of the strongest bond ratings of any utility in the country. SPU's Water and Drainage and Wastewater bonds are rated one notch below the highest rating by both Standard and Poor (S&P) (AA+) and Moody's (Aa1).[30]

12.5 Implementation Plan

The recommended alternative is scheduled to be implemented based on the following schedule:

1. Final design is to be completed by December 2021.
2. Construction is to be initiated by July 2022.
3. Construction is to be completed by September 2025.

[28] City of Seattle 2019-2024 Proposed Capital Improvement Program;
http://www.seattle.gov/financedepartment/1924proposedcip/documents/2019-2024ProposedCIP.pdf
City of Seattle Comprehensive Annual Financial Report for 2017;
http://www.seattle.gov/Documents/Departments/FAS/FinancialServices/CAFR/comprehensive-annual-financial-report-2017.pdf
[30] Seattle Public Utilities, Mami Hara, 2018 Proposed Budget;
http://www.seattle.gov/financedepartment/18proposedbudget/documents/SPU.pdf.

4. One year of commissioning and documentation to achieve controlled status is to be completed by September 2026.

This implementation schedule is consistent with the milestones in SPU's *Plan to Protect Seattle's Waterways*, which require construction completion by September 30, 2025.

Section 13

Other Topics

This section documents the relevance of Basin 69 CSO Control Project to other city, state and federal environmental regulations.

13.1 Water Quality Management Plan Conformance

SPU has several planning documents that address water quality management related to the sewer system and CSOs. Those documents include the 2015 *Plan to Protect Seattle's Waterways*, which includes the *Long-Term Control Plan (Volume 2)* and the *Integrated Plan (Volume 3)*. SPU also has an approved 2015 *Final Post-Construction Monitoring Plan*.

13.2 SEPA Approval

Typically, SEPA review is initiated by completing a SEPA Checklist to assess the potential impact of a proposed project on the environment. SPU, as lead agency, reviews the checklist, ensures it is complete and issues a threshold determination of significance or non-significance. Once SPU issues the determination, there is a public comment period prior and an appeal period.

For Basin 69, a SEPA checklist will be prepared for the Elliott Avenue New Flow Transfer alternative and will be included with the Final Engineering Report, along with the threshold determination and information about the public comment and appeal periods.

13.3 Required Permits and Approvals

Table 13-1 provides a comprehensive list of the anticipated permits and approvals that are required for the Elliott Avenue New Flow Transfer alternative.

Table 13-1
Anticipated Permits and Approvals for Elliott Avenue New Flow Transfer Alternative

Jurisdiction	Anticipated Permit or Approval	Trigger and Notes	Anticipated Time to Obtain following Application Submittal
Local			
SPU	State Environmental Policy Act (SEPA) Review and Threshold Determination *(expected to be a SEPA checklist and Determination of Non-Significance)*	A threshold determination is required for any project or non-project action that exceeds or does not meet the City of Seattle's criteria for categorical exemption.	3 months.
SDOT	Street Improvement Permit (SIP)	Installation of major new permanent improvements within the City of Seattle ROW.	6 to 7 months, generally concurrent with the SDOT SIP design review process. Review times are expected to vary depending on project complexity.
SDOT	Construction Street Use Permit (includes review and permitting for the contractor's temporary ROW use, traffic control plan, pedestrian mobility plan, shoring, tree removal, etc.)	Required when performing construction activities that impact public access to the ROW. When work will last longer than 6 months in duration, a project notification is required, which must be posted on-site at each closure location and visible to the public.	2 to 3 months.
SDCI	Noise Variance *(potential based on construction plan and equipment)*	Required if construction activities outside of the normal hours identified in Seattle Municipal Code 25.08 - typically, 10 PM to 7:00 AM. Also required if construction activities exceed 85 dB(A), measured at the property line of adjacent receiving properties.	Approximately 4 months for major projects.
SDCI/King County	SDCI Side Sewer Permit for Temporary Dewatering, including an Industrial Waste Program Wastewater Discharge Authorization from King County.	Required when discharging construction site water to a public combined or sanitary sewer system. Also required for deep excavations (greater than 12 feet), an acre or more of land disturbance, or if surface/subsurface water is encountered during construction. A temporary dewatering plan, subject to review and approval by SPU will be required.	2 to 3 months. Dependent on project complexity.
State			
Department of Archaeology and Historic Preservation (DAHP)	DAHP Concurrence	Although ground disturbance is not expected to reach native soils and earlier cultural resources surveys in the area suggest that fill has a very low potential for significant cultural materials, DAHP may require a cultural resources survey, which would be submitted to DAHP for review and approval. If ground disturbance would extend into native soils, early consultation with DAHP is highly recommended.	Typically, 2 months depending on DAHP staff availability.
Washington State Department of Ecology (Ecology)	National Pollutant Discharge Elimination System Construction Stormwater General Permit	Required for land-disturbing activities exceeding 1 acre **and** with construction stormwater or groundwater discharge to waters of the state.	2 to 3 months.

13.4 Compliance with Federal Cross-Cutting Authorities

Not applicable for this project.

Appendix A

NPDES Waste Discharge Permit No. WA0031682

Issuance Date:	March 30, 2016
Effective Date:	May 1, 2016
Expiration Date:	April 30, 2021
Modification Date:	September 28, 2017

National Pollutant Discharge Elimination System Waste Discharge Permit No. WA0031682

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq.

City of Seattle, Seattle Public Utilities

700 Fifth Avenue, Suite 4900

P.O. Box 34018

Seattle, WA 98124-4018

The City of Seattle is authorized to discharge combined sewage and stormwater at eighty-six (86) combined sewer overflow outfall locations, as indicated in Special Condition S1, and in accordance with the other Special and General Conditions that follow.

Mark Henley, P.E.
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

Table of Contents

Summary of Permit Report Submittals

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S4.A	Combined Sewer Overflow Monitoring Report	Monthly	June 28, 2016
S4.B	Annual CSO Report	Annually	March 31, 2017
S4.G.2.b	Reporting Permit Violations, 5-day Follow-up Report	As necessary	
S4.G.2.d	Reporting Permit Violations, Quarterly Basement Backup Follow-up Report	As necessary	
S6.C.1	Post-Construction Monitoring Program Quality Assurance and Sediment Sampling and Analysis Plans for outfalls 18, 68, and 95.	1 plan per outfall, per permit cycle.	See condition for specific submittal dates.
S6.C.3	Sediment Sampling Data Report for outfalls 13, 18, 68, and 95.	1 report per outfall, per permit cycle.	See permit section for specific submittal dates.
S6.C.4	Post-Construction Monitoring Data Report	1/permit cycle	October 30,2021
S7.A	Combined Sewer Overflow Reduction Plan Amendment	1/permit cycle with renewal application	October 30,2021
S8	Compliance Schedule Submittals	Multiple milestone requirements scheduled for completion between March 31, 2017 and December 31, 2020. See permit section for specific milestone dates.	
S9	Outfall Rehabilitation Plan and Inventory	1/permit cycle	October 30,2021
S10	Application for Permit Renewal	1/permit cycle	October 30,2021
G1	Notice of Change in Authorization	As necessary	
G4	Reporting Planned Changes	As necessary	
G5	Engineering Report for Construction or Modification Activities	As necessary	
G7	Notice of Permit Transfer	As necessary	
G10	Duty to Provide Information	As necessary	
G20	Compliance Schedules	As necessary	
G21	Contract Submittal	As necessary	

Special Conditions

S1. Authorized combined sewer overflow (CSO) discharge locations

Beginning on the effective date of this permit, the Permittee may discharge combined wastewater and stormwater from the CSO outfalls listed in Table 1. The CSO outfalls represent occasional point sources of pollutants as a result of overloading of the combined sewer system during precipitation events. The permit prohibits discharges not caused by precipitation events. This permit does not authorize a discharge from a CSO outfall that causes adverse impacts that threaten characteristic uses of the receiving water as identified in the water quality standards, Chapter 173-201A WAC, or result in an exceedance of the Sediment Management Standards, Chapter 173-204 WAC.

Outfall No.	Street Address	Latitude	Longitude	Name of Receiving Water
12	NE 60th ST & NE WINDERMERE RD	47.67108	-122.25295	Lake Washington
13	WINDERMERE PARK; NE AMBLESIDE RD & NE PENRITH RD	47.66382	-122.26522	Lake Washington
14	4218 55TH AVE NE	47.65925	-122.26799	Lake Washington
15	NE LAURELCREST LN & 51ST AVE NE	47.65523	-122.27129	Lake Washington
16	3005 WEBSTER POINT RD NE	47.64845	-122.27815	Lake Washington
18	3901 NE SURBER DR	47.65672	-122.28764	Union Bay
19	4501 27TH AVE NE	47.66103	-122.29782	Union Bay
20	E SHELBY ST & EAST PARK DR E	47.64696	-122.30074	Union Bay
22	2539 39TH AVE E	47.64246	-122.28285	Union Bay
24	E LEE ST & 42ND AVE E	47.63093	-122.27623	Lake Washington
25	E LEE ST & 42ND AVE E	47.63087	-122.27533	Lake Washington
27	1502 LAKE WASHINGTON BLVD	47.61492	-122.27996	Lake Washington
28	1500 LAKE WASHINGTON BLVD	47.61385	-122.28017	Lake Washington
29	LAKE WASHINGTON BLVD & FULLERTON AVE	47.60683	-122.28210	Lake Washington
30	LAKE WASHINGTON BLVD & E JEFFERSON ST	47.60577	-122.28262	Lake Washington
31	299 LAKESIDE AVE S	47.60013	-122.28498	Lake Washington
32	LAKESIDE AVE S & S DEARBORN ST	47.59572	-122.28621	Lake Washington
33	LAKESIDE AVE S & S CHARLES ST	47.59456	-122.28668	Lake Washington
34	LAKESIDE AVE S & S CHARLES ST	47.59451	-122.28666	Lake Washington
35	LAKESIDE AVE S & S MASSACHUSETTS ST	47.58756	-122.28456	Lake Washington
36	2310 LAKE WASHINGTON BLVD S	47.58261	-122.28612	Lake Washington
38	STANLEY SAYRES PARK; 3808 LAKE WASHINGTON BLVD S	47.57139	-122.27555	Lake Washington
40	LAKE WASHINGTON BLVD S & 49TH AVE S	47.56840	-122.27192	Lake Washington
41	LAKE WASHINGTON BLVD S & 50TH AVE S	47.56824	-122.26983	Lake Washington
42	4608 LAKE WASHINGTON BLVD S	47.56234	-122.26664	Lake Washington
43	LAKE WASHINGTON BLVD S & S ALASKA ST	47.56062	-122.26389	Lake Washington
44	SEWARD PARK; LAKE WASHINGTON BLVD S & S JUNEAU ST	47.54735	-122.25531	Lake Washington
45	MARTHA WASHINGTON PARK; 5711 S HOLLY ST	47.54150	-122.25961	Lake Washington
46	PRITCHARD ISLAND BEACH PARK; 8314 ISLAND DR S	47.52946	-122.26177	Lake Washington
47	BEER SHEVA PARK; SEWARD PARK AVE S & S HENDERSON ST	47.52329	-122.26287	Lake Washington
48	9722 RAINIER AVE S	47.51601	-122.25318	Lake Washington
49	9861 RAINIER AVE S	47.51341	-122.25029	Lake Washington
57	6701 SEAVIEW AVE NW	47.67843	-122.40693	Puget Sound - Central

Outfall No.	Street Address	Latitude	Longitude	Name of Receiving Water
59	5637 SEAVIEW AVE NW	47.67029	-122.40590	Salmon Bay
60	W CRAMER ST & 39TH AVE W	47.66782	-122.40740	Salmon Bay
61	2599 PERKINS LN W	47.64315	-122.41871	Elliott Bay
62	2599 PERKINS LN W	47.64200	-122.41774	Elliott Bay
64	1499 32ND AVE W	47.63158	-122.39925	Elliott Bay
68	PIER 91 AT 1523 W GARFIELD ST	47.63307	-122.37919	Elliott Bay
69	ALASKAN WAY & VINE ST	47.61321	-122.35232	Elliott Bay
70	ALASKAN WAY & UNIVERSITY ST	47.60581	-122.34053	Elliott Bay
71	ALASKAN WAY & MADISON ST	47.60370	-122.33858	Elliott Bay
72	199 ALASKAN WAY S	47.60090	-122.33671	Elliott Bay
78	SEACREST PARK; HARBOR AVE SW & FAIRMOUNT AVE SW	47.58752	-122.37723	Elliott Bay
80	DON ARMENI PARK; 112 HARBOR AVE SW	47.59327	-122.38206	Elliott Bay
83	ALKI BEACH PARK AT 1501 ALKI AVE SW	47.59125	-122.39415	Puget Sound - Central
85	3219 POINT PL SW	47.57676	-122.42008	Puget Sound - Central
88	5079 BEACH DR SW	47.55567	-122.40025	Puget Sound - Central
90	LOWMAN BEACH PARK; 7015 BEACH DR SW	47.53994	-122.39988	Puget Sound - Central
91	LINCOLN PARK; 8635 FAUNTLEROY WAY SW	47.52569	-122.39549	Puget Sound - Central
94	FAUNTLEROY FERRY TERMINAL; 4829 SW BARTON ST	47.52372	-122.39673	Puget Sound - Central
95	9279 FAUNTLEROY WAY SW	47.52050	-122.39578	Puget Sound - Central
99	TERMINAL 5 AT 3450 W MARGINAL WAY SW	47.57367	-122.36120	West Waterway - Duwamish River
107	3411 E MARGINAL WAY S	47.57367	-122.34269	East Waterway - Duwamish River
111	3 S OREGON ST	47.56314	-122.34531	Duwamish River
120	2770 WESTLAKE AVE N	47.64541	-122.34706	Lake Union
121	2046 WESTLAKE AVE N	47.63811	-122.34026	Lake Union
124	LAKE UNION PARK AT 800 WESTLAKE AVE N	47.62663	-122.33868	Lake Union
127	1099 FAIRVIEW AVE N	47.62965	-122.33123	Lake Union
129	TERRY PETTUS PARK; FAIRVIEW AVE E & E NEWTON ST	47.63681	-122.32950	Lake Union
130	LYNN ST PARK; FAIRVIEW AVE E & E LYNN ST	47.63959	-122.33037	Lake Union
131	2373 FAIRVIEW AVE E	47.64209	-122.33001	Lake Union
132	ROANOKE ST PARK; FAIRVIEW AVE E & E ROANOKE ST	47.64331	-122.32883	Lake Union
134	FAIRVIEW AVE E & E ALLISON ST	47.64924	-122.32501	Lake Union
135	3315 EASTLAKE AVE E	47.65208	-122.32092	Lake Union
136	3100 PORTAGE BAY PL E	47.64885	-122.31769	Lake Union
138	1209 E SHELBY ST	47.64693	-122.31604	Portage Bay
139	MONTLAKE PLAYFIELD AT 1618 E CALHOUN ST	47.64268	-122.31077	Portage Bay
140	W MONTLAKE PARK; WEST PARK DR E & E SHELBY ST	47.64693	-122.30952	Portage Bay
141	BRYANT SITE PARK AT 1215 NE BOAT ST	47.65086	-122.31563	Portage Bay
144	3790 LATONA AVE NE	47.65313	-122.32556	Lake Union
145	SUNNYSIDE AVE N BOAT RAMP; 2301 N NORTHLAKE WAY	47.65009	-122.33048	Lake Union
146	1430 N NORTHLAKE WAY	47.64722	-122.33962	Lake Union
147	N NORTHLAKE WAY & STONE WAY N	47.64801	-122.34285	Lake Union
148	4125 9TH AVE NW	47.65653	-122.36679	Lake Washington - Ship Canal
150	5301 24TH AVE NW	47.66677	-122.38801	Salmon Bay Waterway

Outfall No.	Street Address	Latitude	Longitude	Name of Receiving Water
151	5301 24TH AVE NW	47.66680	-122.38821	Salmon Bay Waterway
152	5301 28TH AVE NW	47.66728	-122.39284	Salmon Bay Waterway
161	MAGNUSON PARK AT 6451 65TH AVE NE	47.67713	-122.24909	Lake Washington
165	LAKE WASHINGTON BLVD S & S ALASKA ST	47.56061	-122.26401	Lake Washington
168	2311 SW MYRTLE ST	47.53920	-122.36241	Longfellow Creek
169	LONGFELLOW CREEK; 2450 SW THISTLE ST	47.52916	-122.36380	Longfellow Creek
170	2311 SW MYRTLE ST	47.53919	-122.36242	Longfellow Creek
171	CHINOOK BEACH PARK AT 9510 RAINIER AVE S	47.52062	-122.25972	Lake Washington
174	FREMONT CANAL PARK AT 151 NW CANAL ST	47.65276	-122.35980	Lake Washington - Ship Canal
175	FAIRVIEW AVE E & E GARFIELD ST	47.63389	-122.32722	Lake Union

S2. Nine minimum controls

In accordance with Chapter 173-245 WAC and US EPA CSO control policy (59 Fed. Reg. 18688), the Permittee must implement the following nine minimum controls (NMC) for CSOs. The Permittee must document compliance with the NMC in the Annual CSO Reports required in special condition S4.B.

The Permittee must comply with the following technology-based requirements for CSO systems. The Permittee must:

1. Implement proper operation and maintenance programs for the sewer system and all CSO outfalls to reduce the magnitude, frequency, and duration of CSOs. The Permittee shall implement the Operation and Maintenance Plan for the Combined Sewer System (CSS) that will include the elements listed below. The Permittee also shall update the plan to incorporate any changes to the system and shall operate and maintain the system according to the plan. The Permittee shall keep records to document the implementation of the plan.

   a. *Inspection and Maintenance of CSS.* The Permittee shall inspect and maintain all CSO structures, regulators, pump stations, and tide gates to ensure that they are in good working condition and adjusted to minimize CSOs and prevent tidal inflow. The Permittee shall inspect each CSO regulator structure at an appropriate frequency to ensure no dry weather overflows are occurring. The inspection shall include, but is not limited to, determining the extent of debris and grit buildup, and removing any debris or transfer of debris to the County system that may constrict flow, cause blockage, or result in a dry weather overflow. The Permittee shall keep records of the inspections. For CSO regulator structures that are inaccessible, the Permittee may perform a visual check of the overflow pipe to determine whether or not the CSO is occurring during dry weather flow conditions.

   b. *Provision for Trained Staff.* The Permittee shall ensure the availability of trained staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit.

   c. *Allocation of Funds for O&M.* The Permittee shall allocate adequate funds specifically for operation and maintenance activities.

2. Implement procedures that will maximize use of the collection system for wastewater storage that can be accommodated by the storage capacity of the collection system in order to reduce the magnitude, frequency, and duration of CSOs.

3. Review and modify pretreatment requirements to minimize the impacts of CSO discharges. Compliance with this control includes, but is not limited to, enforcing the Permittee's FOG ordinances and assisting King County in administering their Industrial Pretreatment Program within the Permittee's service area.

4. Operate the conveyance system to King County's interceptors and POTW/CSO treatment plants at the maximum transferable flow during wet weather flow conditions/events and deliver all flows to the treatment plants within the constraints of the capacity of the treatment plants. The Permittee shall keep records to document these actions.

5. Not discharge overflows from CSO outfalls except as a result of precipitation events; dry weather overflows from CSO outfalls are prohibited. The Permittee must report each dry weather overflow to the permitting authority as soon as it becomes aware of the overflow but no later than 24 hours after becoming aware of the dry weather overflow. When it detects a dry weather overflow, the Permittee must begin corrective action immediately and inspect the dry weather overflow each subsequent day until it has eliminated the overflow. The Permittee shall maintain records of the cause, corrective measures taken, estimate of the overflow volume and the dates of beginning and cessation of the dry weather overflow.

6. Implement measures to control solid and floatable materials in CSOs.

7. Implement a pollution prevention program focused on reducing the impact of CSOs on receiving waters. The pollution prevention program must include best management practices (BMPs) as an element to control pollutant sources that impact stormwater in combined basins. Ecology's *Stormwater Management Manual for Western Washington* (2012) contains appropriate BMPs for reference.

   Starting with the Annual CSO Report submitted in 2018, the Permittee must include a detailed description of the pollution prevention program, appropriate BMPs, and the legal authority and administrative procedures that the Permittee will use to ensure the program implementation. If the legal authority and/or administrative procedures are not in place, the Annual CSO Report must include a detailed description of the steps needed to establish such a program and the timeline for getting the program in place.

8. Continue to implement the public notification process to inform the citizens of when and where CSOs occur. The process must include (a) mechanism to alert persons of the occurrence of CSOs and (b) a system to determine the nature and duration of conditions that are potentially harmful for users of receiving waters due to CSOs.

9. Monitor CSO outfalls to characterize CSO impacts and the efficacy of CSO controls.

S3. Monitoring requirements

S3.A. CSO monitoring schedule

The Permittee must monitor all discharges from CSO outfalls listed in Special Condition S1 using the following monitoring schedule. The Permittee must use automatic flow monitoring equipment to collect the information required below. The Permittee must calibrate flow monitoring equipment according to requirements in S3.C. The Permittee must also conduct ambient water quality and sediment monitoring at select outfalls according to the schedule and protocols detailed in condition S6.C.

Parameter	Units	Minimum Sampling Frequency	Sample Type
(1) Discharge			
CSO discharge is defined as any untreated CSO which will exit or has exited the CSO outfall.			
Volume Discharged	Gallons	Per Event [c]	Measurement/Calculation [a,b]
Discharge Duration	Hours	Per Event [c]	Measurement
Storm Duration	Hours	Per Event [d]	Measurement
Precipitation	Inches	Per Event [c]	Measurement/Calculation [b]
(2) Post-Construction Monitoring Program			
The Permittee must monitor ambient water and sediment quality as Specified in Special Condition S6.C for select outfalls.			
Footnotes for CSO Monitoring:			
[a] Flow measurement must be continuous, except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. During periods of interrupted service, a calculation may be used to estimate the discharge volume. An explanation must be provided in the monthly DMR for all disruptions in flow measurement.			
[b] "Measurement/Calculation" means the total volume of the discharge or amount of precipitation event as estimated by direct measurement or indirectly by calculation (i.e. flow weirs, pressure transducers, tipping bucket). Precipitation must be measured by the nearest possible precipitation-measuring device and actively monitored during the period of interest.			
[c] "Per Event" means a unique flow event as defined in the *Permit Writer's Manual*, p. V-17. Ecology defines the minimum inter-event period (MIET) as 24 hours. A CSO event is considered to have ended only after at least 24 hours has elapsed since the last measured occurrence of an overflow.			
[d] Storm duration is the amount of total time when precipitation occurred that contributed to a discharge event. It is determined on a case-by-case basis.			

S3.B. Sampling and analytical procedures[1]

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

[1] The Permittee must conduct sampling and measurement only for volume discharged and precipitation, as noted in S3.A. The permit may require additional sampling and analyses in accordance with Sections S4.G, S4.H, and S6.C.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapters N [Parts 400–471] or O [Parts 501-503]) unless otherwise specified in this permit . Ecology may only specify alternative methods for parameters without permit limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S3.C. Flow measurement, field measurement, and continuous monitoring

The Permittee must:

1. Select and use appropriate flow measurement, field measurement, and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard, the manufacturer's recommendation, and approved O&M manual procedures for the device and the wastestream.
3. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.
4. Establish a calibration frequency for each device or instrument in the O&M manual that conforms to the frequency recommended by the manufacturer.
5. Maintain calibration records for at least three years.

S3.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*. Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement.

S4. Reporting and recording requirements

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

S4.A. Monthly CSO discharge monitoring reports

The first monitoring period begins on the effective date of the permit (unless otherwise specified). The Permittee must:

1. Submit CSO monitoring results each month.
2. Summarize, report, and submit the electronic discharge monitoring report (DMR) form provided by Ecology within the Water Quality Permitting Portal for all event-based monitoring data obtained during each monitoring period. Include data for each of the parameters tabulated in Special Condition S2 and

as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.

To find out more information and to sign up for the Water Quality Permitting Portal go to: http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html

1. Enter the "no discharge" reporting code for an entire eDMR or for a specific outfall, if the Permittee did not have a CSO during a given monitoring period.
2. For any automatic flow monitoring equipment that is installed but non-operational during the reporting month, the Permittee must identify the duration of the outage and whether or not it is likely that a discharge occurred during the non-operational period.
3. Ensure that DMRs are electronically submitted no later than the 28th day of the month following the completed monitoring period.

S4.B. Annual CSO reports

The Permittee must submit an annual CSO report to Ecology for review and approval by March 31st of each year. The annual CSO report must cover the previous calendar year. The report must comply with the requirements of WAC 173-245-090(1) and must include documentation of compliance with the Nine Minimum Controls for CSOs described in Special Condition S2. The Permittee must submit the reports electronically using the *Water Quality Permitting Portal – Permit Submittals* application. Each submittal must include all appropriate written report(s) in PDF format and all significant spreadsheets in Microsoft Excel format. The annual CSO report must include the following information:

1. A summary of the number and volume of untreated discharge events per outfall for that year.
2. A summary of the 20-year moving average[2] number of untreated discharge events per outfall, calculated once annually.
3. An event-based reporting form (provided by Ecology) for all CSO discharges for the reporting period, summarizing all data collected according to the monitoring schedule in Special Condition S2.
4. An explanation of the previous year's CSO reduction accomplishments, including a description of the progress made on all sewer system improvement projects and an assessment of the control status and effectiveness of these improvements.
5. A list of CSO reduction projects planned for the next year.

[2] The 20-year moving average shall be calculated by counting the number of untreated discharge events as of December 31 for each of the twenty years that immediately precede the year of the annual report, adding those numbers of untreated discharge events together, and then dividing that summation by twenty to arrive at the 20-year moving average.

6. A list of which permitted CSO outfalls that can be categorized as meeting the no more than one untreated discharge per year on a 20-year moving average performance standard. This annual assessment may be based on historical long-term discharge data, modeling, or other reasonable methods as approved by Ecology.

S4.C. Other permit submittals and schedules

The Permittee must use the *Water Quality Permitting Portal – Permit Submittals* application to submit all other written permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper document or a report/file that cannot be accepted by the Water Quality Permitting Portal (i.e. video file for outfall inspection, documents with large file sizes or documents divided into several separate electronic files), the Permittee must ensure that the report/file is postmarked or received by Ecology no later than the dates specified by this permit. Send these reports/files to Ecology at:

NPDES Permit Manager
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

S4.D. Records retention

The Permittee must retain records of all monitoring information for a minimum of three (3) years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S4.E. Recording of results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.
2. The individual who performed the sampling or measurement.
3. The dates the analyses were performed.
4. The individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

All laboratory reports providing data for sediments for organic and metal parameters must include the following information: sampling date, sample location, date of analysis, parameter name, CAS number, analytical method/number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected. Analytical results from samples sent to a contract laboratory must include information on the chain of custody, the analytical method, Quality Assurance (QA)/Quality Control (QC) results, and documentation of accreditation for the parameter.

S4.F. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special Condition S3 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR unless otherwise specified by Special Condition S3.

S4.G. Reporting permit violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.
2. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

   a. **Immediate reporting**

   The Permittee must *immediately* report to Ecology and Public Health of Seattle – King County at the numbers listed below all:

   - Collection system overflows that discharge to surface water, stormwater conveyance systems, or into areas open to public access. This reporting requirement does not apply to permitted CSO discharges.
   - Any other failures of the sewage system (pipe breaks, etc.) that may impact surface water or public health.

Northwest Regional Office	425-649-7000
Public Health of Seattle-King County	206-296-4932

   Additionally, for any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4), the Permittee must notify the appropriate MS4 owner or operator. The Permittee must report Dry Weather Overflows and backups into buildings within 24 hours, as required in subparts 2.c and 2.d below.

   If any of the situations noted above impact shellfish growing and harvesting areas, the Permittee must also immediately notify the Department of Health, Shellfish Program at the following numbers:

Department of Health, Shellfish Program	360-236-3330 (business hours) 360-789-8962 (after business hours)

b. Report within five days

The Permittee must also submit a written report within five business days of the time that the Permittee becomes aware of any reportable event under subparts 2.a, above. Submit the written report electronically using the *Water Quality Permitting Portal – Permit Submittals* application under the “As Needed, 5-day Written Follow-up” submittal schedule. Include the ERTS number in the name of the file uploaded for this submittal. If the letter covers multiple ERTS reports, include the incident date in the file name (example file names: “ERTS XXXXXX follow-up” or “follow-up-MMDDYYYY incidents”).

The report must contain:

1. A description of the noncompliance and its cause.
2. The period of noncompliance, including exact dates and times.
3. The estimated time the Permittee expects the noncompliance to continue if not yet corrected.
4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
5. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

c. Reporting – Dry weather overflows

Dry weather overflows (i.e. overflows from permitted CSO outfalls during periods of non-precipitation) are prohibited. The Permittee must report all dry weather overflows from CSO outfalls to Ecology at the ERTS phone number listed in subpart 2.a above as soon as the Permittee becomes aware of the dry weather overflow, but no later than 24 hours after becoming aware of the overflow. Submit a detailed, written report to Ecology within five (5) business days as required under subpart 2.b above, unless requested earlier by Ecology.

Corrective actions shall commence immediately and continue until the dry weather overflow has been eliminated.

d. Reporting – Sewer backups into buildings

The Permittee must report sewer backups into buildings (basements, low-lying first floors, garages, and toilets regardless of floor) to Ecology at the ERTS phone number listed in subpart 2.b above or via the online ERTS reporting form within 24 hours of becoming aware of the backup. The Permittee must submit a spreadsheet once per quarter that provides updated information on each backup reported during the quarter, if any occur. Submit the spreadsheet electronically using the *Water Quality Permitting Portal – Permit Submittals* application under the “As Needed, Basement Backup Follow-up” submittal schedule. The spreadsheet file name must identify the quarter and year for the report (example: “basement-2016Q1”). The Permittee must submit the report no later than the 15th day of the month following each reporting period. Quarterly reporting periods are January through March, April through June, July through September, and October through December.

e. **All other permit violation reporting**

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S4.A ("Reporting"). Electronically attach written reports of other violations to the DMR for the reporting period in which the violation occurred. The reports must contain the information listed in subpart 2.b, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

S4.H. Other reporting

a. **Spills of oil or hazardous materials**

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and Chapter 173-303-145. You can obtain further instructions at the following website: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm.

b. **Failure to submit relevant or correct facts**

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

S4.I. Maintaining a copy of this permit

The Permittee must keep a copy of this permit at their office and make it available upon request to Ecology inspectors.

S5. Operation and maintenance

The Permittee must at all times properly operate and maintain all facilities and systems of conveyance and control (and related appurtenances) that are installed to achieve compliance with the terms and conditions of this permit. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Operation and maintenance program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.

2. Keep maintenance records on all major electrical and mechanical components of the combined sewage system, including its pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer or a site-specific reliability-centered maintenance analysis and must show the frequency and type of maintenance performed.
3. Make maintenance records available for inspection at all times.

S5.B. Short-term reduction

If a Permittee contemplates a reduction in the level of operation or monitoring that would cause a violation on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.
2. Detail the reasons for, length of time of, and the potential effects of the reduced level of operation or monitoring.

This notification does not relieve the Permittee of its obligations under this permit. The Permittee must attempt to minimize the duration of short-term reductions and must attempt to restrict short-term reductions to dry weather periods.

S5.C. Electrical power failure

The Permittee must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not conveyed in accordance with the requirements of this permit during electrical power failure at sewage lift stations. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes, bypass pumping (for example, pumping of combined sewer flows with a means other than the pump station’s pumps), or other equally protective means.

S5.D. Prevent connection of inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow sources (roof drains, foundation drains, etc.) to the sanitary sewer system.

S5.E. Operations and maintenance (O&M) manual

1. O&M manual submittal and requirements

   The Permittee must:

   a. Review operations and maintenance manuals (O&M manuals) for facilities at least annually and update it as needed.
   b. Ensure operations personnel have access to and follow the instructions and procedures in the O&M manuals.

S6. Requirements for controlled CSO outfalls

S6.A. CSOs identified as controlled

Based on information presented in the City of Seattle's *2014 CSO Annual Report*, the CSO outfalls listed below meet the requirement of "greatest reasonable reduction" as defined in chapter WAC 173-245-020(22). Frequency of overflow events at these CSO outfalls, as a result of precipitation events, must continue to meet the performance standard.

Outfall No.	Street Address	Latitude	Longitude	Name of Receiving Water
12	NE 60th ST & NE WINDERMERE RD	47.67108	-122.25295	Lake Washington
14	4218 55TH AVE NE	47.65925	-122.26799	Lake Washington
16	3005 WEBSTER POINT RD NE	47.64845	-122.27815	Lake Washington
19	4501 27TH AVE NE	47.66103	-122.29782	Union Bay
24	E LEE ST & 42ND AVE E	47.63093	-122.27623	Lake Washington
25	E LEE ST & 42ND AVE E	47.63087	-122.27533	Lake Washington
27	1502 LAKE WASHINGTON BLVD	47.61492	-122.27996	Lake Washington
33	LAKESIDE AVE S & S CHARLES ST	47.59456	-122.28668	Lake Washington
38	STANLEY SAYRES PARK; 3808 LAKE WASHINGTON BLVD S	47.57139	-122.27555	Lake Washington
48	9722 RAINIER AVE S	47.51601	-122.25318	Lake Washington
57	6701 SEAVIEW AVE NW	47.67843	-122.40693	Puget Sound - Central
59	5637 SEAVIEW AVE NW	47.67029	-122.4059	Salmon Bay
61	2599 PERKINS LN W	47.64315	-122.41871	Elliott Bay
62	2599 PERKINS LN W	47.642	-122.41774	Elliott Bay
64	1499 32ND AVE W	47.63158	-122.39925	Elliott Bay
68	PIER 91 AT 1523 W GARFIELD ST	47.63307	-122.37919	Elliott Bay
70	ALASKAN WAY & UNIVERSITY ST	47.60581	-122.34053	Elliott Bay
72	199 ALASKAN WAY S	47.6009	-122.33671	Elliott Bay
78	SEACREST PARK; HARBOR AVE SW & FAIRMOUNT AVE SW	47.58752	-122.37723	Elliott Bay
80	DON ARMENI PARK; 112 HARBOR AVE SW	47.59327	-122.38206	Elliott Bay
83	ALKI BEACH PARK AT 1501 ALKI AVE SW	47.59125	-122.39415	Puget Sound - Central
85	3219 POINT PL SW	47.57676	-122.42008	Puget Sound - Central
88	5079 BEACH DR SW	47.55567	-122.40025	Puget Sound - Central
90	LOWMAN BEACH PARK; 7015 BEACH DR SW	47.53994	-122.39988	Puget Sound - Central
91	LINCOLN PARK; 8635 FAUNTLEROY WAY SW	47.52569	-122.39549	Puget Sound - Central
94	FAUNTLEROY FERRY TERMINAL; 4829 SW BARTON ST	47.52372	-122.39673	Puget Sound - Central
120	2770 WESTLAKE AVE N	47.64541	-122.34706	Lake Union
121	2046 WESTLAKE AVE N	47.63811	-122.34026	Lake Union
124	LAKE UNION PARK AT 800 WESTLAKE AVE N	47.62663	-122.33868	Lake Union
127	1099 FAIRVIEW AVE N	47.62965	-122.33123	Lake Union
129	TERRY PETTUS PARK; FAIRVIEW AVE E & E NEWTON ST	47.63681	-122.3295	Lake Union
130	LYNN ST PARK; FAIRVIEW AVE E & E LYNN ST	47.63959	-122.33037	Lake Union
131	2373 FAIRVIEW AVE E	47.64209	-122.33001	Lake Union
132	ROANOKE ST PARK; FAIRVIEW AVE E & E ROANOKE ST	47.64331	-122.32883	Lake Union
134	FAIRVIEW AVE E & E ALLISON ST	47.64924	-122.32501	Lake Union
135	3315 EASTLAKE AVE E	47.65208	-122.32092	Lake Union
136	3100 PORTAGE BAY PL E	47.64885	-122.31769	Lake Union

Outfall No.	Street Address	Latitude	Longitude	Name of Receiving Water
141	BRYANT SITE PARK AT 1215 NE BOAT ST	47.65086	-122.31563	Portage Bay
144	3790 LATONA AVE NE	47.65313	-122.32556	Lake Union
145	SUNNYSIDE AVE N BOAT RAMP; 2301 N NORTHLAKE WAY	47.65009	-122.33048	Lake Union
146	1430 N NORTHLAKE WAY	47.64722	-122.33962	Lake Union
148	4125 9TH AVE NW	47.65653	-122.36679	Lake Washington - Ship Canal
161	MAGNUSON PARK AT 6451 65TH AVE NE	47.67713	-122.24909	Lake Washington
170	2311 SW MYRTLE ST	47.53919	-122.36242	Longfellow Creek
175	FAIRVIEW AVE E & E GARFIELD ST	47.63389	-122.32722	Lake Union

S6.B. Performance standard for controlled CSOs

The performance standard for each controlled CSO outfall is not more than one discharge event per outfall per year on average, due to precipitation. Ecology evaluates compliance with the performance standard annually based on a 20-year moving averaging period. The Permittee must report the running 20-year average number of overflow events per year during this permit term from these CSO outfalls in the CSO Annual report required in Section S4.B.

S6.C. Post-construction monitoring program

The Permittee must continue to implement a post-construction compliance monitoring program to verify the effectiveness of CSO controls and to demonstrate that the controls comply with water quality standards and protect designated uses for the receiving water. The Permittee must follow the conditionally approved City of Seattle *2015 Post-Construction Monitoring Program* (2015 Plan) and submit to Ecology for review and approval any proposed changes to this plan. The plan proposes monitoring of flow at all outfalls and ambient monitoring near select outfalls.

The 2015 plan requires monitoring of ambient water quality and sediment quality at certain surrogate outfalls. Ecology considers the surrogate outfalls as representative of nearby outfalls in the same receiving water body. According to the 2015 plan and subsequent supplemental compliance plans, the Permittee must conduct ambient water quality sampling at the following outfalls: Magnolia (#68) and Barton (#95). In addition, the Permittee must sample sediments in accordance with the 2015 plan, subsequent supplemental compliance plans, the schedules in S6.C.2 and S6.C.3 below, and respective SAPs. Post-construction monitoring of sediments is required with the completion of CSO projects once the CSO has been deemed controlled unless sufficient recent data exists that shows there are no SMS exceedances. An exception is made if an area-wide cleanup project is planned with sediment sampling scheduled at cleanup project completion.

The following sections describe protocols the Permittee must follow to prepare for and to report the findings of ambient monitoring at each surrogate outfall. The Permittee must submit all monitoring plans and reports electronically (preferably as a PDF) using the *Water Quality Permitting Portal – Permit Submittals* application.

1. Post-Construction Monitoring Program Quality Assurance Project Plans

Prior to conducting ambient water quality compliance monitoring program, the Permittee must develop a quality assurance project plan (QAPP) that details the monitoring protocols the Permittee will follow to determine overflow frequency and volume, to assess compliance with the narrative water quality standards and to determine potential impacts to sediments (see conditions S6.C.2 and 3 for sediment monitoring requirements). The Permittee must submit PCMP-QAPPs to Ecology for review and approval according to the following schedule. The Permittee may submit the required QAPP and the sediment sampling analysis plan described below as a single document.

Outfall	Due Date
95	May 31, 2016
68	June 30, 2016
QAPP not required for outfall 13; Permittee submitted plan in August 2015.	

2. Sediment Sampling and Analysis Plans

In conjunction with the QAPP required above, the Permittee must submit a Sediment Sampling and Analysis Plan (SAP) to Ecology for review and approval for each outfall. The Permittee must submit the SAP for sediment monitoring at least eight months prior to sediment testing. The purpose of the plan is to describe how the Permittee will characterize sediment quality (the nature and extent of chemical contamination and biological toxicity) in the vicinity of the discharge locations. The sediment SAP must follow the guidance provided in the *Sediment Cleanup User's Manual II* (Ecology, 2015). The Permittee must list method detection limits in the plan.

3. Sediment Sampling Data Reports

Following Ecology approval of the Sediment Sampling and Analysis Plan, the Permittee must collect and analyze sediments for controlled CSO outfall 95. The Permittee must electronically submit to Ecology a Sediment Data Report containing the results of the sediment sampling and analysis according to the following schedule. The Sediment Data Report must conform to the approved sediment sampling and analysis plan.

Outfall	Due Date
95	July 31, 2019

In addition to a Sediment Data Report, the Permittee must submit the sediment chemical and biological data (if applicable) to Ecology's EIM database (http://www.ecy.wa.gov/eim/).The Permittee must also use Ecology's MyEIM tools to confirm the accuracy of the submitted data (http://www.ecy.wa.gov/eim/MyEIM.htm).

4. Post-Construction Monitoring Data Report

The Permittee must submit to Ecology by October 30, 2020 a post-construction monitoring summary data report that provides validation that each CSO outfall listed as controlled in Condition S6.A, as well as those brought under control during the permit term, complies with the performance requirements. It must also summarize monitoring results relative to state water and sediment quality standards. The report must conform to the approved *CSO Post-Construction Monitoring Program*, subsequent supplemental compliance plans, and associated QAPPs.

If sampling near any surrogate outfalls reveal exceedances of SMS, the report must identify whether the Permittee knows of area-wide clean-up activities in the vicinity, including any clean-up actions planned or that have been performed in the past. As part of the identification of existing clean-up activities, the report must identify the chemicals targeted by the cleanup activity, discuss the availability of any pre- and post-cleanup monitoring results, show the clean-up project schedule and post-project monitoring schedule, and provide a list of parties involved in the clean-up project.

The Permittee may limit the scope of post construction monitoring data reported for outfall 68 to water quality data collected through flow volume, frequency and duration monitoring and field observations. The Permittee must also include sediment monitoring data collected by the Port of Seattle in the vicinity of outfall 68 if data becomes available by April 30, 2020.

S7. CSO reduction plan amendments and engineering documents

S7.A. Combined sewer overflow reduction plan amendment

The Permittee must submit to Ecology an amendment to its *2015 Plan to Protect Seattle's Waterways – Long Term Control Plan* (also referred to as a CSO Reduction Plan) for review and approval by October 30, 2020. The amendment must comply with the requirements of WAC 173-245-090(2)(a) and (c).

1. The CSO Reduction Plan Amendment must provide an assessment of completed control projects and identify which of the permitted CSO outfalls can be categorized as meeting the Performance Standard for Controlled CSOs as defined in Condition S6.B. The Permittee must determine the controlled status based on historical long-term discharge data (up to 20 years – past and present data), modeling, and/or other reasonable methods as approved by Ecology.

2. For outfalls that do not meet the Performance Standard for Controlled CSOs as defined in Condition S6.B, the Permittee must include in the amendment a list of projects from the approved Long-Term Control Plan that the Permittee will complete during the next five-year permit term.

3. The CSO Control Plan Amendment may not propose changes to the project list or implementation schedule in the approved Long-Term Control Plan unless modified according to allowances in the 2013 Consent Decree for Civil Action No. 2:13-cv-00678.

S7.B. Engineering reports and plans and specifications for CSO storage and pump station projects

The Permittee must submit to Ecology an engineering report for each specific CSO reduction construction project. Engineering documents associated with each CSO reduction project must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to construction.

The report must:

1. Specify any contracts, ordinances, methods of financing, or any other arrangements necessary to achieve this objective.
2. Identify the potential hydraulic impact(s) of the project on downstream City-owned wastewater conveyance facilities as well as any impact(s) to King County's conveyance and treatment systems.
3. Describe how a project will achieve the performance standard and explicitly state the expected frequency of overflow event(s) per year per associated outfall after the CSO reduction construction project has been completed.

For each specific CSO reduction construction project, the Permittee must prepare and submit approvable plans and specifications to Ecology for review and approval in accordance with Chapter 173-240-070 WAC. Plans and specifications must be approved prior to construction.

Prior to the start of construction, the Permittee must submit to Ecology a construction quality assurance plan as required by Chapter 173-240-075 WAC.

S8. Compliance schedule

In order to achieve the greatest reasonable reduction of combined sewer overflows at the earliest possible date, the Permittee must complete the elements of the approved Long Term Control Plan identified in the table below by the specified dates.

A. West Ship Canal Tunnel – Outfalls 147, 150, 151, 152, and 174		
1.	Submit draft engineering report for the West Ship Canal Tunnel project for review and comment	March 31, 2017
2.	Submit a final engineering report for the West Ship Canal Tunnel project for approval	December 31, 2017
3.	Submit 90% draft plans and specifications for the West Ship Canal Tunnel project for review and comment	March 31, 2020
4.	Submit final plans and specifications for the West Ship Canal Tunnel project for approval	December 31, 2020
Permittee must include planning and design for rehabilitation of outfall 151 as part of the West Ship Canal Tunnel Project.		

B. Central Waterfront Storage – Outfall 69		
1.	Submit a draft engineering report for the Central Waterfront Storage project for review and comment	June 30, 2019
2.	Submit a final engineering report for the Central Waterfront Storage Project for approval	December 31, 2019

C. Sewer System Improvement Projects		
1.	Submit a report describing the scope of work for the Leschi Sewer System Improvement Projects (outfalls 28, 29, 31, 32, and 36).	March 31, 2017
2.	Complete all Leschi Sewer System Improvement projects (outfalls 28, 29, 31, 32, and 36).	December 29, 2017
3.	Submit a report describing the scope of work for the North Union Bay Sewer System Improvement Projects (outfall 18).	March 30, 2018
4.	Complete all North Union Bay Sewer System Improvement projects (outfall 18).	December 31, 2018
5.	Submit a report describing the scope of work for the Delridge Sewer System Improvement Projects (outfall 99).	March 29, 2019
6.	Complete all Delridge Sewer System Improvement projects (outfall 99).	December 31, 2019
7.	Submit a report describing the scope of work for the Montlake Sewer System Improvement Projects (outfalls 20, and 139/140).	March 31, 2020
8.	Submit a report describing the scope of work for the East Waterway Sewer System Improvement Projects (outfall 107).	March 31, 2020
9.	Submit a report describing the scope of work for the Magnolia Sewer System Improvement Projects (outfall 60).	March 31, 2020
10..	Submit a report describing the scope of work for the Portage Bay Sewer System Improvement Projects (outfall 138).	March 31, 2020
11.	Complete all Montlake Sewer System Improvement Projects (outfalls 20, and 139/140).	December 31, 2020
12..	Complete all East Waterway Sewer System Improvement projects (outfall 107).	December 31, 2020
13.	Complete all Magnolia Sewer System Improvement Projects (outfall 60).	December 31, 2020
14.	Complete all Portage Bay Sewer System Improvement Projects (outfall 138).	December 31, 2020

D. Integrated Plan Projects		
1.	NDS Partnering – Begin Construction	July 17, 2019
2.	Street Sweeping Expansion Arterials – Complete Post-Construction Monitoring	September 30, 2019

E. Outfall Rehabilitation Projects		
1.	Complete replacement of trash rack on Outfall 99	March 29, 2019
2.	Complete repair of bedding and foundation material surrounding land section and bulkhead of outfall 171	December 31, 2019
3.	Replace land section of outfall 174	March 31, 2017

S9. Outfall rehabilitation plan and inventory

The Permittee must conduct an underwater analysis of five (5) previously uninspected outfalls to assess their physical condition and to determine the need for rehabilitation. By October 30, 2020, the Permittee must submit to Ecology for review and approval an outfall rehabilitation plan that describes outfalls to be repaired or replaced during the next permit cycle.

In addition, the Permittee must complete a desktop evaluation of all CSO outfalls to determine the current number of discharge points from their system. The evaluation must identify outfalls located in close proximity to each other that share a hydraulic connection to a common control structure. The Permittee must include the results of this evaluation in the outfall rehabilitation report required above.

S10. Application for permit renewal

The Permittee must submit an application for renewal of this permit by October 30, 2020.

General Conditions

G1. Signatory requirements

1. All applications, reports, or information submitted to Ecology must be signed and certified.
   a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
      - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or
      - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

   b. In the case of a partnership, by a general partner.
   c. In the case of sole proprietorship, by the proprietor.
   d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

   Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
   a. The authorization is made in writing by a person described above and submitted to Ecology.
   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph G1.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section must make the following certification:

   "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   a. Violation of any permit term or condition.
   b. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
   c. A material change in quantity or type of waste disposal.
   d. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.
   e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.

f. Nonpayment of fees assessed pursuant to RCW 90.48.465.

g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

   a. A material change in the condition of the waters of the state.

   b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

   c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

   d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

   e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

   f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

   g. Incorporation of an approved local pretreatment program into a municipality's permit.

3. The following are causes for modification or alternatively revocation and reissuance:

   a. When cause exists for termination for reasons listed in 1.a through 1.g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

   b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than sixty (60) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:

1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

2. A significant change in the nature or an increase in quantity of pollutants discharged.

3. A significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least sixty (60) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification

   Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

2. Automatic Transfers

   This permit may be automatically transferred to a new Permittee if:

   a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.

   b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.

   c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – “Upset” means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
2. The permitted facility was being properly operated at the time of the upset.
3. The Permittee submitted notice of the upset as required in Special Condition S4.G.
4. The Permittee complied with any remedial measures required under S4.G of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

APPENDIX A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a quantitation limit (QL) to Ecology with appropriate laboratory documentation.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122.), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit appendix A list does not include those parameters.

CONVENTIONAL POLLUTANTS

Pollutant	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B [3]		2 mg/L
Fecal Coliform		SM 9221E,9222	N/A	Specified in method - sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
pH		SM4500-H^+ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

NONCONVENTIONAL POLLUTANTS				
Pollutant & CAS No. (if available)	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] µg/L unless specified**	**Quantitation Level (QL)[2] µg/L unless specified**
Alkalinity, Total		SM2320-B		5 mg/L as CaCO3
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-Cl B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 Cl G		50.0
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as CaCO3
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO3-E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N_{org}B/C and SM4500NH_3-B/C/D/EF/G/H		300
NWTPH Dx [4]		Ecology NWTPH Dx	250	250
NWTPH Gx [5]		Ecology NWTPH Gx	250	250
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO_4)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S^2F/D/E/G		0.2 mg/L
Sulfite (as mg/L SO_3)		SM4500-SO3B		2 mg/L
Temperature (max. 7-day avg.)		Analog recorder or use micro-recording devices known as thermistors		0.2º C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5
Total Coliform		SM 9221B, 9222B, 9223B	N/A	Specified in method - sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total dissolved solids		SM2540 C		20 mg/L

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
METALS, CYANIDE & TOTAL PHENOLS					
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10
Phenols, Total	65		EPA 420.1		50

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
ACID COMPOUNDS					
2-Chlorophenol	24	95-57-8	625	1.0	2.0
2,4-Dichlorophenol	31	120-83-2	625	0.5	1.0
2,4-Dimethylphenol	34	105-67-9	625	0.5	1.0
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625/1625B	1.0	2.0
2,4 dinitrophenol	59	51-28-5	625	1.0	2.0
2-Nitrophenol	57	88-75-5	625	0.5	1.0
4-Nitrophenol	58	100-02-7	625	0.5	1.0
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625	1.0	2.0
Pentachlorophenol	64	87-86-5	625	0.5	1.0
Phenol	65	108-95-2	625	2.0	4.0
2,4,6-Trichlorophenol	21	88-06-2	625	2.0	4.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
VOLATILE COMPOUNDS					
Acrolein	2	107-02-8	624	5	10
Acrylonitrile	3	107-13-1	624	1.0	2.0
Benzene	4	71-43-2	624	1.0	2.0
Bromoform	47	75-25-2	624	1.0	2.0
Carbon tetrachloride	6	56-23-5	624/601 or SM6230B	1.0	2.0
Chlorobenzene	7	108-90-7	624	1.0	2.0
Chloroethane	16	75-00-3	624/601	1.0	2.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
VOLATILE COMPOUNDS					
2-Chloroethylvinyl Ether	19	110-75-8	624	1.0	2.0
Chloroform	23	67-66-3	624 or SM6210B	1.0	2.0
Dibromochloromethane (chlordibromomethane)	51	124-48-1	624	1.0	2.0
1,2-Dichlorobenzene	25	95-50-1	624	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624	4.4	17.6
Dichlorobromomethane	48	75-27-4	624	1.0	2.0
1,1-Dichloroethane	13	75-34-3	624	1.0	2.0
1,2-Dichloroethane	10	107-06-2	624	1.0	2.0
1,1-Dichloroethylene	29	75-35-4	624	1.0	2.0
1,2-Dichloropropane	32	78-87-5	624	1.0	2.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) [6]	33	542-75-6	624	1.0	2.0
Ethylbenzene	38	100-41-4	624	1.0	2.0
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0
Methyl chloride (Chloromethane)	45	74-87-3	624	1.0	2.0
Methylene chloride	44	75-09-2	624	5.0	10.0
1,1,2,2-Tetrachloroethane	15	79-34-5	624	1.9	2.0
Tetrachloroethylene	85	127-18-4	624	1.0	2.0
Toluene	86	108-88-3	624	1.0	2.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624	1.0	2.0
1,1,1-Trichloroethane	11	71-55-6	624	1.0	2.0
1,1,2-Trichloroethane	14	79-00-5	624	1.0	2.0
Trichloroethylene	87	79-01-6	624	1.0	2.0
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Acenaphthene	1	83-32-9	625	0.2	0.4
Acenaphthylene	77	208-96-8	625	0.3	0.6
Anthracene	78	120-12-7	625	0.3	0.6
Benzidine	5	92-87-5	625	12	24
Benzyl butyl phthalate	67	85-68-7	625	0.3	0.6
Benzo(*a*)anthracene	72	56-55-3	625	0.3	0.6
Benzo(b)fluoranthene (3,4-benzofluoranthene) [7]	74	205-99-2	610/625	0.8	1.6
Benzo(j)fluoranthene [7]		**205-82-3**	625	0.5	1.0
Benzo(k)fluoranthene (11,12-benzofluoranthene) [7]	75	207-08-9	610/625	0.8	1.6
Benzo(r,s,t)pentaphene		**189-55-9**	625	0.5	1.0
Benzo(*a*)pyrene	73	50-32-8	610/625	0.5	1.0
Benzo(*ghi*)Perylene	79	191-24-2	610/625	0.5	1.0
Bis(*2-chloroethoxy)*methane	43	111-91-1	625	5.3	21.2
Bis(*2-chloroethyl*)ether	18	111-44-4	611/625	0.3	1.0
Bis(*2-chloroisopropyl*)ether	42	39638-32-9	625	0.3	0.6
Bis(*2-ethylhexyl*)phthalate	66	117-81-7	625	0.1	0.5
4-Bromophenyl phenyl ether	41	101-55-3	625	0.2	0.4

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
2-Chloronaphthalene	20	91-58-7	625	0.3	0.6
4-Chlorophenyl phenyl ether	40	7005-72-3	625	0.3	0.5
Chrysene	76	218-01-9	610/625	0.3	0.6
Dibenzo (a,h)acridine		**226-36-8**	610M/625M	2.5	10.0
Dibenzo (a,j)acridine		**224-42-0**	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (1,2,5,6-dibenzanthracene)	82	53-70-3	625	0.8	1.6
Dibenzo(a,e)pyrene		192-65-4	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene		189-64-0	625M	2.5	10.0
3,3-Dichlorobenzidine	28	91-94-1	605/625	0.5	1.0
Diethyl phthalate	70	84-66-2	625	1.9	7.6
Dimethyl phthalate	71	131-11-3	625	1.6	6.4
Di-n-butyl phthalate	68	84-74-2	625	0.5	1.0
2,4-dinitrotoluene	35	121-14-2	609/625	0.2	0.4
2,6-dinitrotoluene	36	606-20-2	609/625	0.2	0.4
Di-n-octyl phthalate	69	117-84-0	625	0.3	0.6
1,2-Diphenylhydrazine (*as Azobenzene*)	37	122-66-7	1625B	5.0	20
Fluoranthene	39	206-44-0	625	0.3	0.6
Fluorene	80	86-73-7	625	0.3	0.6
Hexachlorobenzene	9	118-74-1	612/625	0.3	0.6
Hexachlorobutadiene	52	87-68-3	625	0.5	1.0
Hexachlorocyclopentadiene	53	77-47-4	1625B/625	0.5	1.0
Hexachloroethane	12	67-72-1	625	0.5	1.0
Indeno(*1,2,3-cd*)Pyrene	83	193-39-5	610/625	0.5	1.0
Isophorone	54	78-59-1	625	0.5	1.0
3-Methyl cholanthrene		**56-49-5**	625	2.0	8.0
Naphthalene	55	91-20-3	625	0.3	0.6
Nitrobenzene	56	98-95-3	625	0.5	1.0
N-Nitrosodimethylamine	61	62-75-9	607/625	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625	0.5	1.0
Perylene		**198-55-0**	625	1.9	7.6
Phenanthrene	81	85-01-8	625	0.3	0.6
Pyrene	84	129-00-0	625	0.3	0.6
1,2,4-Trichlorobenzene	8	120-82-1	625	0.3	0.6

PRIORITY POLLUTANT	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
DIOXIN					
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
PESTICIDES/PCBs					
Aldrin	89	309-00-2	608	0.025	0.05
alpha-BHC	102	319-84-6	608	0.025	0.05
beta-BHC	103	319-85-7	608	0.025	0.05
gamma-BHC (Lindane)	104	58-89-9	608	0.025	0.05
delta-BHC	105	319-86-8	608	0.025	0.05
Chlordane [8]	91	57-74-9	608	0.025	0.05

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL)[2] *µg/L unless specified***
PESTICIDES/PCBs					
4,4'-DDT	92	50-29-3	608	0.025	0.05
4,4'-DDE	93	72-55-9	608	0.025	0.05
4,4' DDD	94	72-54-8	608	0.025	0.05
Dieldrin	90	60-57-1	608	0.025	0.05
alpha-Endosulfan	95	959-98-8	608	0.025	0.05
beta-Endosulfan	96	33213-65-9	608	0.025	0.05
Endosulfan Sulfate	97	1031-07-8	608	0.025	0.05
Endrin	98	72-20-8	608	0.025	0.05
Endrin Aldehyde	99	7421-93-4	608	0.025	0.05
Heptachlor	100	76-44-8	608	0.025	0.05
Heptachlor Epoxide	101	1024-57-3	608	0.025	0.05
PCB-1242 [9]	106	53469-21-9	608	0.25	0.5
PCB-1254	107	11097-69-1	608	0.25	0.5
PCB-1221	108	11104-28-2	608	0.25	0.5
PCB-1232	109	11141-16-5	608	0.25	0.5
PCB-1248	110	12672-29-6	608	0.25	0.5
PCB-1260	111	11096-82-5	608	0.13	0.5
PCB-1016 [9]	112	12674-11-2	608	0.13	0.5
Toxaphene	113	8001-35-2	608	0.24	0.5

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.
2. Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer (64 FR 30417).
   ALSO GIVEN AS:
   The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency, December 2007).
3. Soluble Biochemical Oxygen Demand method note: First, filter the sample through a Millipore Nylon filter (or equivalent) - pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.
4. NWTPH Dx - Northwest Total Petroleum Hydrocarbons Diesel Extended Range – see http://www.ecy.wa.gov/biblio/97602.html
5. NWTPH Gx - Northwest Total Petroleum Hydrocarbons Gasoline Extended Range – see http://www.ecy.wa.gov/biblio/97602.html
6. 1, 3-dichloroproylene (mixed isomers) You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).
7. Total Benzofluoranthenes - Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.
8. Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 0.025/0.050.
9. PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

Appendix B

Basin 69 CSO Control Project Public Outreach Summary

Seattle Public Utilities

February 2019 Outreach Summary

Vine Basin Combined Sewer Overflow (CSO) Control Project

Last updated: February 28, 2019

Seattle Public Utilities

On February 6, 2019, Seattle Public Utilities (SPU) hosted an in-person open house to introduce the Vine Basin Combined Sew Overflow (CSO) Control project to the public, share information about potential options for reducing CSO events in the basin, and ask for feedback on potential community benefits to be implemented as a part of the project. In addition to the in-person open house, an online open house was available between January 24 and February 13. The online open house provided the same information as the in-person event and allowed for people to submit comments or questions.

Twelve participants attended the in-person open house. A total of 46 users visited the online open house between January 24 and February 13. All participants were given the opportunity to view boards, learn more about the project, and share their feedback with the project team.

Common themes from the feedback received from participants included an interest in additional greenery, pedestrian safety (lighting and crosswalks), and a priority to maintain parking and car/bike lanes. A summary of all feedback received can be found below.

Notifications

Community members were notified of the open houses using the following methods:

Method	Purpose	Dates
Postcard	• Mailed to all addresses in project area • Introduced the project, invited public to open house/online open house, and encouraged the public to sign-up for email list	Jan. 23, 2019
Emails to stakeholders	• Listserv email to project email list inviting public to open house/online open house • Email to stakeholder organizations in the area personally inviting them to the open house and asking that they share the event with their networks	Jan. 23, 2019 Feb. 4, 2019 Feb. 7, 2019
Webpage update	• Advertised open house/online open house information to project webpage	Week of Jan. 21

Meeting Format

The format of the in-person open house was drop-in style, where community members were able to stop by and speak directly with project staff throughout the meeting. No formal presentation was held.

Date: February 6, 2019
Time: 5:30 – 7:30 p.m.
Location: KPG Offices, 3133 Elliott Ave, #400, Seattle, WA 98121

The goals of the in-person and online open houses included:

- **Provide clear and transparent information** about the project to the community.
- **Educate the public** on the project and schedule, what a CSO basin is, the options analysis process, and the viability of potential options.
- **Set realistic expectations** about potential public benefits, impacts of the project, and areas for public engagement.
- **Provide opportunity for feedback** on design alternatives and potential benefits to the community, where possible.

Materials

Project materials were available both in-person and online for participants to view. Materials shared with the public included:

- Email sign-up sheet
- Project display boards
- Factsheet
- FAQ
- Comment form
- Brochures from other projects in the area (Waterfront Seattle Program and Alaskan Way Viaduct Replacement Program)

Project team members were stationed at display boards throughout the in-person open house and were available to answer questions and gather feedback from participants. The boards and stations included:

Station	Content/Boards
Welcome/Sign-in Table	• "Welcome" board • Sign-in sheet • Factsheets • FAQ
Project Overview	• "Project Overview & Schedule" • "What is a Combined Sewer Overflow (CSO)?" • "Exploring Options in Belltown" • "How We Will Choose a Preferred Option" • "What about Green Stormwater Infrastructure (GSI)?"
Feedback	• "Tell Us: Opportunities for Community Benefits" • "Tell Us Where!" • "How to Stay Involved"
Other projects	• Brochures from Waterfront Seattle • Brochures from Alaskan Way Viaduct

Digital versions of the display boards were available on the online open house.

Summary of Feedback

Attendees were given the opportunity to provide feedback on general opportunities for community benefits. Staff were available to solicit and record questions and concerns residents had.

The topics the project team requested feedback on included:

- **Opportunities for community benefits:** SPU solicited feedback on community benefit elements that may be incorporated into the project. Comment collection tools included comment cards, interactive boards, and conversations with staff.

Key themes:
Comments shared by participants fall under the following general themes:

- Desire to preserve existing on-street parking in Belltown
- Desire to maintain existing vehicle or bicycle lanes in Belltown
- Highest interest in pedestrian safety enhancements such as lighting and crosswalks
- Opinion that greening can help connect the urban environment to nature

Appendix A: Open house feedback

1. Please choose the two most important options to you and let us know why you chose these options.

Option	Total responses
Wayfinding - let us know to where!	3
Pedestrian safety - lighting, wider sidewalks, etc.	10
Greening	7
Installations - seating, bike racks, public art, etc.	3
Other possibilities - add your suggestions in the comment box below	4

Comments

- "Belltown needs more crosswalks so pedestrians can walk east and west without zigzagging."
- "More greenery that won't be ruined by dog pee :)"
- "Please don't take any parking or car lanes away - we have already had too much of this and you need a PhD to drive on 2nd Avenue now!"
- "Please do not reduce the amount of street parking."
- "Please do not take away needed car lanes in belltown [sic]. Please do not take away parking in belltown [sic]. Please add more patrol and lighting in alleys. Please enforce restaurants have sufficient garbage and compost cans."
- "Please don't take away any more street parking or car lanes!"
- "Please don't take away any more lanes for cars!"
- "I chose lighting for pedestrian safety because of all the sketchy people at night, and greenery because its [sic] a link to nature in an urban environment."

2. Tell us where you want to see community benefits!

Location	Comment
Western Ave and Vine St	Consider building on growing Vine Street GSI. Connect to Waterfront and native plants.
1st Ave and Battery St	Portal to future park. GSI opportunities. Bell St Park. - Friends of Historic Belltown
Western Ave and Bell St	Native village and historic native camp at foot of Bell St. Consider site that tells story and value of water to native people - Friends of Historic Belltown
Western Ave and Bell St	Seconded! (Comment above)
3rd Ave and Blanchard St	This intersection could use more lighting

3. Anything else to add? Share your comments on the project here.

- "Please do not take away needed lanes and parking spaces in Belltown. There is a shortage. Thank you."

- "Do not take away any more lanes on the streets! Although we understand the math does not work out for everyone to have a car, we still need to preserve the streets to keep the transport we do have moving. There are folks in sales that are trying to make a living and making the city into gridlock does not help by taking more lanes away for bike lanes."

Appendix C

Basis of Estimate and OPCC for Alaskan Way Parallel Flow Transfer Alternative

Title	**Basis of Capital Estimate-Before Stage Gate 2** ****Note this BOE is for estimating the Total Cost Projection** **Vine Basin CSO Control Project** **Options Analysis** **April 5, 2019** **AACE Class 4 OPCC**	
1. Project Information: Seattle Public Utilities	* Activity Name/Number * LOB Representative and Project Manager * Cost estimator * Estimate Reviewer(s)	Option 1: Flow Transfer, Alaskan Way Shailee Sztern, SPU PM Rick Johnson, SPU LOB Rep. Nichole Kruse, PE - Murraysmith Brian Bartle, PE - Murraysmith
2. Project Objectives	The Vine Basin CSO Control Project seeks to brainstorm alternatives and select recommended improvements to reduce the frequency of combined sewer overflows (CSOs) experienced in the Vine Basin (NPDES 069) to one or less event per year on a 20-year rolling average to meet regulatory requirements (reference Consent Decree). The OPCCs will be used as part of a multi-objective decision analysis (MODA) to select the best alternative to achieve the project goals. The recommended alternative will be presented for Stage Gate 2 approval and WDOE approval.	
3. Project Scope	Option 1: This option consists of transferring excess sewer flow to King County's Elliott Bay Interceptor (EBI) via a new 24-inch diameter sewer in Alaskan Way to reduce CSO event frequency. The sewer will parallel the existing sewer from the intersection of Vine St. and Alaskan Way to a location near the end of Bay St. and Alaskan Way located in a portion of SDOT right-of-way managed by the Seattle Parks Department (adjacent to the Elliott Bay Trail). The project area is within an urban area within in downtown Seattle. The project will include the following: • Excavation to expose a portion of King County's EBI (approx. 20-ft deep). • Installation of a 24-inch connection to King County's EBI with KC Oversight . o The connection will be made while the EBI is in use (active flow). • Installation of approximately 1,800 linear feet of 24-inch diameter RCP with MHs (approx. 15-ft deep). • Connection to the existing CSO Control Structure at the intersection of Vine St. and Alaskan Way and limited internal modification of the CSO Control Structure. • Right-of-Way restoration including concrete pavement replacement and ADA curb ramp improvements. • Restoration of disturbed areas within Parks-managed ROW (adjacent to the Elliott Bay Trail). • Protection of existing art sculptures. • GSI and/or community benefits that are not yet defined.	
4. Location	The proposed sewer alignment is located in Alaskan Way between Vine Street and through a portion of SDOT right-of-way managed by City of Seattle Parks Department (adjacent to Elliott Bay Trail); refer to the attached preliminary layout figure. The alignment is located within SDOT Right-of-Way. Site Constraints: • BNSF railroad is located to the east of the proposed sewer alignment • Shoreline and seawall is located to the west of the proposed sewer alignment (urban harbor front shoreline environment) • Extensive traffic control will be required during construction within Alaskan Way (anticipate having 1 lane open in each direction during construction; parking will be closed). • Alaskan Way is identified as a liquefaction prone area (seismic hazard). • Groundwater is expected to be encountered when excavating more than 5-feet below grade. • There is potential for soil contamination and groundwater contamination in Alaskan Way. • Vibration and settlement monitoring of the adjacent cast iron water main will be required. • The proposed sewer alignment is within close proximity of multiple SCL vaults and ductbanks. • Limited staging areas are available within close proximity of the site. • Pedestrian and vehicle access to two piers shall be maintained. • The western portion of the Parks-managed area (adjacent to Elliott Bay Trail) is considered a flood prone area. • CSO Monitoring shall be undisrupted throughout construction. • Rechannel CSO Control Vault discharge to encourage regular flow through both sewer to minimize risk of odors.	

5. Schedule	Draft Engineering Report Submission to WDOE - 06/28/2019 Final Engineering Report Submission to WDOE - 11/2019 Stage Gate 2 Approval - 11/2019 Final Design Completion - 12/2021 Construction Contract Award and NTP - 03/2022 Construction Activities - 07/2023 (16 months) 1-year Commissioning - 07/2024	
6. Labor Resourcing Strategy	Consultant team will deliver design; SPU will provide design direction, review and oversight. Consultant team will provide engineering support during construction and will produce record drawings. SPU will provide site survey data and benchmarking for design. SPU will provide geotechnical report; geotechnical borings will be required prior to design. SPU will review construction material submittals. SPU will provide Construction Management/Construction Oversight. All construction activities will be completed by a construction contractor.	
7. Construction Contracting Strategy	Construction work will be procured using a traditional design-bid-build (DBB) procurement with award to the lowest responsible and responsive bidder. • Assumed construction work week will be Monday through Friday. • Assumed construction work hours will be 9am to 3pm to avoid periods of high-volume traffic. • SPU will not provide any construction materials (not materials to be furnished by owner) or services.	
8. Conceptual Design	* Design Assumptions * Conceptual drawing/sketch * Specifications (if applicable)	24-inch diameter RCP gravity sewer pipe. Sewer bedding will be Class B (type 9 mineral aggregate) per CSO Std. Plan 285. MHs will be precast per CSO Std. Plan 204a/b. Refer to 10% Layout Drawing 2017 City of Seattle Standard Specifications.
9. Basis of Quantity:	* Take-off by LOB * Take-off by Engineering * Take-off by SPU Consultant	☐ ☐ ☑

Basis of Capital Estimate-Before Stage Gate 2

Title	**Vine Basin CSO Control Project** **Options Analysis** **April 5, 2019** **AACE Class 4 OPCC**	
10. Basis of Labor, Materials & Equipment Pricing (aka Unit Price) Seattle Public Utilities	* Historical unit costs (aka parametric estimating) * Similar completed project (aka analogous estimating) * Engineering Judgment * Semi-detailed unit costs	Nichole Kruse, PE - Murraysmith Brian Bartle, PE - Murraysmith 2017 Cost Estimate Template
11. Allowance For Indeterminates:	30% AFI as a % of the hard costs; per SPU CEG Table 4-1, Note 6 an AFI is appropriate if the scope is well defined and based on construction bid items rather than parametric or analogous cost estimates. 25% AFI is appropriate for 30% design per SPU CEG Table 4-1. We have added the AFI at this stage since we have completed a detailed OPCC based on bid items.	
12. Sales Tax	* Sales Tax Applicable	10.10%
	* Sales Tax Not Applicable	
13. SPU Field Crew Costs/Misc. Hard Costs	• SPU Construction Management/Oversight • SPU materials lab for material submittal review and approval.	
14. Soft Cost	* From SPU CEG * Not from SPU CEG	49% (soft costs as a % of hard costs) per SPU CEG Table 4-2
15. Property Acquisition Cost	No property acquisition is anticipated to be required for this option.	
16. Contingency Reserve	* From SPU CEG Recommended Range * Not from SPU CEG	25% per SPU CEG Table 5-1
17. Management Reserve	* From SPU CEG * Not from SPU CEG	20% per SPU CEG Table 5-2
18. Inflation	* Yes * No	☑ Apply the current inflation amount of 2.3% to the Total Cost ☐
19. Escalation Adjustment	* Yes * No	☑ Apply the current escalation adjustment of 1.0% to the construction contract amount. ☐

20. Other Assumptions:	• No in-water work will be performed. • No betterments or replacements beyond those indicated on the layout. • No replacement or relocation of other utilities unless specifically indicated on the layout. • No damage to or replacement of existing art sculptures. • No odor control facilities are included. • No automation, instrumentation, or online monitoring is included. • No rock excavation will be required. • No cost for additional/new art is included. • Cultural resource monitoring of excavations will be performed. • Internal modifications to the CSO Control Structure will be required however are not anticipated to require external modifications to the structure. Included minor CSO Control Structure improvements (i.e. access ladder removal and replacement, minimal mortar repair and gate removal). • CSO monitoring shall be uninterrupted during construction. • CSO Control Structure modifications will be scheduled during dry-weather forecast to minimize risk of CSO or SSO as a result of bypass pumping. • Complete street closures are not acceptable. At least one lane must always be kept open. • Traffic control and signage will be required. • Peace officers will be required during work within intersections. • Paved bike-path through Myrtle Edwards Park will be closed during construction within the park. • Open-cut construction will be utilized; no trenchless construction methods will be used. • Right-of-way surface restoration will be completed in accordance with the ROWORR and per current City of Seattle Standards. • Excavations will require interlocking steel sheet piles. • At utility crossings, hand-digging will be required and special shoring will be required. • Static stainless steel plate/orifice restriction will be installed at MH prior to EBI connection for flow control. • Trench dewatering will be required; assumed sump pumps will be used. Discharge will be treated with Baker Tanks and oil absorbent filters prior to discharge to Elliott Bay via existing stormwater outfall to minimize risk of CSO and SSO due to sewer capacity limitations. • Groundwater contamination sampling will be required. • Construction schedule will overlap with wet season. • Limited bypass pumping will be required when connecting to the CSO Control Structure. Bypassing will be above grade and will not be trenched or require pavement restoration. • Additional temporary power supply will be required during construction for dewatering pumps and bypass pumps. • Private parcel will be rented for construction staging and parking. • Excavated soils outside of the Parks-managed area (adjacent to Elliott Bay Trail) are anticipated to require contaminated soils testing and potentially disposal. • Assumed a portion of the excavated soil outside the Parks-managed area (adjacent to Elliott Bay Trail) will not be suitable for re-use as trench backfill. • Excavated soils within the Parks-managed area (adjacent to Elliott Bay Trail) are assumed to have no contamination; assumed contamination was addressed during previous projects. • RR Crossing Arm at the intersection of Alaskan Way and Vine Street will be removed, stored and reinstalled. • RR Crossing Arm at the intersection of Alaskan Way and Clay Street will be removed, stored and reinstalled. • RR Crossing Arm at the intersection of Alaskan Way and Broad Street will be removed, stored and reinstalled.
21. Exceptions:	
22. Risks	• Potential for survey and potholing data to identify conflict with proposed alignment. • Potential for damaging art sculptures within Parks-managed ROW (adjacent to Elliott Bay Trail) • Potential for future impact to the sewer when seawall is rebuilt • Potential for encountering seawall tiebacks or creosote piles during excavation • Potential for encountering historical or archeological artifacts during construction • Potential for damaging KC EBI when making discharge connection

	• Potential for damaging KC EBI when making discharge connection • Potential for damaging CSO Control Structure During Modifications • Potential for spill during bypass pumping • Potential for encountering conflicting utilities during excavation. • Potential for utility crossing conflicts • WDOE approval required for contaminated construction dewatering discharge to Elliott Bay. Potential for hydrocarbons, heavy metals, creosote and other. Additional site assessment is recommended. • Potential for encountering soil contamination beyond preliminary estimation and assumptions made for this OPCC. No formal investigation has been conducted; OPCC is based on limited information and anecdotal evidence. Additional site assessment and geotechnical investigation are recommended. • Site is within liquefaction prone area; potential for significant damages if earthquake is experienced during construction. • The project site parallels the BNSF RR tracks - additional work safety requirements may be recommended.	
23. Basis of Estimate Reviews and Benchmarking	* How/Why Estimate Has Changed * Benchmarking * Attachments	N/A N/A See preliminary 10% layout.

APWA 2017

Bid item	Item/Description	Take-Off QTY	Unit	Total Cost Unit 2017	Estimate Total	NOTES
Sect 1-07	**Legal Relations & Responsibilities**					
107005	SAFETY AND HEALTH PROGRAM-CSI (REF)	16	MO	$1,725.00	***$27,600***	Unit Cost from CSI Tab
	Existing Conditions					
FROM CSI	CONSTRUCTION SURVEY (2 MAN CREW)	25	DAY	$1,800.00	***$45,000***	Unit Cost from CSI Tab
FROM CSI	UTILITY POTHOLING {QTY >10 EA}	15	EA	$1,000.00	***$15,000***	Unit Cost from CSI Tab; lowered cost since minimal restoration required when done during construction
ADDED	ART PROTECTION	5	EA	$2,000.00	***$10,000***	Estimated, fencing around art
	General Requirements					
ADDED	STAGING AREA RENTAL	16	MO	$10,000.00	***$160,000***	Estimated
FROM CSI	AS-BUILT RECORDS, MIN. BID	30	EA	$400.00	***$12,000***	Unit Cost from CSI Tab; Assumed 30 Drawings
ADDED	1-Year Commissioning Support	1	LS	$10,000.00	***$10,000***	
ADDED	Permits, Materials Testing, and Misc. Hard Costs	1	LS	$185,000.00	***$185,000***	
Sect 1-09	**Measurement & Payment**					
109005	Mobilization Small to Mid. Project {Value $2.5M-$5.0M} - 10% Sub Total Const. Cost	1	LS	$545,168.41	***$545,168***	10% of total
Sect 1-10	**Temporary Traffic Control**					
110005	MAINTENANCE & PROTECTION OF TRAFFIC CONTROL INCLUDING FLAGGING-CSI (REF)	240	DAY	$895.00	***$214,800***	Needed throughout in street work since high traffic - 5 days/week, 4 weeks per month, 12 months
ADDED	PARKING METER HOODS BY SDOT	1	LS	$2,000.00	***$2,000***	Estimated (per Casseday)
ADDED	SDOT SIGNAL MODIFICATION (BY SDOT)	1	LS	$20,000.00	***$20,000***	Estimated, modified signals (per Casseday)
ADDED	PARKING FEES (PER SPACE PER DAY; MON-SAT)	3,600	DAY	$25.00	***$90,000***	Estimated, 25 street parking spaces to be impacted; est. phased construction; 6 days/week; 6 months, 4 weeks per month
110020	TRAFFIC CONTROL PEACE OFFICERS	360	HR	$97.00	***$34,920***	Needed at Intersections (3 intersections, 4 weeks per intersection, 6 hour days, 5 days per week) (per Casseday)
ADDED	Remove and Store Railroad Crossing Arms with Signals	3	EA	$5,000.00	***$15,000***	Estimated, Allowance
Sec 2-01	**Clearing, Grubbing, and Roadside Cleanup**					
201005	CLEARING & GRUBBING {QTY<=5,000}	5,000	SF	$3.10	***$15,500***	Within Park, Allowance for GSI
Sec 2-02	**Remove, Abandon, Or Relocate Structures and Obstructions**					
ADDED	ART REMOVAL, STORAGE AND INSURANCE	4	EA	$10,000.00	***$40,000***	Estimated
ADDED	REMOVE MH ACCESS LADDERS	2	EA	$500.00	***$1,000***	Estimated; at CSO Control Structure
ADDED	REMOVE SLIDE GATE AND STEM	1	EA	$1,000.00	***$1,000***	Estimated; at CSO Control Structure
202030	REMOVE ASPHALT PAVEMENT {QTY >50 SY}	100	SY	$16.00	***$1,600***	Bike Path
202035	REMOVE CEMT. CONCR. SIDEWALK {QTY >50}	521	SY	$17.00	***$8,849***	Curb Ramps and Park Plaza
202045	REMOVE PAVEMENT {QTY>400}	2,889	SY	$21.00	***$60,667***	Pavement Restoration Area
202068	REMOVE LANDSCAPING 12" IN DEPTH (INCLUDING TO SOIL) - {QTY>100 SY}	750	SY	$40.00	***$30,000***	Allowance for Park and GSI
202145	REMOVE CURB {QTY>50}	750	LF	$11.00	***$8,250***	Assumed will be damaged during construction
202170	REMOVE FENCE, CHAIN LINK {QTY<=500 LF}	50	LF	$12.00	***$600***	Near EBI Connection
202425	REMOVE Shrub {QTY<=10}	5	EA	$105.00	***$525***	Assumed
202480	REMOVE Tree - 8" to 12" diameter	8	EA	$590.00	***$4,720***	Near EBI connection
202750	SAWCUT Asphalt Concrete, Full Depth {QTY<=100LF}	120	LF	$10.00	***$1,200***	Bike Path
202767	SAWCUT Cement Concrete Sidewalk, Full Depth {QTY>50LF}	240	LF	$7.00	***$1,680***	Plaza
202770	SAWCUT Rigid Pavement, Full Depth {QTY >500 LF}	3,216	LF	$12.00	***$38,592***	Trench sawcut and pavement restoration sawcut
Sec 2-04	**Excavations**					
204005	COMMON Excavation {QTY >500}	85	CY	$52.00	***$4,437***	Excavation at EBI
ADDED	Creosote Pile Removal and Disposal	1	LS	$20,000.00	***$20,000***	Estimated, Allowance
Sec 2-07	**Protective System**					
207010	SAFETY SYSTEM IN TRENCH EXCAVATION {16-22 Feet Deep}	39,000	SF	$30.00	***$1,170,000***	15' deep ex. X 1800lf x 2 sides; Updated unit price per HWA assuming Sheet Pile Shoring
207010	SAFETY SYSTEM IN TRENCH EXCAVATION {16-22 Feet Deep}	20,000	SF	$35.00	***$700,000***	Deeper excavation within hillside in Park
	Dewatering					
FROM CSI	Dewatering - Pumping Water (6" Pump) to Baker Tank - Large Water Flow Capacity	150	Day	$3,200.00	***$480,000***	Assumed 30 days per month for 5 months; unit cost increased for additional contamination cleaning and testing for discharge to Elliott Bay
Sec 2-10	**Backfilling**					
210052	BORROW MINERAL AGGREGATE TYPE 2 {QTY>50TN}	2,268	TN	$31.00	***$70,308***	Fill for trench to replaced contaminated soils that were removed
FROM CSI	Contaminated Soils Disposal	2,268	TN	$135.00	***$306,180***	Assumed 14'd x 6'w x 900'L; 1/2 of excavated soil would be contaminated in Alaskan Way only; no contamination in park; 120 lb./ft3 unit weight
Sec 3	**Geotechnical Instrumentation and Monitoring**					
ADDED	VIBRATION AND SETTLEMENT MONITORING (1625 LF Pipe/Monthly)	10	MO	$7,500.00	***$75,000***	Unit Cost from CSI Tab, Updated to Include Settlement Monitoring
ADDED	Cultural Resource Monitoring	512	HR	$125.00	***$64,000***	Assume 32 hrs/week x 4 weeks x 4 months
Sec 5-04	**Hot Mix Asphalt (HMA) & Warm Mix Asphalt (WMA) Pavement**					
504020	SURFACE PREPARATION PRELEVEL {QTY > 50T}	315	TN	$130.00	***$40,950***	Bike path; 15'w x 700 ft l x 6" D x 120 lb./cf /2000 lb.
504045	PAVEMENT, HMA (CL 1/2 IN) {QTY>50 TN}	508	TN	$225.00	***$114,188***	Bike path; 15'w x 700 ft l x 8" D x 145 lb./cf /2000 lb.
504260	PAVEMENT PATCH, TEMPORARY {QTY>50TN}	392	TN	$265.00	***$103,748***	Cold patch for trench; 6' x 900 LF x 12"d * 145 lb./cf /2000 lb.
Sec 5-05	**Cement Concrete for Roadway and Related Work**					
505144	ROADWAY Cem Conc., HES (72HR), 10IN {QTY>50SY}	2,883	SY	$120.00	***$345,960***	Roadway Restoration Area
FROM CSI	MINERAL AGGREGATE TYPE 2	973	TN	$50.00	***$48,651***	Roadway Base; 6-inches
505310	DOWEL Bar {QTY > 25EA}	3,600	EA	$6.00	***$21,600***	Est. # of panels = 4 joints, 900 lf each, 1 dowel per ft.
505315	TIE Bar With Drill Hole {QTY >25EA}	980	EA	$4.00	***$3,920***	40' wide restoration area, bar every 3 ft, 15'wide panels for 900' l
Sec 6-02	**Cement Concrete Structures and Cement Concrete for Miscellaneous Work**					
602100	CONCRETE CL 4000 {QTY<=5CY}	15	CY	$915.00	***$13,725***	Allowance for CSO Control Structure Mods
602355	EPOXY Coated Steel Reinforcing Bar {QTY <=2000lbs}	750	LB	$4.10	***$3,075***	Allowance for CSO Control Structure Mods
ADDED	FRP MH RUNGS	20	EACH	$250.00	***$5,000***	Estimated, fro CSO Control Structure
Sec 6-11	**Reinforced Concrete Walls**					
611130	CONCRETE CL 4000 For Retaining Wall (3-5% Reinforcing)	133	CY	$1,550.00	***$206,667***	500' l x 1.5'w x 3't (within Park and Along Trail)
Sec 7-05	**Maintenance Hole, Catch Basins and Inlets**					
705008	MAINTENANCE HOLE, TYPE 204A {QTY<=5 EA}	8	EA	$5,200.00	***$41,600***	
705108	EXTRA Depth, Type 204A Maintenance Hole	40	VF	$260.00	***$10,400***	Assumed extra 5' per MH
705300	RE-CHANNEL Maintenance Hole	1	EA	$1,250.00	***$1,250***	In CSO Control Structure
Sec 7-08	**Miscellaneous Pipe Connections**					
ADDED	Pipe Connection to KC EBI	1	LS	$7,000.00	***$7,000***	Estimated
ADDED	KING COUNTY OVERSIGHT	1	LS	$5,000.00	***$5,000***	Estimated
ADDED	Pipe Connection to CSO Control Structure	1	EA	$2,000.00	***$2,000***	Estimated
Sec 7-17	**Storm Drains and Sanitary Sewers**					
717024	BEDDING, CL B, 24 IN Pipe {QTY >50LF}	1,800	LF	$22.00	***$39,600***	24" RCP Bedding, Class B
717724	PIPE, PSS, Conc Reinf C76 CLIV, 24 IN {QTY > 50 FT}	1,800	LF	$140.00	***$252,000***	24" RCP Pipe
717985	TEMPORARY SEWER BYPASS {Length-250-500 FT}	1	LS	$20,000.00	***$20,000***	During work within CSO Control Structure
717990	TELEVISION INSPECTION {QTY >200FT 1 MOB}	1,800	LF	$4.50	***$8,100***	

APWA 2017						
Bid item	Item/Description	Take-Off QTY	Unit	Total Cost Unit 2017	Estimate Total	NOTES
Sec 7-20	Adjustment of New and Existing Utility Structures to Finish Grade					
720005	ADJUST Existing MH, CB, or VC {QTY > 5EA}	10	EA	$410.00	$4,100	Allowance for roadway restoration
Sec 7-21	Bioretention					
721002	BIORETENTION Soil {QTY >20CY}	500	CY	$82.00	$41,000	Allowance for GSI
Sec 8-01	Construction Stormwater Pollution Prevention					
801001	CONSTRUCTION Storm Water & Erosion Control Plan - CSECP {Project Value $3-$5M} CSI (REF)	1	LS	$15,500.00	$15,500	
801002	TREE Vegetation & Soil Protection Plan - TCSPP {Project Value $3-$5M} CSI (REF)	1	LS	$7,575.00	$7,575	
801003	SPILL Plan SP {Project Value $3-$5M} CSI (REF)	1	LS	$4,300.00	$4,300	
801004	TEMPORARY Discharge Plan TDP {Project Value $3-$5M} CSI (REF)	1	LS	$5,125.00	$5,125	
Sec 8-02	Landscape Construction					
ADDED	TREE PROTECTION	20	EA	$250.00	$5,000	Estimated
802030	TREE, Coniferous Evergreen, 8 Ft to 10 FT	5	EA	$255.00	$1,275	
802048	TREE, Deciduous, 6 Ft to 8 FT	10	EA	$510.00	$5,100	
802105	SHRUB, Broadleaf Evergreen, 5 Gal {QTY >5 EA}	10	EA	$55.00	$550	
802218	TURF Area Soil {QTY >20 CY}	417	CY	$41.00	$17,083	For park sod; 22,500sf x .5' thick
802320	BENCH	5	EA	$515.00	$2,575	Allowance for Community Benefit
802380	FLEXIBLE POROUS SURFACE TREATMENT - 1.5" Thick (Black Material)	1	CY	$4,558.00	$4,220	Allowance for Community Benefit
802600	SODDING	22,500	SF	$4.00	$90,000	For Park
802710	LAWN Establishment {QTY 10,000-20,000 SF} CSI (REF)	1	LS	$6,827.62	$6,828	
Sec 8-04	Cement Concrete Curb, Curb and Gutter					
804005	CURB, CEM CONC {QTY >500}	750	LF	$36.00	$27,000	Curb repair; match length of curb removed
Sec 8-12	Chain Link Fence and Wire Fence					
812001	CHAIN LINK Fence, Type 1 {QTY > 200 LF}	1,000	LF	$31.00	$31,000	Allowance for temp. construction fencing
812014	CHAIN LINK Gate, Double 14 Ft Wide {QTY >5 EA}	1	EA	$1,425.00	$1,425	Allowance for temp. construction fencing
812020	CHAIN LINK Gate, Double 20 Ft Wide {QTY <=5 EA}	1	EA	$2,050.00	$2,050	Allowance for temp. construction fencing
Sec 8-14	Cement Concrete Sidewalk					
814021	CURB RAMP {QTY >5SY}	130	SY	$270.00	$35,100	
814030	DETECTABLE Warning Plate {QTY > 20SY}	8	SY	$71.00	$568	Assumed 9 ramps, 2' d x 4' w ea.
814250	PATTERNED Cem Conc Treatment, Sidewalk, (Pattered) {QTY > 50SY}	393	SY	$125.00	$49,125	At Plaza
Sec 8-15	RIPRAP					
815020	LIGHT LOOSE Riprap {QTY >=200 TN}	42	TN	$62.00	$2,604	Along Bike path; 700'l x 1'w x 1' d x 120 lb./ft3
Sec 8-19	Cement Concrete Driveway					
819020	DRIVEWAY, CEM CONC, HES (72 HR), 8 IN {QTY <=50 SY}	21	SY	$120.00	$2,520	At Plaza
Sec 8-21	Permanent Signing and Posts					
821050	RELOCATE Sign, Traffic {QTY <=5EA}	5	EA	$360.00	$1,800	Assumed
Sec 8-22	Pavement Marking					
822018	PAVEMENT MARKING, Thermo, 8 IN Stripe {QTY >200 LF}	2,300	LF	$7.00	$16,100	Centerline, dashed lane lines, turn lanes
822020	PAVEMENT MARKING, Thermo, Legend/Symbol {QTY>5 EA}	10	EA	$205.00	$2,050	Bike logo, sharrow, crosswalks
Sec 8-27	Project Identification Sign					
827020	SIGN, INSTALL PROJECT IDENTIFICATION, POST MOUNTED {Size-Large-8'x10'}	1	EA	$1,400.00	$1,400	
Sec 8-31	Traffic Signal System					
831306	DETECTOR LOOP, 6 FT DIA {QTY > 5 EA}	2	EA	$915.00	$1,830	Assumed, 1 at each lane for intersection with lights
ADDED	Reinstall and Certify Railroad Crossing Arm and Signal	3	EA	$7,000.00	$21,000	Estimated, Allowance
Sec 8-33	Conduit and Trenching					
833400	Relocate Handhole {QTY<=5EA}	2	EA	$510.00	$1,020	For ADA Ramps
				SUBTOTAL	$6,191,852	

Appendix D

Basis of Estimate and OPCC for Elliott Avenue New Flow Transfer Alternative

Basis of Capital Estimate-Before Stage Gate 2

****Note this BOE is for estimating the Total Cost Projection**

Title	**Vine Basin CSO Control Project** **Options Analysis** **April 5, 2019** **AACE Class 4 OPCC**	
1. Project Information: Seattle Public Utilities	* Activity Name/Number * LOB Representative and Project Manager * Cost estimator * Estimate Reviewer(s)	Option 2: Flow Transfer, Elliott Ave. Shailee Sztern, SPU PM Rick Johnson, SPU LOB Rep. Nichole Kruse, PE - Murraysmith Brian Bartle, PE - Murraysmith
2. Project Objectives	The Vine Basin CSO Control Project seeks to brainstorm alternatives and select recommended improvements to reduce the frequency of combined sewer overflows (CSOs) experienced in the Vine Basin (NPDES 069) to one or less event per year on a 20-year rolling average to meet regulatory requirements (reference Consent Decree). The OPCCs will be used as part of a multi-objective decision analysis (MODA) to select the best alternative to achieve the project goals. The recommended alternative will be presented for Stage Gate 2 approval and WDOE approval.	
3. Project Scope	Option 2: This option consists of transferring excess sewer flow to King County's Elliott Bay Interceptor (EBI) via a new 24-inch diameter sewer in Elliott Ave. to reduce CSO event frequency. The sewer will be installed from the intersection of Vine St. and Elliott Ave. to the intersection of Bay St. and Elliott Ave. The project area is within an urban area within in downtown Seattle. The project will include the following: • Excavation to expose a portion of King County's EBI (approx. 20-ft deep) • Installation of a 24-inch connection to King County's EBI with KC Oversight o The connection will be made while the EBI is in use (active flow) • Installation of approximately 1,800 linear feet of 24-inch diameter RCP with MHs (approx. 15-ft deep) • Replacement of an existing MH near Vine St. and Elliott Ave. • Installation of a bypass vault within the intersection of Vine St. and Elliott Ave. • Right-of-Way restoration including concrete pavement with asphalt overlay replacement and ADA curb ramp improvements. • GSI and/or community benefits that are not yet defined.	
4. Location	The proposed sewer alignment is located in Elliott Ave. between Vine St. and Bay St.; refer to the attached preliminary layout figure. The alignment is located within SDOT Right-of-Way. Site Constraints: • Extensive traffic control will be required during construction within Elliott Ave. (anticipate having min. of 1 lane open; two traffic lanes and parking will be closed). • Groundwater is expected to be encountered when excavation and trenching. • There is potential for soil contamination and groundwater contamination in Elliott Ave. • Vibration and settlement monitoring of the adjacent cast iron water main will be required. • The proposed sewer alignment is within close proximity of multiple SCL vaults and ductbanks. • Limited staging areas are available within close proximity of the site. • Pedestrian and vehicle access to businesses and residences to be maintained.	
5. Schedule	Draft Engineering Report Submission to WDOE - 06/28/2019 Final Engineering Report Submission to WDOE - 11/2019 Stage Gate 2 Approval - 11/2019 Final Design Completion - 12/2021 Construction Contract Award and NTP - 03/2022 Construction Activities - 07/2023 (16 months) 1-year Commissioning - 07/2024	

6. Labor Resourcing Strategy	Consultant team will deliver design; SPU will provide design direction, review and oversight. Consultant team will provide engineering support during construction and will produce record drawings. SPU will provide site survey data and benchmarking for design. SPU will provide geotechnical report; geotechnical borings will be required prior to design. SPU will review construction material submittals. SPU will provide Construction Management/Construction Oversight. All construction activities will be completed by a construction contractor.	
7. Construction Contracting Strategy	Construction work will be procured using a traditional design-bid-build (DBB) procurement with award to the lowest responsible and responsive bidder. • Assumed construction work week will be Monday through Friday. • Assumed construction work hours will be 9am to 3pm to avoid periods of high-volume traffic. • SPU will not provide any construction materials (not materials to be furnished by owner) or services.	
8. Conceptual Design	* Design Assumptions * Conceptual drawing/sketch * Specifications (if applicable)	24-inch diameter RCP gravity sewer pipe. Sewer bedding will be Class B per CSO Std. Plan 285. MHs will be precast per CSO Std. Plan 204a/b. Refer to 10% Layout Drawing 2017 City of Seattle Standard Specifications.
9. Basis of Quantity:	* Take-off by LOB * Take-off by Engineering * Take-off by SPU Consultant	☐ ☐ ☑

	Basis of Capital Estimate-Before Stage Gate 2	
Title	**Vine Basin CSO Control Project** **Options Analysis** **April 5, 2019** **AACE Class 4 OPCC**	
10. Basis of Labor, Materials & Equipment Pricing (aka Unit Price)	* Historical unit costs (aka parametric estimating)	
	* Similar completed project (aka analogous estimating)	
Seattle Public Utilities	* Engineering Judgment	Nichole Kruse, PE - Murraysmith Brian Bartle, PE - Murraysmith
	* Semi-detailed unit costs	2017 Cost Estimate Template
11. Allowance For Indeterminates:	30% AFI as a % of the hard costs; per SPU CEG Table 4-1, Note 6 an AFI is appropriate if the scope is well defined and based on construction bid items rather than parametric or analogous cost estimates. 25% AFI is appropriate for 30% design per SPU CEG Table 4-1. We have added the AFI at this stage since we have completed a detailed OPCC based on bid items.	
12. Sales Tax	* Sales Tax Applicable	10.10%
	* Sales Tax Not Applicable	
13. SPU Field Crew Costs/Misc. Hard Costs	• SPU Construction Management/Oversight • SPU materials lab for material submittal review and approval.	
14. Soft Cost	* From SPU CEG	49% (soft costs as a % of hard costs) per SPU CEG Table 4-2
	* Not from SPU CEG	
15. Property Acquisition Cost	No property acquisition is anticipated to be required for this option.	
16. Contingency Reserve	* From SPU CEG Recommended Range	25% per SPU CEG Table 5-1
	* Not from SPU CEG	
17. Management Reserve	* From SPU CEG	20% per SPU CEG Table 5-2
	* Not from SPU CEG	
18. Inflation	* Yes	☑ Apply the current inflation amount of 2.3% to the Total Cost
	* No	☐
19. Escalation Adjustment	* Yes	☑ Apply the current escalation adjustment of 1.0% to the construction contract amount.
	* No	☐

20. Other Assumptions:	• No in-water work will be performed. • No betterments or replacements beyond those indicated on the layout. • No replacement or relocation of other utilities unless specifically indicated on the layout. • No odor control facilities are included. • No automation, instrumentation, or online monitoring is included. • No rock excavation will be required. • No vibration monitoring of adjacent structures is included. • No cost for additional/new art is included. • Cultural resource monitoring of excavations will be performed. • Complete street closures are not acceptable. At least one lane must always be kept open. • Traffic control and signage will be required. • Peace officers will be required during work within intersections. • Open-cut construction will be utilized; no trenchless construction methods will be used. • Right-of-way surface restoration will be completed in accordance with the ROWORR and per current City of Seattle Standards. • Excavations will require interlocking steel sheet piles. • At utility crossings, hand-digging will be required and special shoring will be required. • Static stainless steel plate/orifice restriction will be installed at MH prior to EBI connection for flow control. • Trench dewatering will be required; assumed sump pumps will be used. Discharge will be treated with Baker Tanks and oil absorbent filters prior to sewer discharge; KC approval required. • Groundwater contamination sampling will be required. • Construction schedule will overlap with wet season. • Limited bypass pumping will be required when replacing MH 039-062 and installing new bypass vault at Vine St. and Elliott Ave. Bypassing will be above grade and will not be trenched or require pavement restoration. • Additional temporary power supply will be required during construction for dewatering pumps and bypass pumps. • Private parcel will be rented for construction staging and parking. • Excavated soils will require contaminated soils testing and potentially disposal. • Roadway is assumed to be concrete pavement with asphalt overlay.	
21. Exceptions:		
22. Risks	• Potential for survey and potholing data to identify conflict with proposed alignment. • Potential for encountering historical or archeological artifacts during construction. • Potential for damaging KC EBI when making discharge connection. • Potential for spill during bypass pumping. • Potential for encountering conflicting utilities during excavation. • Potential for utility crossing conflicts. • Potential for vibration and settlement limits of adjacent water main being exceeded. • Potential for business access impacts. • Potential for encountering mature tree roots greater than 2-inch diameter. • Potential for noise complaints during concrete pavement sawcutting. • Potential for damaging overhead crossings (Sculpture Park and Skywalk) during construction. • KC approval required for contaminated construction dewatering discharge. Potential for hydrocarbons, heavy metals, creosote and other. Additional site assessment is recommended. • Potential for encountering soil contamination beyond preliminary estimation and assumptions made for this OPCC. No formal investigation has been conducted; OPCC is based on limited information and anecdotal evidence. Additional site assessment and geotechnical investigation are recommended.	
23. Basis of Estimate Reviews and Benchmarking	* How/Why Estimate Has Changed * Benchmarking * Attachments	N/A N/A See preliminary layout.

APWA 2017

Bid item	Item/Description	Take-Off QTY	Unit	Total Cost Unit 2017	Estimate Total	NOTES
Sect 1-07	**Legal Relations & Responsibilities**					
107005	SAFETY AND HEALTH PROGRAM-CSI (REF)	16	MO	$1,725.00	***$27,600***	Unit Cost from CSI Tab
	Existing Conditions					
FROM CSI	CONSTRUCTION SURVEY (2 MAN CREW)	25	DAY	$1,800.00	***$45,000***	Unit Cost from CSI Tab
FROM CSI	UTILITY POTHOLING {QTY >10 EA}	15	EA	$1,000.00	***$15,000***	Unit Cost from CSI Tab; lowered cost since minimal restoration required when done during construction
	General Requirements					
ADDED	STAGING AREA RENTAL	16	MO	$10,000.00	***$160,000***	Estimated
FROM CSI	AS-BUILT RECORDS, MIN. BID	30	EA	$400.00	***$12,000***	Unit Cost from CSI Tab; Assumed 30 Drawings
ADDED	1-Year Commissioning Support	1	LS	$10,000.00	***$10,000***	
ADDED	Permits, Materials Testing, and Misc. Hard Costs	1	LS	$185,000.00	***$185,000***	
Sect 1-09	**Measurement & Payment**					
109005	MOBILIZATION-CSI (REF)	1	LS	$511,545.54	***$511,546***	10% of total
Sect 1-10	**Temporary Traffic Control**					
110005	MAINTENANCE & PROTECTION OF TRAFFIC CONTROL INCLUDING FLAGGING-CSI (REF)	300	DAY	$895.00	***$268,500***	Needed throughout in street work since high traffic - 5 days/week, 4 weeks per month, 15 months
ADDED	PARKING METER HOODS BY SDOT	1	LS	$2,000.00	***$2,000***	Estimated (per Casseday)
ADDED	SDOT SIGNAL MODIFICATION (BY SDOT)	1	LS	$20,000.00	***$20,000***	Estimated, modified signals (per Casseday)
ADDED	PARKING FEES (PER SPACE PER DAY; MON-SAT)	4,200	DAY	$25.00	***$105,000***	Estimated, 25 street parking spaces to be impacted; est. phased construction; 6 days/week; 7 months, 4 weeks per month (per Casseday)
110020	TRAFFIC CONTROL PEACE OFFICERS	360	HR	$97.00	***$34,920***	Needed at Intersections (3 intersections, 4 weeks per intersection, 6 hour days, 5 days per week) (per Casseday)
Sec 2-02	**Remove, Abandon, Or Relocate Structures and Obstructions**					
202035	REMOVE CEMT. CONCR. SIDEWALK {QTY >50}	544	SY	$17.00	***$9,242***	Curb ramps
202045	REMOVE CEMT. CONCR. SIDEWALK {QTY >50}	4,935	SY	$21.00	***$103,630***	Full depth pavement/roadway removal
202145	REMOVE CURB {QTY>50}	900	LF	$11.00	***$9,900***	Assumed some damaged to curb
202767	SAWCUT Cement Concrete Sidewalk, Full Depth {QTY>50LF}	360	LF	$7.00	***$2,520***	2 saw cuts at each ADA ramp; Assumed 10' each
202770	SAWCUT Rigid Pavement, Full Depth {QTY >500 LF}	5,684	LF	$12.00	***$68,208***	Trench sawcut and pavement restoration sawcut
Sec 2-03	**Structural Demolition**					
203011	Remove Pre-Cast MH Over 8' Deep	16	VLF	$260.00	***$4,160***	FROM CSI; MH at Vine and Elliott
Sec 2-04	**Excavations**					
204005	COMMON Excavation {QTY >500}	107	CY	$52.00	***$5,547***	Excavation at EBI
Sec 2-07	**Protective System**					
207010	SAFETY SYSTEM IN TRENCH EXCAVATION {16-22 Feet Deep}	54,000	SF	$30.00	***$1,620,000***	15' deep ex. X 1800lf x 2 sides; Updated Unit Price per HWA assuming Sheet Pile Shoring
	Dewatering					
FROM CSI	Dewatering - Pumping Water (3" Pump) to Baker Tank - Small to Mid-range Water Flow Capacity	150	Day	$1,500.00	***$225,000***	Assumed 30 days per month for 5 months; assumes discharge to sewer
Sec 2-10	**Backfilling**					
210052	BORROW MINERAL AGGREGATE TYPE 2 {QTY>50TN}	2,430	TN	$31.00	***$75,330***	
FROM CSI	Contaminated Soils Disposal	2,430	TN	$125.00	***$303,750***	Assumed 15' D x 6'w x 1800'L trench; 25% of excavated soils would be contaminated; 120 lb./ft3 unit weight
Sec 3	**Geotechnical Instrumentation and Monitoring**					
ADDED	VIBRATION AND SETTLEMENT MONITORING (1625 LF Pipe/Monthly)	10	MO	$7,500.00	***$75,000***	Unit Cost from CSI Tab, Updated to Include Settlement Monitoring
ADDED	Cultural Resource Monitoring	512	HR	$135.00	***$69,120***	Assume 32 hrs/week x 4 weeks x 4 months
Sec 5-04	**Hot Mix Asphalt (HMA) & Warm Mix Asphalt (WMA) Pavement**					
504045	PAVEMENT, HMA (CL 1/2 IN) {QTY>50 TN}	537	TN	$225.00	***$120,748***	For pavement restoration area, 2" thick; 145 Lb./ft3 unit weight
504260	PAVEMENT PATCH, TEMPORARY {QTY>50TN}	783	TN	$265.00	***$207,495***	Cold patch for trench width: 6'wx1800'Lx1'D; 145 Lb./ft3 unit weight
Sec 5-05	**Cement Concrete for Roadway and Related Work**					
505144	ROADWAY Cem Conc., HES (72HR), 10IN {QTY>50SY}	4,935	SY	$120.00	***$592,173***	Roadway Restoration Area
FROM CSI	MINERAL AGGREGATE TYPE 2	1,665	TN	$50.00	***$83,274***	Roadway Base; 6-inch thick
505310	DOWEL Bar {QTY > 25EA}	3,600	EA	$6.00	***$21,600***	Est. # of panels = 2 joints, 1800 lf each, 1 dowel per ft.
505315	TIE Bar With Drill Hole {QTY >25EA}	880	EA	$4.00	***$3,520***	20' wide restoration area, bar every 3 ft, 15'wide panels for 1800' l
Sec 7-05	**Maintenance Hole, Catch Basins and Inlets**					
705008	MAINTENANCE HOLE, TYPE 204A {QTY>5 EA}	8	EA	$4,000.00	***$32,000***	
705020	MAINTENANCE HOLE, Type 210A {QTY<=5 EA}	1	EA	$20,500.00	***$20,500***	For vault structure in Vine and Elliott
705108	EXTRA Depth, Type 204A Maintenance Hole	40	VF	$260.00	***$10,400***	Assumed extra 5' per MH
705120	EXTRA Depth, Type 210A Maintenance Hole	5	VF	$920.00	***$4,600***	Assumed extra 5' for vault structure in Vine and Elliott
Sec 7-08	**Miscellaneous Pipe Connections**					
ADDED	Pipe Connection to KC EBI	1	LS	$7,000.00	***$7,000***	Estimated
ADDED	KING COUNTY OVERSIGHT	1	LS	$5,000.00	***$5,000***	Estimated
Sec 7-17	**Storm Drains and Sanitary Sewers**					
717024	BEDDING, CL B, 24 IN Pipe {QTY >50LF}	1,800	LF	$22.00	***$39,600***	24" RCP Bedding, Class B
717724	PIPE, PSS, Conc Reinf C76 CLIV, 24 IN {QTY > 50 FT}	1,800	LF	$140.00	***$252,000***	24" RCP Pipe
717985	TEMPORARY SEWER BYPASS {Length-250-500 FT}	1	LS	$20,000.00	***$20,000***	For MH replacement and Vine/Elliott added vault
717990	TELEVISION INSPECTION {QTY >200FT 1 MOB}	1,800	LF	$4.50	***$8,100***	
Sec 7-20	**Adjustment of New and Existing Utility Structures to Finish Grade**					
720005	ADJUST Existing MH, CB, or VC {QTY <=5EA}	5	EA	$615.00	***$3,075***	Allowance for roadway restoration
720020	ADJUST Existing Valve Box {QTY <=5EA}	5	EA	$515.00	***$2,575***	Allowance for roadway restoration
Sec 7-21	**Bioretention**					
721002	BIORETENTION Soil {QTY >20CY}	435	CY	$82.00	***$35,670***	Allowance for GSI
Sec 8-01	**Construction Stormwater Pollution Prevention**					
801001	CONSTRUCTION Storm Water & Erosion Control Plan - CSECP {Project Value $3-$5M} CSI (REF)	1	LS	$15,500.00	***$15,500***	Had to Manually Enter Unit Costs
801002	TREE Vegetation & Soil Protection Plan - TCSPP {Project Value $3-$5M} CSI (REF)	1	LS	$7,575.00	***$7,575***	Had to Manually Enter Unit Costs
801003	SPILL Plan SP {Project Value $3-$5M} CSI (REF)	1	LS	$4,300.00	***$4,300***	Had to Manually Enter Unit Costs
801004	TEMPORARY Discharge Plan TDP {Project Value $3-$5M} CSI (REF)	1	LS	$5,125.00	***$5,125***	Had to Manually Enter Unit Costs
Sec 8-02	**Landscape Construction**					
ADDED	TREE PROTECTION	20	EA	$250.00	***$5,000***	Estimated
802048	TREE, Deciduous, 6 Ft to 8 FT	10	EA	$510.00	***$5,100***	Community Benefit and GSI Allowance
802360	TREE Root Barrier {QTY >20 LF}	160	LF	$12.00	***$1,920***	Assumed 4'x4' tree box; Community Benefit and GSI Allowance
802380	FLEXIBLE POROUS SURFACE TREATMENT - 1.5" Thick (Black Material)	1	CY	$4,558.00	***$4,502***	Assumed 12 tree boxes, 4'x4' ea.; Community Benefit and GSI Allowance
Sec 8-04	**Cement Concrete Curb, Curb and Gutter**					
804005	CURB, CEM CONC {QTY >500}	900	LF	$36.00	***$32,400***	Curb repair; match length of curb removed
Sec 8-12	**Chain Link Fence and Wire Fence**					
812001	CHAIN LINK Fence, Type 1 {QTY > 200 LF}	1,000	LF	$31.00	***$31,000***	Allowance for temp. construction fencing
812014	CHAIN LINK Gate, Double 14 Ft Wide {QTY <=5 EA}	2	EA	$1,625.00	***$3,250***	Allowance for temp. construction fencing
Sec 8-14	**Cement Concrete Sidewalk**					
814021	CURB RAMP {QTY >5SY}	544	SY	$270.00	***$146,790***	All curb ramps
814030	DETECTABLE Warning Plate {QTY > 20SY}	30	SY	$71.00	***$2,146***	Assumed 34 ramps, 2' d x 4' w ea.
Sec 8-22	**Pavement Marking**					
822018	PAVEMENT MARKING, Thermo, 8 IN Stripe {QTY<=200 LF}	3,600	LF	$30.00	***$108,000***	lane markings
822020	PAVEMENT MARKING, Thermo, Legend/Symbol {QTY>5 EA}	7	EA	$205.00	***$1,435***	7 crosswalks
Sec 8-27	**Project Identification Sign**					
827020	SIGN, INSTALL PROJECT IDENTIFICATION, POST MOUNTED {Size-Large-8'x10'}	1	EA	$1,400.00	***$1,400***	
Sec 8-31	**Traffic Signal System**					
831306	DETECTOR LOOP, 6 FT DIA {QTY > 5 EA}	9	EA	$915.00	***$8,235***	Broad and Elliott
Sec 8-33	**Conduit and Trenching**					
833400	Relocate Handhole {QTY<=5EA}	2	EA	$510.00	***$1,020***	ADA ramp work
				SUBTOTAL	**$5,822,001**	

Appendix E

Basis of Estimate and OPCC for Alaskan Way Inline Storage Alternative

	Basis of Capital Estimate-Before Stage Gate 2 ****Note this BOE is for estimating the Total Cost Projection**
Title	**Vine Basin CSO Control Project** **Options Analysis** **April 5, 2019** **AACE Class 4 OPCC**

1. Project Information:	* Activity Name/Number	Option 3: Storage, Alaskan Way
	* LOB Representative and Project Manager	Shailee Sztern, SPU PM
	* Cost estimator	Nichole Kruse, PE - Murraysmith
	* Estimate Reviewer(s)	Brian Bartle, PE - Murraysmith

2. Project Objectives

The Vine Basin CSO Control Project seeks to brainstorm alternatives and select recommended improvements to reduce the frequency of combined sewer overflows (CSOs) experienced in the Vine Basin (NPDES 069) to one or less event per year on a 20-year rolling average to meet regulatory requirements (reference Consent Decree).

The OPCCs will be used as part of a multi-objective decision analysis (MODA) to select the best alternative to achieve the project goals. The recommended alternative will be presented for Stage Gate 2 approval and WDOE approval.

3. Project Scope

Option 3: This option consists of storing excess sewer flow in an inline, large diameter storage pipe in Alaskan Way to reduce CSO event frequency. The storage line will upsize the existing 24-inch sewer to 96-inch (internal diameter), from the intersection of Vine St. and Alaskan Way to a location near the intersection of Broad St. and Alaskan Way. The project area is within an urban area within in downtown Seattle. The project will include the following:

• Removal of 800 LF of SDOT street car tracks.
• Bypassing of the water main during replacement.
• Removal and replacement of 790 LF of 21-inch diameter water main piping, hydrant connections and service connections.
• Bypass pumping for the existing 24-inch diameter combined sewer main in Alaskan way and the contributing sewer laterals.
• Removal of 700 linear feed of 24-inch diameter RCP sewer.
• Installation of approximately 700 linear feet of 96-inch internal diameter RCP. The storage pipe is anticipate to have an invert that is approximately 15.5 feet deep with approximately 6-ft of cover over the top of the pipe.
• Installation of 3 access structures for the storage pipe.
• Connection to the existing CSO Control Structure at the intersection of Vine St. and Alaskan Way and internal modification of the CSO Control Structure.
• Right-of-Way restoration including concrete pavement replacement, sidewalk replacement, curb and gutter replacement, and ADA curb ramp improvements.
• GSI and/or community benefits that are not yet defined.

4. Location

The proposed sewer alignment is located in Alaskan Way, along the existing sewer alignment; refer to the attached preliminary layout figure. The alignment is located within SDOT Right-of-Way.

Site Constraints:
• BNSF railroad is located to the east of the proposed sewer alignment
• Shoreline and seawall is located to the west of the proposed sewer alignment (urban harbor front shoreline environment)
• Extensive traffic control will be required during construction within Alaskan Way (anticipate having 1 lane open in each direction during construction; two traffic lanes and parking will be closed).
• Alaskan Way is identified as a liquefaction prone area (seismic hazard).
• Groundwater is expected to be encountered when excavating more than 5-feet below grade.
• There is potential for soil contamination and groundwater contamination in Alaskan Way.
• Vibration and settlement monitoring of the adjacent cast iron water main will be required.
• The proposed sewer alignment is within close proximity of multiple SCL vaults and ductbanks.
• Limited staging areas are available within close proximity of the site.
• Pedestrian and vehicle access to two piers shall be maintained.
• CSO Monitoring shall be undisrupted throughout construction.
• Rechannel CSO Control Vault discharge to maintain flow through both sewer to minimize risk of odors

5. Schedule	Draft Engineering Report Submission to WDOE - 06/28/2019 Final Engineering Report Submission to WDOE - 11/2019 Stage Gate 2 Approval - 11/2019 Final Design Completion - 12/2021 Construction Contract Award and NTP - 03/2022 Construction Activities - 07/2023 (16 months) 1-year Commissioning - 07/2024	
6. Labor Resourcing Strategy	Consultant team will deliver design; SPU will provide design direction, review and oversight. Consultant team will provide engineering support during construction and will produce record drawings. SPU will provide site survey data and benchmarking for design. SPU will provide geotechnical report; geotechnical borings will be required prior to design. SPU will review construction material submittals. SPU will provide Construction Management/Construction Oversight. All construction activities will be completed by a construction contractor.	
7. Construction Contracting Strategy	Construction work will be procured using a traditional design-bid-build (DBB) procurement with award to the lowest responsible and responsive bidder. • Assumed construction work week will be Monday through Friday. • Assumed construction work hours will be 9am to 3pm to avoid periods of high-volume traffic. • SPU will not provide any construction materials (not materials to be furnished by owner) or services.	
8. Conceptual Design	* Design Assumptions * Conceptual drawing/sketch * Specifications (if applicable)	96-inch internal diameter pre-cast concrete storage pipe. Sewer bedding will be Class B per CSO Std. Plan 285. Refer to 10% Layout Drawing 2017 City of Seattle Standard Specifications.
9. Basis of Quantity:	* Take-off by LOB * Take-off by Engineering * Take-off by SPU Consultant	☐ ☐ ☑

	Basis of Capital Estimate-Before Stage Gate 2	
Title	**Vine Basin CSO Control Project** **Options Analysis** **April 5, 2019** **AACE Class 4 OPCC**	
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11. Allowance For Indeterminates:	30% AFI as a % of the hard costs; per SPU CEG Table 4-1, Note 6 an AFI is appropriate if the scope is well defined and based on construction bid items rather than parametric or analogous cost estimates. 25% AFI is appropriate for 30% design per SPU CEG Table 4-1. We have added the AFI at this stage since we have completed a detailed OPCC based on bid items.	
12. Sales Tax	* Sales Tax Applicable	10.10%
	* Sales Tax Not Applicable	
13. SPU Field Crew Costs/Misc. Hard Costs	• SPU Construction Management/Oversight • SPU materials lab for material submittal review and approval.	
14. Soft Cost	* From SPU CEG * Not from SPU CEG	49% (soft costs as a % of hard costs) per SPU CEG Table 4-2
15. Property Acquisition Cost	No property acquisition is anticipated to be required for this option.	
16. Contingency Reserve	* From SPU CEG Recommended Range * Not from SPU CEG	25% per SPU CEG Table 5-1
17. Management Reserve	* From SPU CEG * Not from SPU CEG	20% per SPU CEG Table 5-2
18. Inflation	* Yes * No	☑ Apply the current inflation amount of 2.3% to the Total Cost ☐
19. Escalation Adjustment	* Yes * No	☑ Apply the current escalation adjustment of 1.0% to the construction contract amount. ☐

20. Other Assumptions:	• No in-water work will be performed. • No betterments or replacements beyond those indicated on the layout. • No replacement or relocation of other utilities unless specifically indicated on the layout. • No damage to or replacement of existing art sculptures. • No odor control facilities are included. • No automation, instrumentation, or online monitoring is included. • No rock excavation will be required. • No cost for additional/new art is included. • Cultural resource monitoring of excavations will be performed. • Internal modifications to the CSO Control Structure will be required however are not anticipated to require external modifications to the structure. Included minor CSO Control Structure improvements (i.e. access ladder removal and replacement, minimal mortar repair and gate removal). • CSO monitoring shall be uninterrupted during construction. • Increased risk of CSO event occurring during construction due to sewer bypassing limitations. • Complete street closures are not acceptable. At least one lane must always be kept open. • Traffic control and signage will be required. • Peace officers will be required during work within intersections. • Open-cut construction will be utilized; no trenchless construction methods will be used. • Right-of-way surface restoration will be completed in accordance with the ROWORR and per current City of Seattle Standards. • Excavations will require interlocking steel sheet piles. • At utility crossings, hand-digging will be required and special shoring will be required. • Static stainless steel plate/orifice restriction will be installed at downstream end of storage pipe for flow control. • Trench dewatering will be required; assumed sump pumps will be used. Discharge will be treated with Baker Tanks and oil absorbent filters prior to discharge to Elliott Bay via existing stormwater outfall to minimize risk of CSO or SSO due to sewer capacity limitations. • Groundwater contamination sampling will be required. • Construction schedule will overlap with wet season. • Bypass pumping will be required as shown on the plans. Bypassing will be shallow trenched for the duration of the project and require pavement restoration. • Additional temporary power supply will be required during construction for dewatering pumps and bypass pumps. • Private parcel will be rented for construction staging and parking. • Excavated soils will require contaminated soils testing and potentially disposal. • Assumed excavated soil will not be suitable for re-use as trench backfill. • Water services and hydrants will be replaced after water main is replaced. • Water main will be replaced after storage facility is installed. • Streetcar track removal is included. • No replacement or relocation of utilities beyond what is indicated in the plans. • RR Crossing Arm at the intersection of Alaskan Way and Vine Street will be removed, stored and reinstalled. • RR Crossing Arm at the intersection of Alaskan Way and Clay Street will be removed, stored and reinstalled.
21. Exceptions:	
22. Risks	• Potential for survey and potholing data to identify conflict with proposed alignment. • Potential for SDOT to not permit streetcar track removal. • Potential for future impact to the storage facility when seawall is rebuilt. • Potential for encountering seawall tiebacks or creosote piles during excavation. • Potential for encountering historical or archeological artifacts during construction. • Potential for damaging CSO Control Structure during modifications. • Potential for sewage spill during bypass pumping. • Potential for encountering conflicting utilities during excavation. • Potential for utility crossing conflicts and relocation of other utilities being required. • Increased risk of SSO and CSO during construction resulting from decreased system capacity. • WDOE approval required for contaminated construction dewatering discharge to Elliott Bay. Potential for hydrocarbons, heavy metals, creosote and other. Additional site assessment is recommended. • Potential for encountering soil contamination beyond preliminary estimation and assumptions made for this OPCC. No formal investigation has been conducted; OPCC is based on limited information and anecdotal evidence. Additional site assessment and geotechnical investigation are recommended. • Site is within liquefaction prone area; potential for significant damages if earthquake is experienced during construction. • Proposed work within close proximity of BNSF RR Tracks will require additional worker safety requirements.

23. Basis of Estimate Reviews and Benchmarking	* How/Why Estimate Has Changed	N/A
	* Benchmarking	N/A
	* Attachments	See preliminary 10% layout.

APWA 2017

Bid item	Item/Description	Take-Off QTY	Unit	Total Cost Unit 2017	Estimate Total	NOTES
Sect 1-07	**Legal Relations & Responsibilities**					
107005	SAFETY AND HEALTH PROGRAM-CSI (REF)	16	MO	$1,725.00	***$27,600***	Unit Cost from CSI Tab
	Existing Conditions					
FROM CSI	CONSTRUCTION SURVEY (2 MAN CREW)	25	DAY	$1,800.00	***$45,000***	Unit Cost from CSI Tab
FROM CSI	UTILITY POTHOLING {QTY >10 EA}	15	EA	$1,000.00	***$15,000***	Unit Cost from CSI Tab; lowered cost since minimal restoration required when done during construction
	General Requirements					
ADDED	STAGING AREA RENTAL	16	MO	$10,000.00	***$160,000***	Estimated
FROM CSI	AS-BUILT RECORDS, MIN. BID	30	EA	$400.00	***$12,000***	Unit Cost from CSI Tab; Assumed 30 Drawings
ADDED	1-Year Commissioning Support	1	LS	$25,000.00	***$25,000***	
ADDED	Permits, Materials Testing, and Misc. Hard Costs	1	LS	$175,000.00	***$175,000***	
Sect 1-09	**Measurement & Payment**					
109005	MOBILIZATION-CSI (REF)	1	LS	$736,328.75	***$736,329***	10% of total
Sect 1-10	**Temporary Traffic Control**					
110005	MAINTENANCE & PROTECTION OF TRAFFIC CONTROL INCLUDING FLAGGING-CSI (REF)	300	DAY	$895.00	***$268,500***	Needed throughout in street work since high traffic - 5 days/week, 4 weeks per month, 15 months
ADDED	PARKING METER HOODS BY SDOT	1	LS	$2,000.00	***$2,000***	Estimated (per Casseday)
ADDED	SDOT SIGNAL MODIFICATION (BY SDOT)	1	LS	$20,000.00	***$20,000***	Estimated, modified signals (per Casseday)
ADDED	PARKING FEES (PER SPACE PER DAY; MON-SAT)	9,000	DAY	$25.00	***$225,000***	Estimated, 25 street parking spaces to be impacted; 6 days/week; 15 months, 4 weeks per month (per Casseday)
110020	TRAFFIC CONTROL PEACE OFFICERS	240	HR	$97.00	***$23,280***	Needed at Intersections (2 intersections, 4 weeks per intersection, 6 hour days, 5 days per week) (per Casseday)
ADDED	BNSF On-site Safety Rep.	240	HR	$150.00	***$36,000***	40 hours per week for 6 weeks (2 weeks for track removal, 2 week for bypassing install, 2 weeks for removal and restoration); $120/hour assumed
ADDED	Remove and Store Railroad Crossing Arms with Signals	2	EA	$5,000.00	***$10,000***	Estimated, Allowance
Sec 2-01	**Clearing, Grubbing, and Roadside Cleanup**					
201005	CLEARING & GRUBBING {QTY<=5,000}	1,400	SF	$3.10	***$4,340***	Near Clay and Alaskan
Sec 2-02	**Remove, Abandon, Or Relocate Structures and Obstructions**					
ADDED	REMOVE MH ACCESS LADDERS	2	EA	$500.00	***$1,000***	Estimated; at CSO Control Structure
ADDED	REMOVE SLIDE GATE AND STEM	1	EA	$1,000.00	***$1,000***	Estimated; at CSO Control Structure
202035	REMOVE CEMT. CONCR. SIDEWALK {QTY >50}	1,252	SY	$17.00	***$21,276***	Sidewalks +ADA ramps
202045	REMOVE PAVEMENT {QTY>400}	2,351	SY	$21.00	***$49,371***	Street area
202145	REMOVE CURB {QTY>50}	480	LF	$11.00	***$5,280***	Did not include curb along east side of street; will be removed with sidewalk, no special care required.
ADDED	REMOVE STREETCAR TRACKS AND TIES	800	LF	$60.00	***$48,000***	Estimated; Assumed a crew of 4 working for 2 weeks to remove the tracks. @ $150/person/hour
ADDED	TRACKS AND TIES DISPOSAL	1	LS	$10,000.00	***$10,000***	Estimated
202170	REMOVE FENCE, CHAIN LINK {QTY>500 LF}	540	LF	$10.00	***$5,400***	Railing adjacent to sidewalk
202190	REMOVE PIPE (15'-24") In TRENCH-Depth 6-8 FEET	255	LF	$36.00	***$9,180***	3 water service lines and 3 hydrant lines
202190	REMOVE PIPE (30"-42") In TRENCH-Depth 8-10 FEET	750	LF	$52.00	***$39,000***	Remove existing 21" Water
202190	REMOVE PIPE (55"-72") In TRENCH-Depth 15-25 FEET	700	LF	$93.00	***$65,100***	Remove existing 24" Sewer
202335	REMOVE Hydrant	3	EA	$925.00	***$2,775***	
202405	REMOVE Post, Parking Meter	2	EA	$125.00	***$250***	
202415	REMOVE Post, Street Name {QTY <=10}	1	EA	$125.00	***$125***	
202430	REMOVE Sign {QTY 10-20}	10	EA	$82.00	***$820***	Parking Signs
202750	SAWCUT Asphalt Concrete, Full Depth {QTY<=100LF}	400	LF	$10.00	***$4,000***	
202767	SAWCUT Cement Concrete Sidewalk, Full Depth {QTY>50LF}	344	LF	$7.00	***$2,408***	
202770	SAWCUT Rigid Pavement, Full Depth {QTY >500 LF}	1,344	LF	$12.00	***$16,128***	Assumed full panel removal sawcut only. No additional trench saw cutting.
Sec 2-04	**Excavations**					
204005	COMMON Excavation {QTY >500}	6,222	CY	$52.00	***$323,556***	Only included additional excavation for larger sewer storage pipe not captured above for pipe removal. 15' w x 16' deep x 700' l
204005	COMMON Excavation {QTY >500}	622	CY	$52.00	***$32,356***	For bypass trenches
ADDED	Creosote Pile Removal and Disposal	1	LS	$10,000.00	***$10,000***	Estimated, Allowance
Sec 2-07	**Protective System**					
207010	SAFETY SYSTEM IN TRENCH EXCAVATION {4-6 Feet Deep}	2,700	SF	$2.00	***$5,400***	Water service trenches; Update unit price
207010	SAFETY SYSTEM IN TRENCH EXCAVATION {7-10 Feet Deep}	12,960	SF	$10.00	***$129,600***	Water main trench; Updated unit price
FROM CSI	SHEET PILE SHORING FOR STRUCTURE {16-25 Foot Deep}	22,880	SF	$35.00	***$800,800***	Sewer storage trench
Sec 2-08	**Dewatering**					
FROM CSI	Dewatering - Pumping Water (6" Pump) to Baker Tank - Large Water Flow Capacity	150	Day	$3,200.00	***$480,000***	Assumed 30 days per month for 5 months; unit cost increased for additional contamination cleaning and testing for discharge to Elliott Bay
Sec 2-10	**Backfilling**					
210052	BORROW MINERAL AGGREGATE TYPE 2 {QTY>50TN}	10,500	TN	$31.00	***$325,500***	Fill for trench, assumes all soil is replaced
FROM CSI	Contaminated Soils Disposal	5,250	TN	$135.00	***$708,750***	Assumed 16'd x 15'w x 700'L; 1/2 of excavated soil would be contaminated; 120 lb./ft3 unit weight
Sec 3	**Geotechnical Instrumentation and Monitoring**					
FROM CSI	VIBRATION AND SETTLEMENT MONITORING (400 LF Pipe/Weekly)	24	WEEK	$2,050.00	***$49,200***	Unit Cost from CSI Tab
ADDED	Cultural Resource Monitoring	512	HR	$125.00	***$64,000***	Assume 32 hrs/week x 4 weeks x 4 months
Sec 5-04	**Hot Mix Asphalt (HMA) & Warm Mix Asphalt (WMA) Pavement**					
504020	SURFACE PREPARATION PRELEVEL {QTY > 50T}	217	TN	$130.00	***$28,247***	
504045	PAVEMENT, HMA (CL 1/2 IN) {QTY>50 TN}	217	TN	$225.00	***$48,889***	At Intersections only; assumed 1' thick
504260	PAVEMENT PATCH, TEMPORARY {QTY>50TN}	554	TN	$265.00	***$146,841***	At Intersections and north of clay; assumed 1' thick
Sec 5-05	**Cement Concrete for Roadway and Related Work**					
505144	ROADWAY Cem Conc., HES (72HR), 10IN {QTY>50SY}	2,185	SY	$120.00	***$262,200***	Roadway Restoration Area
FROM CSI	MINERAL AGGREGATE TYPE 2	737	TN	$70.00	***$51,621***	Roadway Base; 6-inch thick
505310	DOWEL Bar {QTY > 25EA}	2,600	EA	$6.00	***$15,600***	Est. # of panels = 2 joints, (800 lf+500 lf each), 1 dowel per ft.
505315	TIE Bar With Drill Hole {QTY >25EA}	722	EA	$4.00	***$2,889***	25' wide restoration area, bar every 3 ft, 15'wide panels for 800' L+550'L
Sec 6-02	**Cement Concrete Structures and Cement Concrete for Miscellaneous Work**					
602100	CONCRETE CL 4000 {QTY<=5CY}	15	CY	$915.00	***$13,725***	Allowance for CSO Control Structure Mods
602355	EPOXY Coated Steel Reinforcing Bar {QTY <=2000lbs}	750	LB	$4.10	***$3,075***	Allowance for CSO Control Structure Mods
ADDED	FRP MH RUNGS	20	EACH	$250.00	***$5,000***	Estimated, for CSO Control Structure

Sec 7-05	**Maintenance Hole, Catch Basins and Inlets**					
705074	MAINTENANCE HOLE, Type 212B {QTY<=5 EA}	3	EA	$35,750.00	***$107,250***	For 3 access vaults, expected to be complex
705174	EXTRA Depth, Type 212B Maintenance Hole	15	VF	$1,125.00	***$16,875***	5 ft of extra depth per access vault; expected to be complex
705300	RE-CHANNEL Maintenance Hole	1	EA	$1,250.00	***$1,250***	for CSO Control Structure Mods
Sec 7-11	**Pipe Installation For Water Mains**					
711006	PIPE, WM, D.I, CL 52, 6 IN, INCL Fitt {QTY<=50 LF}	30	LF	$105.00	***$3,150***	for hydrants
711008	PIPE, WM, D.I, CL 52, 8 IN, INCL Fitt {QTY>50 LF}	81	LF	$130.00	***$10,530***	for water service connections
711120	PIPE, WM, D.I, CL 52, 20 IN, RJ, INCL Fitt {QTY >50 LF}	800	LF	$500.00	***$400,000***	20" DIP Water Main
711206	BEDDING, Water Main, CL B, 6 IN Pipe	30	LF	$12.00	***$360***	for hydrants
711208	BEDDING, Water Main, CL B, 8 IN Pipe	81	LF	$14.00	***$1,134***	for water service connections
711220	BEDDING, Water Main, CL B, 20 IN Pipe	800	LF	$59.00	***$47,200***	Bedding for 20" Water Main
711500	STATION Electrolysis Test {QTY <=2 EA}	2	EA	$5,100.00	***$10,200***	Assumed
711510	SACRIFICIAL Anode Bonded to Pipe {QTY <=20 EA}	8	EA	$500.00	***$4,000***	Assumed
ADDED	TEMPORARY WATER BYPASS {Length-500-1000 FT}	800	LF	$80.00	***$64,000***	Estimated
Sec 7-12	**Valves For Water Mains**					
712006	VALVE, GATE 6 IN {QTY <=3EA}	3	EA	$1,300.00	***$3,900***	one per hydrant
712008	VALVE, GATE 8 IN {QTY <=3EA}	3	EA	$2,050.00	***$6,150***	one per service connection
712500	VALVE BOX, Cast Iron {QTY > 3 EA}	3	EA	$360.00	***$1,080***	3 for service connections
Sec 7-14	**Hydrants**					
714007	HYDRANT, 6 IN CONN, TYPE 310	3	EA	$5,250.00	***$15,750***	hydrants
Sec 7-17	**Storm Drains and Sanitary Sewers**					
ADDED	BEDDING, CL B, 96 IN Pipe {QTY >50LF}	700	LF	$90.00	***$63,000***	Estimated, for storage pipe
ADDED	PIPE PSD, Conc Reinf C76 CL IV, 96IN {QTY >50 FT}	700	LF	$2,085.00	***$1,459,500***	Estimated, for storage pipe (raw material cost is $695/ft)
717985	TEMPORARY SEWER BYPASS {Length-250-500 FT}	1	LS	$30,000.00	***$30,000***	12" sewer bypass (west side)
717985	TEMPORARY SEWER BYPASS {Length-500-1000 FT}	1	LS	$70,000.00	***$70,000***	24" sewer bypass (east side); Updated unit price due to complexity
ADDED	VISUAL INSPECTION {QTY >200FT 1 MOB}	700	LF	$25.00	***$17,500***	Estimated, for storage pipe
Sec 7-20	**Adjustment of New and Existing Utility Structures to Finish Grade**					
720005	ADJUST Existing MH, CB, or VC {QTY > 5EA}	15	EA	$410.00	***$6,150***	Allowance for roadway restoration
Sec 7-21	**Bioretention**					
721002	BIORETENTION Soil {QTY >20CY}	400	CY	$82.00	***$32,800***	Allowance for GSI
Sec 8-01	**Construction Stormwater Pollution Prevention**					
801001	CONSTRUCTION Storm Water & Erosion Control Plan - CSECP {Project Value $3-$5M} CSI (REF)	1	LS	$15,500.00	***$15,500***	
801002	TREE Vegetation & Soil Protection Plan - TCSPP {Project Value $3-$5M} CSI (REF)	1	LS	$7,575.00	***$7,575***	
801003	SPILL Plan SP {Project Value $3-$5M} CSI (REF)	1	LS	$4,300.00	***$4,300***	
801004	TEMPORARY Discharge Plan TDP {Project Value $3-$5M} CSI (REF)	1	LS	$7,000.00	***$7,000***	Updated unit cost due to reflect increased complexity.
Sec 8-02	**Landscape Construction**					
ADDED	TREE PROTECTION	20	EA	$250.00	***$5,000***	Estimated
802320	BENCH	5	EA	$515.00	***$2,575***	Allowance for Community Benefit
802380	FLEXIBLE POROUS SURFACE TREATMENT - 1.5" Thick (Black Material)	1	CY	$4,558.00	***$3,601***	Assumed 15 tree boxes, 4'x4' ea.; Community Benefit and GSI
Sec 8-04	**Cement Concrete Curb, Curb and Gutter**					
804005	CURB, CEM CONC {QTY >500}	999	LF	$36.00	***$35,964***	
Sec 8-12	**Chain Link Fence and Wire Fence**					
812001	CHAIN LINK Fence, Type 1 {QTY > 200 LF}	1,000	LF	$31.00	***$31,000***	Allowance for temp. construction fencing
812014	CHAIN LINK Gate, Double 14 Ft Wide {QTY <=5 EA}	1	EA	$1,625.00	***$1,625***	Allowance for temp. construction fencing
Sec 8-14	**Cement Concrete Sidewalk**					
814005	SIDEWALK, CEM CONC {QTY >=500 SY}	1,094	SY	$72.00	***$78,792***	Sidewalk, excludes curb ramps
814021	CURB RAMP {QTY >5SY}	158	SY	$270.00	***$42,720***	Curb ramps
814030	DETECTABLE Warning Plate {QTY > 20SY}	11	SY	$71.00	***$757***	12 ramps, 4'w x 2'd each
Sec 8-15	**RIPRAP**					
815020	LIGHT LOOSE Riprap {QTY >200 TN}	267	TN	$41.00	***$10,943***	For Streetcar track area restoration; assumed 0.5' thick
Sec 8-18	**Cement Concrete Stairways, Landings and Steps**					
818142	HANDRAIL, Type 442 {QTY 50-100 LF}	540	LF	$105.00	***$56,700***	For railing near streetcar tracks; asumed will be replaced, not reuse existing
Sec 8-21	**Permanent Signing and Posts**					
821030	POST, Traffic Sign {QTY >5EA}	10	EA	$205.00	***$2,050***	
821035	POST, Parking Meter {QTY<=5EA}	2	EA	$205.00	***$410***	
821040	POST, Street Name {QTY<=5EA}	1	EA	$205.00	***$205***	
Sec 8-22	**Pavement Marking**					
822018	PAVEMENT MARKING, Thermo, 8 IN Stripe {QTY >200 LF}	3,200	LF	$7.00	***$22,400***	Centerline, dashed lane lines, turn lanes
822020	PAVEMENT MARKING, Thermo, Legend/Symbol {QTY>5 EA}	6	EA	$205.00	***$1,230***	Crosswalks
Sec 8-27	**Project Identification Sign**					
827020	SIGN, INSTALL PROJECT IDENTIFICATION, POST MOUNTED {Size-Large-8'x10'}	1	EA	$1,400.00	***$1,400***	
Sec 8-31	**Traffic Signal System**					
831306	DETECTOR LOOP, 6 FT DIA {QTY > 5 EA}	4	EA	$915.00	***$3,660***	Assumed, 1 at each lane for intersection with lights
ADDED	Reinstall and Certify Railroad Crossing Arm and Signal	2	EA	$7,000.00	***$14,000***	Estimated, Allowance
Sec 8-33	**Conduit and Trenching**					
833400	Relocate Handhole {QTY<=5EA}	2	EA	$510.00	***$1,020***	For ADA Ramps
ADDED	Cathodic Protection Anodes and Test Station	4	EA	$1,000.00	***$4,000***	Estimated, For water main
				TOTAL	**$8,299,616**	

Appendix F

Basin 69 Hydraulic Modeling Technical Memorandum

December 19, 2019

To: Shailee Sztern – Seattle Public Utilities (SPU)

From: Andrew Henson - Aqualyze
Marshall Kosaka – Aqualyze

Cc: Nichole Kruse – Murraysmith
Rizwan Hamid - Aqualyze

Subject: Basin 69 Modeling Technical Memorandum

1. Introduction

The Central Waterfront Basin 69 (Basin 69) is located at the north end of the Seattle's downtown waterfront, adjacent to Elliott Bay. The Basin is highly developed and densely populated. Sanitary flows and stormwater runoff are collected in a combined sewer system that discharges to King County infrastructure, to be treated at the King County West Point Wastewater Treatment Plant (WWTP). During heavy precipitation events, stormwater runoff can overwhelm the sewer system within the Basin and trigger a combined sewer overflow (CSO), discharging excess flows into Elliott Bay at Outfall 69.

In 2013, the City of Seattle entered into a Consent Decree requiring the City to control each combined sewer outfall to the State CSO performance standard. Per the Consent Decree and SPU's wastewater NPDES permit, control is defined as one CSO per year, based on a 20 year moving average. Observed records are available for 2006 through 2017 and there were 31 recorded CSO events in this period, equating to a frequency of 2.6 CSO events per year.

A hydraulic and hydrologic (H/H) model of the Basin was recently refined by Aqualyze under the Modeling On-Call Contract (C13-031) Work Assignment 8 (WA08) using the United States Environmental Protection Agency's (EPA) Stormwater Management Model Version 5.1.012 (SWMM5). This model was used as the basis for the modeling activities under this project. SPU's Uncertainty Analysis (UA) process was also performed as a part of WA08 to help inform the selection of a control volume for this project. The UA process was developed to quantify the uncertainties that underlie monitoring, precipitation and modeling when it comes to deciding on control volume (CV). The UA process considers three areas of uncertainty:

1. Uncertainties in historic precipitation (stationary climate) - How representative is the historic rainfall record for use in prediction of future flows?
2. Uncertainties in predictions from watershed modeling - Values determined from quality of model calibration in terms of flow prediction.
3. Residual uncertainties – "catch-all" for uncertainties not captured in the other three categories.

Additionally, the UA accounts for climate change through a set of perturbed rainfall timeseries that represent three different climate epochs:

1. 2015 or Current Climate - the same as the historic rainfall record
2. 2035 Climate - perturbed rainfall representative of what the climate could resemble in the year 2035
3. 2100 Climate - perturbed rainfall representative of what the climate could resemble in the year 2100

Two CVs were ultimately selected for use in evaluating different options. A CV of 233,000 gallons, equating to a 50 percent confidence interval with rainfall representative of the expected 2035 climate, is used for flow transfer options (a confidence interval of 50 percent means that there is a 50 percent chance that the basin will be in compliance in the year 2035 if the CV is controlled). Storage options use a CV of 182,000 gallons, equating to a 40 percent confidence interval with rainfall representative of the expected 2035 climate (Aqualyze Inc 2018). Note that the simulated overflow volumes generally over-predicted CSO volumes as compared to observed events, therefore SPU was comfortable selecting a CV with a confidence interval less than 50 percent. The alternatives identified and documented in this technical memorandum were developed with the intent of planning system improvements to achieve control of Basin 69.

2. Purpose

The purpose of this TM is to document the modeling procedures, results, and assumptions associated with the Phased Consultant Services for the Vine Basin CSO Control Project Contract (SU0-18-007-S). The results presented herein document alternatives development and modeling that is intended to help inform SPU's selection of a preferred CSO control solution for Basin 69.

2.1. Project Goals and Objectives

The following project objectives were used to guide the efforts of this project towards achieve the project goal of evaluating the anticipated efficacy of various alternatives to achieve CSO control within Basin 69:

- Identify and develop CSO control alternatives
- Develop framework to gauge efficacy of stormwater control alternatives
- Test efficacy of the CSO control alternatives using short term H/H modeling
- Perform long-term H/H modeling simulations for alternatives
- Document results to support the Option Analysis process

2.2. Study Boundaries

Basin 69, shown in Figure 2-1, covers approximately 150 acres in the Central Waterfront area of downtown Seattle. It is bordered by Bay Street and Denny Way to the north, Virginia Street to the south, 5th Avenue to the east, and Elliott Bay to the west.

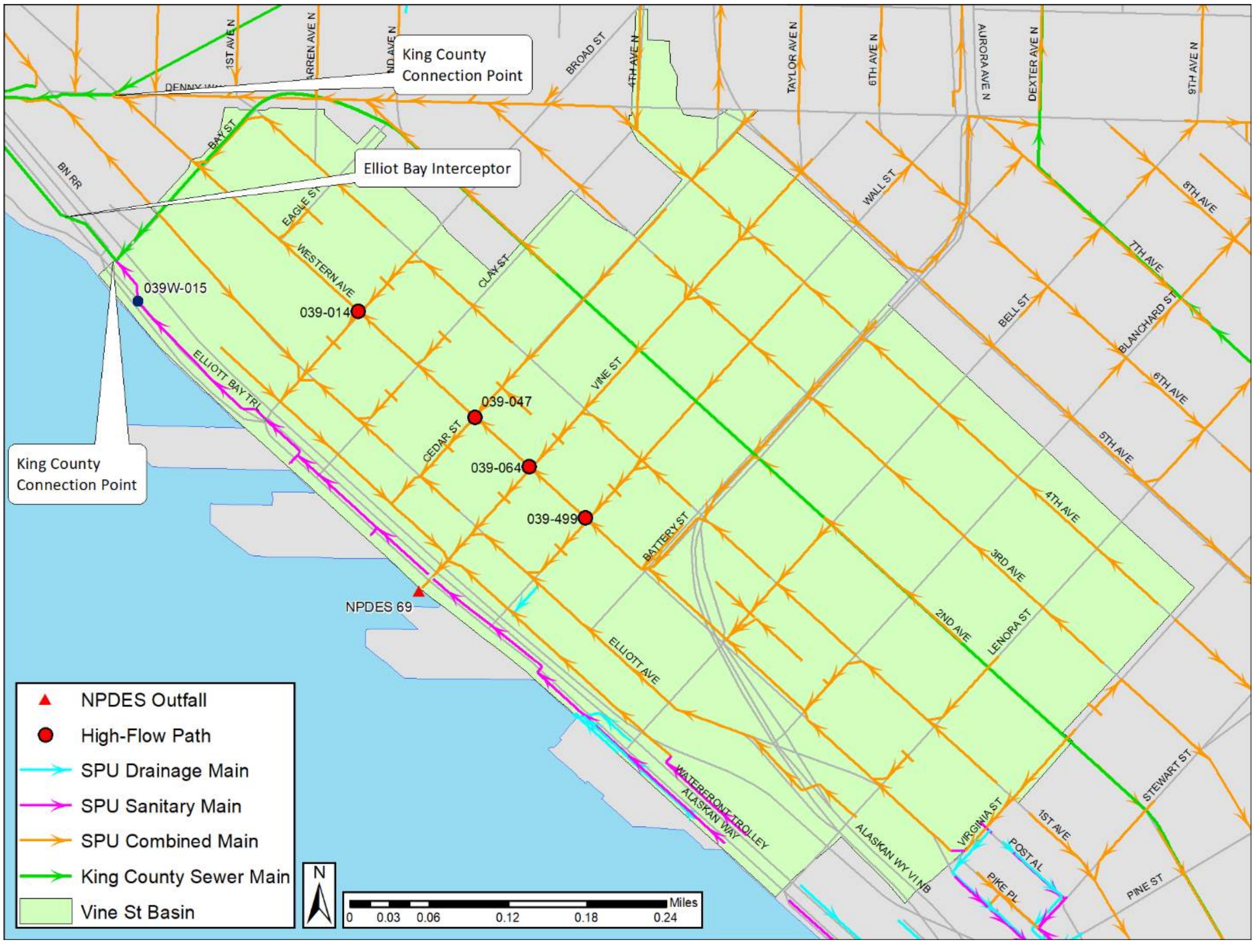


Figure 2-1: Map of Basin 69 Model Area

3. Basin Characterization

Sanitary flows and stormwater runoff are collected in a combined sewer system that discharges to the King County (KC) Denny Way Interceptor and KC Elliott Bay Interceptor (EBI). Both interceptors convey flows to the KC Denny Regulator. The KC Denny Regulator pumps flows to the KC West Point Wastewater Treatment Plant (WWTP) for treatment. During heavy precipitation events, stormwater runoff can overwhelm the sewer system within the Basin and trigger a CSO event at the CSO Control Structure, located within the intersection of Alaskan Way and Vine Street. The Basin 69 CSO Outfall (Outfall 69) discharges overflows through the seawall into Elliott Bay, just west of the Alaskan Way and Vine Street intersection. Table 3-1 provides a summary information for the Basin.

Table 3-1: Basin 69 Summary

Basin Features	Count
Basin Area, acres	150
Number of Diversions	6
Number of CSO structures/outfalls	1
Associated SPU Rain gage	RG11

3.1. Conveyance System

The sewer system in Basin 69 is primarily a combined system except for a relatively small drainage system in the southwest corner (outfalls into Elliott Bay). During dry weather flows, Basin 69 is divided into two separate sub-basins: the “Lower Basin” located to the west of Western Avenue and the “Upper Basin” located to the east of Western Avenue as shown in Figure 3-1. Dry weather flows collected in the “Upper Basin” are collected in a 24 inch/30 inch combined sewer within Western Avenue that conveys flows north and discharges to the KC Denny Way Interceptor at the intersection of Western Avenue and Denny Way. The KC Denny Way Interceptor conveys flows to the KC Denny Regulator. The “Lower Basin” collects dry weather flows from the “Lower Basin” and conveys them through a 48 inch diameter sewer that crosses beneath the BNSF Railroad Tracks along Alaskan Way. Flows then pass through the CSO Control Structure to the combined sewer in Alaskan Way, which flows north and ultimately discharges to the KC Elliott Bay Interceptor. The KC Elliott Bay Interceptor also conveys flows to the KC Denny Regulator. The KC Denny Regulator pumps flows to the KC West Point Wastewater Treatment Plant (WWTP).

During wet weather events, the sewer levels in Western Avenue rise. As the sewer levels rise, four high flow paths along the Western Avenue allow excess flow to pass from the “Upper Basin” into sewer infrastructure in the “Lower Basin.” The four high flow paths are located at the intersections of Western Avenue and Bell Street, Vine Street, Cedar Street, and Broad Street. Three high-flow paths are pipes at maintenance holes (MH) MH 039-499, MH 039-064, and MH 039-014. The fourth high-flow path is a weir at MH 039-047. The locations are shown in Figure 2-1 and Figure 3-1.

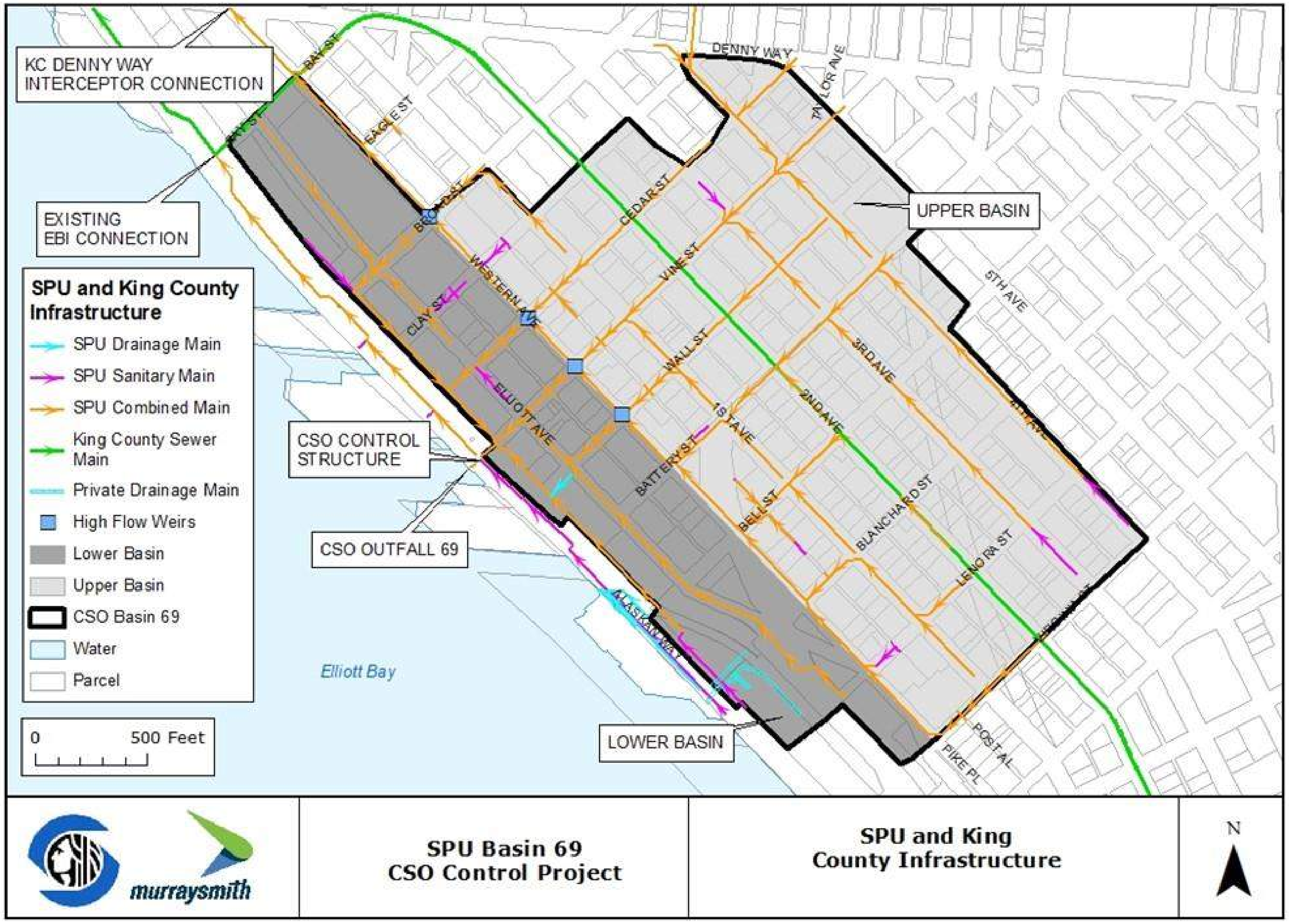


Figure 3-1: SPU and King County Basin Infrastructure

As the sewer level in the Alaskan Way sewer rises, the level within the CSO Control Structure also rises. If the level rises above the elevation of the CSO weir located in the CSO Control Structure, a CSO event is triggered and flows discharge to Elliott Bay via CSO Outfall 69.

The CSO Control Structure is a below-grade concrete vault with a bottom orifice that conveys flow to the sewer to the north within Alaskan Way to the KC Elliott Bay Interceptor. Excess flows are conveyed over a weir in the CSO Control Structure and discharge to Elliott Bay through CSO Outfall 69. A plan view of the CSO Control Structure is provided in Figure 3-12.

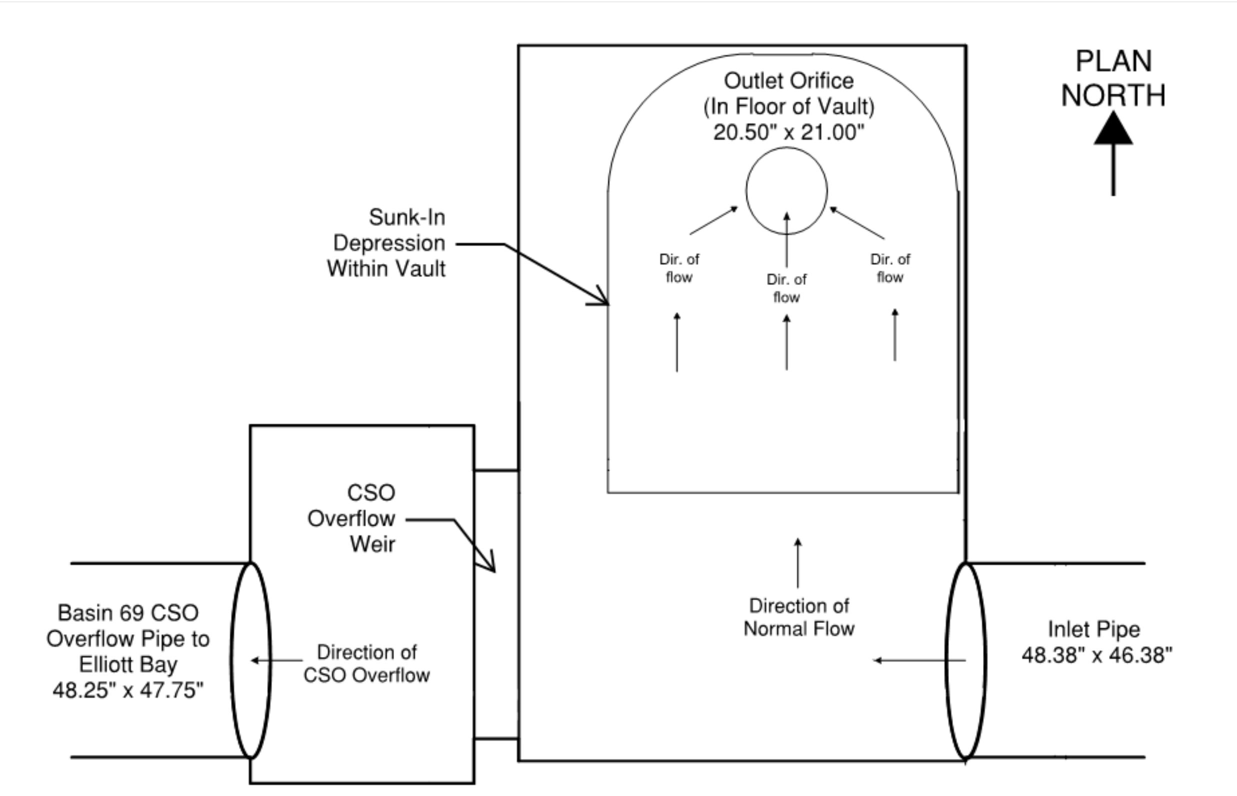


Figure 3-2: Basin 69 CSO Control Structure - Plan View

Significant transportation and infrastructure improvement projects are planned or in progress in Basin 69 that could impact the conveyance system configuration in portions of the Basin. Modeling and options analysis reflect the state of the conveyance system at the time of this project. No planned development or planned changes to stormwater code were incorporated in the alternatives analysis as limited information was available. It is recommended that any planned conveyance changes in the Basin be reviewed as the project progresses to design.

3.2. Land Use

The land use in Basin 69 is primarily heavily developed urban residential and commercial area except for Olympic Sculpture Park, which is parkland. Estimates from the Puget Sound Regional Council show that the population in the Basin could increase in the coming decades, however expected population increases were not included in modeling for this project as the fraction of the wet weather flow that would be affected by population change is relatively low (approximately two percent increase). It is recommended that this assumption is reviewed, and future population and land use be considered prior to the design of a selected alternative.

Impacts to basin flows due to future land use changes was evaluated using the methodology employed in SPU's Wastewater System Analysis project (Aqualyze Inc. 2019). Increased flows due to increased impervious area associated with development are expected to be mitigated as a as a result of implementing the City's current Stormwater Code applied to redevelopment within the Basin (i.e. lower peak stormwater runoff flows are required as area is redeveloped by the current Stormwater Code).

4. H/H Model

The H/H model used for this project was developed under WA08. The model hydraulics were updated based on SPU GIS data, survey data, and flow/level measurements (collected by ADS) at meter locations. The model sub-catchment boundaries were delineated at an approximate block scale and sub-catchment parameters were computed through GIS routines. The model was then calibrated to 12 meter locations following SPU's modeling guidelines (Seattle Public Utilities 2017). For this project, no updates or revisions were made to the baseline model. The modeling and analysis presented in this document utilizes the NAVD88 datum. For more details on model development and updates refer to the WA08 modeling TM (Aqualyze Inc 2018).

4.1. Modeling Platform

EPA SWMM5 version 5.1.012 modeling engine was used to test effectiveness of various options, run long-term simulations and compute control volumes for this work assignment. The PCSWMM software package, that utilizes the SWMM5 modeling engine, was used on this project.

4.2. Boundary Conditions

A water surface elevation timeseries, provided by SPU/KCWTD, was used to account for the downstream water level in the EBI. A free outfall was used at the connection at the Denny Way/Lake Union Tunnel (MH 034-272) as the invert at MH 034-272 is approximately 25 feet higher than the invert of the Denny Way/Lake Union Tunnel and is not thought to be influenced by downstream water levels.

A tidal boundary condition was used at the CSO Outfall 69 to account for the tide in Elliott Bay. Tidal data were obtained from the National Oceanic and Atmospheric Administration (NOAA) National Ocean Service's (NOS's) gauge station (Sta.) 9447130 (NOAA 2018). A saltwater correction was applied to the tidal boundary condition.

4.3. Rainfall and Evapotranspiration

Basin 69 falls entirely within the Thiessen polygon of Rain Gage (RG) 11. SPU provided two rainfall timeseries for this modeling effort: historical observed rainfall at RG11 and a perturbed RG11 timeseries representative of the 2035 climate. The rainfall time series starts on 9/1/1976 and ends on 5/19/2018. The 2035 rainfall, scaled to correspond to the selected CV per the UA process, was used to analyze the options. The rainfall was scaled by 1.014 for flow transfer options and 0.985 for storage and GSI options. The decision is based on the understanding that incremental cost to deliver a slightly larger flowrate is very low and thereby a more conservative flowrate should be used during alternatives analysis to size a transfer pipe.

Evapotranspiration data was also utilized in the model simulations. Evapotranspiration data is collected by Washington State University (WSU) at the Puyallup, WA campus. SPU provided original timeseries data which was supplemented with data from the Washington Agricultural Weather Network Version 2.0 downloaded from the WSU website.

5. Existing System Performance

5.1. Capacity Limitations and Surface Flooding in the System

Minor surface flooding was simulated in the existing conditions model for the period from 1978 through 2017 at various points in the system. However, there are capacity limitations in the Basin due to site hydraulics. Flow through the CSO Control Structure and along Alaskan Way is heavily influenced by the HGL in the KC Elliott Bay Interceptor (EBI). Figure 5-1 shows a plot of the HGL in the EBI, the head at 039W-015 (the last SPU-owned MH near the EBI connection, shown in Figure 2-1), and the head in the CSO Control Structure. For all but the periods of highest intensity rainfall, the head just upstream of the connection to the EBI mirrors that of the head in the EBI. The CSO Control Structure is also influenced by the water level in EBI during periods of moderate rainfall, however, the head continues to rise in the structure during very intense rainfall or periods of elevated flow. This indicates that the SPU system between the CSO Control Structure and the EBI connection point has limited capacity during intense rainfall events.

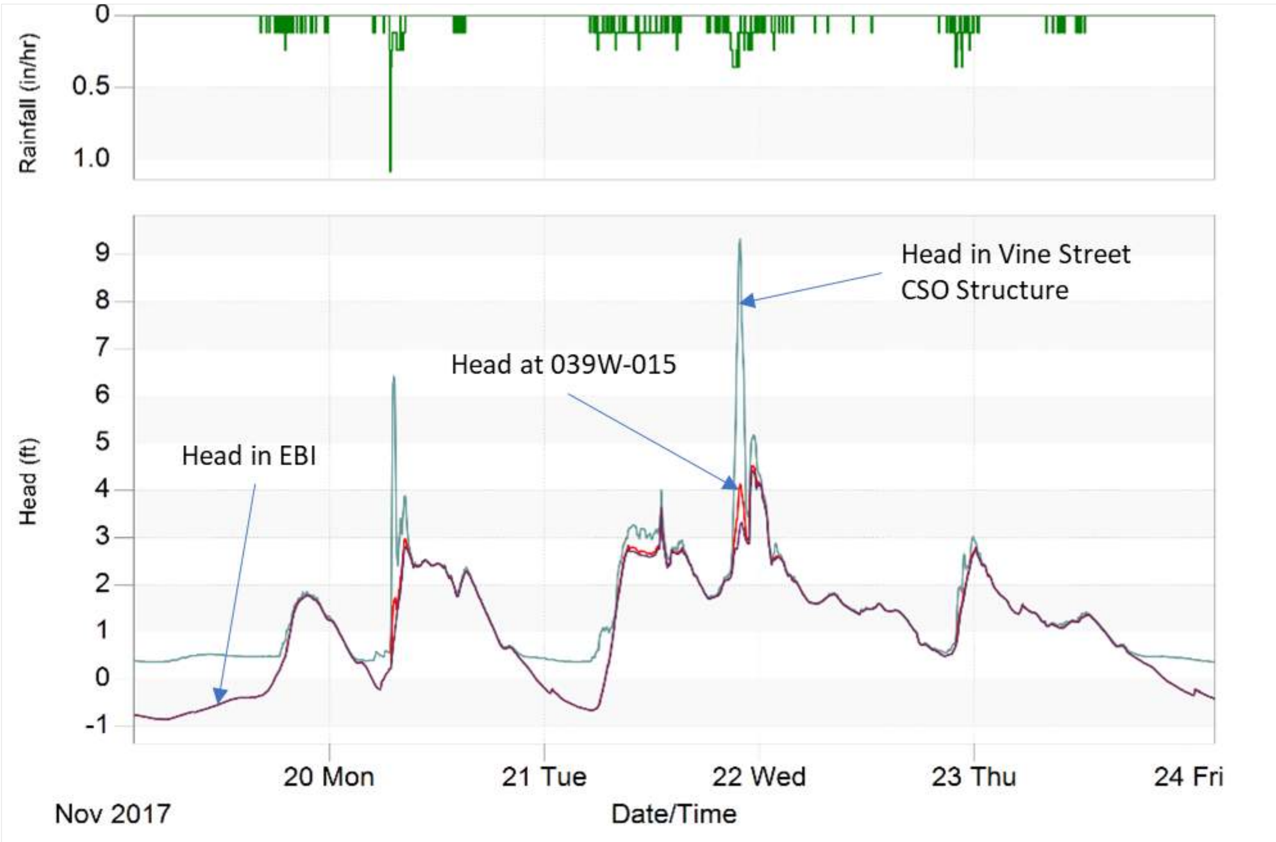


Figure 5-1: Head at 039W-015 (red), Head in the EBI Near the Denny Lake Union Regulator (blue), and Head in the CSO Control Structure (turquoise)

5.2. Characteristics of Combined Sewer Overflows

SPU conducts flow monitoring at their CSO Outfalls throughout Seattle. Recorded flows for Outfall 69 are available as annual CSO counts from 2006 through 2009. Starting in 2010, SPU has published an annual report on the Combined Sewer Overflow Reduction Program which provides detailed information on each CSO event like date, duration, and volume.

A long-term simulation was performed to evaluate CSO events and the Basin CV under existing conditions. The long-term simulation utilized historical rainfall from 1978 through 2017 and the boundary conditions described in Section 4. Table 5-1 shows simulated and observed counts of CSO events and frequency in events per year from 2006 through 2017. Table 5-2 provides simulated CSO count and frequency for the most recent (1998-2017) and worst 20 year period (1996-2015) during the 40 year period of record. Worst here is defined in terms of volume of the 21st largest storm. Table 5-3 provides simulated and observed CSO volumes for 2006-2017 (the period of record for which observed CSO volumes are published). In general, the model over simulates CSO volumes by roughly 100,000 gallons per event.

Table 5-1: Observed and Simulated CSO Count and Frequency for 2006 through 2017

CSO Metric	Observed	Simulated
Count	31	30
Frequency	2.6	2.5

Table 5-2: Simulated CSO Count and Frequency for the Most Recent and Worst 20 Year Period

CSO Metric	1998 – 2017 (Most Recent)	1996 – 2015 (Worst)
Count	39	38
Frequency	2.0	1.9
21st Largest Storm Volume (gal)	**99,350**	**181,900**

Table 5-3: Observed and Simulated CSO Volume 2010-2017[1]

CSO Metric	Total Observed	Total Simulated	Average Difference
CSO Volume (gal)	1,841,915	4,412,319	98,862

[1]Observed volume only available for this period.

6. Alternatives Analysis

A series of alternatives were developed for analysis using H/H modeling. The alternatives considered as part of this project fall into three categories:

- **Transfer:** These alternatives identified ways of conveying excess flows to KC for conveyance to the treatment plant to prevent CSO events. This type of alternative requires either larger or additional connections to KC's existing infrastructure, as well as coordination and approval from KC to receive, convey and treat the additional flows.
- **Storage:** These alternatives identified ways of capturing and storing excess flows within the Basin to prevent CSO events. This type of alternative included inline storage, offline storage and storage tank configurations, with a preference for inline storage if it is hydraulically feasible due to fewer equipment requirements and lower operation and maintenance requirements. Potential storage locations were identified based on sewer slopes, topography, City-owned property locations and planning level utility information.
- **Stormwater Infrastructure and Program Improvements:** These alternatives identified ways for reducing or removing stormwater inflow from the combined sewer system. Green stormwater infrastructure (GSI) best management practices (BMPs) such as cisterns and roadway bioretention were considered in additional to programmatic changes to the City's Stormwater Code for capacity constrained basins, and incentive programs that encourage private property owners and developers to reduce peak stormwater discharge rates into the combined sewer system.

Several alternatives were evaluated at a high level for initial screening including two flow transfer configurations and storage at various locations in the Basin. Four final options were carried through for more detailed H/H modeling analysis which are detailed herein.

6.1. Flow Transfer Options

The goal of the flow transfer options is to meet the performance standard of no more than one CSO event per year on a 20 year moving average by transferring excess flow to KCWTD. Two alternatives were evaluated using perturbed rainfall representative of the 2035 climate scaled by a factor of 1.014 which corresponds to CV of approximately 233,000 gallons. Each alternative was simulated for a 40 year period. The alternatives were evaluated based on CSO frequency, count, as well as peak flows entering the KC system for precipitation events of various return periods. The alternatives were optimized to have the smallest increase in peak flows to KC while still meeting the performance standard.

6.1.1. Alternative 1 – Alaskan Way Parallel Flow Transfer

The Alaskan Way Parallel Flow Transfer Alternative, shown in Figure 6-1, conveys excess flow to KCWTD via a 24 inch diameter parallel sewer that flows from the CSO Control Structure to a new connection to the KC EBI where flows are discharged for further conveyance and treatment. A diversion weir, 5 feet tall by 5 feet long, is proposed just upstream of the CSO Control Structure at an inlet elevation of 9.5 feet (NAVD88). This is higher than the existing inlet downstream at 4.13 feet but lower than the CSO weir inlet elevation of 12.05 feet (NAVD88). The weir inlet elevation was optimized to limit the increase in peak flows to KCWTD while still meeting the performance standard. This configuration also features a 5 foot tall by 5 foot long weir at Broad Street which allows flow to travel from the existing line to the parallel line when the existing pipe is surcharged. Flow from the proposed parallel sewer discharges to the EBI at a connection point near Bay Street via a 2 foot diameter orifice. Figure 6-2 shows the operation of the Alaskan Way Parallel Flow Transfer Alternative for the 6/3/2008 CSO event. This event has the 21st largest CSO volume for the baseline configuration in the worst 20 year period.

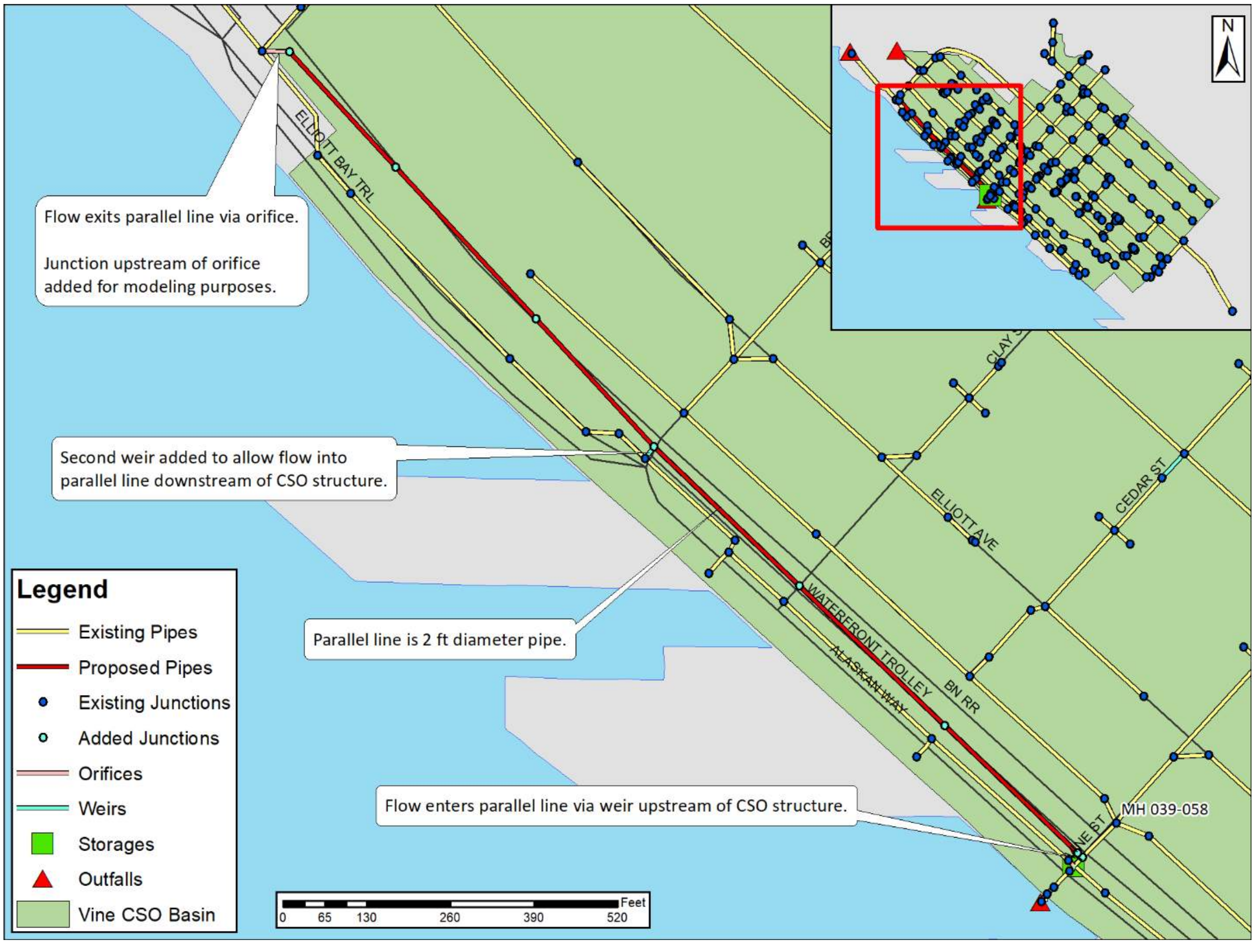


Figure 6-1: Alaskan Way Parallel Flow Transfer Alternative Configuration

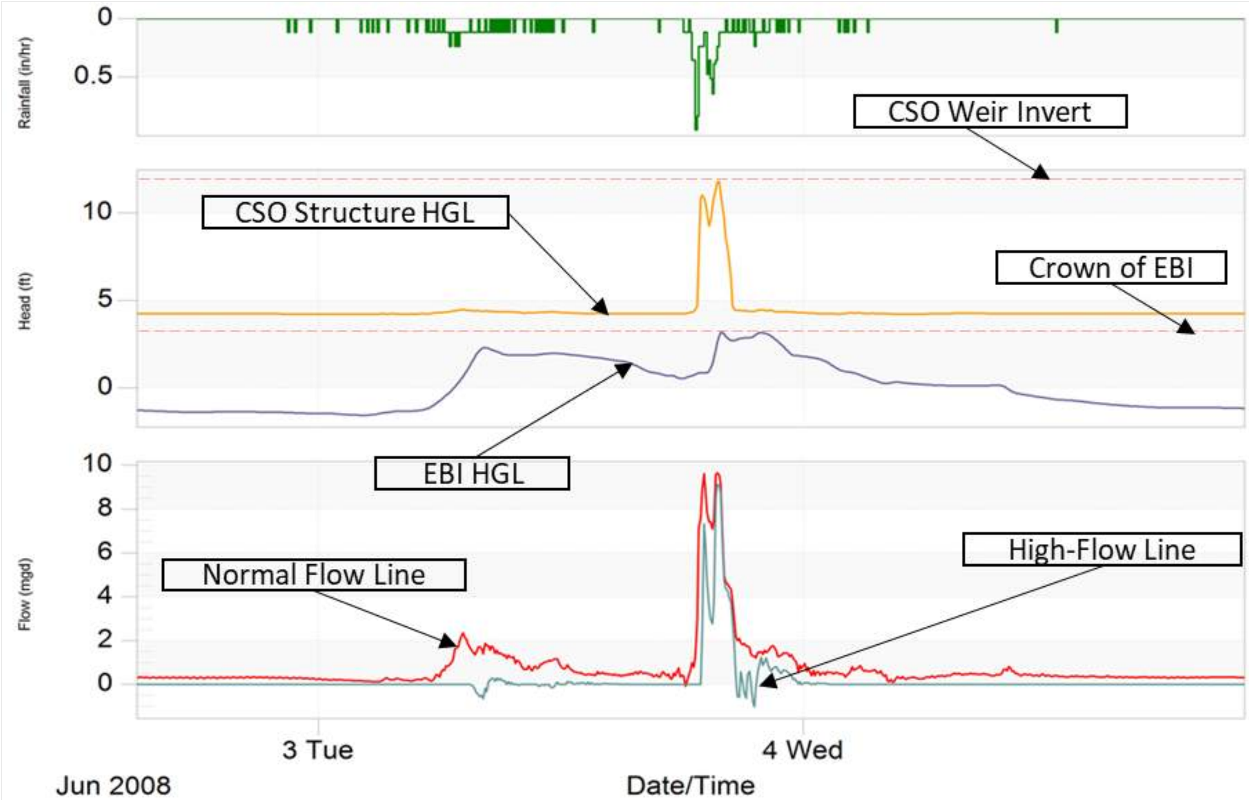


Figure 6-2: Alaskan Way Parallel Flow Transfer Alternative Operation – 6/3/2008 CSO Event

A long-term simulation was performed for this configuration to assess the performance of this alternative and characterize the expected reduction in CSO events and CV. The simulation was run using 2035 climate perturbed rainfall for a period from January 1, 1978 to January 1, 2018 scaled by a factor of 1.014. Boundary conditions as described in Section 4 were used to simulate downstream water surface elevations. Table 6-1 provides a summary of long-term simulation results for this alternative. The increased conveyance in combination with diversion of flow upstream of the CSO Control Structure reduces the HGL between the EBI and the CSO Control Structure resulting in the Basin meeting the performance standard.

Table 6-1: Summary of Long-Term Simulation Results - Alaskan Way Parallel Flow Transfer

Period of Record (years)	CSO Frequency		Alaskan Way Parallel Flow Transfer		
	Total # of CSO Events	Average Annual	Total Volume of CSOs (MG)	CV (MG)	CV Event Date
20 worst	20	1	5.61	0	N/A
40	29	0.7	8.28	0	N/A

A comparison of flows to the KCWTD EBI for the baseline configuration and the Alaskan Way Parallel Flow Transfer configuration is provided in Table 6-2. Average peak and annual flows for Alaskan Way reflect the sum of flow through the existing line and flow through the proposed parallel line.

Table 6-2: Alaskan Way Parallel Flow Transfer Downstream Impact Comparison

Scenario	Average Annual Peak Flow Rate (MGD)			Average Annual Flow Volume (MG)	
	Alaskan Way	Alaskan Way	Western Avenue	Alaskan Way	Western Avenue
Baseline	10.06	N/A	18.13	127.2	371.1
Option 1	9.63	7.86	18.13	127.6	371.1

In addition to meeting the performance standard, alternative options should not significantly increase the HGL such that basement backups or sewer overflows (SSO) might occur. To asses this, the maximum head was evaluated at MH 039-058 (labeled in Figure 6-1), the first MH upstream of the proposed flow diversion. Heads with recurrence intervals from approximately 0.5 years to approximately 67 years at MH 039-058were plotted against their respective recurrence intervals for the baseline and the Alaskan Way Parallel Flow Transfer configurations. This plot is shown in Figure 6-3. For all return intervals plotted, the head in the baseline configuration is greater than that of the flow transfer configuration.

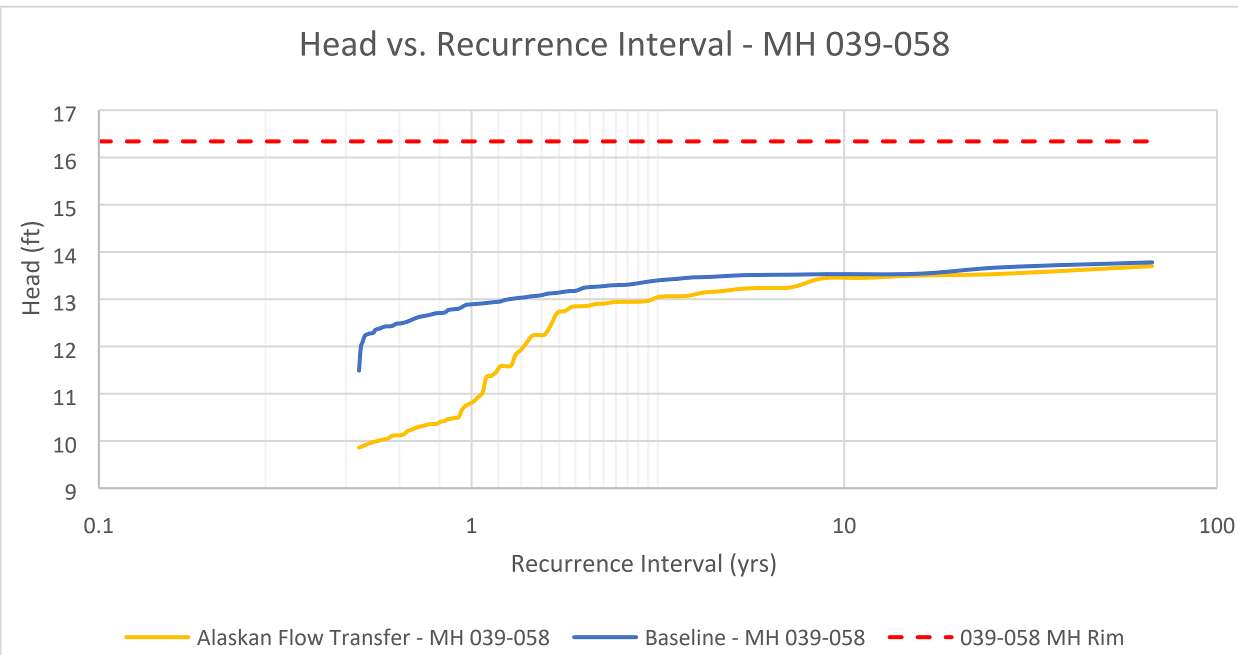


Figure 6-3: Maximum Head versus Recurrence Interval at MH 039-058 for the Baseline and Alaskan Way Parallel Flow Transfer Configurations

6.1.2. Alternative 2 – Elliott Avenue New Flow Transfer

The Elliott Avenue New Flow Transfer Alternative, shown in Figure 6-4, conveys flow to KCWTD via diversion at the intersection of Elliott Avenue and Vine Street and a proposed 24 inch diameter sewer in Elliott Avenue. For this alternative, the proposed sewer in Elliott Avenue becomes the primary flow path with an invert elevation of 14.2 feet at the diversion. High flows on Vine Street are conveyed to the existing CSO Control Structure over a 2 feet tall by 3.5 feet long weir with an invert elevation of 18 feet. The configuration of the diversion and high-flow weir were optimized to meet the performance standard while minimizing peak flows to KCWTD.

Flows are conveyed to the north along Elliott Avenue and discharged to the KC EBI via a 2 foot diameter orifice at the intersection of Bay Street and Elliott Avenue. This alternative is relatively unaffected by downstream water levels; however, the proposed diversion can impact levels in the existing sewer along Elliott Avenue to the south of Vine Street. The diversion was configured such that levels in the existing sewer south of Vine Street do not cause SSO upstream of the structure. Figure 6-5 shows the Elliott Avenue New Flow Transfer Alternative operations for the 6/3/2008 CSO event.

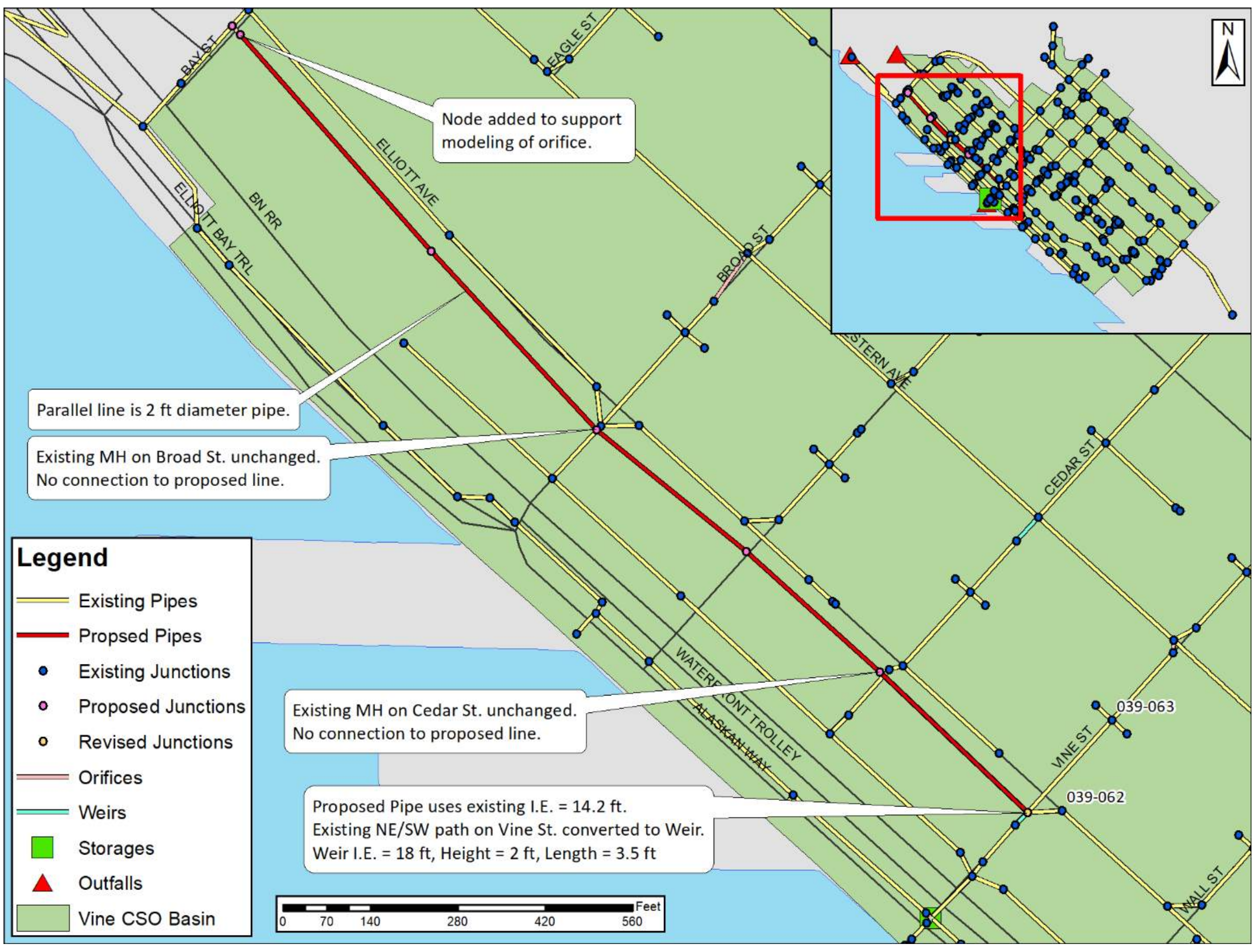


Figure 6-4: Elliott Avenue New Flow Transfer Alternative Configuration

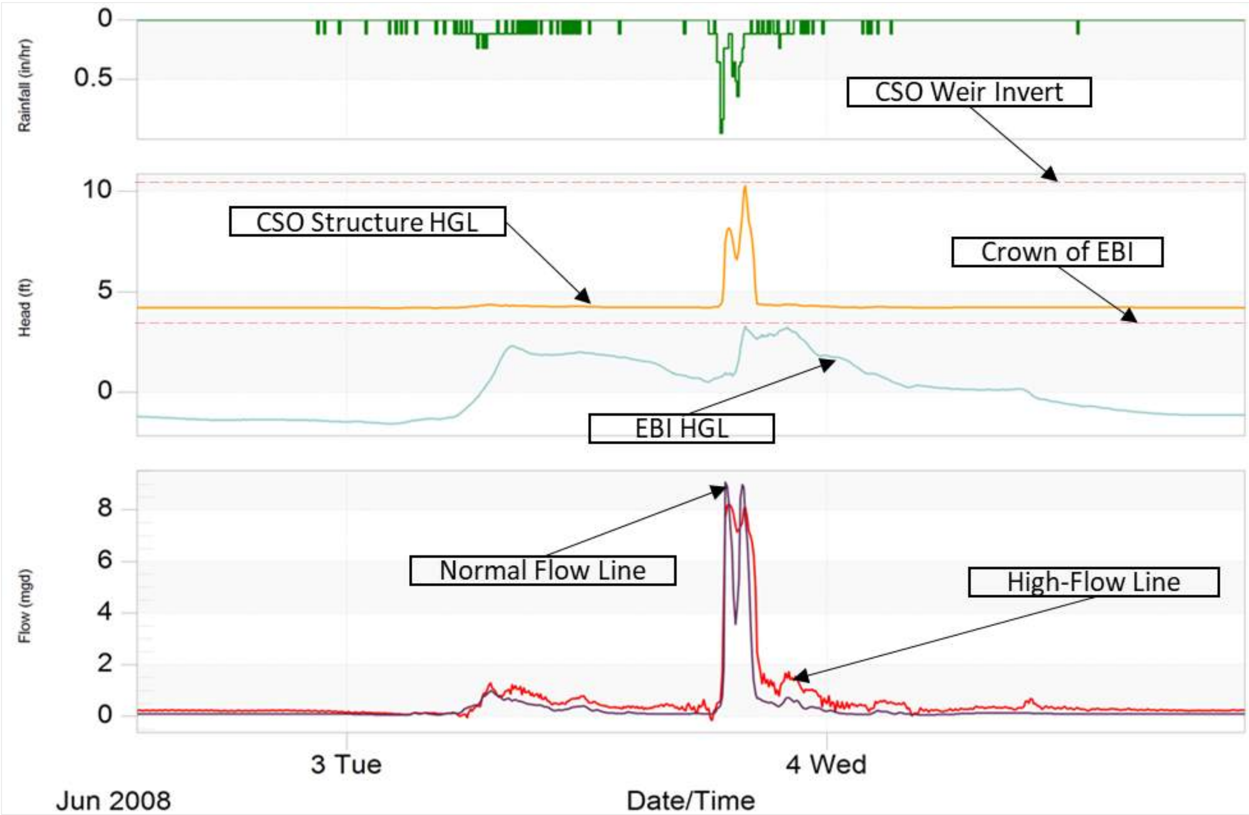


Figure 6-5: Elliott Avenue New Flow Transfer Alternative Operation – 6/3/2008 CSO Event

A long-term simulation using rainfall as described in Section 6 and boundary conditions as described in Section 4 was performed to assess the performance of this configuration. Table 6-3 provides a summary of long-term simulation results for this alternative.

Table 6-3: Summary of Long-Term Simulation Results – Elliott Avenue New Flow Transfer

Period of Record (years)	CSO Frequency		Elliott Avenue New Flow Transfer Alternative		
	Total # of CSO Events	Average Annual	Total Volume of CSOs (MG)	CV (MG)	CV Event Date
20 worst	20	1.0	3.64	0	N/A
40	27	0.7	5.15	0	N/A

A comparison of flows to KCWTD system for the baseline configuration and the Elliott Avenue New Flow Transfer configuration is provided in Table 6-4.

Table 6-4: Elliott Avenue New Flow Transfer Downstream Impact Comparison

Scenario	Average Annual Peak Flow Rate (MGD)			Average Annual Flow Volume (MG)		
	Alaskan Way	Elliott Avenue	Western Avenue	Alaskan Way	Elliott Avenue	Western Avenue
Baseline	10.06	N/A	18.13	127.2	N/A	371.1
Alternative 2	8.76	8.12	18.13	89.0	38.5	371.1

To assess the effect of the Elliott Avenue New Flow Transfer configuration on HGLs in the Basin, the maximum head was evaluated at MH 039-062 and MH 039-063 (labeled in Figure 6-4), the first upstream MHs of the proposed flow diversion. Heads with recurrence intervals from approximately 0.5 years to approximately 67 years at MH 039-062 and MH 039-063were plotted against their respective recurrence intervals for the baseline and the Elliott Avenue New Flow Transfer configurations. These plots are shown in Figure 6-6 and Figure 6-7. For all return intervals plotted, the head in the baseline configuration is greater than that of the flow transfer configuration for both MHs.

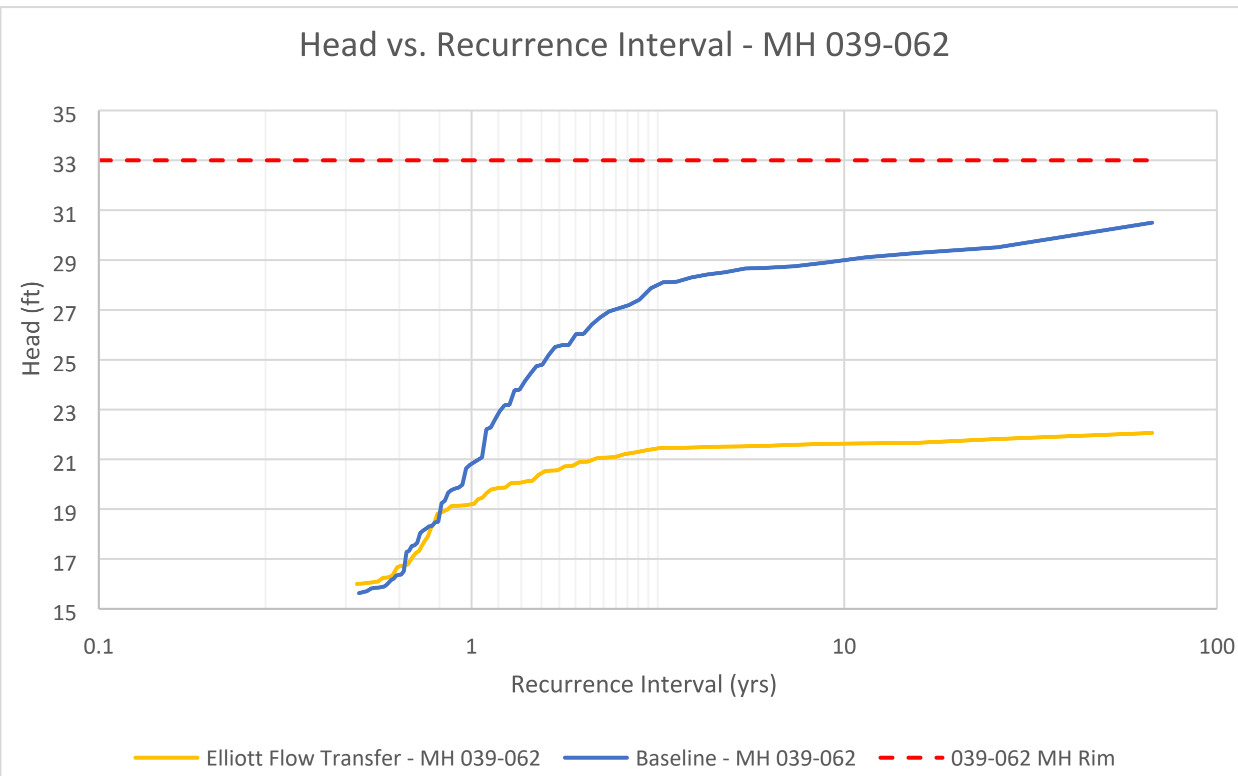


Figure 6-6: Maximum Head at MH 039-062 versus Recurrence Interval for the Baseline and Elliott Avenue New Flow Transfer Configurations

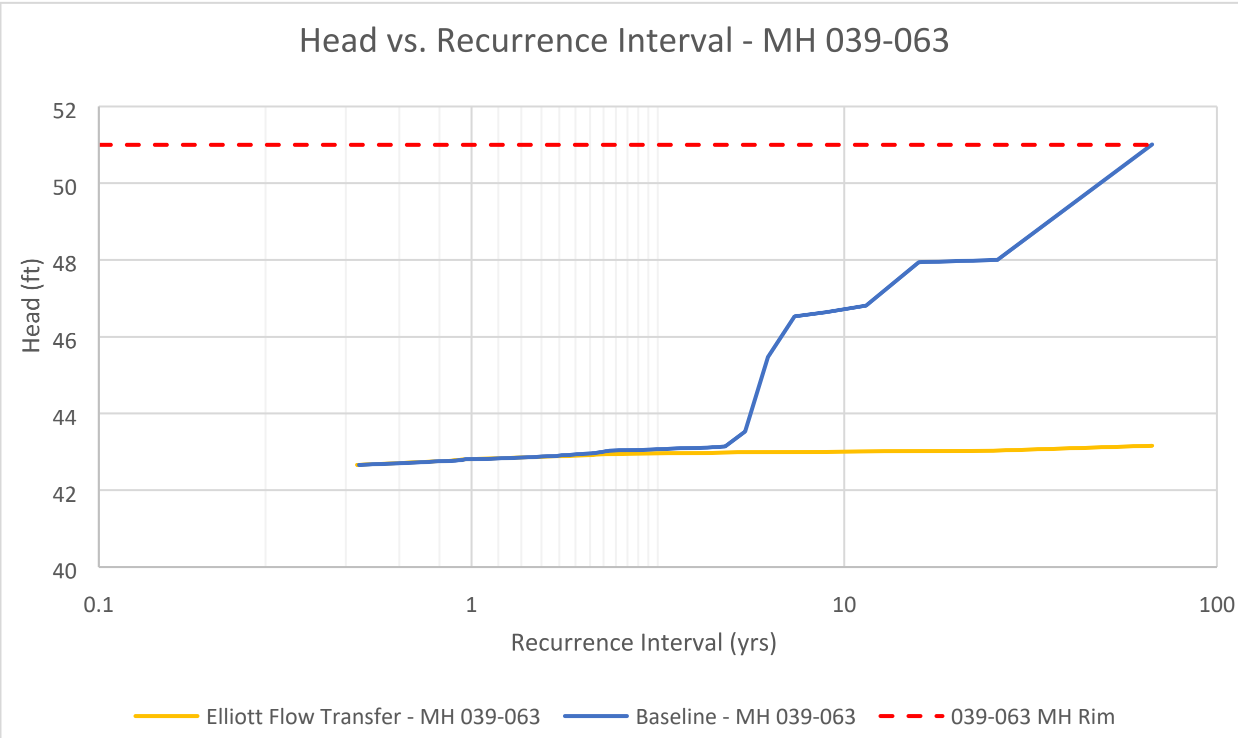


Figure 6-7: Maximum Head at MH 039-063 versus Recurrence Interval for the Baseline and Elliott Avenue New Flow Transfer Configurations

6.2. Storage Options

Only one storage alternative was selected for detailed analysis (Alternative 3) which features inline storage in Alaskan Way. The goal of the storage option is to meet the performance standard of no more than one CSO event per year on a 20 year moving average by storing excess flow when the system is at capacity. In the existing configuration, flow passes through the CSO Control Structure into the Alaskan Way sewer and is conveyed north to the KC EBI connection. The proposed storage pipe is located downstream of the CSO Control Structure (to the north of the CSO Control Structure) and releases flow as water levels between the proposed storage and EBI recede.

This alternative was evaluated using perturbed rainfall representative of the 2035 climate scaled by a factor of 0.985 which corresponds to CV of approximately 182,000 gallons. The storage option was simulated for a 40 year period and was evaluated based on CSO frequency, count, as well as peak flows entering the KCWTD system for precipitation events of various return periods. The alternative was optimized to not significantly increase peak flows to KC while still meeting the performance standard.

Alternative 3 consists of approximately 263,000 gallons of inline storage located directly downstream of the CSO Control Structure. The bottom orifice in the CSO Control Structure is upsized to 2.25 feet in diameter and the pipe between the CSO Control Structure and the proposed storage is upsized to 3 feet in diameter. Flow exits the inline storage via two orifices, each 2 feet in diameter; the first is located at the bottom of the storage with an invert elevation of -0.8 feet and the second located at invert elevation of 2 feet. The storage also features a high flow weir 10 feet in length and 2 feet tall located at the top of the storage at an invert elevation of 7.2 feet. The Alaskan Way Inline Storage Alternative configuration is shown in Figure 6-8.

This alternative relies on storing flows downstream of CSO Control Structure to control CSO events in Basin 69. The upsized orifice and conveyance downstream of the CSO Control Structure allows more flow to pass through the CSO Control Structure and on to the inline storage. This reduces the HGL in the CSO Control Structure thereby reducing CSOs, allowing the Basin to meet the performance standard.

The inline storage pipe is sized larger than the CV because it is located downstream of the CSO Control Structure. This is due to the impact of the levels in the EBI on the proposed storage; the proposed storage must store the CV as well as mitigate the effect of downstream water levels. Additionally, the configuration was optimized to not significantly increase peak flows to KCWTD along Alaskan Way. This was accomplished with the use of multiple orifices. The first and lower of the two orifices is surcharged for most large events. The second, higher, orifice allows for higher flows to exit the storage. During the peak of large events this orifice is often surcharged and the level in the storage can build until it reaches the high-flow weir. This weir serves as an outlet to allow the storage to drain before it becomes full and floods. Figure 6-9 shows the Alaskan Way Inline Storage Alternative operations for the 11/18/2003 CSO event. This event has the 21st largest CSO volume for the baseline configuration in the worst 20 year period.

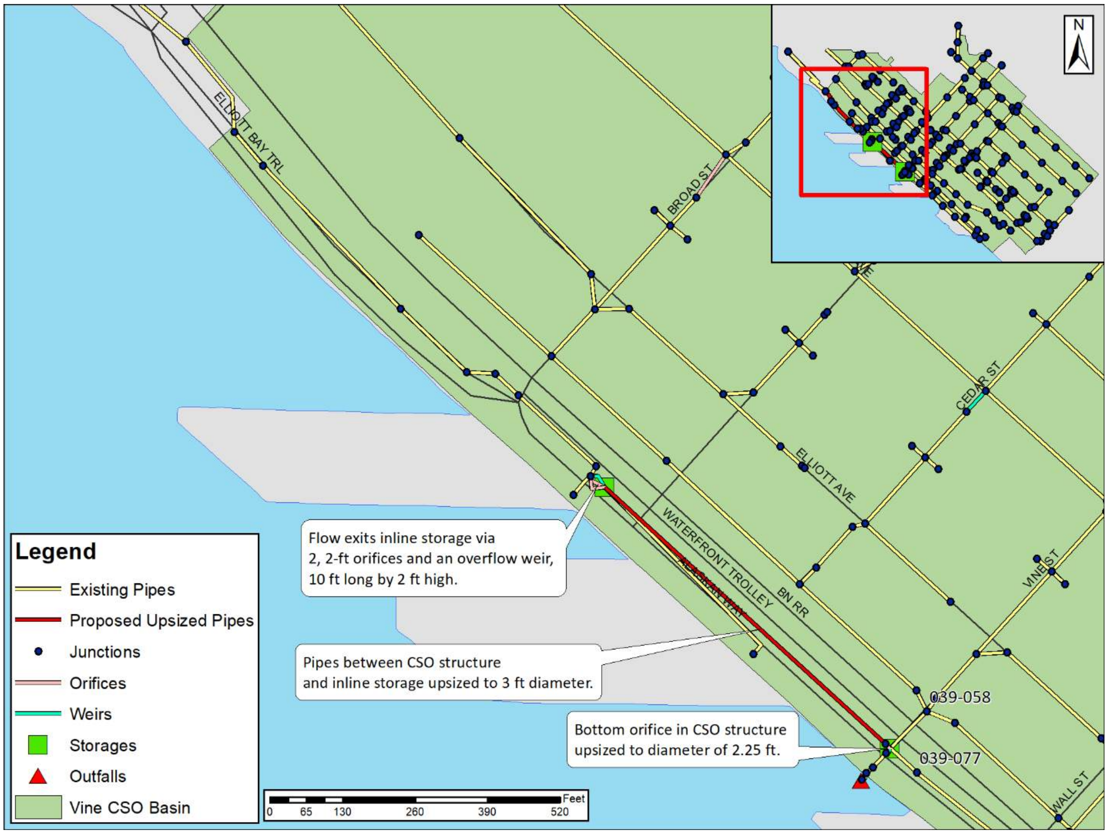


Figure 6-8: Alaskan Way Inline Storage Alternative Configuration

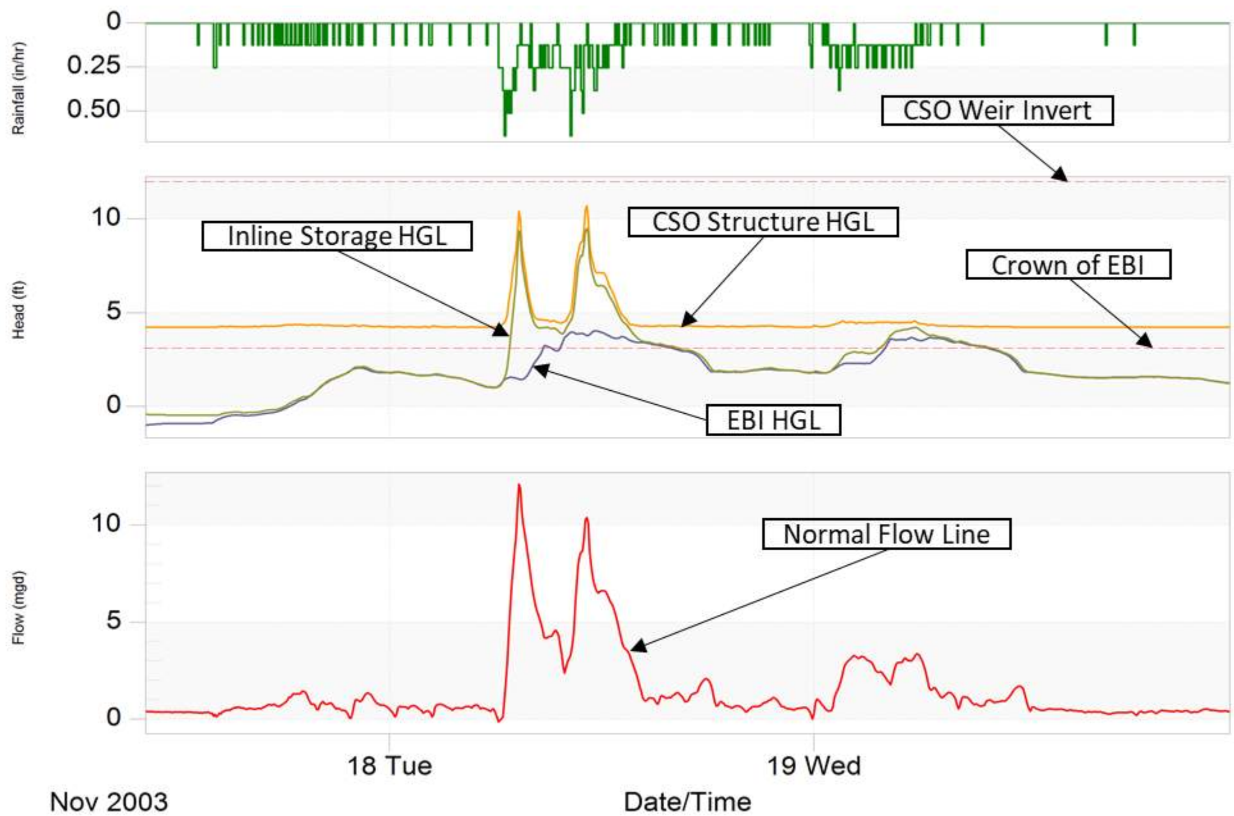


Figure 6-9: Alaskan Way Inline Storage Operation – 11/18/2003 CSO Event

A long-term simulation using rainfall and boundary conditions as described in Section 4 was performed to assess the performance of this configuration. Table 6-5 provides a summary of long-term simulation results for this alternative.

Table 6-5: Summary of Long-Term Simulation Results – Alaskan Way Inline Storage

Period of Record (years)	CSO Frequency		Elliott Ave Flow Transfer Option		
	Total # of CSO Events	Average Annual	Total Volume of CSOs (MG)	CV (MG)	CV Event Date
20	20	1.0	5.79	0	N/A
40	31	0.8	8.19	0	N/A

A comparison of flows to KCWTD CS system for the baseline configuration and the Elliott Avenue New Flow Transfer configuration is provided in Table 6-6.

Table 6-6: Alaskan Way Inline Storage Downstream Impact Comparison

Scenario	Average Annual Peak Flow Rate (MGD)		Average Annual Flow Volume (MG)	
	Alaskan Way	Western Avenue	Alaskan	Western Avenue
Baseline	10.06	18.13	127.2	371.1
Alternative 3	10.59	18.13	128.6	371.1

To assess the effect of the Alaskan Way Inline Storage configuration on HGLs in the Basin, the maximum head was evaluated at MH 039-058 and MH 039-077 (labeled in Figure 6-8), the first upstream MHs of the proposed storage and CSO Control Structure. Heads with recurrence intervals from approximately 0.5 years to approximately 67 years at MH 039-058 and MH 039-077were plotted against their respective recurrence intervals for the baseline and the Elliott Avenue New Flow Transfer configurations. These plots are shown in Figure 6-10 and Figure 6-11. For all return intervals up to approximately 40 years, the head in the baseline configuration is greater than that of the storage configuration for both MHs. Above the 40 year recurrence interval the head at MH 039-077 does increase for the Alaskan storage configuration. However, this is beyond the level of service for this option. Further optimization could mitigate increases in head at higher recurrence intervals.

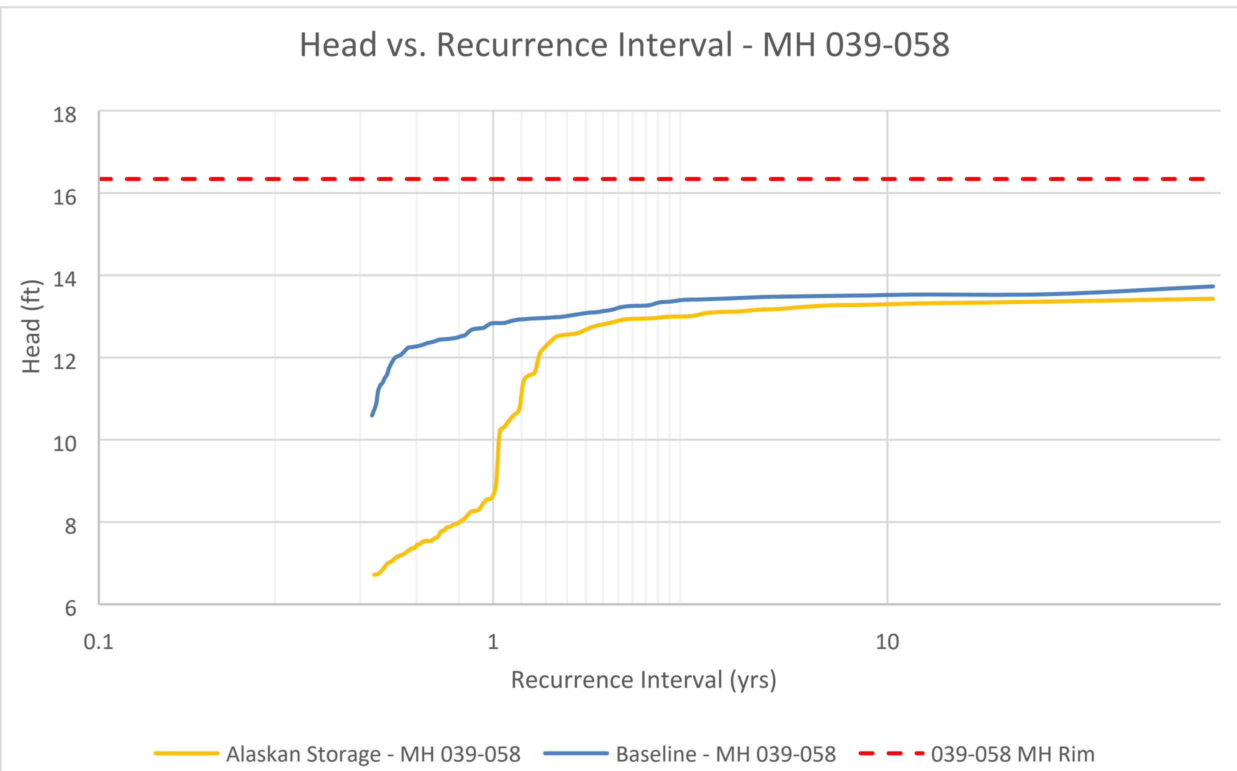


Figure 6-10: Maximum Head versus Recurrence Interval for the Baseline and Alaskan Way Inline

Storage Configurations

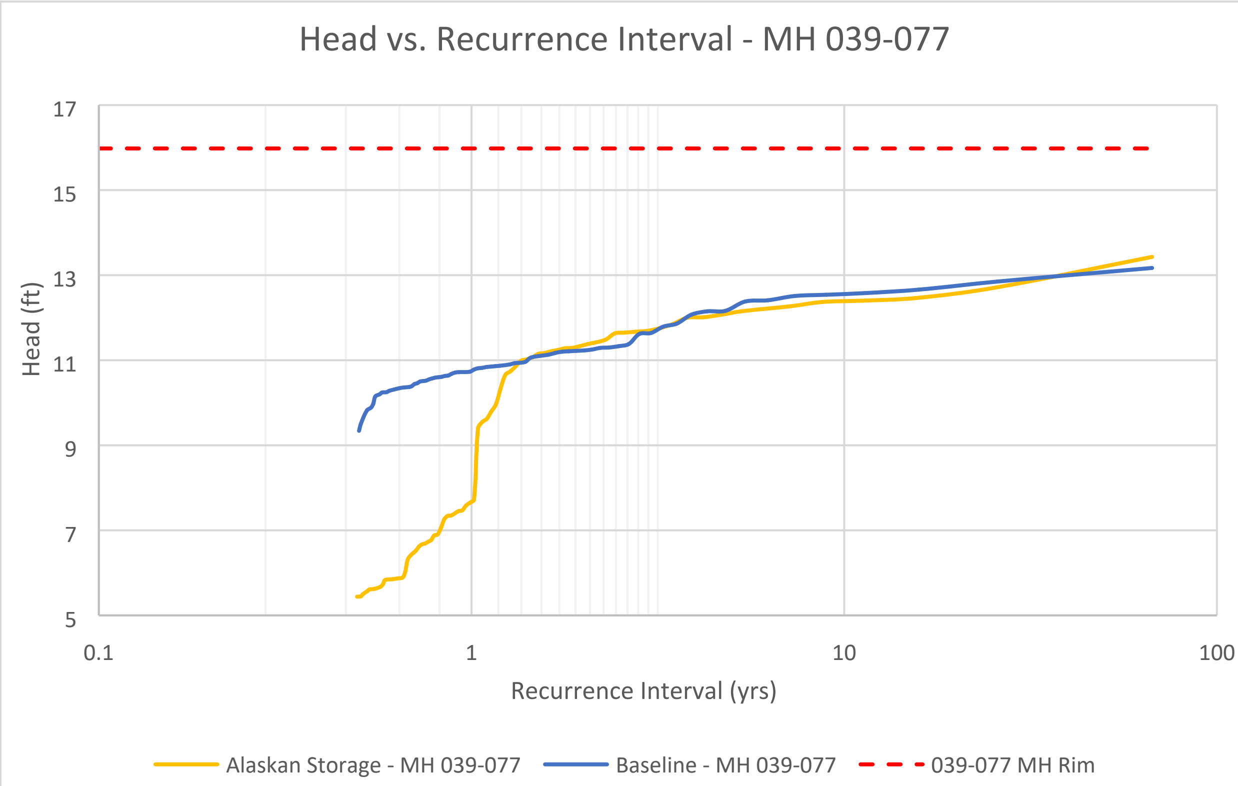


Figure 6-11: Maximum Head at MH 039-077 versus Recurrence Interval for the Baseline and Alaskan Way Inline Storage Configurations

6.3. Green Options

The goal of the green options is to meet the performance standard of no more than one CSO event per year on a 20 year moving average by implementing stormwater control methods including green stormwater infrastructure (GSI) such as bioretention and stormwater storage in alleys (green alleys) to reduce peak flows to the CSO Control Structure. GSI located throughout the Basin will collect and store stormwater runoff from impervious areas but are assumed to not infiltrate any of the runoff collected. Therefore, the GSI function primarily as small storage, delaying the timing of peak flows to the CSO Control Structure. One green option will also be supplemented with standard grey storage similar to the inline storage described in Section 6.3.2.

Two options were evaluated using perturbed rainfall representative of the 2035 climate scaled by a factor of 0.985 which corresponds to CV of approximately 182,000 gallons. This scaling factor was selected for consistency with the inline storage option as one green option will include a grey inline storage as part of the option.

6.3.1. Bioretention/Green Alley Performance

To assess the performance of bioretention cells and green alleys in the Basin prior to running long-term simulations, a relationship was developed between impervious area captured by bioretention cells and green alleys and the reduction in CSO volume for the Basin. Execution of this task was based upon two important assumptions: first, the bioretention cells and green alleys store the 1 year storm. Second, the bioretention cells and green alley have no infiltrative capacity.

Using these assumptions, the performance of these elements was estimated by removing runoff from impervious area from the system in the SWMM5 model. Two scenarios were constructed by removing impervious area from sub-catchments above and below Western Avenue. Due to the presence of high-flow paths along Western Avenue, runoff from areas above Western Avenue has a different impact to CSO volumes than runoff below Western Avenue. For each scenario, varying amounts of impervious area were removed, and a CV was computed based on the 11/18/2003 CSO event. This event has the 21st largest CSO volume for the baseline configuration in the worst 20 year period. These model runs used 2035 rainfall scaled by a factor of 0.985 and used boundary conditions as described in Section 1. Impervious area removed and peak runoff reduction for each scenario and the corresponding CV reduction are provided in Table 6-7. These results were used to develop CV reduction curves, shown in Figure 6-12.

Table 6-7: Basin 69 Impervious Area Removed and CV Reduction

Scenario		1	2	3	4	5	6
Above Western (Upper Basin)	Impervious Area Removed (ac)	0.15	0.55	0.94	4.89	38.91	87.65
	Peak Runoff Reduction (MGD)	0.05	0.21	0.37	1.63	12.57	43.93
	CV Reduction (MG)	0.0058	0.0088	0.0104	0.0449	0.1755	0.1755
Below Western (Lower Basin)	Impervious Area Removed (ac)	0.14	0.62	1.12	5.05	12.34	27.93
	Peak Runoff Reduction (MGD)	0.05	0.21	0.93	1.93	4.33	14.84
	CV Reduction (MG)	0.0040	0.0093	0.0132	0.0398	0.0801	0.1640

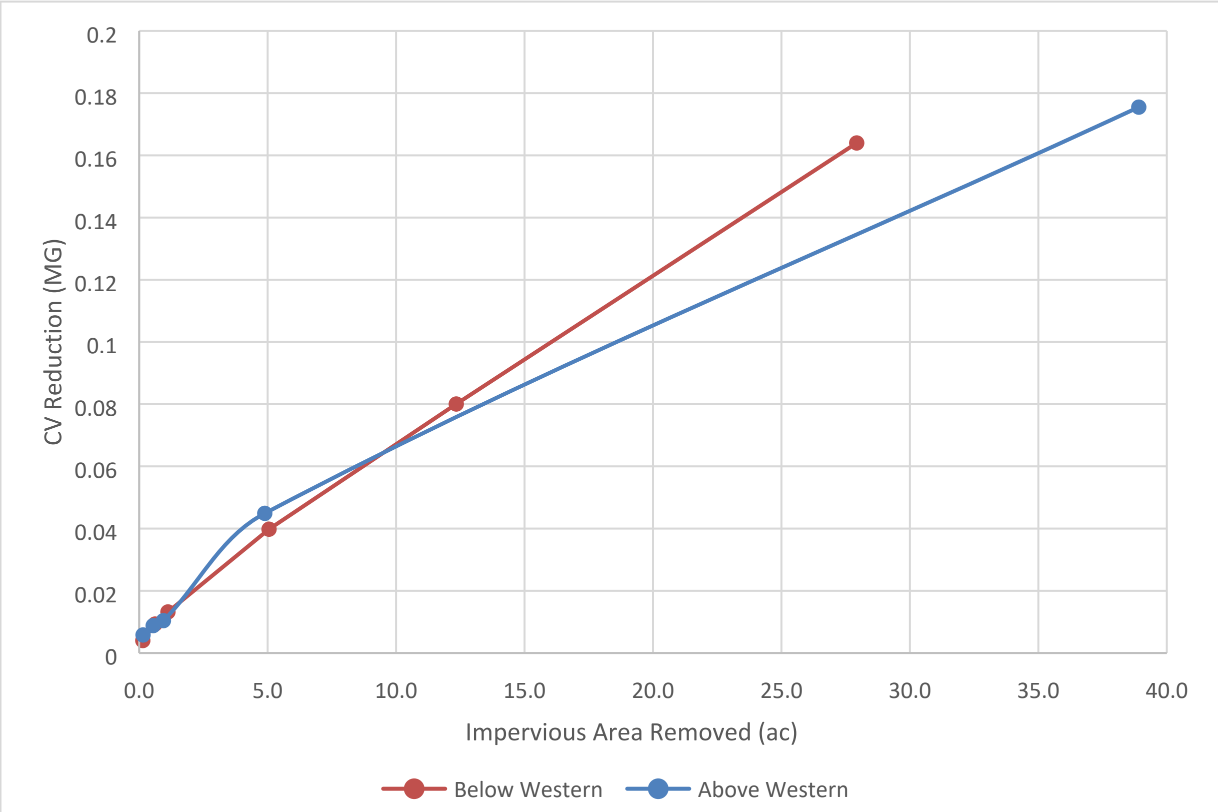


Figure 6-12: CV Reduction Versus Impervious Area Removed Above and Below Western

MGS Flood modeling was performed by Robin Kirschbaum, Inc. (RKI) to establish the anticipated performance of "typical" bioretention cells and green alleys under a 1 year storm. This analysis determined bioretention cells and green alleys were unable to completely store a 1 year storm due to the assumed passive orifice design controlling discharge to the sewer system (design of the green option configurations are detailed in Section 6.3.2). Therefore, the CV reduction versus impervious area removed could not be used to estimate the CV performance of the green options. Instead, a relationship between peak flow reduction and CV reduction was developed using MGS Flood and SWMM5 modeling results. Table 6-8 provides the peak flow reduction for the bioretention and green alleys based on MGS Flood modeling by RKI (Robin Kirschbaum, Inc. 2019). Impervious area removed in SWMM5 modeling versus peak runoff reduction is shown in Figure 6-13.

Table 6-8: MGS Flood Peak Flow Reduction Results

	Impervious Area Captured (ac)	Peak Flow Reduction (CFS)	Peak Flow Reduction (MGD)	Peak Flow Reduction per Impervious Acre (MGD/ac)
Bioretention	0.5	0.0620	0.0401	0.0801
Green Alley	0.5	0.0810	0.0524	0.1047

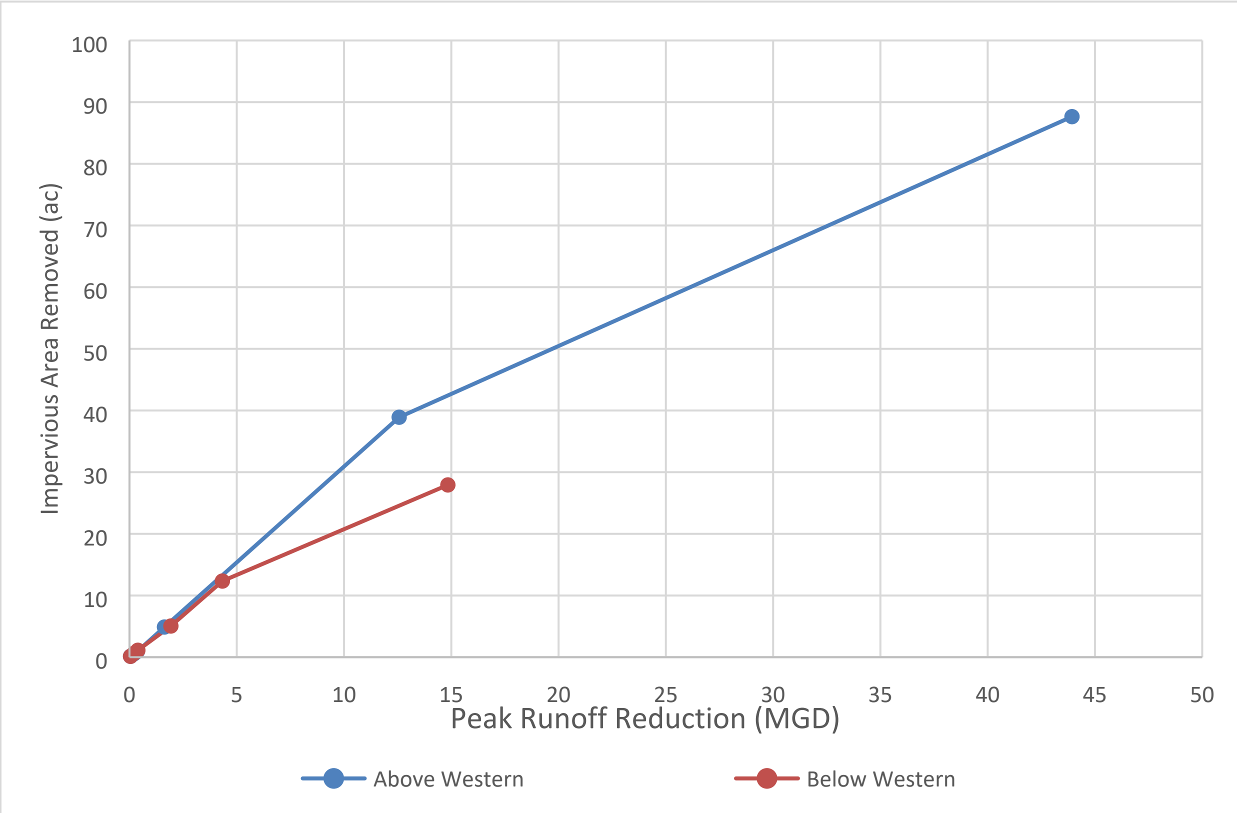


Figure 6-13: Impervious Area Removed Versus Peak Runoff Reduction Above and Below Western

For a given amount of impervious area captured, one can determine the expected CV reduction by first computing peak flow reduction based on the peak flow reduction per impervious acre rate determined by the RKI analysis and summarized in Table 6-8. Using trendlines developed from the curves in Figure 6-13 and the peak runoff reduction computed above, the impervious area removed was computed. Using the calculated impervious area removed and the trendlines developed from the curves in Figure 6-12, the expected CV reduction for the Basin was determined. Using these curves and the MGS Flood modeling results, SPU selected two green options to model with long term simulations. The configurations and results of these simulations are discussed in the following sections.

6.3.2. Alternative 4A – Green/Grey Option

Alternative 4A consists of GSI, in the form of green alleys and roadside bioretention, as well as inline combined sewer storage in Alaskan Way to delay the peak flow to the CSO Control Structure and store flow downstream of the CSO Control Structure. The configuration of Alternative 4A is shown in Figure 6-14.

Two green alleys were implemented for this option; the first located above Western Avenue between Wall Street, 1st Avenue, Battery Street, and Western Avenue, collects and stores runoff from approximately 0.5 acres of impervious area adjacent to the alley and discharges to the combined sewer.

The second green alley, located below Western Avenue between Vine Street, Elliott Avenue, Wall Street, and Alaskan Way, collects and stores runoff from approximately 1 acre of impervious area adjacent to the alley and discharges to the combined sewer. Both green alleys discharge to the combined sewer via a 0.5 inch diameter orifice located at the bottom of the green alley and feature a 1 foot tall by 5 feet long high flow orifice to prevent flow from overtopping the alley surface.

A total of 16 bioretention cells are proposed along Vine Street; eight are located above Western Avenue (within the “upper basin”) and 8 are located below Western Avenue (within the “lower basin”). Each set of 8 bioretention cells were modeled as one storage node. A set of 8 bioretention cells collects runoff from a total of approximately 1 acre of impervious right-of-way (ROW) area adjacent to the cells. Each bioretention cell drains via a 0.5 inch diameter orifice located at the bottom of the cells and feature a 0.5 feet tall by 5 feet long high flow weir located 1 foot from the top of the cell to maintain 1 foot freeboard in each cell.

The drain orifices for both the bioretention and the green alleys were modeled as 3 inch diameter pipes with flow limits based on the MGS Flood modeling. MGS Flood analysis, performed by RKI, determined the peak flow from the bioretention cells was 0.0155 MGD; peak flow from the alley capturing 0.5 acres of impervious area was 0.00388 MGD and 0.0084 MGD from the green alleys which collected 1 acre of impervious area (Robin Kirschbaum, Inc. 2019). These flow rates were applied as flow limits in the PCSWMM modeling.

This alternative also utilizes approximately 92,000 gallons of inline storage located just downstream of the CSO Control Structure. The pipe between the CSO Control Structure and the proposed storage is upsized to 3 feet in diameter. Flow exits the inline storage via two orifices, the first, 2 feet in diameter, is located at the bottom of the storage with an invert elevation of -0.2 feet. The second orifice is 0.65 feet in diameter with an invert elevation of 1.75 feet. The storage also features a high flow weir 0.5 feet long and 2 feet tall with an invert elevation of 12.2 feet.

Neither the green alleys nor the bioretention cells can infiltrate flow which effectively makes them small storages which delay peak flow to the CSO Control Structure. The addition of inline storage downstream of the CSO Control Structure, in conjunction with the GSI assets, slightly reduces the level in the CSO Control Structure and thus provides some reduction in CSO events. However, the combination of GSI and inline storage does not delay the timing of peak flows enough or provide enough HGL reduction in the CSO Control Structure for the Basin to meet the performance standard. Figure 6-15 shows Alternative 4A operations for the 11/18/2003 CSO event.

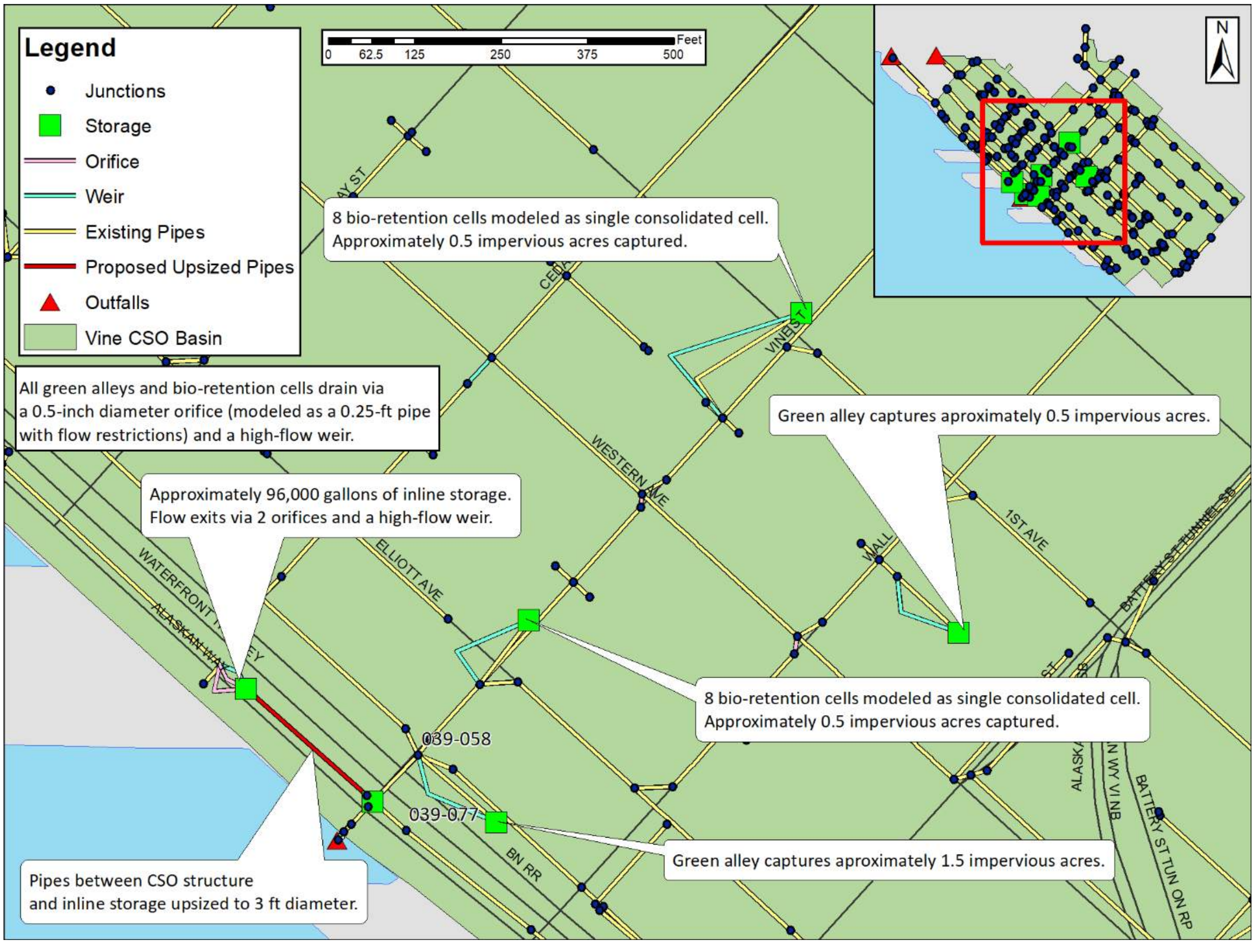


Figure 6-14: Alternative 4A – Green Option

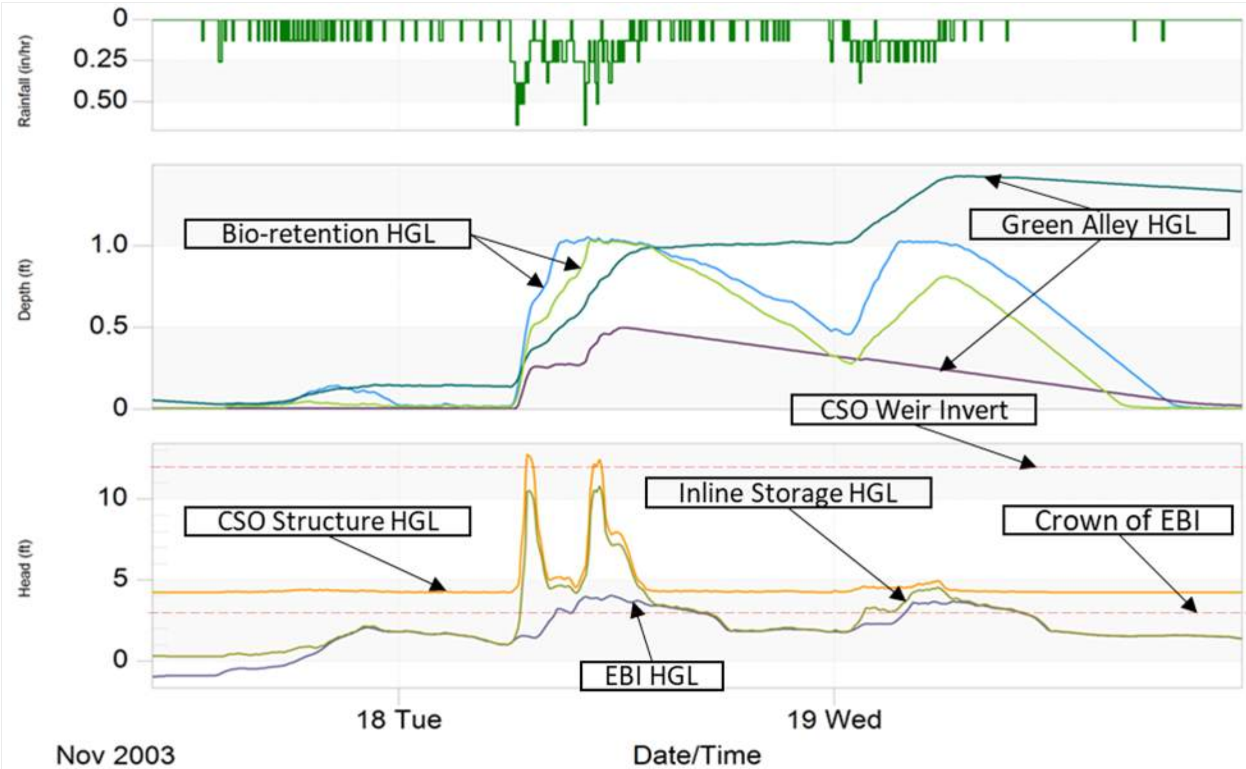


Figure 6-15: Alternative 4A Operations – 11/18/2003 CSO Event

A long-term simulation using rainfall as described in Section 6.3 and boundary conditions as described in Section 4 was performed to assess the performance of this configuration. Table 6-9 provides a summary of long-term simulation results for this alternative.

Table 6-9: Summary of Long-Term Simulation Results – Alternative 4A

Period of Record (years)	CSO Frequency		Alternative 4A		
	Total # of CSO Events	Average Annual	Total Volume of CSOs (MG)	CV (MG)*	CV Event Date
20	30	1.5	11.39	0.092	11/18/2003
40	45	1.1	15.88	0.092	11/18/2003

*The CV volume represents the remaining volume to be mitigated by Stormwater Code revisions.

A comparison of flows to KCWTD CS system for the baseline configuration and the configuration of Alternative 4A is provided in Table 6-10. The project scope did not allow for optimization of this alternative for the Basin to meet the performance standard.

Table 6-10: Alternative 4A Downstream Impact Comparison

Scenario	Average Annual Peak Flow Rate (MGD)		Average Annual Flow Volume (MG)	
	Alaskan Way	Western Avenue	Alaskan Way	Western Avenue
Baseline	10.06	18.13	127.2	371.1
Alternative 4A	9.37	17.73	126.4	369.7

To assess the effect of Alternative 4A on HGLs in the Basin, the maximum head was evaluated at MH 039-058 and MH 039-077(labeled in Figure 6-14), the first upstream MHs of the proposed storage and CSO Control Structure. The green alley located between Western Avenue and Alaskan Way also discharges to 039-058. Heads with recurrence intervals from approximately 0.5 years to approximately 67 years at MH 039-058 and MH 039-077 were plotted against their respective recurrence intervals for the baseline and the Alternative 4A configurations. These plots are shown in Figure 6-16 and Figure 6-17. For all return intervals up to approximately 40 years, the head in the baseline configuration is greater than that of the Alternative 4A configuration for both MHs. Above the 40 year recurrence interval the head at 039-077 does increase for Alternative 4A. However, this is beyond the level of service for this alternative. Further optimization could mitigate increases in head at higher recurrence intervals.

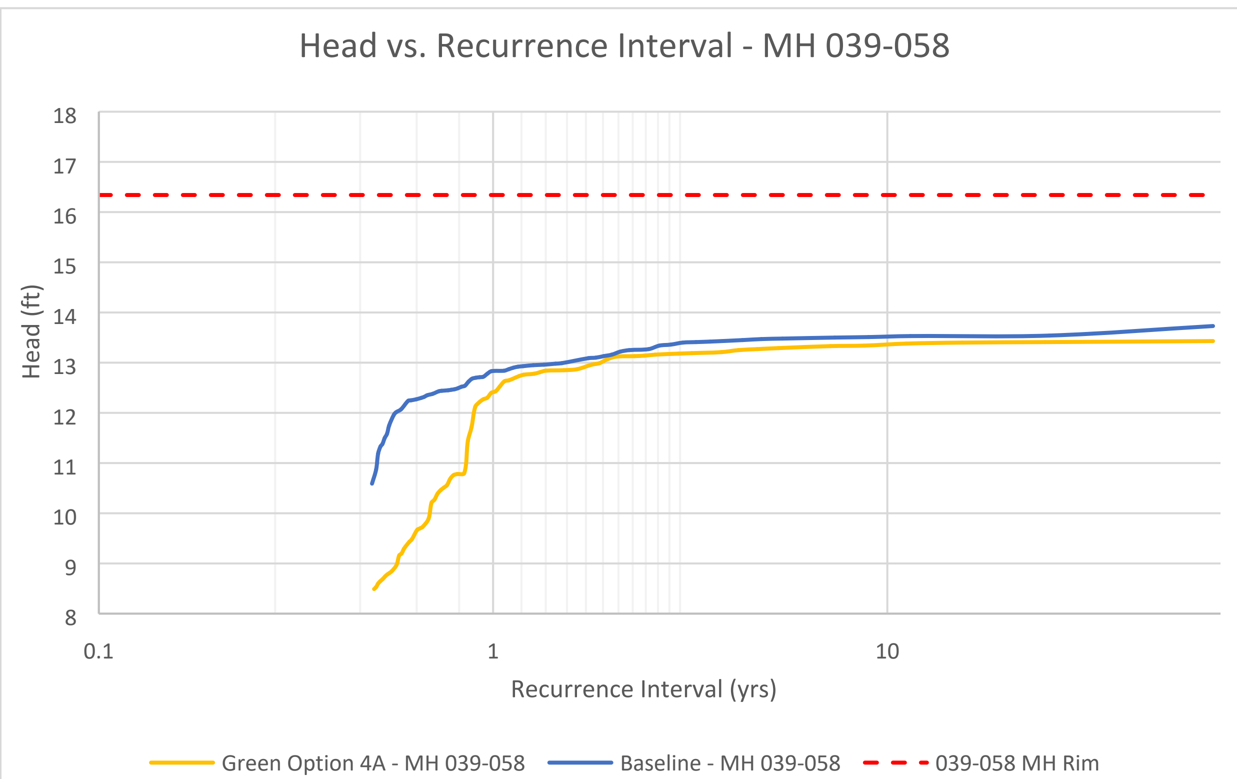


Figure 6-16: Maximum Head versus Recurrence Interval at MH 039-058 for Baseline Condition and Alternative 4A

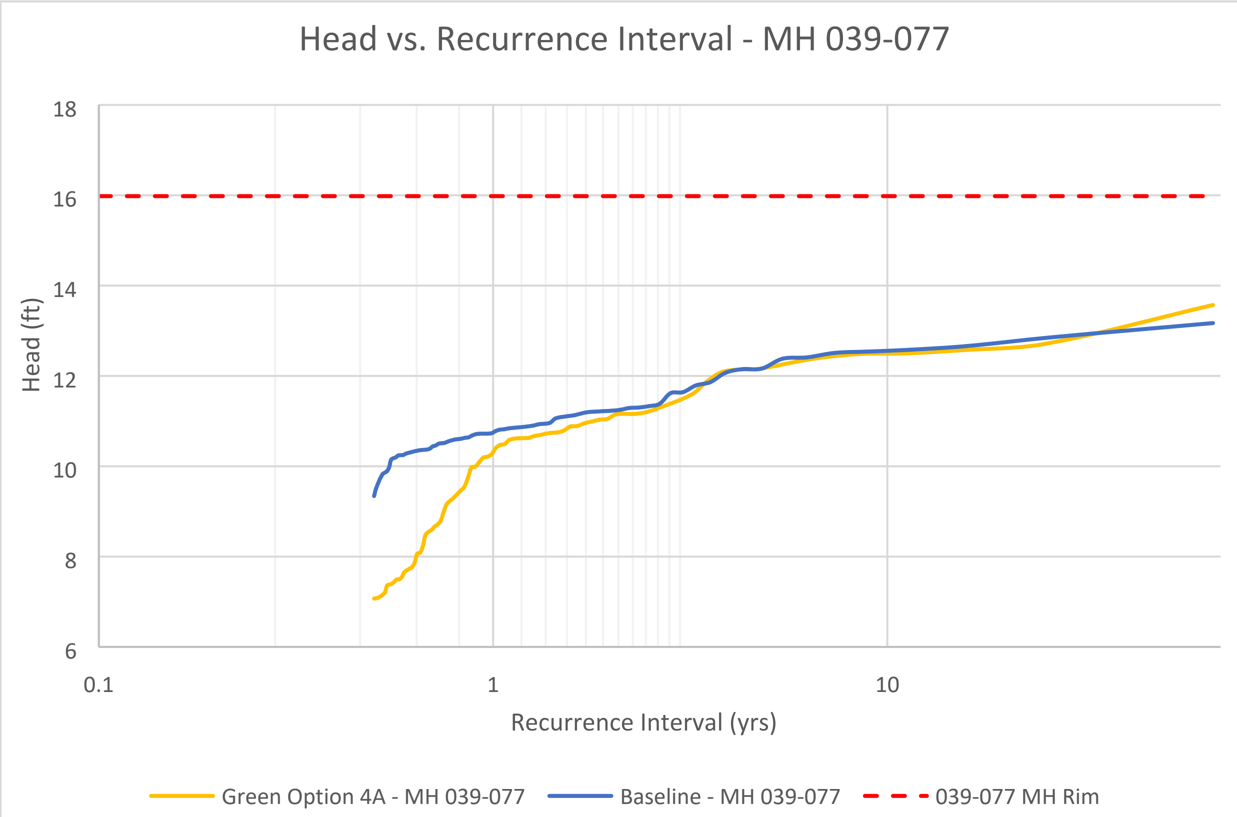


Figure 6-17: Maximum Head versus Recurrence Interval at MH 039-077 for the Baseline Condition and Alternative 4A

6.3.3. Alternative 4B – Green Option

This alternative uses GSI, in the form of green alleys and roadside bioretention cells, to delay peak flows to the CSO Control Structure. This alternative is identical to Alternative 4A except for the lack of inline storage on Alaskan Way. Bioretention cells and green alleys are located and configured as in Alternative 4A and have no infiltration capacity. The configuration of Alternative 4B is shown in Figure 6-18. Like Alternative 4A, this configuration slightly reduces the HGL in the CSO Control Structure resulting in a small reduction of CSO events, however, it does not meet the performance standard. Figure 6-19 shows Alternative 4B operations for the 11/18/2003 CSO Event.

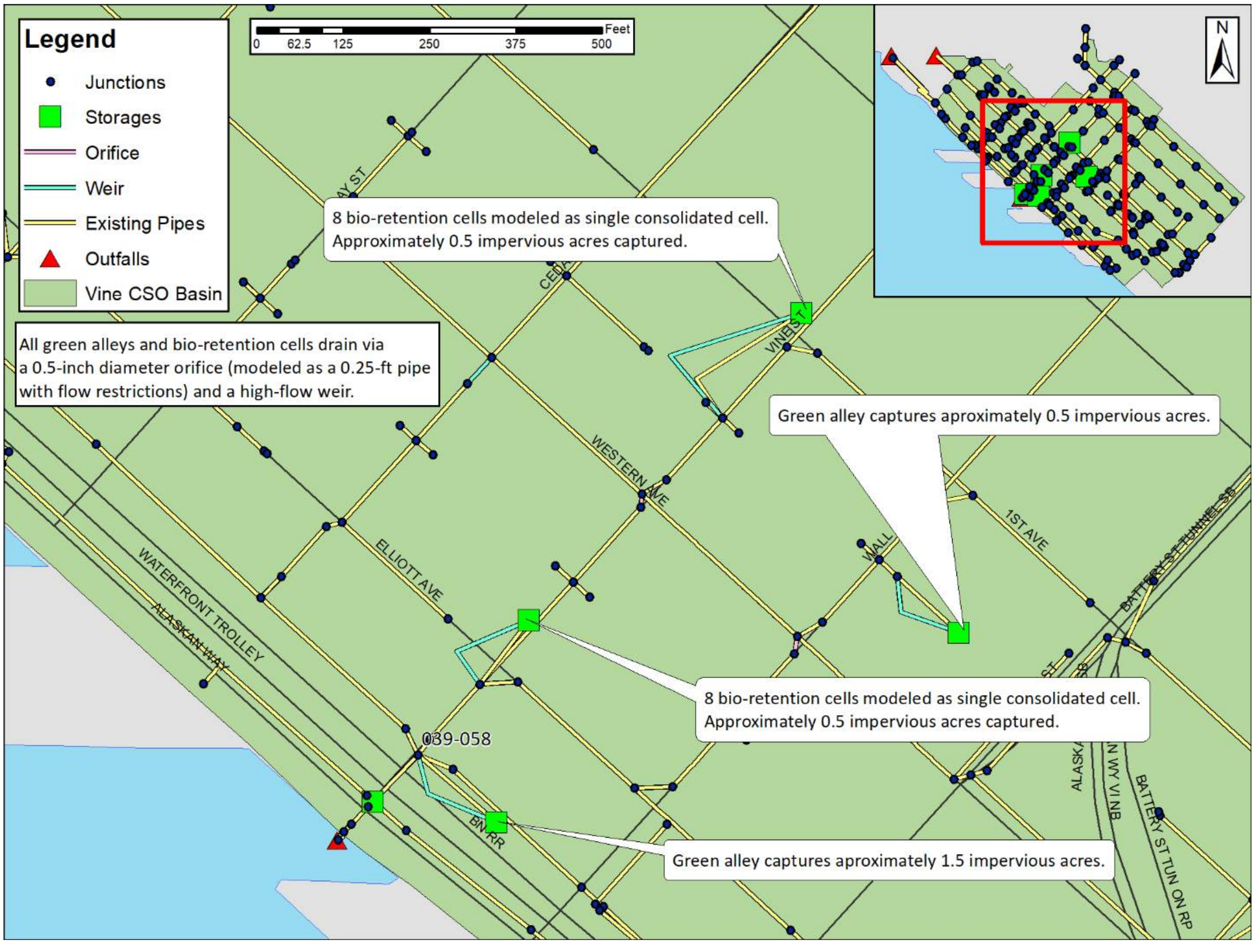


Figure 6-18: Alternative 4B – Green Option

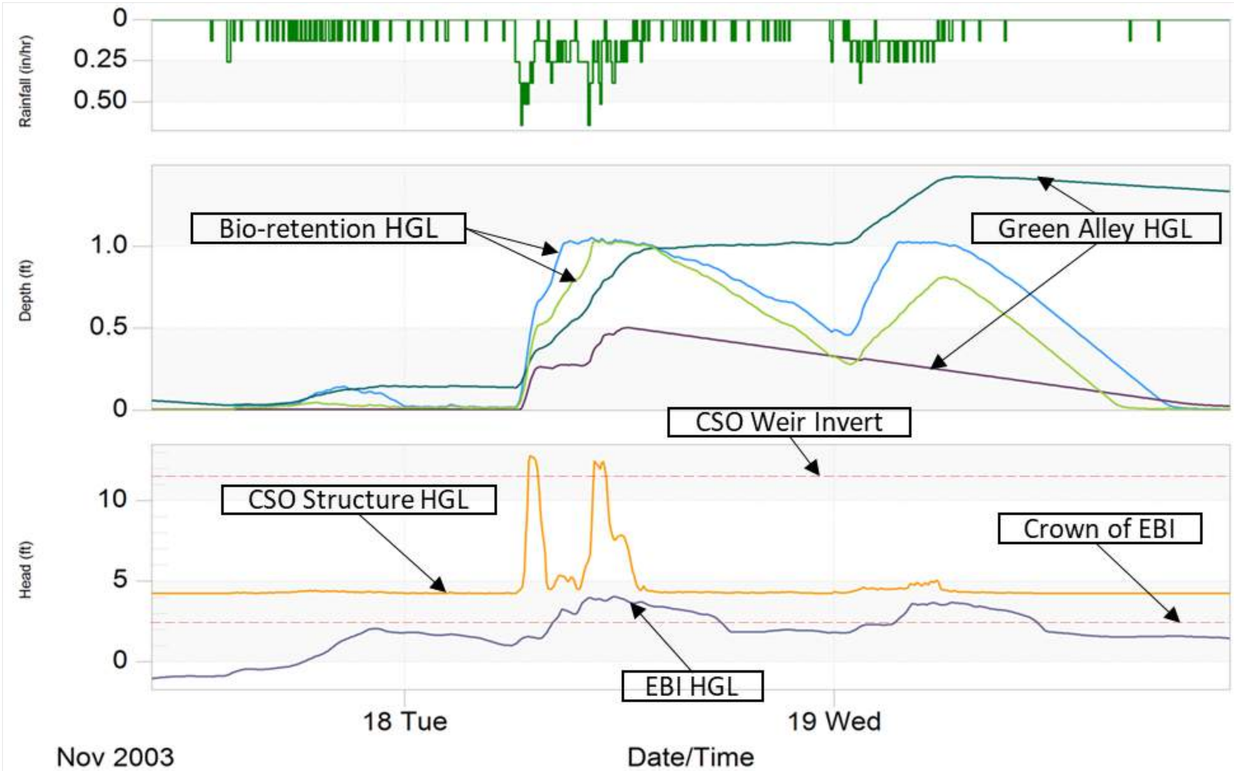


Figure 6-19: Alternative 4B Operations – 11/18/2003 CSO Event

A long-term simulation using rainfall as described in Section 8 and boundary conditions as described in Section 4.2 was performed to assess the performance of this configuration. Table 6-11 provides a summary of long-term simulation results for this alternative.

Table 6-11: Summary of Long-Term Simulation Results – Alternative 4B

Period of Record (years)	CSO Frequency		Alternative 4B		
	Total # of CSO Events	Average Annual	Total Volume of CSOs (MG)	CV (MG)*	CV Event Date
20	40	2.0	12.90	0.150	11/18/2003
40	65	1.6	18.08	0.150	11/18/2003

*The CV volume represents the remaining volume to be mitigated by Stormwater Code revisions

A comparison of flows to KCWTD for the baseline configuration and Alternative 4B is provided Table 6-12.

Table 6-12: Alternative 4B Downstream Impact Comparison

Scenario	Average Annual Peak Flow Rate (MGD)		Average Annual Flow Volume (MG)	
	Alaskan Way	Western Avenue	Alaskan Way	Western Avenue
Baseline	10.06	18.13	127.2	371.1
Alternative 4B	9.80	17.74	126.5	369.8

To assess the effect of Alternative 4B on HGLs in the Basin, the maximum head was evaluated at MH 039-058 (labeled in Figure 6-18). This MH is the discharge point for the green alley, which is located between Western Avenue and Alaskan Way, and is expected to be most impacted by the green alleys and bioretention cells. Heads with recurrence intervals from approximately 0.5 years to approximately 67 years at MH 039-058 were plotted against their respective recurrence intervals for the baseline and Alternative 4B configurations. This plot is shown in Figure 6-20. For all return intervals, the head in the baseline configuration is greater than that of Alternative 4B.

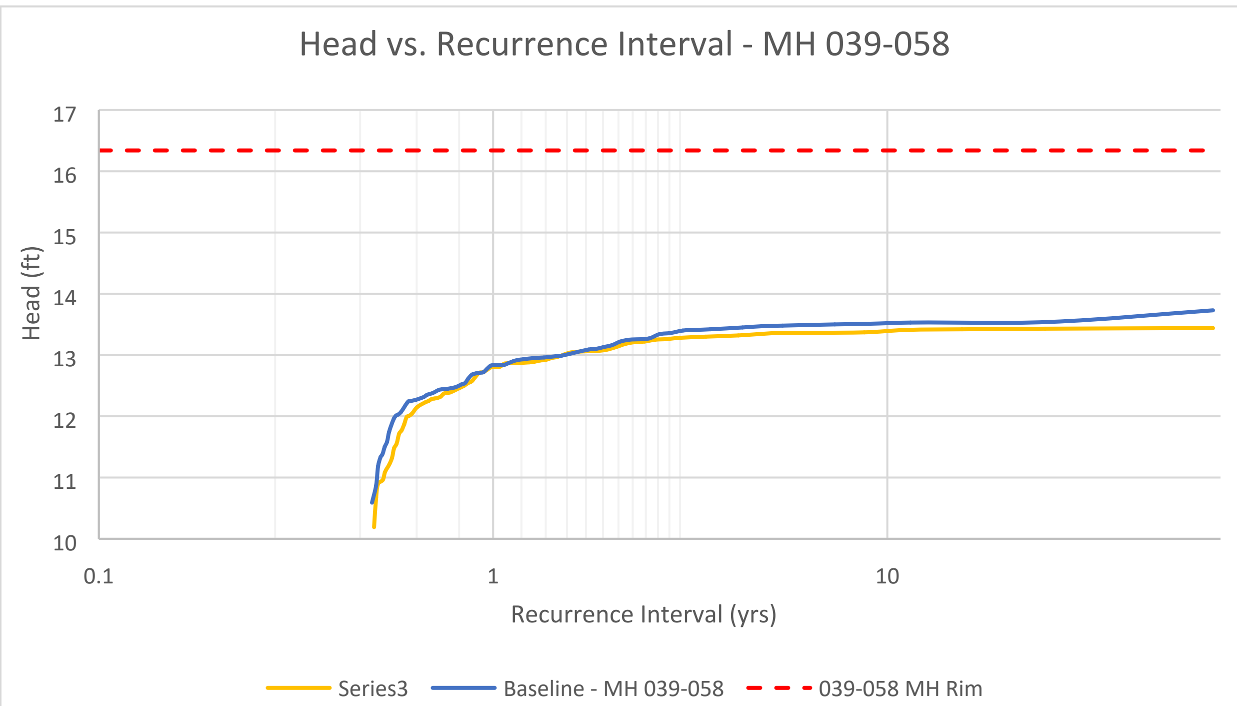


Figure 6-20: Maximum Head versus Recurrence Interval at MH 039-058 for the Baseline and Alternative 4B Configurations

7. Conclusion

The Vine Basin CSO Control Project options analysis effort has produced flow transfer, storage, stormwater control alternatives to achieve CSO control in Basin 69. These alternatives were simulated for short periods of time, generally single CSO events, to test effectiveness and refine the configuration.

The refined alternatives were then run through a long-term simulation to determine their CSO performance over the 40 year rainfall period of record.

These alternatives have varying levels of effectiveness with flow transfer alternatives being most effective, followed by the storage, with the stormwater control alternatives being least effective. The storage and flow transfer alternatives could meet the performance standard of no more than one CSO event per year on a 20 year moving average, while the stormwater control alternative could not meet this performance standard.

The most effective alternative, the Elliott Avenue New Flow Transfer, proposes a diversion at Vine Street and Elliott Avenue and conveys flow via a proposed line along Elliott Avenue discharging to the EBI via a proposed connection at Elliott Avenue and Bay Street. This option converts the primary flow path in the Basin to the proposed line along Elliott Avenue, allowing it to collect most of the flow in the Basin and transfer it to KCWTD, circumventing the CSO Control Structure and significantly reducing the occurrence of CSO events.

8. Limitations and Uncertainties

The GSI options relied on assumptions and modeling by others to determine CSO efficacy. It was outside of the Aqualyze scope to perform QA/QC on modeling analysis provided by RKI and it was assumed that that information was suitable for use in this analysis. These options also relied on best-fit trendlines developed from multiple model simulations and some variability in results could be expected if these options were developed further. It is not recommended that those trendlines be used for other projects without first determining applicability. Note that the GSI options were not optimized such that the Basin meets the performance standard.

The analysis relies on boundary conditions provided by KCWTD, and it was assumed that this information was suitable for use. These conditions should be reviewed for applicability as a selected option moves into design.

Care was taken to review impacts to HGL in the portions of the system adjacent to proposed options to ensure no unintended SSOs. It was outside of the scope of this project to review impacts to adjacent basement (if any) elevations. This should be considered as the project moves into more mature option definition, design, and construction.

As stated in previous sections, no consideration was made for population changes or changes to the basin conveyance system that are proposed or are being designed by others outside of this project. It is recommended that those areas be revisited prior to modeling in support of design.

9. References

Aqualyze Inc. 2018. "Central Waterfront Basin 69 Calibration and Control Volume Modeling Technical Memorandum."

Aqualyze Inc. 2019. "Wastewater System Analysis Project Report."

NOAA. 2018. "Tides and Currents: Seattle, WA - Station ID:9447130."

Robin Kirschbaum, Inc. 2019. "SPU Vine Basin CSO Control MGS Flood Summary DRAFT 20190408.xlsx." doi:eeee.

Seattle Public Utilities. 2017. "Drainage Standards and Guidlines." Seattle.

Appendix G

SEPA Determination and Checklist

Seattle Public Utilities

Memorandum

Date: October 16, 2019

To: Shailee Sztern, Project Delivery Branch

From: Betty Meyer
Lead SEPA Responsible Official

RE: SEPA Closeout: Vine Basin CSO Control Project

This memorandum documents the completion of the State Environmental Policy Act (SEPA) process for the Determination of Non-Significance (DNS).

The DNS was issued on September 16, 2019. The DNS and SEPA Environmental Checklist were transmitted to the Washington Department of Ecology and recorded as entry #201905266 in the State SEPA Register for September 16, 2019.

The DNS was published in the Daily Journal of Commerce in the September 16 edition. It was recorded in the Seattle Department of Construction and Inspections "Portal" as Record Number 001655-19PN and listed in the Public Notices Summary.

The comment period ended on September 30, 2019. On September 26, a comment was received from the King County Wastewater Treatment Division (WTD), noting that the project would establish a new discharge connection to King County's Elliott Bay Interceptor, requesting the location and details of the proposed connection, requesting preliminary plans for WTD to review, and requesting construction drawings in order to assess potential impacts. SPU's project manager replied on October 15, providing a letter documenting project coordination with WTD, noting that the project is currently in the options analysis phase, committing to follow up with WTD during project design, and indicating that the project will likely be deferred two to ten years following completion of options analysis.

Following the close of the comment period, on October 2, 2019 SPU received an email from the State Department of State Department of Archaeology and Historic Preservation. DAHP's email included several recommendations for follow-up work, including a desktop survey of the project area and a targeted monitoring and inadvertent discovery plan developed by a professional archaeologist prior to ground disturbing activities. DAHP also recommended consultation with the concerned Tribes' cultural committees and staff regarding cultural resource issues. The email was forwarded to the SPU project manager, so that the project team could determine how best to address DAHP's recommendations during project development and design. SPU's project manager replied on October 15, indicating that the project plans to conduct a desktop study and develop a targeted monitoring and inadvertent discovery plan during design, noting that the project is currently in the options analysis phase, and indicating that the project will likely be deferred two to ten years following completion of options analysis

The appeal period ended on October 7. There were no appeals.

The SEPA process was completed on October 16, 2019 and the project is authorized to proceed, contingent on any other required permits and approvals.

Seattle Public Utilities

Vine Basin Combined Sewer Overflow Control
SEPA Determination of Non-Significance (DNS)

<u>Description of Proposal</u>
The proposed Project would control the frequency of Vine Basin combined sewer overflows (CSOs) by increasing combined sewer system conveyance capacity upstream of an existing CSO Control Structure. It would also establish a new discharge connection to King County's Elliott Bay Interceptor. The Project would increase peak flows and total discharged flows to King County's Elliott Bay Interceptor, which would reduce the flow managed by the existing CSO Control Structure.

Proposed Project elements include:

- Installation of approximately 1,800 linear feet of new 24-inch-diameter gravity sewer pipe and other appurtenances, such as maintenance holes, within Elliott Avenue, from Vine Street to Bay Street.
- Installation of a new connection to King County's existing Elliott Bay Interceptor.
- Construction of a new sewer diversion vault and weir at the crossing of the existing sewer line at the intersection of Vine Street and Elliott Avenue.

The following Project elements may be required by Seattle Department of Transportation's restoration requirements and/or coordinated with other City agencies throughout design:

- Improvements to existing curb ramps within the Project corridor, consistent with Americans with Disabilities Act (ADA) specifications.
- Green Stormwater Infrastructure, such as bioretention facilities within existing planter strips in the Elliott Avenue right-of-way (ROW).
- Installation of flexible porous surface treatment within existing tree pits along the Project corridor.
- Potential improvements to street lighting and pedestrian crossings.

Project construction would be completed entirely within the Elliott Avenue ROW through open trench construction. Work would occur in one-block increments to minimize traffic and community impacts; once installation is complete for a respective block, the pavement would be temporarily restored and parking spaces/drive lanes would be restriped. Once construction of all CSO control improvements is complete, the impacted pavement would be restored per the Seattle Department of Transportation's street restoration requirements. Construction is anticipated to last approximately 12 to 16 months.

SPU or SPU's Contractor may lease space within proximity to the Project area to support construction staging and laydown. Properties that do not have a current active use or existing vertical structures are most likely to be used in this capacity. The lease would require that the site be restored to preconstruction conditions or better following completion of the Project.

<u>Proponent</u>
Seattle Public Utilities
Seattle Municipal Tower Suite 4900
P.O. Box 34018
Seattle, WA 98124-4018

Location of Proposal
The Project is within the ROW of Elliott Avenue, from its intersection with Bay Street to its intersection with Vine Street. The Project corridor is located within the NE quarter of Section 36, Township 25N, Range 3E; and NW quarter of Section 31, Township 25N, Range 4E of the Willamette Meridian. There is no street address available for the Project corridor.

Lead Agency
Seattle Public Utilities, the lead agency for this proposal, has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

This Determination of Non-Significance (DNS) is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for fourteen (14) days from the issuance date below.

A copy of the environmental checklist is available at:

- Seattle Public Utilities, General Manager/CEO's Office Main Reception Area, Seattle Municipal Tower, Suite 4900, 700 Fifth Avenue, Seattle, Washington
- Seattle Central Library, Public Review Documents, Level 5 Reference
- Online at https://www.seattle.gov/utilities/environment-and-conservation/projects/vine-basin-cso-control

Public and Agency Comments
Comments on this DNS must be submitted by September 30, 2019 and must be sent to:

Betty Meyer, SEPA Responsible Official
Seattle Public Utilities
Seattle Municipal Tower, Suite 4900
P.O. Box 34018
Seattle, WA 98124-4018
betty.meyer@seattle.gov

Signature: Betty Meyer (signed) Issue Date: September 16, 2019
Betty Meyer

Appeals
Appeals of this DNS must be accompanied by an $85.00 filing fee and must be filed by 5:00 p.m. on October 7, 2019. Delivery of appeals filed by any form of USPS mail service may be delayed by several days. Allow extra time if mailing an appeal.

- Written appeals must be sent to:

City of Seattle Hearing Examiner
700 5th Avenue Suite 4000
P.O. Box 94729
Seattle, WA 98124-4729

- Appeals can be filed electronically. Details on electronic filing procedures are available under "e-File" at the Office of the Hearing Examiner's web site: http://www.seattle.gov/examiner/
- Filing fees must be paid by the appeal deadline and can be paid *via* check (made payable to the City of Seattle) or credit/debit card (Visa and MasterCard only). Credit/debit card payments can be made in-person or over-the-phone.
- You should be prepared to make specific factual objections. Please refer to the Hearing Examiner Rules of Practice and Procedure for rules that govern appeals. These rules are available on the Hearing Examiner's website at www.seattle.gov/examiner/rules-toc.htm or by calling 206-684-0521.

For interpretation services please call **(206) 256-5256**

如需要口譯服務，請撥電話號碼 **(206) 256-5256**

통역 서비스를 원하시면 **(206) 256-5256**으로 전화하세요

Wixii turjubaan afka ah ku saabsan, Fadlan la soo xariir taleefoonka **(206) 256-5256**

Para servicios de interpretación por favor llame al **(206) 256-5256**

Para sa serbisyo ng tagapagpaliwanag, tumawag sa **(206) 256-5256**

SEATTLE PUBLIC UTILITIES
SEPA ENVIRONMENTAL CHECKLIST

This State Environmental Policy Act (SEPA) environmental review of Seattle Public Utilities' (SPU's) Vine Basin Combined Sewer Overflow (CSO) Control Project has been conducted in accordance with the Washington SEPA (RCW 43.21C), state SEPA regulations (Washington Administrative Code [WAC] Chapter 197-11), and the City of Seattle (City) SEPA ordinance (Seattle Municipal Code [SMC] Chapter 25.05).

A. BACKGROUND

1. **Name of proposed project**:

   Vine Basin CSO Control Project

2. **Name of applicant**:

   Seattle Public Utilities

3. **Address and phone number of applicant and contact person:**

   Shailee Sztern, PE, Project Manager
   Seattle Public Utilities
   Project Delivery and Engineering Branch
   Seattle Municipal Tower, Suite 4900
   P.O. Box 34018
   Seattle, WA 98124-4018
   (206) 256-5256
   Shailee.Sztern@seattle.gov

4. **Date checklist prepared:**

   September 5, 2019

5. **Agency requesting checklist:**

   Seattle Public Utilities

6. **Proposed timing or schedule (including phasing, if applicable):**

   Construction of the CSO control improvements in the Vine Basin (the Project) is anticipated to require approximately 12 to 16 months, with a tentative start date of July 2022. Construction is required to be completed no later than December 31, 2025.Project construction would progress block-by-block to minimize traffic impacts and impacts to the downtown urban environment and community.

7. **Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.**

   The Project is part of a larger City-wide effort by SPU, as mandated through Consent Decree, to complete certain CSO-control related activities. Several CSO-reduction projects are being actively pursued throughout the City, including the Ship Canal Water Quality Project and the East Montlake (Basin 20), Portage Bay (Basin 138), and Magnolia (Basin 60) pump station upgrades. Cumulatively, these projects contribute to CSO reduction throughout the City;

however, this proposed Project – called the Central Waterfront (Basin 69) CSO Control Project in earlier planning documents – is subject to its own environmental review and permit processes. No additional expansions or additions related to this proposal are currently planned.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

- Central Waterfront (Basin 69) CSO Control Project Draft Engineering Report (June 2019), which describes the project need, existing conditions, the alternatives that were evaluated, and the selected alternative to achieve the Consent Decree CSO performance standard. The Engineering Report will be approved by the Washington State Department of Ecology (Ecology) prior to construction. Submittal to Ecology will occur no later than December 31, 2019.
- On March 14, 2013, Seattle Department of Transportation (SDOT) issued a SEPA Final Environmental Impact Statement (FEIS) for the Elliott Bay Seawall Project, which has a project area that overlaps with a majority of the Project corridor (defined as the extent of proposed area of disturbance within the public right of way of Elliott Avenue) for the proposed Project. On December 16, 2013, SDOT issued a Final Supplemental Environmental Impact Statement (FSEIS) that analyzed impacts related to design refinements and adjustments to the construction sequencing and approach. These documents are on file with the City.

  The proposed Project lies largely within the area analyzed by the FEIS and FSEIS. Because the environments of the projects overlap, the Elliott Bay Seawall Project FEIS and FSEIS and all their supporting Discipline Reports, in their entireties and as corrected and amended, are incorporated by reference into this SEPA environmental review for SPU's proposed Project (per WAC 197-11-635 and 754 and SMC 25.05.635 and 754).

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

According to the City of Seattle Land Use and Building Permit Maps, there are one active land use application and four building permit applications awaiting government approval adjacent to the Project area. However, these projects are located on private parcels, outside the Right-of-Way (ROW) where the majority of construction for this proposed Project would occur.

According to the SDOT Project and Construction Coordination Map, there are currently no planned ROW projects within the Project corridor that would be under construction during the Project's anticipated 2022–2025 construction window.

10. List any government approvals or permits that will be needed for your proposal, if known.

The following permits or approvals will be required before Project construction can commence:

- Ecology approval of the Vine (Basin 69) CSO Control Project Final Engineering Report
- SPU SEPA Review
- SDOT Street Improvement Permit
- SDOT Construction Street Use Permit

- Seattle Department of Construction and Inspections (SDCI) Noise Variance *(potential based on construction plan and equipment)*
- SDCI/King County Permit for Temporary Dewatering
- Ecology National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit (CSGP) *(potential based on approach to stormwater management)*
- Seattle Parks & Recreation Revocable Use Permit *(potential based on selected construction staging area)*

11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

Project Background

The proposed Project has been initiated to fulfill requirements from the City's Wastewater Consent Decree (Civil Action No. 2:13-cv-678, entered in U.S. District Court on July 3, 2013). SPU operates and maintains combined sewer systems within the City. During large storm events, the combined systems can overflow, resulting in CSOs. The Consent Decree requires the City to control CSO events to no more than one untreated discharge per year, assessed on a 20-year moving average, for each CSO outfall. The purpose of this Project is to construct system improvements to achieve that performance standard for Vine Basin (Basin 69). The Project is needed because during the period of 1999 to 2018, Outfall 69 averaged 1.8 CSOs per year.

The Consent Decree mandated the preparation of a Long-Term Control Plan (LTCP). The LTCP set the following milestones for controlling CSOs from Vine Basin:

- Submit Draft Engineering Report to Ecology by June 30, 2019.
- Submit Final Engineering Report to Ecology by December 31, 2019.
- Complete Draft Plans and Specifications by June 30, 2021.
- Complete Final Plans and Specifications by December 31, 2021.
- Begin Construction by July 1, 2022.
- Complete Construction by September 30, 2025.
- Achieve Controlled Status by September 30, 2026.

This proposed Project, as outlined in these discrete steps, will achieve the goal of controlling CSOs from the Vine Basin, as required by the Consent Decree and applicable environmental regulations.

This SEPA checklist analyzes the potential Project-specific environmental impacts that could result from construction and operation of the recommended alternative.

Project Description

The proposed Project would control the frequency of Vine Basin CSOs by increasing combined sewer system conveyance capacity upstream of an existing CSO Control Structure. It would also establish a new discharge connection to King County's Elliott Bay Interceptor. The Project would increase peak flows and total discharged flows to King County's Elliott Bay Interceptor, which would reduce the flow managed by the existing CSO Control Structure. The combined sewer system currently experiences a CSO event when the hydraulic grade line in the existing

Alaskan Way sewer and CSO Control Structure are elevated above the CSO overflow weir elevation. The Project would provide additional conveyance capacity by adding a new sewer in Elliott Avenue and diversion structure upstream of the CSO Control Structure to divert flows away from the existing CSO Control Structure. This delays the hydraulic grade line from rising above the CSO weir elevation, resulting in a reduction in CSO event frequency.

Proposed Project Elements:

- Installation of approximately 1,800 linear feet of new 24-inch-diameter gravity sewer pipe and other appurtenances, such as maintenance holes, within Elliott Avenue, from Vine Street to Bay Street
- Installation of a new connection to King County's existing Elliott Bay Interceptor
- Construction of a new sewer diversion vault and weir at the crossing of the existing sewer line at the intersection of Vine Street and Elliott Avenue

The following Project elements may be required by Seattle Department of Transportation's restoration requirements and/or coordinated with other City agencies throughout design:

- Improvements to existing curb ramps within the Project corridor, consistent with Americans with Disabilities Act (ADA) specifications
- Green Stormwater Infrastructure (such as bioretention facilities within existing planter strips in the ROW)
- Installation of flexible porous surface treatment within existing tree pits along the Project corridor
- Potential improvements to street lighting and pedestrian crossings

Project Construction

Project construction would be completed entirely within the ROW of Elliott Avenue through open trench construction. Work would occur in one-block increments to minimize traffic and community impacts; once installation of the proposed CSO control improvements is complete for a respective block, the pavement would be temporarily restored, and parking spaces/drive lanes would be restriped. Once construction of all CSO control improvements is complete, the impacted pavement would be restored per the Seattle Department of Transportation's street restoration requirements, which may include additional right-of-way improvements (ADA curb ramps, bioretention facilities, tree pit covers, and lighting/pedestrian crossing improvements, if applicable). Construction is anticipated to last approximately 12 to 16 months.

SPU or SPU's Contractor may lease space within proximity to the Project area to support construction staging and laydown. Properties that do not have a current active use or existing vertical structures are most likely to be used in this capacity. The lease would require that the site be restored to preconstruction conditions or better following completion of the Project.

Project Operation

Operations and maintenance (O&M) of the completed Project is anticipated to be consistent with SPU's existing gravity sewer infrastructure, which requires annual maintenance, and inspection every 10 years with a closed-circuit television (CCTV) to further evaluate conditions. No sewer solids handling is anticipated to be required, as solids would be conveyed to the West Point Wastewater Treatment Plant with the sewer flows. If solids do build-up, they would be removed using a Vactor Truck and disposed of at an approved location.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The Project is within the ROW of Elliott Avenue, from its intersection with Bay Street to its intersection with Vine Street. The Project corridor is located within the NE quarter of Section 36, Township 25N, Range 3E; and NW quarter of Section 31, Township 25N, Range 4E of the Willamette Meridian. There is no street address available for the Project corridor. The following attachments provide additional detail:

Attachment A – Vicinity Map
Attachment B – Site Plan

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site: *[Check the applicable boxes]*

☒ Flat ☐ Rolling ☐ Hilly ☐ Steep Slopes ☐ Mountainous
☐ Other: (identify)

The Project corridor is approximately 1,800 linear feet in length and is composed entirely of developed ROW. According to the SDCI GIS Mapping Application, topography within the Project corridor is generally flat, with little to no discernable slope.

Additional information on geology and soils is found in the Geology and Soils Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

b. What is the steepest slope on the site (approximate percent slope)?

The Project corridor is flat, with little to no discernable slope.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Over the last century, urban development in the Project area has resulted in a predominance of disturbed native soils/sediments, cut slopes, and large placements of fill material. The entire Project area has been developed and disturbed in this way. Due to the developed conditions of the Project area, there are no existing soils suitable for agriculture and no agricultural lands. Additional information on geology and soils is found in the Geology and Soils Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe:

According to the SDCI GIS Mapping Application, a portion of the Project corridor is located within a liquefaction-prone area. Additional information on seismic issues and slope stability is found in the Geology and Soils Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate the source of fill.

Construction of the proposed Project would require excavation of approximately 7,000 cubic yards of material as part of the proposed open trench construction. Excavated areas would be backfilled with stockpiled material once the new sewer pipe and other improvements have been installed. Approximately 2,500 cubic yards of pipe bedding, aggregate, and other fill material would also be imported to provide adequate base for this infrastructure.

Material that requires export would be disposed of at a City-approved upland location or used as fill material (if determined suitable) at sites approved for filling and grading. Imported fill material would be clean and obtained from an approved local supplier.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe:

Given the construction approach and the urban setting, no significant erosion is anticipated during or as a result of SPU's proposed work. To minimize the potential for erosion, the contractor will implement erosion and sediment control best management practices (BMPs) contained within a Project-specific Construction Stormwater and Erosion Control (CSEC) Plan and a Tree, Vegetation, and Soil Protection (TVSP) Plan.

The completed Project would not increase the potential for erosion because the type of surface and use of the Project area would not change. Once Project construction is complete, disturbed areas would be restored to preconstruction conditions or better.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

The Project corridor is almost entirely covered with impervious asphalt or concrete surfaces (exception being the limited street tree pits and planter strips along Elliott Avenue). Surfaces disturbed by Project construction would be replaced with impervious asphalt or concrete surfaces. No discernable change in impervious surface area would occur as a result of the completed Project.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

To reduce and control erosion during construction, the contractor will be required to implement BMPs identified within a Project-specific Stormwater Pollution Prevention Plan (SWPPP), CSEC Plan, and TVSP Plan. In addition, if the contractor elects to treat and discharge stormwater to Elliott Bay during construction, the contractor will be responsible for complying with Ecology's NPDES CSGP. No other earth impacts are anticipated to result from construction or operation of the proposed Project.

2. Air

a. What types of emissions to the air would result from the proposal [*e.g.*, dust, automobile, odors, industrial wood smoke, greenhouse gases (GHG)] during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Mobile and stationary equipment would be used for project construction, thus generating emissions due to the combustion of gasoline and diesel fuels (such as oxides of nitrogen, carbon monoxide, particulate matter and smoke, uncombusted hydrocarbons, hydrogen sulfide, carbon dioxide, and water vapor). Emissions during construction could also include dust from grading activities and exhaust (carbon monoxide, sulfur, and particulates) from construction equipment; these emissions are expected to be minimal, localized, and temporary.

The proposed project would produce greenhouse gases (GHGs) in three ways: embodied in the proposed gravel aggregate, paving and concrete work; through construction activity (as described above); and during regular operation, maintenance, and monitoring activities. Total GHG emissions for the proposed project are estimated to be approximately 5,084.06 metric tons of carbon dioxide emission ($MTCO_2e$); however, approximately 93.5 percent of this total would be generated by GHG's embodied in the proposed gravel aggregate, paving and concrete. GHG emissions embodied in the gravel aggregate, paving and concrete would be spread out over the 100-year design life of the constructed project. The GHG emission calculations are shown in Attachment C and described in the table below. One metric ton is equal to approximately 2,205 pounds. Also, the embodied energy in other materials (such as ductile iron pipe) used in this project has not been estimated for purposes of this SEPA environmental review due to the difficulty and inaccuracy of calculating those estimates.

The proposed project would also generate GHG emissions during operation, maintenance, and monitoring. The estimated emissions are based on the assumed emissions that would be generated annually. The estimated average GHG emissions generated from operations, maintenance, and monitoring over the 100-year design life of the constructed project is 157.51 $MTCO_2e$.

Summary of Greenhouse Gas Emissions

Activity/Emission Type	GHG Emissions (pounds of CO_2e)[1]	GHS Emissions (metric tons of CO_2e)[1]
Paving and Concrete	10,480,668	4,754
Construction Activities (Diesel)	310,423	140.81
Construction Activities (Gasoline)	69,984	31.74
Long-term Maintenance (Diesel)	N/A	N/A
Long-term Maintenance (Gasoline)	347,247	157.51
Total GHG Emissions	11,208,322	5,084.06

[1] Note: 1 metric ton = 2,204.62 pounds of CO_2e. 1,000 pounds = 0.45 metric tons of CO_2e

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

There are no known off-site sources of emissions or odors that could negatively affect the proposed Project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

During construction, impacts to air quality would be reduced and controlled through implementation of standard federal, state, and local emission control criteria and City construction practices. These would include requiring the contractor to use the best available control technologies, proper vehicle maintenance, and minimizing vehicle and equipment idling. In addition, the contractor will implement dust control measures during earthwork, including but not limited to street sweeping, water application to exposed soil surfaces, and covering of soil stockpiles to minimize fugitive dust.

3. Water

a. Surface:

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If so, describe type and provide names. If appropriate, state what stream or river it flows into.

The Project area is paved. There are no surface waterbodies within the Project corridor. The nearest surface waterbody is Elliott Bay, located approximately 300 feet to the southwest of the Project corridor.

(**2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If so, please describe, and attach available plans.**

The proposed Project would not require work within 200 feet of Elliott Bay, which is the nearest surface waterbody to the Project corridor.

(3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands, and indicate the area of the site that would be affected. Indicate the source of fill material.

The proposed Project would not require filling or excavation of any surface water.

(4) Will the proposal require surface water withdrawals or diversions? If so, give general description, purpose, and approximate quantities if known.

The proposed Project would not require surface water withdrawals or diversions.

(5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

The Project corridor does not lie within a designated 100-year floodplain.

(6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The proposed Project would not create a new discharge point of waste materials to surface waters. However, the Project purpose is to reduce the frequency of CSO events that currently occur from the Vine Basin. CSOs are a source of water pollution that can result in temporary increases in bacterial counts, odors, aesthetic degradation of shorelines, adverse effects on sediment quality, and increased public health concerns in areas where there is potential for public contact. The proposed Project would reduce the number and volume of those CSOs and thereby improve water quality of the nearby surface water.

b. Ground:

(1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

During Project construction, groundwater is expected to be withdrawn from the open trenches given the anticipated excavation depths of up to 16 feet and the anticipated elevation of the groundwater table. Collected groundwater is expected to be treated and discharged to the King County sewer system, following receipt of a King County Industrial Wastewater Discharge Permit. Groundwater would be treated before discharge. The contractor may also elect to treat and discharge water to Elliott Bay, in accordance with a CSGP. The volumes, quality, and ultimate disposition of collected groundwater are not known at this time.

The completed Project would not require the use of groundwater.

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals…; agricultural, *etc.*). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

The proposed Project would not require discharge of any waste material to groundwater.

c. Water Runoff (including storm water):

(1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Stormwater runoff within the Vine Basin is generated from upstream streets, sidewalks, driveways, and impervious areas from privately and publicly owned improvements. Stormwater is collected by inlets and catch basins throughout Vine Basin. The Basin is divided into two separate sub-basins: the "lower basin" located west of Western Avenue and the "upper basin" located east of Western Avenue. Dry weather flows in the "upper basin" are collected in a combined sewer within Western Avenue that conveys flows north and discharges to the King County Denny Way Interceptor, which conveys flows to the King County Denny Regulator. The "lower basin" collects dry weather flows and conveys them through a 48-inch diameter sewer that crosses beneath the BNSF Railroad Tracks along Alaskan Way. Flows then pass through a CSO Control Structure to the combined sewer in Alaskan Way, which flows north and ultimately discharges to the King County Elliott Bay Interceptor. The King County Elliott Bay Interceptor also conveys flows to the King County Denny Regulator. The King County Denny Regulator pumps flows to the King County's West Point Wastewater Treatment Plant (WWTP).

During wet weather events, the combined sewage levels in the pipes within Western Avenue rise. As the sewage levels rise, four high-flow paths along Western Avenue allow excess flow to pass from the "upper basin" into sewer infrastructure in the "lower basin." The four high-flow paths are located at the intersections of Western Avenue and Bell Street, Vine Street, Cedar Street, and Broad Street. These high flows paths are elevated sewer connections or weirs. As the combined sewage level in the Alaskan Way sewer rises, the level within the CSO Control Structure also rises. If the level rises above the elevation of the CSO weir located in the CSO Control Structure, a CSO event is triggered and flows discharge to Elliott Bay via CSO Outfall 69.

The proposed Project would change how flows from the "upper basin" and portions of the "lower basin" are conveyed to the King County Elliott Bay Interceptor. Dry weather flows in the Vine Street sewer (flowing from the east to the west) would be directed into the proposed sewer line in Elliott Avenue. Additionally, sewer flows in Elliott Avenue to the south of Vine Street would also be directed into the proposed sewer line within Elliott Avenue. A diversion vault would be constructed at the intersection of Vine Street and Elliott Avenue and would redirect the two existing sewers into the proposed Elliott Avenue sewer line. During a wet weather event, a weir in the proposed diversion vault would allow high flows to continue down the Vine Street sewer into the CSO Control Structure and Alaskan Way sewer, matching the current flow path. The rest of Vine Basin would continue to operate as before. These improvements would reduce the frequency and volume of CSO discharges to Elliott Bay. Additional details are provided in the *Central Waterfront (Basin 69) CSO Control Project Draft Engineering Report* (June 2019).

Stormwater runoff may need to be managed during construction of the proposed Project to prevent sediment from entering and leaving the construction site. Any precipitation falling on the construction site would be contained on-site and either allowed to infiltrate or collected and then treated before being discharged to a combined sewer or surface water.

(2) Could waste materials enter ground or surface waters? If so, generally describe.

The potential for waste materials to enter ground or surface waters would be low, given that all construction work is expected to take place within the ROW. However, the contractor will be required to implement BMPs identified in a Project-specific SWPPP or CSEC Plan to avoid or minimize this risk. Additionally, groundwater and stormwater in the Project area would be collected and treated during Project construction, prior to discharge.

(3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

The proposed Project would be constructed within the ROW of Elliott Avenue. Existing concrete and pavement would be restored consistent with original conditions where construction has occurred. The Project would not increase the amount of impervious surfaces currently present within the Project corridor. Therefore, drainage patterns in the vicinity of the Project corridor would remain the same as the existing conditions.

The flow paths for stormwater in the combined sewer conveyance system within the Vine Basin would be altered by the completed Project, consistent with the description provided in Section B.3.c.1 above. The purpose of these modifications is to achieve the aforementioned CSO performance standard.

d. Proposed measures to reduce or control surface, ground, runoff water, and drainage impacts, if any:

A fundamental goal of the proposed Project is to reduce the frequency and volume of CSOs from the Vine Basin. The proposed Project would reduce the frequency and volume of CSO events and improve water quality of the nearby surface water (Elliott Bay). Typical open trenching construction methods are anticipated, and no adverse impacts to surface waters or groundwater are expected. The contractor will be required to comply with BMPs identified in a Project-specific SWPPP or CSEC Plan and, if applicable, the Ecology NPDES CSGP.

4. Plants

a. Types of vegetation found on the site: *[check the applicable boxes]*

☒ Deciduous trees:	☐ Alder	☐ Maple	☐ Aspen	☐ Other: (identify)
☒ Evergreen trees:	☐ Fir	☒ Cedar	☐ Pine	☐ Other: (identify)
☒ Shrubs				
☒ Grass				
☐ Pasture				
☐ Crop or grain				
☐ Orchards, vineyards, or other permanent crops				
☐ Wet soil plants:	☐ Cattail	☐ Buttercup	☐ Bulrush	☐ Skunk cabbage
☐ Other: (identify)				
☐ Water plants:	☐ water lily	☐ eelgrass	☐ milfoil	☐ Other: (identify)
☐ Other types of vegetation: (identify)				

Vegetation found within and near the Project corridor is consistent with vegetation common of an urban setting. Vegetation is generally limited to landscaped trees, shrubs, and grasses located within planter strips or tree pits within the Elliott Avenue ROW.

b. What kind and amount of vegetation will be removed or altered?

There are no plans to remove existing vegetation within the Project corridor.

c. List threatened or endangered species known to be on or near the site.

No federally listed endangered or threatened plant species or state-listed sensitive plant species are known to occur within the urban environment of downtown Seattle and the Project area.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Bioretention cells would be constructed within the Project corridor, in existing planter strips. Native plants would be used for these facilities. Existing vegetation within the Project corridor will be protected during construction by the contractor, through adherence to a TVSP Plan.

e. List all noxious weeds and invasive species known to be on or near the site.

Construction would occur within the paved ROW, which is not suitable habitat for noxious weeds or invasive species. In addition, vegetated areas within the Project corridor are landscaped and maintained to eliminate/control the growth of noxious weeds or invasive species.

5. Animals

a. List any birds and other animals that have been observed on or near the site or are known to be on or near the site: *[check the applicable boxes]*

Birds:	☒ Hawk	☐ Heron	☒ Eagle	☒ Songbirds
☒ Other: pigeon, crow, seagull				
Mammals:	☐ Deer	☐ Bear	☐ Elk	☐ Beaver
☒ Other: possum, rat				
Fish:	☐ Bass ☐ Salmon	☐ Trout	☐ Herring	
☐ Shellfish	☐ Other:			

Fauna within the Project corridor are those adapted to urban environs.

b. List any threatened or endangered species known to be on or near the site:

The proposed Project is more than 300 feet east of Elliott Bay. There are several Endangered Species Act-listed species within the Elliott Bay. While these species occur within the general vicinity of the Project corridor, Project construction and operation would not occur within the regulatory buffer for Elliott Bay, and therefore, no adverse impacts are expected as a result of the proposed Project.

c. Is the site part of a migration route? If so, explain.

The Puget Sound region is known to be an important migratory route for many animal species. Portions of the Seattle downtown waterfront area may be part of migratory corridors for bald eagles and other bird species traveling to and from foraging areas in Puget Sound or Lake Washington. Bull trout; steelhead; and chinook, chum, pink, and coho salmon use the Puget Sound nearshore. The Puget Sound region is also within the Pacific Flyway—a flight corridor for migrating waterfowl, migratory songbirds, and other birds. The Pacific Flyway extends from Alaska to Mexico and South America.

d. Proposed measures to preserve or enhance wildlife, if any:

The proposed Project would not result in adverse impacts to wildlife or their environs; therefore, measures to preserve or enhance wildlife are not included.

e. List any invasive animal species known to be on or near the site.

Many invasive animal species are found within the City. However, the Project corridor is entirely paved and does not support habitat for noxious or invasive animal species.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, *etc.*

The completed CSO control improvements would not require any supplementary energy to operate because they would rely on gravity-driven flow. However, SPU currently uses minor amounts of electricity to monitor flows in this part of its existing combined sewer system and would continue to do so for the completed Project. If it is determined through coordination with SDOT that pedestrian lighting/crossing improvements are warranted, the Project would require limited use of electricity to power these improvements. The improvements to pedestrian lighting/crossing throughout the Project area would be typical of an urban environment.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

Most of the completed Project would be buried, with few components constructed above ground surface. Portions of the Project that would be constructed above ground surface (lighting/crossing improvements, bioswales, curb ramps, etc.) would not interfere with adjacent properties' usage of solar energy due to their low or narrow profiles.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The proposed Project would not result in adverse energy or natural resource impacts; therefore, measures to reduce or control energy impacts are not included in the Project design.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe:

During construction of SPU's proposed Project, small amounts of materials present may include gasoline and diesel fuels, hydraulic fluids, oils, lubricants, solvents, paints, and other chemical products. A spill of one of these chemicals could potentially occur during construction as a result of either equipment failure or worker error. Also, contaminated soils, sediments, or groundwater could be exposed during excavation. If disturbed, contaminated substances could expose construction workers and potentially other individuals in the vicinity through blowing dust, stormwater runoff, or vapors.

SPU's completed Project would convey combined sewage and stormwater flows as part of an existing conveyance system. The completed Project would not create any new exposure to environmental health hazards and would reduce the number and volume of CSO discharges.

(1) Describe any known or possible contamination at the site from present or past uses.

Existing environmental data indicate that, in general, soil and groundwater contamination is present throughout the urban waterfront area of downtown Seattle. Historical and current land uses in the Project area include industrial, commercial, and residential activity. Previous industrial uses in this area include metal works, foundries and plating operations, machine shops, warehouses, and fueling facilities. In the downtown area, commonly encountered contaminants include metals, solvents, and petroleum products. A high-level review of geotechnical reports from other projects determined that more than 50 percent of the boreholes/monitoring wells along Elliott Avenue indicated the presence of hydrocarbons. However, contamination found in the area is generally less than levels of concern for soil and groundwater. Additional information on historical land uses and contaminated materials is found in the Contaminated Materials Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

(2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

Elliott Avenue contains natural gas lines, which would be a consideration during construction. Ground disturbance would occur in proximity to the natural gas utility corridor. Hazardous conditions could occur in the event that Project construction unexpectedly encounters these utilities.

No known hazardous chemicals/conditions could affect Project development and design.

(3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

Construction of the proposed Project would require use and storage of relatively small amounts of materials such as gasoline and diesel fuels, hydraulic fluids, oils, lubricants, solvents, paints, and other chemical products. No toxic or hazardous chemicals would be stored, used, or produced at any time during the operating life of the Project.

(4) Describe special emergency services that might be required.

Fire and medical response services may be required in the event of an emergency during construction or operation/maintenance of the proposed Project. However, the completed Project would not result in higher levels of special emergency services than already exist at the Project location.

(5) Proposed measures to reduce or control environmental health hazards, if any:

A Phase 1 site assessment would be completed prior to construction to evaluate the presence and possible sources of contaminated soil or groundwater. If contaminated materials are encountered during construction, these materials would be segregated and removed from the site for proper disposal at a Subtitle D-permitted landfill. The removal and disposal of contaminated material encountered during construction would result in beneficial effects related to soil and groundwater quality in the Project area.

The contractor will be required to comply with City-approved CSEC Plan and a Fugitive Dust Control Plan; potentially obtain coverage under and comply with the NPDES CSGP; develop and implement a City-approved Spill Prevention, Control, and Countermeasures Plan that addresses handling and disposal of known and unanticipated contamination of soil and groundwater; and develop and comply with a City-approved Hazardous Materials Spill Prevention and Management Plan during construction. Any soils contaminated by spills during construction would be excavated and disposed of in a manner consistent with the level and type of contamination, in accordance with federal, state, and local regulations.

As required by the Washington Department of Labor and Industries (WAC 296-843), the contractor will be required to prepare a City-approved Health and Safety Plan prior to work commencing. The plan would address proper employee training, use of protective equipment, contingency planning, and secondary containment of hazardous materials. In work areas with known contamination in soil, sediment, and groundwater, workers would be required to be Hazardous Waste Operation and Emergency Response-certified (40-hour HAZWOPER Certification [29 CFR and WAC 296-843]), which is required for individuals involved in cleanup of uncontrolled hazardous waste sites.

b. Noise

(1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

There are no existing sources of noise that would affect the proposed Project.

(2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Project construction would result in a short-term increase of noise levels within the Project area. This temporary increase in noise levels would result from construction equipment and practices within the Project corridor. Short-term noise from construction equipment would largely be within the allowable maximum levels of the City’s Noise Control Ordinance (SMC Chapter 25.08); noise monitoring would occur to ensure compliance with the maximum permissible noise levels. Within the allowable maximum levels, SMC 25.08 permits noise from construction equipment between the hours of 7 a.m. and 7 p.m. weekdays, and 9 a.m. and 7 p.m. weekends and legal holidays. Some construction activities, such as saw cutting, may temporarily exceed the maximum permissible noise levels. In these discrete cases, which may amount to 40 days over the course of construction, a noise variance would be acquired for the proposed work.

Long-term, the completed Project would not produce noise discernable over the existing background noise of the Project’s urban setting.

(3) Proposed measures to reduce or control noise impacts, if any:

Construction equipment would be muffled in accordance with the applicable laws. Noise monitoring would be implemented to ensure that Project construction remains in compliance with the maximum permissible noise limitations prescribed in SMC Chapter 25.08. A noise variance would be acquired in the discrete cases when prescriptive noise limitations are expected to be exceeded.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The Project corridor is composed of the right of way of Elliott Avenue. Adjacent land uses include park, multi-family residential, office, retail/service, and other uses. More information on land uses of the adjacent properties is found in the Land Use, Shorelines, and Parks and Recreation Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS. The proposed Project would not affect current land uses on nearby or adjacent properties.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

There are no working farms or forest lands on or near the Project corridor.

(1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how?

The proposed Project would not be affected by normal business operations of working farms or forest lands as there are no designated agricultural or forest lands in the City.

c. Describe any structures on the site.

The Project corridor is composed of Elliott Avenue right of way. Structures within the Project corridor are limited to traffic signals, wayfinding, below-grade maintenance holes, below-grade vaults and pedestrian amenities (lighting/crossing, etc.). Adjacent properties contain a wide array of structures consistent with the urban development of downtown Seattle.

d. Will any structures be demolished? If so, what?

The proposed Project would require pavement/concrete cutting to access the underlying utility corridor and to modify existing curb ramps within Elliott Avenue. Existing utilities are not expected to require relocation or removal. No other demolition/alteration of existing structures would occur.

e. What is the current zoning classification of the site?

Per SMC 23.30.020 zoning boundaries extend to the center line of public rights of way. Therefore, the Project corridor contains a mixture of downtown mixed-use zones such as downtown mixed commercial, residential, and harbor front.

f. What is the current comprehensive plan designation of the site?

The Project corridor is located within the downtown comprehensive plan designation, largely within the "downtown mixed residential/commercial." More information on current comprehensive plan designations is found in the Land Use, Shorelines, and Parks and Recreation Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

g. If applicable, what is the current shoreline master program designation of the site?

The Project corridor is located more than 200 feet from the nearest regulated water body and does not lie within City shoreline master program jurisdiction.

h. Has any part of the site been classified as an "environmentally critical" area? If so, specify.

A majority of the Project corridor would be located directly adjacent to a liquefaction prone delineated area, an environmentally critical area as identified and mapped by SDCI's GIS Mapping Application. However, approximately 650 feet of the westernmost portion of the Project corridor is mapped within the liquefaction prone area.

i. Approximately how many people would reside or work in the completed project?

The proposed Project is a utility improvement project; no people would reside or work within the completed Project.

j. Approximately how many people would the completed project displace?

No people would be displaced by the proposed Project.

k. Proposed measures to avoid or reduce displacement impacts, if any:

The proposed Project would not result in displacement impacts; therefore, no avoidance or reduction measures are proposed.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed Project is a utility improvement project. No land use compatibility impacts would occur; therefore, no additional measures other than obtaining pertinent permit approval to conduct the proposed work would occur.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

The Project would have no effect on agriculture or forest lands; therefore, no impact control or reduction measures are proposed.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

The proposed Project does not include the construction of housing units.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

The proposed Project would not eliminate existing housing units.

c. Proposed measures to reduce or control housing impacts, if any:

No housing impacts would occur; therefore, the proposed Project does not include housing impact reduction or control measures.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas? What is the principal exterior building material(s) proposed?

The proposed CSO control improvements would occur within the subsurface of Elliott Avenue; however, the proposed Project includes lighting/pedestrian crossing improvements. Lighting/pedestrian crossing improvements would be mounted on metal poles along the Project corridor. Exact locations/configurations for these improvements have yet to be determined.

b. What views in the immediate vicinity would be altered or obstructed?

The viewshed within the Project corridor would be temporarily altered during Project construction. However, these impacts would be limited to the duration of construction. Long-term, the viewshed would be slightly improved through the installation of bioretention cells within existing planter strips.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Project construction would occur in one-block phases. This allows for temporary pavement/concrete restoration and restriping to occur before work progresses further along the Project corridor. Once all CSO control improvements are installed, the Project corridor would be permanently resurfaced and restriped. No other aesthetic reduction or control measures are proposed as only short-term construction impacts would occur.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Most of the Project construction would occur during daylight hours. Work conducted in low light conditions would require artificial lighting to ensure worker safety. To minimize potential spillover from this lighting, the lights would be downcast and focused on the construction zone. Construction lighting may increase ambient light conditions within the immediate Project area but impacts to sensitive receivers are not anticipated.

Long-term light and glare impacts are not anticipated. Interagency coordination with SDOT may result in the addition of lighting/pedestrian crossing improvements throughout the Project corridor; however, these improvements would be consistent with typical conditions throughout the downtown urban environment and would not result in an adverse impact.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

The proposed CSO control improvements would not result in the production of light or glare. If minor lighting/pedestrian crossing improvements are included in the scope of work, these improvements would not result in light or glare impacts; rather, these improvements would increase pedestrian safety along the Project corridor.

c. What existing off-site sources of light or glare may affect your proposal?

The proposed Project consists of subsurface utility improvements, curb ramp modifications, installation of bioretention cells, pedestrian lighting/crossing improvements, and the addition of flexible porous pavement within existing tree wells. These Project components would not be affected by existing sources of light or glare.

d. Proposed measures to reduce or control light and glare impacts, if any:

No adverse light or glare impacts would result from the completed Project; therefore, no reduction or control measures are proposed.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

The proposed Project would be constructed adjacent to the Olympic Sculpture Park and near the Belltown Cottage Park. The Project area is also located in the vicinity of the Elliott Bay Trail, multiple piers extending into Elliott Bay, and Puget Sound, all of which provide recreation opportunities. More information on those resources is found in the Land Use, Shorelines, and Parks and Recreation Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

b. Would the proposed project displace any existing recreational uses? If so, describe.

The proposed Project would temporarily disrupt pedestrian use and access to bike lanes one block at a time. Additionally, SPU might reach an agreement with Seattle Parks and Recreation to temporarily utilize portions of the Olympic Sculpture Park as a construction staging/laydown area during Project construction, if other staging options are not considered viable. If SPU were to utilize this park land, temporary recreational impacts would occur, as a portion of the Olympic Sculpture Park would be inaccessible to park users.

Post-construction, recreational opportunities would be consistent with existing conditions as the Elliott Avenue right of way and Olympic Sculpture Park (if used for staging/laydown) would be restored to original conditions or better once Project construction is complete.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Construction of the proposed Project would require temporary lane closures and establishment of detours. Such closures and detours would comply with relevant policies administered by SDOT as part of its Street Use permitting process. There are numerous route alternatives for pedestrians, joggers, and bicyclists in the neighborhood. Portions of Elliott Avenue disturbed by Project construction, and if applicable, any staging areas established within park space, would also be restored to original conditions or better. Permanent displacement of existing recreational resources would not occur.

13. Historic and Cultural Preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers? If so, specifically describe.

According to the Washington State Department of Archaeology & Historic Preservation Washington Information System for Architectural and Archaeological Records Data (WISAARD), there is one resource within the immediate vicinity of the Project corridor that is determined eligible for listing (Ainsworth & Dunn Warehouse). Other resources that are in the general Project area, approximately 250 feet from the Project corridor, have yet to receive an eligibility determination. More information regarding historic and cultural resources in the Project area can be found in the Cultural Resources Assessment Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

As stated above, the Ainsworth & Dunn Warehouse (determined eligible for listing) is located adjacent to the Project corridor. However, according to the Seattle Department of Neighborhoods Landmarks Map, there are no designated landmarks within the Project corridor. The nearest landmarks are the William Tell Hotel and Bell Building, located more than 1,000 feet from the Project corridor on Battery Street.

Based on the historical and cultural setting of the Project area, if excavation extended into native soils, pre-contact Native American and historical period artifacts or sites could be encountered. However, it is unlikely that native soils would be encountered during construction. According to the Cultural Resources Assessment Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS, the average fill depth in the Project area from Broad Street south to Vine Street is approximately 23.8 feet below ground surface; Project construction is not anticipated to extend below 16 feet below ground surface. More information can be found in the Cultural Resources Assessment Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the Department of Archaeology and Historic Preservation, archaeological surveys, historic maps, GIS data, *etc.*

SDOT issued a SEPA FEIS on March 14, 2013 for the Elliott Bay Seawall Project. The FEIS was supported by a Cultural Resource Assessment prepared by SWCA Consultants and Mimi Sheridan. This document was previously incorporated by reference into this Environmental Checklist (see Section A.8).

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

The proposed Project would not affect buildings or known cultural resources. Only soils beneath Elliott Avenue within the Project corridor would be affected by construction. There are no documented historic or cultural resources beneath this portion of Elliott Avenue.

The proposed Project is located on previously disturbed and filled upland areas of the City. The Project's location on previously disturbed and filled ground reduces the likelihood of encountering contextually significant archaeological resources. It is anticipated that excavations could reach depths of approximately 16 feet deep; at this depth, it is not anticipated that native soils would be encountered. However, the contractor will implement measures from a Project-specific Inadvertent Discovery Plan to protect unknown resources during construction. Should evidence of cultural artifacts or human remains, either historic or prehistoric, be encountered during excavation, work in that immediate area would be suspended and the find would be examined and documented by a professional archaeologist. Decisions regarding appropriate mitigation and further action would be made at that time.

14. Transportation

a. Identify public streets and highways serving the site or affected geographic area, and describe proposed access to the existing street system. Show on site plans, if any.

The proposed Project is located within the public ROW of Elliott Avenue and its intersection with Bay, Broad, Clay, Cedar, and Vine Streets. To accommodate construction, one traffic lane on Elliott Avenue would be open at all times. Where construction work overlaps with the intersections mentioned above, detours would be provided to mitigate for temporary accessibility impacts.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

Downtown Seattle is served by numerous Metro public transit routes, although no route currently uses the portion of Elliott Avenue that comprises the Project corridor. The nearest transit stops are located near the intersection of Denny Way and 1st Avenue, approximately 600 feet to the north of the Project corridor.

c. How many additional parking spaces would the completed project or nonproject proposal have? How many would the project or proposal eliminate?

The completed Project would not create any new parking spaces; no existing parking spaces would be permanently displaced. Construction would temporarily eliminate on-street parking spaces; however, the one-block construction phasing would limit temporary on-street parking impacts to approximately 3 months per block. Specific timing and duration of parking and lane closures are not known at this time, but such closures would comply with relevant policies administered by SDOT as part of its Street Use permitting process.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

The proposed Project includes restoration of the portion of Elliott Avenue impacted by construction, to pre-construction conditions or better. Minor improvements to the public right of way would also occur. These include ADA improvements to existing curb ramps, installation of bioretention facilities, placement of porous pavement within existing tree wells, and potentially minor lighting/pedestrian crossing improvements (to be determined through coordination with SDOT).

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The proposed Project is located near the Seattle Waterfront at Elliott Bay, which is used by ferries, cruise ships, and commercial vessels. In addition, BNSF owns and operates a railway approximately 160 feet to the southwest of the Project corridor. The proposed Project would not require use of, or interfere with, these transportation resources.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

The completed Project would produce minimal vehicle trips. Vehicle trips would be produced only during monitoring/maintenance of completed Project. This would result in approximately one annual roundtrip to the Project corridor (anticipated to be an existing SPU maintenance vehicle used for these purposes). Every 10 years, SPU crews would inspect the pipes with a closed-circuit television to evaluate conditions by way of video surveillance. This could require a total of two additional roundtrips for that year. These trips would likely occur during business hours (between 7 a.m. and 6 p.m.) on weekdays. Monitoring and maintenance would occur over the constructed Project's 100-year lifespan.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

Neither the proposed Project nor its construction would interfere with, affect, or be affected by the movement of agricultural and forest products on roads or streets.

h. Proposed measures to reduce or control transportation impacts, if any:

The construction-related transportation impacts of the proposed Project would be controlled through implementation of the following:

- The contractor will adhere to a City-approved, Project-specific Traffic Control Plan, prepared in accordance with SDOT's Traffic Control Manual.
- Project construction would occur in one-block phases. Pavement restoration/ restriping would occur after installation of the proposed CSO control improvements is complete per each one-block phase. This would ensure that conditions could be restored to the greatest extent practicable for blocks where construction is complete.
- The proposed right of way work would be reviewed and approved by SDOT prior to commencement of Project construction to ensure that impacts to the transportation network are within appropriate limits.
- Construction would be implemented in a way that avoids full closure of any block so through traffic could be maintained. Where work would occur within an intersection, a detour would be provided.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

The proposed Project is not expected to create an increased need for public services. Project construction would always be required to accommodate emergency access for buildings accessed via the Project corridor. Emergency access would comply with relevant policies administered by SDOT as part of its Street Use permitting process.

b. Proposed measures to reduce or control direct impacts on public services, if any.

During construction, the Project would always be required to accommodate emergency access for structures accessed via the Project corridor. Otherwise, reduction or control measures are not included as no adverse impacts on public services would result from the proposed Project.

16. Utilities

a. Check utilities available at the site, if any: *[check the applicable boxes]*

☐ None
☒ Electricity ☒ Natural gas ☒ Water ☒ Refuse service
☒ Telephone ☒ Sanitary sewer ☐ Septic system
☐ Other:

An extensive network of utilities is located within the Project corridor. More information on public utilities is found in the Public Services and Utilities Discipline Report for the Elliott Bay Seawall Project FEIS and FSEIS.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

The proposed Project is a CSO control improvement project led by SPU that would reduce the frequency and volume of CSOs from the Vine Basin. The proposed CSO control improvements would consist of the following:

- Installation of approximately 1,800 linear feet of 24-inch-diameter gravity sewer pipe and other appurtenances, such as maintenance holes, within Elliott Avenue, from Vine Street to Bay Street
- Establishment of a new connection to King County's existing Elliott Bay Interceptor
- Construction of a new sewer diversion vault and weir at the crossing of the existing sewer at the intersection of Vine Street and Elliott Avenue

Construction of the proposed CSO control improvements would be completed through open trench construction. While relocation of existing utilities is not currently planned, if it is anticipated that vertical or horizontal spacing conflicts occur with existing utilities, relocation of these utilities may be required. This would be determined during detailed design of the proposed Project, and during construction, if necessary.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

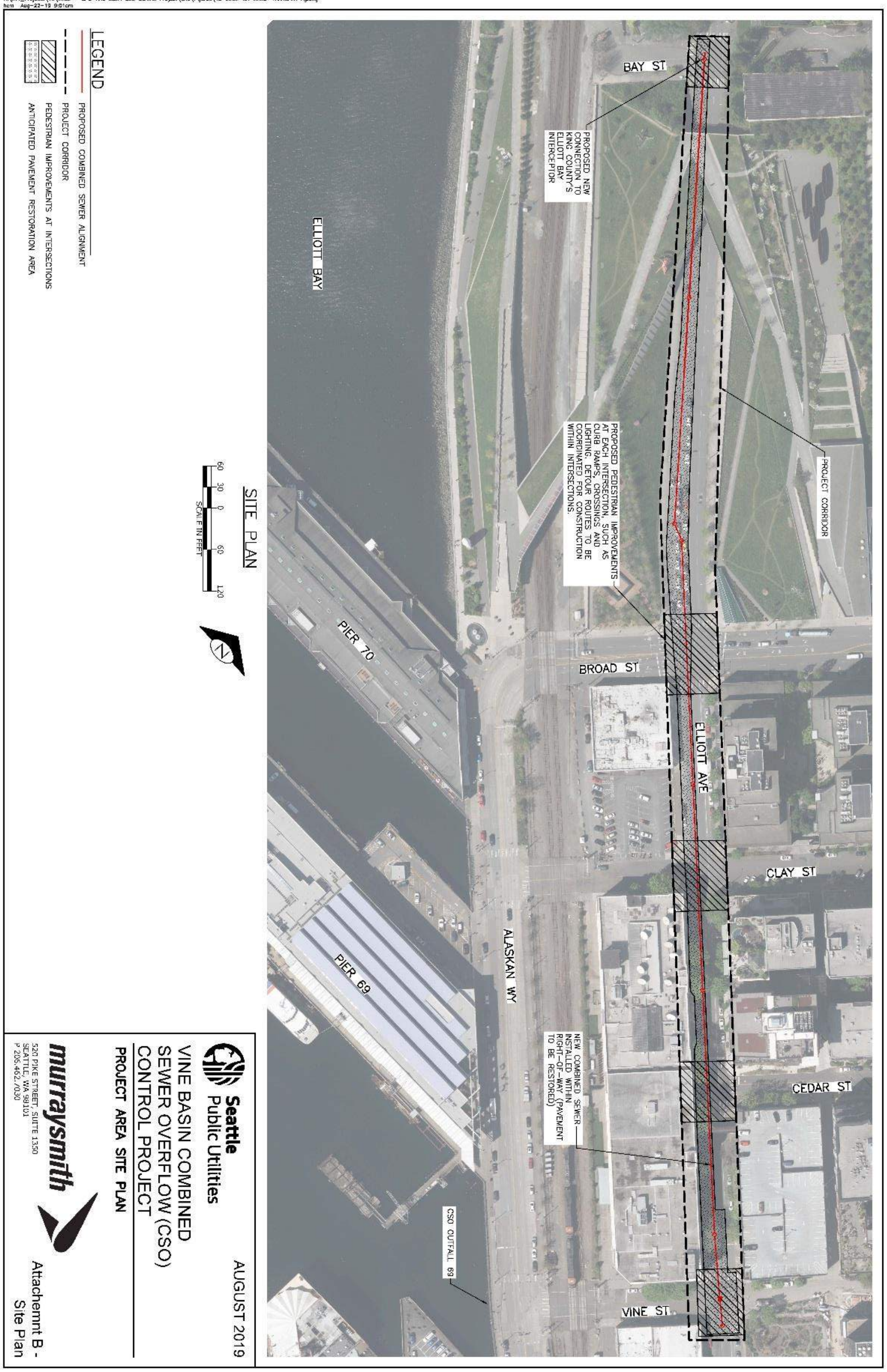
Signature: [signature] Date: 9/5/19

Shailee Sztern, PE, Project Manager

Attachment A – Vicinity Map
Attachment B – Site Plan
Attachment C – Greenhouse Gas Emissions Worksheet

Attachment A – Vicinity Map

Attachment B – Site Plan



Attachment C – Greenhouse Gas Emissions Worksheet

Section I: Buildings

			Emissions Per Unit or Per Thousand Square Feet ($MTCO_2e$)			
Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Embodied	Energy	Transportation	Lifespan Emissions ($MTCO_2e$)
Single-Family Home	0		98	672	792	0
Multi-Family Unit in Large Building	0		33	357	766	0
Multi-Family Unit in Small Building	0		54	681	766	0
Mobile Home	0		41	475	709	0
Education		0.0	39	646	361	0
Food Sales		0.0	39	1,541	282	0
Food Service		0.0	39	1,994	561	0
Health Care Inpatient		0.0	39	1,938	582	0
Health Care Outpatient		0.0	39	737	571	0
Lodging		0.0	39	777	117	0
Retail (Other than Mall)		0.0	39	577	247	0
Office		0.0	39	723	588	0
Public Assembly		0.0	39	733	150	0
Public Order and Safety		0.0	39	899	374	0
Religious Worship		0.0	39	339	129	0
Service		0.0	39	599	266	0
Warehouse and Storage		0.0	39	352	181	0
Other		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0
					TOTAL Section I Buildings	**0**

Section II: Pavement

						Emissions ($MTCO_2e$)
Pavement (street, sidewalk, asphalt patch) or concrete pad, in thousands of square feet (50 $MTCO_2e$ per 1,000 square feet of pavement)		94,500				4,725
Gravel aggregate, in cubic yards (import volume of material is converted to tons and multiplied by an emissions conversion factor of 0.0034 MTCO2e per metric ton of material; see note 1)		6,111				**29.1**
					TOTAL Section II Pavement	**4,754.1**

Section III: Construction

	Emissions ($MTCO_2e$)
(See detailed calculations below)	
TOTAL Section III Construction	**172.55**

Section IV: Operations and Maintenance

	Emissions ($MTCO_2e$)
(See detailed calculations below)	
TOTAL Section IV Operations and Maintenance	**157.51**

TOTAL GREENHOUSE GAS (GHG) EMISSIONS FOR PROJECT ($MTCO_2e$)	**5,084.16**

Attachment C – Greenhouse Gas Emissions Worksheet, continued

Section III Construction Details		
Construction: Diesel		
Equipment	**Diesel (gallons)**	**Assumptions**
Trackhoe	1,048	523.8 hours X 2 gallons per hour
Dump Truck	9,993	49,968 miles / 5 mpg
Concrete Truck	231	1,155 miles / 5 mpg
Road Roller	420	120 hours X 3.5 gallons per hour
Subtotal Diesel Gallons	11,692	
GHG Emissions in lbs CO_2e	310,423	26.55 lbs CO_2e per gallon of diesel
GHG Emissions in metric tons CO_2e	140.81	1,000 lbs = 0.45359237 metric tons

Construction: Gasoline		
Equipment	**Gasoline (gallons)**	**Assumptions**
Pick-up Trucks or Crew Vans	2,880	57,600 miles / 20 mpg (assumed Ford F-150)
Subtotal Gasoline Gallons	2,880	
GHG Emissions in lbs CO_2e	69,984	24.3 lbs CO_2e per gallon of gasoline
GHG Emissions in metric tons CO_2e	31.74	1,000 lbs = 0.45359237 metric tons

Construction Summary		
Activity	**CO_2e in pounds**	**CO_2e in metric tons**
Diesel	310,423	140.81
Gasoline	69,984	31.74
Total for Construction	380,407	**172.55**

Section IV Long-Term Operations and Maintenance Details		
Operations and Maintenance: Diesel		
Equipment	**Diesel (gallons)**	**Assumptions**
Operations and Maintenance	N/A	
Subtotal Diesel Gallons		
GHG Emissions in lbs CO_2e		26.55 lbs CO_2e per gallon of diesel
GHG Emissions in metric tons CO_2e		1,000 lbs = 0.45359237 metric tons

Operations and Maintenance: Gasoline		
Equipment	**Gasoline (gallons)**	**Assumptions**
O&M truck (CCTV)	40	2 days of O&M every 10 years, 30 miles/day, 15 mpg, 100 years
WetVac Truck	14,250	135 gallons/year to complete O&M (27 hours X 5 gallons per hour) + 7.5 gallons/year for trips to and from site (30 miles roundtrip/12 mpg X 3 trips), 100 years
Subtotal Gasoline Gallons	14,290	
GHG Emissions in lbs CO_2e	347,247	24.3 lbs CO_2e per gallon of gasoline
GHG Emissions in metric tons CO_2e	157.51	1,000 lbs = 0.45359237 metric tons

Operations and Maintenance Summary		
Activity	**CO_2e in pounds**	**CO_2e in metric tons**
Diesel	N/A	
Gasoline	347,247	157.51
Total Operations and Maintenance	347,247	**157.51**

1. For purposes of estimating greenhouse gas emissions, the volume of gravel aggregate was converted to tonnage with a conversion factor of 1.4 metric tons (MT) per cubic yard. The tonnage was multiplied by the USEPA's estimated emissions rate, 0.0034 MTCO2e per MT of gravel/sand/clay production, as presented in the EPA's Spreadsheets for Environmental Footprint Analysis. Emissions associated with construction equipment used to construct the access road are presented in Section III.

Appendix H

King County Letter of Flow Transfer Collaboration

King County
Department of Natural Resources and Parks
Wastewater Treatment Division
Project Planning and Delivery Section
King Street Center, KSC-NR-0503
201 S. Jackson Street
Seattle, WA 98104

December 10, 2019 sent via e-mail: Alexander.Mockos@seattle.gov

Alexander Mockos
Seattle Public Utilities
PO Box 34018
Seattle, WA 98124-4018

RE: Analysis of Vine Street Combined Sewer Overflow (CSO) Alternatives

Dear Mr. Mockos:

The purpose of this letter is to provide Seattle Public Utilities (SPU) with the outcome of Wastewater Treatment Division's (WTD) analysis of two alternatives for the SPU Vine Street CSO Project involving potential flow transfers to WTD. Vine Street is part of the Central Waterfront basin. Based on WTD's analysis, both alternatives are feasible for SPU to consider in completing their Options Analysis process.

WTD agreed to review the amount of flow transfer from the SPU Vine Street CSO basin alternatives (NPDES 069). SPU's Vine Street basin currently connects to WTD on Alaskan Way and on Western Avenue. SPU would add a parallel pipeline to WTD's Elliott Bay Interceptor (EBI). SPU provided WTD with two alternate locations for the flow transfer to occur, one on Alaskan Way and one on Elliott Avenue. This additional flow would be conveyed to WTD's Elliott West Wet Weather Treatment Station (WWTS) and the Interbay Pump Station overflow weir.

Based on the analysis of two large storms and two smaller storms, additional flow from SPU's Vine Street basin is less than five percent of the estimated Elliott West WWTS one-year flow rate of about 220 MGD.

Another location that was analyzed is the Interbay Weir, a current CSO location that is controlled. The projected peak flows from the Vine Street transfer does not impact the number of overflow events at the Interbay Weir but will increase the volume and is not anticipated to cause the CSO location to be out of compliance.

In conclusion, the projected SPU flow transfer alternatives will have slight impacts on WTD's conveyance system and CSO facilities downstream. WTD concludes that all the alternatives are feasible and can be accommodated as SPU and WTD continue to collaborate on capital projects.

Please let me know if you have any questions.

Sincerely,

Janice Johnson, P.E.
CSO Program Lead

cc: Lisa Taylor, PMP, Project Planning and Delivery (PPD) Section Manager, Wastewater Treatment Division (WTD), Department of Natural Resources and Parks (DNRP)
Susan Kaufman-Una, Planning, Inspection, Modeling, Monitoring and Mapping Unit Manager, WTD, DNRP

APPENDIX C

King County | Wastewater Treatment

Project, Planning and Delivery, CSO Planning Program
King Street Center, KSC-NR-6200
201 South Jackson Street
Seattle, WA 98104-3854

February 4, 2025

Ben Marré, Division Director
Drainage & Wastewater Planning and Program
Seattle Public Utilities
PO Box 34018
Seattle, WA 98124-4018
ben.marre@seattle.gov

RE: Vine Street Combined Sewer Overflow (CSO) Flows

Dear Mr. Marré:

The purpose of this letter is to provide Seattle Public Utilities (SPU) with the outcome of Wastewater Treatment Division's (WTD) analysis of a time series of flows from SPU that represent the anticipated flow transfers to WTD from their Vine St CSO Control project. Vine Street is part of the Central Waterfront basin.

The flows from SPU will enter the WTD system at two locations in the Elliott Bay Interceptor (EBI) and at one location in the Denny-Lake Union Trunk. WTD compared SPU's projected flows to existing flow estimates from the contributory area to Vine St CSO and found this project will contribute an additional 10 MGD to the peak flow at a one-year recurrence interval.

These flows will likely be conveyed to WTD's Elliott West Wet Weather Treatment Station (WWTS). Including these additional flows in modeling of the future Elliott West WWTS upgrade indicated that the current design has capacity to handle these additional flows. These flows will increase the volume treated and discharged at Elliott West WWTS. The flows will also increase the number and volume of untreated CSO events discharged from the Denny CSO (Interbay Weir). Modeling indicates that the additional flows can be accommodated while maintaining control of Denny CSO. Should flows to Elliott West WWTS increase as a result of climate change or other development or system modifications, the additional Vine St. flows will accelerate the need for additional capacity at Elliott West WWTS.

In conclusion, the projected SPU flow transfer from the Vine St. CSO basin will have slight impacts on WTD's conveyance system and CSO facilities downstream. WTD concludes that the proposed flow diversion is feasible and can be accommodated.

If you have any questions, please contact me at (206) 477-4499, or email me at Faon.OConnor@kingcounty.gov.

Sincerely,

Signed by:
Faon O'Connor
132AE3BE872D427...

Faon O'Connor
CSO Planning Program Manager

cc: Lisa Taylor, PMP, Project Planning and Delivery (PPD) Section Manager, Wastewater Treatment Division (WTD), Department of Natural Resources and Parks (DNRP)
Susan Kaufman-Una, Project Resources Unit Manager, WTD, DNRP

consor

APPENDIX D

APWA 2017								Blue cells use ENR Adj. due to no APWA estimate		
Bid item	**Item/Description**	**Take-Off QTY**	**Unit**	**Total Cost Unit 2017**	**Estimate Total**	**NOTES**	**Line Item Assignment**	**2023 Unit Cost (from SPU Template)**	**ENR Adjustment 2017 to 2023**	**2023 Estimate Total**
Sect 1-07	**Legal Relations & Responsibilities**									
107005	SAFETY AND HEALTH PROGRAM-CSI (REF)	16	MO	$1,725.00	***$27,600***	Unit Cost from CSI Tab	1	$3,175	1.250	$50,800
	Existing Conditions									
FROM CSI	CONSTRUCTION SURVEY (2 MAN CREW)	25	DAY	$1,800.00	***$45,000***	Unit Cost from CSI Tab	2	$3,325	1.250	$83,125
FROM CSI	UTILITY POTHOLING {QTY >10 EA}	15	EA	$1,000.00	***$15,000***	Unit Cost from CSI Tab; lowered cost since minimal restoration required when done during construction	2	$2,000	1.250	$30,000
	General Requirements									
ADDED	STAGING AREA RENTAL	16	MO	$10,000.00	***$160,000***	Estimated	1	$12,498	1.250	$199,963
FROM CSI	AS-BUILT RECORDS, MIN. BID	30	EA	$400.00	***$12,000***	Unit Cost from CSI Tab; Assumed 30 Drawings	1	$740	1.250	$22,200
Sect 1-09	**Measurement & Payment**									
109005	MOBILIZATION-CSI (REF)	1	LS	$513,791.54	***$513,792***	10% of total	1	$797,815	1.250	$797,815
Sect 1-10	**Temporary Traffic Control**									
110005	MAINTENANCE & PROTECTION OF TRAFFIC CONTROL INCLUDING FLAGGING-CSI (REF)	300	DAY	$895.00	***$268,500***	Needed throughout in street work since high traffic - 5 days/week, 4 weeks per month, 15 months	1	$1,650	1.250	$495,000
ADDED	PARKING METER HOODS BY SDOT	1	LS	$2,000.00	***$2,000***	Estimated (per Casseday)	1	$2,500	1.250	$2,500
ADDED	SDOT SIGNAL MODIFICATION (BY SDOT)	1	LS	$20,000.00	***$20,000***	Estimated, modified signals (per Casseday)	1	$24,995	1.250	$24,995
ADDED	PARKING FEES (PER SPACE PER DAY; MON-SAT)	4,200	DAY	$25.00	***$105,000***	Estimated, 25 street parking spaces to be impacted; est. phased construction; 6 days/week; 7 months, 4 weeks per month (per Casseday)	1	$31	1.250	$131,225
110020	TRAFFIC CONTROL PEACE OFFICERS	360	HR	$97.00	***$34,920***	Needed at Intersections (3 intersections, 4 weeks per intersection, 6 hour days, 5 days per week) (per Casseday)	1	$180	1.250	$64,800
Sec 2-02	**Remove, Abandon, Or Relocate Structures and Obstructions**									
202035	REMOVE CEMT. CONCR. SIDEWALK {QTY >50}	544	SY	$17.00	***$9,242***	Curb ramps	2	$35	1.250	$19,028
202045	REMOVE CEMT. CONCR. SIDEWALK {QTY >50}	4,935	SY	$21.00	***$103,630***	Full depth pavement/roadway removal	2	$32	1.250	$157,913
202145	REMOVE CURB {QTY>50}	900	LF	$11.00	***$9,900***	Assumed some damaged to curb	2	$16	1.250	$14,400
202767	SAWCUT Cement Concrete Sidewalk, Full Depth {QTY>50LF}	360	LF	$7.00	***$2,520***	2 saw cuts at each ADA ramp; Assumed 10' each	2	$10	1.250	$3,600
202770	SAWCUT Rigid Pavement, Full Depth {QTY >500 LF}	5,684	LF	$12.00	***$68,208***	Trench sawcut and pavement restoration sawcut	2	$19	1.250	$107,996
202850	ABANDON AND FILL PIPE {QTY<=100}	60	LF	$41.00	***$2,460***	Abandon existing sewer		$63	1.250	$3,780
Sec 2-03	**Structural Demolition**									
203011	Remove Pre-Cast MH Over 8' Deep	16	VLF	$260.00	***$4,160***	FROM CSI; MH at Vine and Elliott	2	$475	1.250	$7,600
Sec 2-04	**Excavations**									
204005	COMMON Excavation {QTY >500}	107	CY	$52.00	***$5,547***	Excavation at EBI	2	$84	1.250	$8,960
Sec 2-07	**Protective System**									
207010	SAFETY SYSTEM IN TRENCH EXCAVATION {16-22 Feet Deep}	54,000	SF	$30.00	***$1,620,000***	15' deep ex. X 1800lf x 2 sides; Updated Unit Price per HWA assuming Sheet Pile Shoring	2	$37.49	1.250	$2,024,620
	Dewatering									
FROM CSI	Dewatering - Pumping Water (3" Pump) to Baker Tank - Small to Mid-range Water Flow Capacity	150	Day	$1,500.00	***$225,000***	Assumed 30 days per month for 5 months; assumes discharge to sewer	2	$2,750	1.250	$412,500
Sec 2-10	**Backfilling**									
210052	BORROW MINERAL AGGREGATE TYPE 2 {QTY>50TN}	2,430	TN	$31.00	***$75,330***		2	$52	1.250	$126,360
FROM CSI	Contaminated Soils Disposal	2,430	TN	$125.00	***$303,750***	Assumed 15' D x 6'w x 1800'L trench; 25% of excavated soils would be contaminated; 120 lb./ft3 unit weight	2	$245	1.250	$595,350
Sec 3	**Geotechnical Instrumentation and Monitoring**									
ADDED	VIBRATION AND SETTLEMENT MONITORING (1625 LF Pipe/Monthly)	10	MO	$7,500.00	***$75,000***	Unit Cost from CSI Tab, Updated to Include Settlement Monitoring	2	$13,750	1.250	$137,500
ADDED	Cultural Resource Monitoring	512	HR	$135.00	***$69,120***	Assume 32 hrs/week x 4 weeks x 4 months	2	$169	1.250	$86,384
Sec 5-04	**Hot Mix Asphalt (HMA) & Warm Mix Asphalt (WMA) Pavement**									
504045	PAVEMENT, HMA (CL 1/2 IN) {QTY>50 TN}	537	TN	$225.00	***$120,748***	For pavement restoration area, 2" thick; 145 Lb./ft3 unit weight	3	$350	1.250	$187,830
504260	PAVEMENT PATCH, TEMPORARY {QTY>50TN}	783	TN	$265.00	***$207,495***	Cold patch for trench width: 6'wx1800'Lx1'D; 145 Lb./ft3 unit weight	3	$410	1.250	$321,030
Sec 5-05	**Cement Concrete for Roadway and Related Work**									
505144	ROADWAY Cem Conc., HES (72HR), 10IN {QTY>50SY}	4,935	SY	$120.00	***$592,173***	Roadway Restoration Area	3	$180	1.250	$888,260
FROM CSI	MINERAL AGGREGATE TYPE 2	1,665	TN	$50.00	***$83,274***	Roadway Base; 6-inch thick	3	$67	1.250	$111,588
505310	DOWEL Bar {QTY > 25EA}	3,600	EA	$6.00	***$21,600***	Est. # of panels = 2 joints, 1800 lf each, 1 dowel per ft.	3	$8	1.250	$28,800
505315	TIE Bar With Drill Hole {QTY >25EA}	880	EA	$4.00	***$3,520***	20' wide restoration area, bar every 3 ft, 15'wide panels for 1800' l	3	$5	1.250	$4,400
Sec 7-05	**Maintenance Hole, Catch Basins and Inlets**									
705008	MAINTENANCE HOLE, TYPE 205A {QTY>5 EA}	13	EA	$4,000.00	***$52,000***	APWA unit cost (2017 was 204a)	2	$11,750	1.250	$152,750
705020	MAINTENANCE HOLE, Type 210A {QTY<=5 EA}	1	EA	$20,500.00	***$20,500***	For vault structure in Vine and Elliott	2	$32,750	1.250	$32,750
705108	EXTRA Depth, Type 204A Maintenance Hole	40	VF	$260.00	***$10,400***	Assumed extra 5' per MH (2017 was 204a)	2	$470	1.250	$18,800
705120	EXTRA Depth, Type 210A Maintenance Hole	5	VF	$920.00	***$4,600***	Assumed extra 5' for vault structure in Vine and Elliott	2	$1,475	1.250	$7,375
Sec 7-08	**Miscellaneous Pipe Connections**									
ADDED	Pipe Connection to KC EBI	1	LS	$7,000.00	***$7,000***	Estimated	2	$8,748	1.250	$8,748
ADDED	KING COUNTY OVERSIGHT	1	LS	$5,000.00	***$5,000***	Estimated	2	$6,249	1.250	$6,249
Sec 7-17	**Storm Drains and Sanitary Sewers**									
717036	BEDDING, CL B, 36 IN Pipe {QTY >50LF}	1,800	LF	$22.00	***$39,600***	36" RCP Bedding, Class B (2017 cost was 24")	2	$50	1.250	$90,000
717724	PIPE, PSS, Conc Reinf C76 CLIV, 24 IN {QTY > 50 FT}	1,800	LF	$140.00	***$252,000***	36" RCP Pipe 2024 Bid Tabs Adjusted for Seattle (2017 cost was 24" APWA)	2	$316	1.250	$568,800
717985	TEMPORARY SEWER BYPASS {Length-250-500 FT}	1	LS	$20,000.00	***$20,000***	For MH replacement and Vine/Elliott added vault	2	$50,500	1.250	$50,500
717990	TELEVISION INSPECTION {QTY >200FT 1 MOB}	1,800	LF	$4.50	***$8,100***		2	$6.75	1.250	$12,150
Sec 7-20	**Adjustment of New and Existing Utility Structures to Finish Grade**									
720005	ADJUST Existing MH, CB, or VC {QTY <=5EA}	5	EA	$615.00	***$3,075***	Allowance for roadway restoration	3	$955	1.250	$4,775
720020	ADJUST Existing Valve Box {QTY <=5EA}	5	EA	$515.00	***$2,575***	Allowance for roadway restoration	3	$795	1.250	$3,975
Sec 7-21	**Bioretention**									
721002	BIORETENTION Soil {QTY >20CY}	435	CY	$82.00	***$35,670***	Allowance for GSI	4	$135	1.250	$58,725
Sec 8-01	**Construction Stormwater Pollution Prevention**									
801001	CONSTRUCTION Storm Water & Erosion Control Plan - CSECP {Project Value $3-$5M} CSI (REF)	1	LS	$15,500.00	***$15,500***	Had to Manually Enter Unit Costs	1	$19,371	1.250	$19,371
801002	TREE Vegetation & Soil Protection Plan - TCSPP {Project Value $3-$5M} CSI (REF)	1	LS	$7,575.00	***$7,575***	Had to Manually Enter Unit Costs	1	$9,467	1.250	$9,467
801003	SPILL Plan SP {Project Value $3-$5M} CSI (REF)	1	LS	$4,300.00	***$4,300***	Had to Manually Enter Unit Costs	1	$5,374	1.250	$5,374
801004	TEMPORARY Discharge Plan TDP {Project Value $3-$5M} CSI (REF)	1	LS	$5,125.00	***$5,125***	Had to Manually Enter Unit Costs	1	$6,405	1.250	$6,405
Sec 8-02	**Landscape Construction**									
ADDED	TREE PROTECTION	20	EA	$250.00	***$5,000***	Estimated	3	$312	1.250	$6,249
802048	TREE, Deciduous, 6 Ft to 8 FT	10	EA	$510.00	***$5,100***	Community Benefit and GSI Allowance	4	$915	1.250	$9,150
802360	TREE Root Barrier {QTY >20 LF}	160	LF	$12.00	***$1,920***	Assumed 4'x4' tree box; Community Benefit and GSI Allowance	4	$19	1.250	$3,040
802380	FLEXIBLE POROUS SURFACE TREATMENT - 1.5" Thick (Black Material)	1	CY	$4,558.00	***$4,502***	Assumed 12 tree boxes, 4'x4' ea.; Community Benefit and GSI Allowance	4	$6,287	1.250	$6,209

Sec 8-04	**Cement Concrete Curb, Curb and Gutter**									
804005	CURB, CEM CONC {QTY >500}	900	LF	$36.00	***$32,400***	Curb repair; match length of curb removed	3	$55	1.250	$49,500
Sec 8-12	**Chain Link Fence and Wire Fence**									
812001	CHAIN LINK Fence, Type 1 {QTY > 200 LF}	1,000	LF	$31.00	***$31,000***	Allowance for temp. construction fencing	1	$53	1.250	$53,000
812014	CHAIN LINK Gate, Double 14 Ft Wide {QTY <=5 EA}	2	EA	$1,625.00	***$3,250***	Allowance for temp. construction fencing	1	$2,825	1.250	$5,650
Sec 8-14	**Cement Concrete Sidewalk**									
814021	CURB RAMP {QTY >5SY}	544	SY	$270.00	***$146,790***	All curb ramps	3	$415	1.250	$225,622
814030	DETECTABLE Warning Plate {QTY > 20SY}	30	SY	$71.00	***$2,146***	Assumed 34 ramps, 2' d x 4' w ea.	3	$89	1.250	$2,682
Sec 8-22	**Pavement Marking**									
822018	PAVEMENT MARKING, Thermo, 8 IN Stripe {QTY<=200 LF}	3,600	LF	$30.00	***$108,000***	lane markings	3	$52	1.250	$187,200
822020	PAVEMENT MARKING, Thermo, Legend/Symbol {QTY>5 EA}	7	EA	$205.00	***$1,435***	7 crosswalks	3	$350	1.250	$2,450
Sec 8-27	**Project Identification Sign**									
827020	SIGN, INSTALL PROJECT IDENTIFICATION, POST MOUNTED {Size-Large-8'x10'}	1	EA	$1,400.00	***$1,400***		1	$2,225	1.250	$2,225
Sec 8-31	**Traffic Signal System**									
831306	DETECTOR LOOP, 6 FT DIA {QTY > 5 EA}	9	EA	$915.00	***$8,235***	Broad and Elliott	3	$1,600	1.250	$14,400
Sec 8-33	**Conduit and Trenching**									
833400	Relocate Handhole {QTY<=5EA}	2	EA	$510.00	***$1,020***	ADA ramp work	3	$1,025	1.250	$2,050
									2023 Total:	**$8,775,963**