Major Project Decision

for

Alaskan Way Viaduct and Seawall Replacement Project

Stormwater and CSO Control for Vine, University, Madison and Washington Basins

Seattle Public Utilities

April 2009

Seattle Public Utilities

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1.0 Introduction

The Federal Highway Administration (FHWA), the Washington State Department of Transportation (WSDOT), and the City of Seattle (City) are lead agencies involved in the Alaskan Way Viaduct and Seawall Replacement Project (AWVSRP) which will require the replacement of the utilities in the vicinity of the project. Most of the existing combined sewer pipelines, outfalls, and appurtenances will have to be replaced. See Figure1 for a map of the AWVSRP project area (at the end of this section).

- In particular, the existing piping of the combined sewer system must be replaced and the transportation project provides an opportunity to construct a new upgraded combined sewer system to meet the Washington State Department of Ecology (Ecology) regulatory requirement of one combined sewer overflow (CSO) event per year required by 2020.
- As a result of the Adaptive Management Strategy adopted by AMC for the AWVSRP project in August 2005 (see Appendix P), this Major Project Decision incorporates a combined sewer analysis based on new data, technical reports, alternatives, and documents a final recommendation for complying with regulatory requirements for CSOs.

1.1 Problem Definition

The AWVSRP will result in two major impacts to the existing stormwater and combined sewer systems:

1. The AWVSRP will require the replacement of the major sewer trunk lines that convey combined sewer flows to the Elliott Bay Interceptor (EBI) and ultimately to the West Point Wastewater Treatment Plant (West Point).
2. Stormwater systems within the AWVSRP corridor must be updated to meet current codes in accordance with the regulatory requirements of Seattle Municipal Code (Code) 22.800 and 22.808 (Stormwater, Grading, and Drainage Control Code).

1.1.1 Combined Sewer System

Ecology regulations require SPU to control CSOs to an average of one untreated overflow event per year per overflow site by 2020. The transportation project provides an opportunity for SPU to upgrade its existing CSO system in the transportation footprint to bring SPU's CSO system into regulatory compliance concurrently with the construction of the transportation project.

Within the AWVSRP vicinity, the City of Seattle is responsible for permits that govern performance of four active CSO outfalls located at Vine Street (NPDES 69), University Street (NPDES 70), Madison Street (NPDES 71) and Washington Street (NPDES 72), as shown in Figure2. For further details see Appendix M

Table 1 shows the average annual number and volume of overflows based on updated hydraulic modeling results using the 29-year rainfall record, new flow monitoring, and King County data. These estimates are based on a best-fit curve from the uncertainty analysis. For further details, see Appendix A

The average overflow counts and volumes have been reduced significantly from prior estimates due to the additional work performed. Over the course of the project, the CSO control volumes have ranged from 0.5 million gallons (MG) to 8.5 MG depending on the assumptions used, for example flap gates open, regulatory limit or greater. The CSO control volume is now at the lower end of the range.

Table 1. Average Overflows and Average Volume

Location	Average Annual Overflow Count	Average Annual Overflow Volume (MG)
Vine	4.4	1.38
University	0.9	0.15
Madison	1.3	0.30
Washington	1.2	0.28

In order to control CSOs down to the regulatory target of one overflow per site per year (on average), the alternatives must be sized to store, reduce, or treat sufficient CSO volume. Hydrologic/hydraulic modeling was used to determine this volume. Due to the normal errors in data collection and modeling, as well as the uncertainly regarding the size and intensity of future storms, there is considerable uncertainty in determining this CSO volume. An uncertainty and risk analysis was performed, and the analysis determined that the optimal equivalent CSO storage size to manage risks and uncertainties is approximately 0.65 MG. The recommended size of the CSO facility to be constructed may be modified in the future depending upon the results of ongoing efforts. For further information, see Appendix J.

This Major Project Decision Business Case is intended to document and recommend a combined sewer system option for CSO control and combined sewer infrastructure relocation and replacement for the Central Business District to meet the requirements of the AWVSRP Project and CSO regulations, recognizing that the recommended solution to the Central Waterfront CSO problem is located in the footprint of the AWVSRP South End Project (Holgate to King).

AMC Decision 1

If the AMC agrees with the recommended combined sewer system option 29, this direction will be given to WSDOT to incorporate into the design for multiple AWVSRP Projects, including the South End Project and the Central Waterfront Project.

1.1.2 Stormwater System

This Major Project Decision is primarily about addressing the combined sewer system replacement. However, stormwater issues associated with the combined sewer system replacement are relevant and timely to discuss with the AMC in the same decision framework.

AMC Decision 2

The transportation project is responsible to comply with SPU stormwater regulatory requirements. SPU is assisting WSDOT with analysis and choice of options for stormwater detention and treatment. From a strict “prescriptive” compliance perspective, a stormwater detention system would have to be constructed in the south area to control runoff from the project footprint before it enters the combined sewer system. However, hydraulic modeling performed by SPU shows that the stormwater detention would not provide a benefit to the combined sewer system and in some cases would actually increase CSOs. If AMC agrees that SPU should not require WSDOT to prescriptively comply with the Stormwater Code for the AWSRP in the south end, SPU will require WSDOT to work with the City Attorney's Office and Line of Business to figure out an implementation approach that is not prescriptive, but is also not an unmitigated exception as allowed under code section 22.808.010.

AMC Decision 3

If the AMC agrees with the recommendation to consider the new combined sewer system as a potential regional stormwater compliance alternative, SPU will coordinate efforts for such a program in the downtown region with concurrent work planned for the South Park area, including a structured program for administering cost sharing and criteria for Alternative Compliance.

AMC Decision 4

Finally, stormwater runoff from the AWVSRP in separated areas (i.e., stormwater that will not enter the combined sewer system for treatment at West Point) must be treated prior to being discharged into Elliott Bay. If the transportation lead agency chooses to use green alternatives for treatment, it presents an opportunity for SPU to partner with the lead transportation agency to expand the capacity of the stormwater treatment projects, and re-route some existing downtown stormwater flows into those systems for additional treatment above and beyond regulatory requirements.

If AMC wishes to pursue further treatment beyond regulatory requirements for stormwater flows from downtown using green technology, then SPU will request that WSDOT reserve space for expansion of stormwater treatment options and SPU will conduct further analysis on the feasibility, costs and benefits of this potential opportunity. If this is the course of action AMC prefers, then AMC is requested to approve $50,000 for further analysis in 2009 and 2010, and present the results to AMC at the conclusion of the analysis for decision-making in a timeline which supports the transportation project schedule.

2.0 Options Descriptions

CSO reduction can be accomplished by different strategies, including green stormwater infrastructure, separation of combined sewers, storage, CSO treatment, and operational modifications. One or a combination of these methods may be chosen to reduce the central waterfront CSOs. This analysis reviews implementation of the various options with a focus on determining the most cost effective "suite" of options.

SPU identified many strategies to address CSO reduction and improve water quality in the Central Business District and the AWVSRP area. These strategies included both traditional infrastructure solutions for CSO control and demand management. Traditional infrastructure CSO control alternatives included offline detention, inline detention and a wet weather treatment facility. Demand management is the implementation of upstream controls to solve a downstream problem. It includes both traditional elements such as building detention and green elements such as green roofs. Demand management techniques considered as part of this analysis included source separation, flow swapping, detention retrofit of existing buildings, increased building detention resulting from redevelopment, green roof retrofits, porous sidewalks and bioretention planter boxes. See appendix D for additional information.

The alternatives considered had the same overall goals of reducing CSOs to one per year per outfall and improving water quality in Elliott Bay. SPU did consider going beyond one CSO event per year and decided not to pursue that explicitly. However, toward the goal of going beyond one CSO event per year, SPU focused efforts on providing water quality treatment to areas of the downtown basin that currently discharge to the Puget Sound untreated. Initial screening pared the many options down to seven most-promising concept-level alternatives for CSO Control for further evaluation. These seven are summarized in the following sections. Exhibit 1 shows the cost summary of the alternatives.

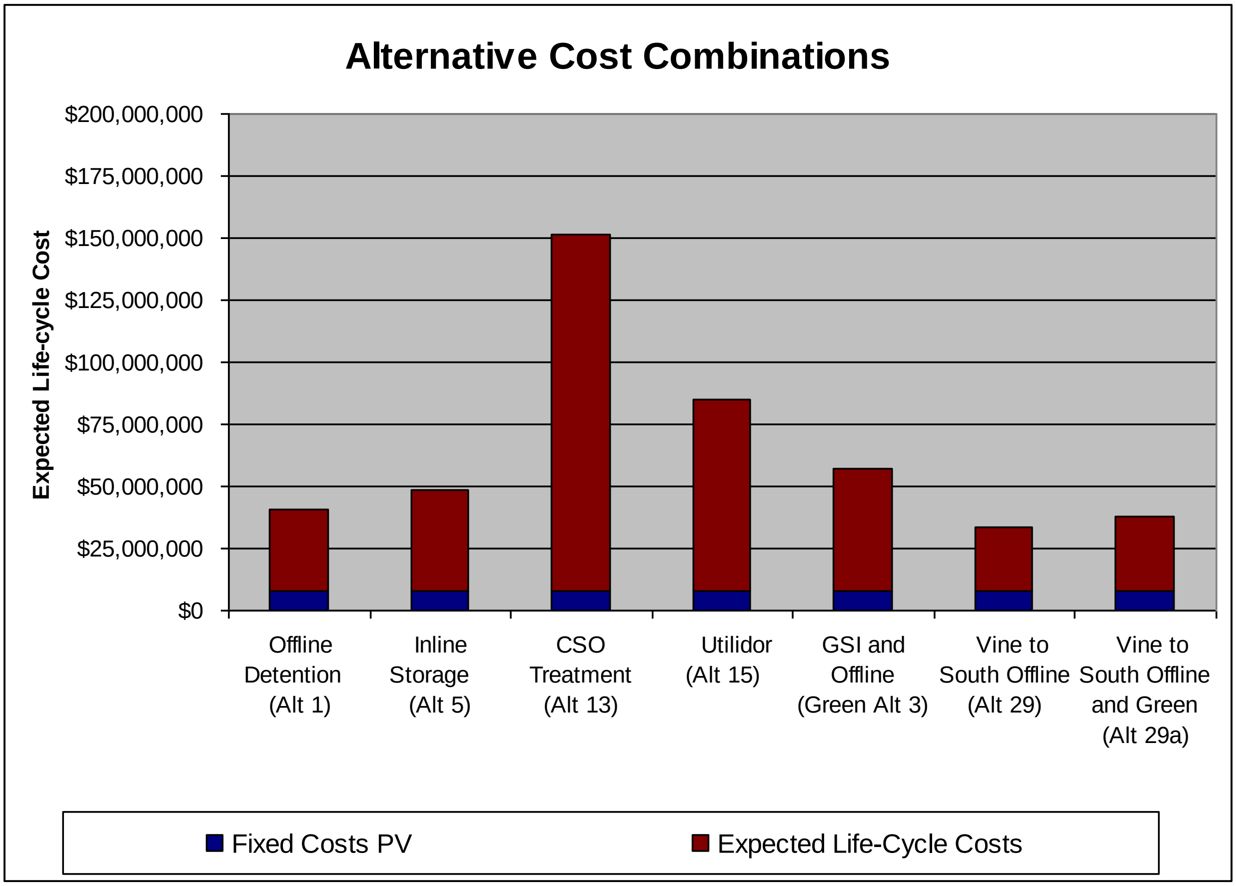

Exhibit 1. Alternative Cost Combinations

Alternative 1 - Offline Detention

Alternative 1 consists of two offline detention facilities to store flows in excess of system capacity. The two detention facilities are an offline detention pipe south of South King Street and an offline buried storage tank near the Vine Street CSO outfall, as shown in Figure 3.

The 84-inch-diameter offline detention pipe would extend from South King Street to Railroad Way South and would be approximately 420 feet long. This facility would store flows that would otherwise be discharged at the University, Washington and Madison CSO outfalls. The second storage facility would be an offline, buried storage tank to store flows that would otherwise be discharged at the Vine CSO outfall. The location for the offline, buried storage tank near the Vine Street CSO outfall has not been selected; however, one potential site has been identified approximately 1,000 feet north of the Vine diversion structure and outfall.

Summary of Major Components:

- 0.12 MG South Area Detention Pipe, 420 feet long, with odor control
- 0.53 MG Vine Detention Tank underground, with pump station and odor control

Alternative 5 - Inline Detention Central Waterfront and Offline Detention Vine Basin

Alternative 5 consists of inline detention for controlling CSOs within the University, Washington and Madison basins and offline detention for controlling CSOs in the Vine basin. The inline detention would consist of a single, continuous 72-inch-diameter interceptor, approximately 4,370 feet long, as shown in Figure 4. The offline detention facility would be a buried storage tank to store flows that would otherwise be discharged at the Vine CSO outfall.

Summary of Major Components:

- Central Waterfront Interceptor, 72-inch-diameter, 4,370 feet long
- 0.60 MG Vine Detention Tank underground, with pump station and odor control

Alternative 13 - CSO Wet Weather Treatment Facility

A wet weather treatment facility located south of South King Street would provide treatment of peak combined sewer flows that would otherwise be discharged as CSOs. A pump station and control structure located near South King Street would transfer peak flows from the Washington, University, Madison and Vine Basins to a 40 MGD wet weather treatment facility in the South of Downtown (SODO) area as shown in Figure 5.

Summary of Major Components:

- King Pump Station, control structure and force main
- 40 MGD CSO Wet Weather Treatment Facility

Alternative 15 - Western Tunnel (Utilidor)

WSDOT has proposed a deep tunnel beneath Western Avenue that would be used as an utilidor for electrical transmission and distribution lines. The proposed utilidor consists of installing an approximately 4,000-foot long, 12.5-foot outside diameter, bolted and gasketed segmental liner tunnel from Railroad Way South to the Seattle City Light's Union Substation, as shown in Figure 6. The proposed electrical utilidor project would include elements of a CSO control facility. The utilidor tunnel could include combined sewage conveyance pipes, and the south shaft could be finished as a CSO storage tank with capacity of 1.4 million gallons. See Appendix H for additional information.

Summary of Major Components:

- Utilidor - 4,000-foot long, 12.5-foot outside diameter tunnel
- 1.4 MG Shaft Storage Facility and pump station

Green Alternative 3 - Green Stormwater Infrastructure and Offline Detention

This alternative consists of green roof retrofit, porous sidewalks, bioretention planter boxes and offline detention. Green roof systems capture rainfall, providing detention and reducing the overall volume of runoff. Porous sidewalks are constructed with pervious pavement that has large pore openings that allow runoff to infiltrate through the pavement. Porous sidewalks would be constructed as part of large private redevelopment projects under the new stormwater code requirement to use Green Stormwater Infrastructure to the Maximum Extent Feasible. The costs for porous sidewalks would be borne by the developer. Bioretention planter boxes are rain gardens installed to detain and partially treat stormwater runoff. The planter boxes would be constructed along the north-south streets in downtown Seattle as part of SDOT's Bridging the Gap projects for 2010 and beyond.

Offline detention includes two storage facilities: an offline detention pipe south of South King Street and an offline buried storage tank near the Vine Street CSO outfall. This alternative is illustrated in Figure 7.

Summary of Major Components:

- Porous sidewalks, 8.0 acres
- Green roof retrofit, 17.49 acres
- Bioretention planter boxes, 3.54 acres (drainage area)
- 0.10 MG South Area Detention Pipe, 350 feet long, with odor control
- 0.46 MG Vine Detention Tank underground, with pump station and odor control

Alternative 29 - Vine Basin to South Offline Detention

Alternative 29 consists of an 84-inch-diameter offline detention pipe, as shown in Figure 8. The 84-inch-diameter offline detention pipe would extend from South King Street to South Royal Brougham Way and would provide 0.65 MG of detention. This facility would store flows that would otherwise be discharged at the University, Washington, Madison and Vine CSO outfalls. The Vine basin would be connected to the central waterfront interceptor through a 54-inch conveyance pipe along Alaskan Way. A control structure at South King Street would direct the flows to the detention facility as the conveyance system reached capacity. After a storage event, the flows would be emptied via gravity or pump station, if needed, from the detention facility and into the conveyance system at South King Street.

Summary of Major Components:

- North Waterfront Conveyance, 54-inch-diameter, 3,200 feet long
- 0.65 MG South Area Detention Pipe, 84-inch-diameter, 2,260 feet long, with odor control

Alternative 29a - Green Stormwater Infrastructure with Vine Basin to South Offline Detention

Alternative 29a consists of porous sidewalks, bioretention planter boxes and offline detention. The offline detention component consists of an 84-inch-diameter offline detention pipe, as shown in Figure 9. The 84-inch-diameter offline detention pipe would extend from South King Street to South Royal Brougham Way and would provide

0.65 MG of detention. This facility would store flows that would otherwise be discharged at the University, Washington, Madison and Vine CSO outfalls. The Vine basin would be connected to the central waterfront interceptor through a 54-inch conveyance pipe along Alaskan Way. A control structure at South King Street would direct the flows to the detention facility as the conveyance system reached capacity. After a storage event, the flows would be emptied from the detention facility via gravity or pump station, if needed, and into the conveyance system at South King Street.

Similar to Green Alternative 3, porous sidewalks are sidewalks constructed with pervious pavement that has large pore openings that allow runoff to infiltrate through the pavement. Porous sidewalks would be constructed as part of large private redevelopment projects under the new stormwater code requirement to use Green Stormwater Infrastructure to the Maximum Extent Feasible. The costs for porous sidewalks would be borne by the developer. Bioretention planter boxes are rain gardens installed to detain and partially treat stormwater runoff. The planter boxes would be constructed along the north-south streets in downtown Seattle as part of the Bridging the Gap projects for 2010 and beyond.

Building Detention Retrofit and Redevelopment consist of generating additional building detention through reclaiming existing facilities by increased maintenance and new detention based on redevelopment under City Code. SPU performed inspections of existing facilities and determined that additional storage capacity could be achieved with cleanout of the facilities and related enforcement of SPU code. Costs for cleanout of the facilities would be borne by the owners or building managers. SPU would provide additional O&M inspections. For the building detention redevelopment, it was assumed that 29 buildings in the downtown Seattle area would be redeveloped (including construction of detention facilities) by the year 2020. The costs for redevelopment of private property would be borne by the developer or property owner.

Summary of Major Components:

- Porous sidewalks, 8.0 acres
- Building Detention Retrofit and Redevelopment
- Bioretention planter boxes, 3.54 acres (drainage area)
- North Waterfront Conveyance, 54-inch-diameter, 3,200 feet long
- 0.65 MG South Area Detention Pipe, 84-inch-diameter, 2,260 feet long, with odor control

Alternatives Considered and Subsequently Removed from Further Analysis

Several alternatives were considered and subsequently removed from further analysis; details are contained in Appendix N.

3.0 Key Evaluation Criteria

Each of the seven options identified in Section 2 have been evaluated using SPU's triple bottom line economic analysis that considers the financial, environmental, and social risks and benefits associated with each alternative.

3.1 Assumptions

The following assumptions were used during the development of this Major Project Decision Business Case:

1. The modeling goal for each alternative was to have a long-term average of one overflow per year using a 29-year record of rainfall data.
2. Climate change will result in an average 6% increase in rainfall intensities in the future. See Appendix K for additional information about climate change.
3. There will be no future increase in impervious surfaces in the Central Business District area since the area is already fully developed and future redevelopment will likely reduce the amount of impervious area.
4. Stormwater code implementation for building development into the year 2020 will result in approximately 1.4 million gallons of additional decentralized storage.
5. Financial assumptions:
   - O&M costs based on a 100-year life span
   - Life-cycle costs include construction, allied costs (40% of construction cost), O&M costs, and repair and replacement costs.
   - Discount rate of 5%
6. Repair and replacement of mechanical equipment was assumed to be every 25 years. Soil replacement for green alternatives was estimated at every 25 years.
7. Storage facilities can discharge CSO volume into the EBI when the EBI level drops below 75% full.
8. SPU is considering potentially eliminating some CSO outfalls. Washington and/or University CSO outfalls may be removed. Removing the Washington CSO outfall would be consistent with potential future habitat improvements in that location. Further analysis will be conducted as the AWVSRP project progresses. Additionally, new stormwater outfalls may be added. Any stormwater discharged through the new outfalls would be treated stormwater.
9. The model boundaries are from the EBI upstream of the King Street connection to the EBI at Denny Way. Areas within these boundary conditions have been modeled in detail. Outside of these boundaries, a skeletonized model from Duwamish Pump Station to Interbay Pump Station has been developed.
10. Detention volumes obtained from the hydraulic modeling effort were adjusted based on the risk assessment performed to determine the size of the problem. For Alternatives 1 and 5, the detention volumes were modified to match the control volume of 0.65 MG based on the risk assessment performed. Numbers contained in the modeling report reflect the initial modeling but don't necessarily match the volumes and cost estimates contained in the Change Business Case. Refinement of detention volumes would be performed during design.

11. The present value calculations assume construction of all alternatives would be in the same time frame, 2012 through 2014.

3.2 Cost Estimate Summary

Cost estimates for each of the seven alternatives include the following:

- Base construction cost estimate – engineer's cost estimate based on the design completed to date.
- Construction contingency – a multiplier intended to capture the cost of details not yet considered due to the lack of design.
- Design contingency – a plus/minus range reflecting the uncertainty in the final design. Because very little design work has been completed, the uncertainty range of the cost estimates is class 5.

A summary of the alternatives' costs is shown in Table 2. The life-cycle costs include the construction costs, allied costs, and O&M costs over the 100-year life of the system. The allied costs include the design, management and administrative costs and were estimated at 40% of the construction cost. As discussed previously, the cost estimates for Alternative 15 were split between SPU and SCL based on the use of the amenities and systems. For more detail, see Appendix B.

Several elements are common to all alternatives, including central waterfront pipeline minimum replacement, overflow regulators, EBI control structures, and Basement Retrofit. The present value of the life-cycle cost of these elements is estimated to be $7,586,000 and has been removed from the costs of the alternatives.

Additionally, other SPU-owned utilities will be impacted by the AWVSRP. The costs for replacing these other utilities are not included in the cost estimates. These other utilities include (but are not limited to):

1. Roadway drainage system (assumed to be WSDOT costs)
2. Water mains and appurtenances

Table 2. Alternative Cost Estimates

Alternative	2008 Total Project Cost (without fixed costs)	Annual SPU O&M Cost	PV Life-Cycle Costs[1] (without fixed costs)	Expected Life-Cycle Costs (includes risk costs)	Expected Life-Cycle Costs + Fixed Costs
Alternative 1 Offline Detention	$30,070,000	$86,000	$24,890,000	$32,160,000	$39,750,000
Alternative 5 Inline Detention and Offline Detention	$33,230,000	$81,000	$27,270,000	$34,760,000	$42,350,000
Alternative 13 CSO Wet Weather Treatment Facility	$108,400,000	$374,000	$90,880,000	$135,920,000	$143,510,000
Alternative 16 Western Tunnel (Utilidor)	$68,930,000	$158,000	$56,470,000	$74,860,000	$82,450,000
Green Alternative 3 Green Stormwater Infrastructure and Offline Detention	$43,110,000	$54,000(2)	$34,640,000	$47,120,000	$54,710,000
Alternative 29 – Vine Basin to South Offline Detention	$24,120,000	$134,000	$20,940,000	$27,110,000	$34,700,000
Alternative 29a – Green Stormwater Infrastructure & Vine Basin to South Detention	$25,560,000	$260,000(3)	$23,940,000	$31,790,000	$39,380,000

1. Life-Cycle Costs include construction costs, annual O&M over the life of the facility (100 years), allied costs, and mechanical equipment replacement costs. Allied costs include design and administrative costs and were calculated at 40% of estimated construction costs. All costs were discounted at 5% and O&M was assumed to start in 2015. Construction was assumed to be 2012 through 2014. Costs are in 2008 dollars.

2. Property owners would be responsible for O&M of Green roofs and porous sidewalks, estimated to be $1.24 million annually for all 29 buildings. Construction costs to be borne by the owners are estimated to be $307,000 for all 29 buildings.

3. Property owners would be responsible for O&M of porous sidewalks estimated to be $5,000 per year for all 29 buildings. Construction costs borne by the owners are estimated to be $9.7 million for all 29 buildings.

3.3 Risk Analysis

The team identified risks that could affect the cost of each option. This was accomplished in a series of workshops, wherein subject-matter experts from SPU and outside experts discussed and documented the specific risk factors. For each risk factor, the team estimated the likelihood that it would occur and the consequential cost if it did. Appendix E contains the risks for each sub-alternative, including likelihood and consequential cost.

3.3.1 Monte Carlo Cost Distributions

The cost estimates contain two major sources of uncertainty: the general contingencies and the specific risks. To describe the effect of these uncertainties, the team developed probability distributions of the cost for each alternative using a Monte Carlo analysis. The expected cost is the mean of the distribution curve for each alternative. The expected life-cycle cost is calculated by adding the allied costs, life-cycle O&M and life-cycle replacement costs to the expected construction cost with risk costs applied.

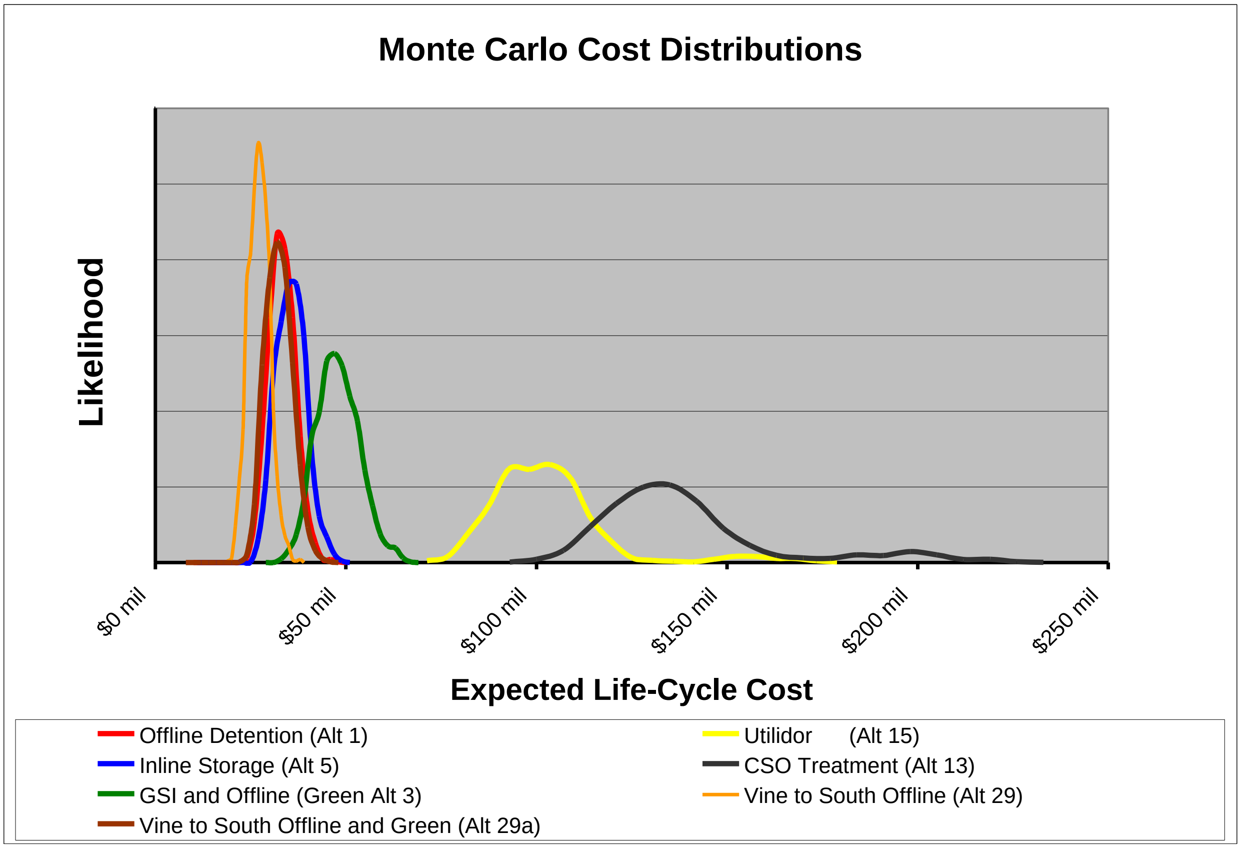

Exhibit 2. Monte Carlo Cost Distributions

Based on the analysis, the more traditional options involving offline and inline detention proved to be both less costly and more certain. In contrast, three of the other alternatives, the utilidor, green alternative 3, and treatment plant, proved to be more expensive and had less certainty in terms of costs.

3.3.2 Qualitative Risks

The team also identified risks that could not be easily expressed in percent likelihood and dollars of consequence cost. The team defined these "qualitative risks" in relative terms based on Seattle Public Utilities' "Risk Assessment Framework," included as Appendix F. The purpose of the qualitative risk assessment is to allow SPU to identify and document non-dollar risks, and to present them alongside the cost estimates and risk analysis for consideration in making the final decision.

3.4 Benefits Analysis

In addition to cost and risk, each alternative was evaluated in terms of the non-monetized benefits it provides. The team used a value model for this evaluation which allowed for explicit identification and consistent comparison in terms of subjective or difficult-to-quantify values. The value modeling approach used is described in detail in Appendix E. Generally, the process comprised three steps.

1. Identifying the categories of values that are relevant to the decision.
2. Weighting each value in terms of its relative importance.
3. Scoring the alternatives relative to each value, according to the scoring rules developed.

Values were identified by the team in a workshop setting. The alternatives were then scored from one (low) to four (high) relative to each value. The scatter plot below shows the alternatives in terms of their expected life-cycle cost and benefit score (i.e., expected value).

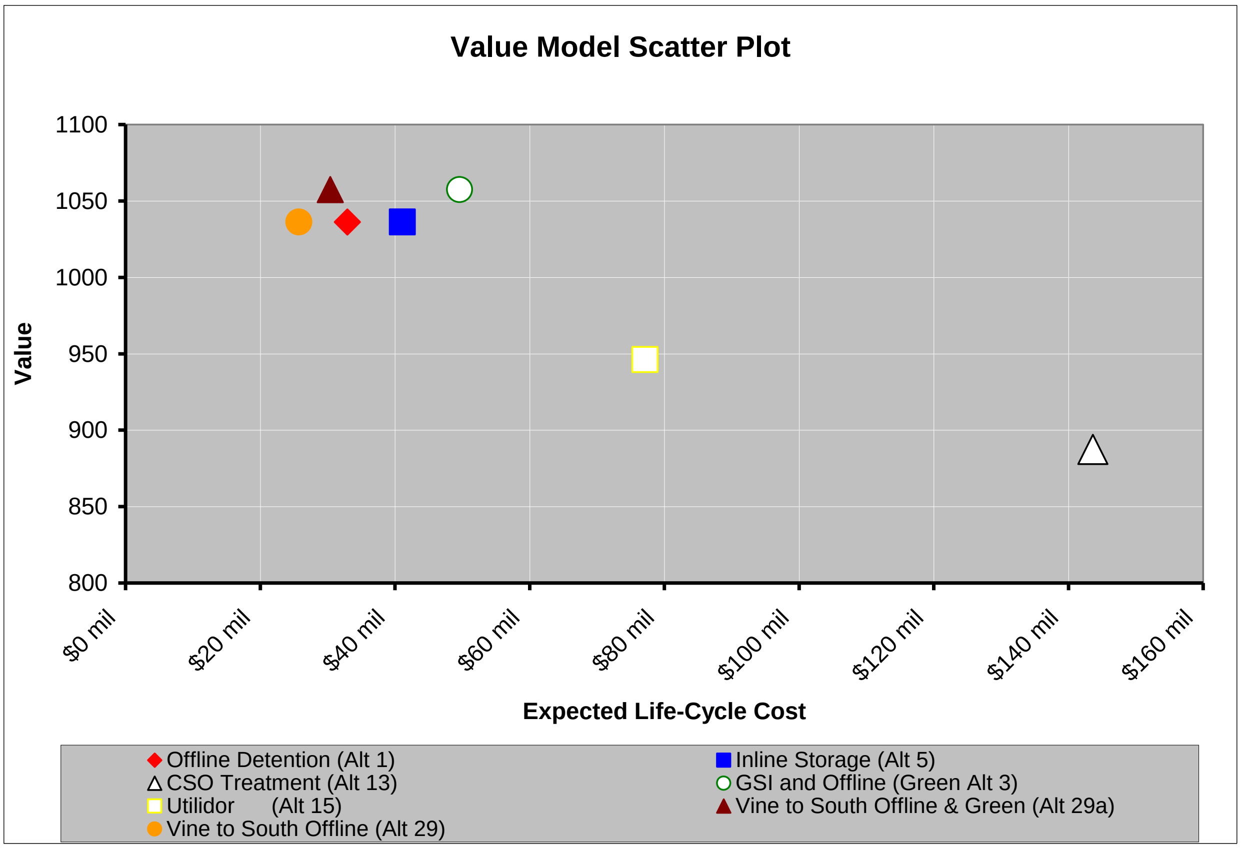

Exhibit 3. Scatter Plot of Expected Value and Benefit

4.0 Recommendation

Seven concept-level options for CSO Control in the Central Waterfront AWVSRP project area were evaluated using the triple bottom line analysis. For the triple bottom line economic analysis, capital costs, life-cycle costs, risks and benefits were quantified and compared for each of the seven options.

AMC Decision 1: ***What should the overall CSO Approach be for the Central Waterfront?***

<u>Recommendation for Combined Sewer System Replacement:</u> Based on CSO compliance requirements, regulatory requirements and the results of the economic analyses explained in Section 3, Alternative 29 optimally meets the criteria at the lowest life-cycle cost***.*** Alternative 29 consists of constructing 0.65 million gallons of off-line detention in the South of Downtown area and routing flows from the City's downtown waterfront CSO basins to the storage facility to attain CSO control. The expected life-cycle cost of Alternative 29 is $27.1 million, and $34.7 million with fixed costs.

<u>AMC Decision:</u> Alternative 29 optimally meets the criteria at the lowest life-cycle cost.

4.1 Related Stormwater Issues

4.1.1 Alternative Stormwater Compliance in AWVSRP South Area

From a strict "prescriptive" compliance perspective, a separate stormwater detention system would have to be constructed in the AWVSRP South End Project to control runoff from the project footprint.

AMC Decision 2: Should SPU require WSDOT to prescriptively comply with the Stormwater Code for the AWVSRP project in the south end?

Recommendation for AWVSRP to work with City Attorney's Office and Line of Business to determine an alternative approach in South Combined Area:

If AWVSRP were to comply with the code, WSDOT would be required to build stormwater detention vaults with pumps, and oversized pipes for in-line detention. The current code does allow exceptions if the Director determines that substantial reasons exist for the exception. In this case, following a strict prescriptive approach does not improve water quality. SPU has performed modeling documenting the results of adhering to the code.

SPU used an InfoWorks model of the South Downtown area to analyze the effectiveness of the two proposed stormwater detention facilities within the SRP South Project corridor in reducing the number of CSOs at the King Street Outfall and the Royal Brougham Outfall.

Two sets of long term continuous simulation consisting of a 29-yr period from Jan 1, 1978 to Jan 1, 2007 were used in this analysis. Rainfall data used were from SPU's Rain gauge 20 and Rain gauge 11. These two sets of continuous long term simulations results represented two scenarios – one with detention facilities and one without. Simulation and statistical results showed that the proposed detention facilities would have minimal impact on the number of overflow through the outfalls. Table 3 summarizes the simulation and statistic results.

Table 3. Statistics from Simulation Results: King and Royal Brougham

Scenario	Outfall	Total Overflow Count	Annual Average Overflow Count over 29-yrs
Without Detention	King Street Outfall	686	24
With Detention	King Street Outfall	693	24
Without Detention	Royal Brougham Outfall	415	14
With Detention	Royal Brougham Outfall	417	14

Based on the results from the hydraulic modeling, the benefit of the proposed stormwater detention to the combined sewer system is negligible; therefore, it is recommended that WSDOT work with City Attorney's Office and Line of Business to determine an alternative approach.

AMC Decision: SPU should not require WSDOT to prescriptively comply with the Stormwater Code. WSDOT should work with the City Attorney's Office and Line of Business to determine an alternative approach.

4.1.2 Regional Detention for Alternative Stormwater Compliance with Future Development Projects (Roads and Properties)

After construction of the recommended option for combined sewer system replacement, CSOs in the basin will be controlled so future development projects (redevelopment and/or transportation projects) may not need additional storage to meet regulatory requirements if they are located in the basins served by this detention facility. However, in some cases, additional detention in the basin may provide additional benefits of reduced loads on the conveyance system and avoidance of localized street or basement flooding issues or concerns.

AMC Decision 3: Should SPU consider the AWVSRP South End Detention facility a regional facility?

Recommendation for Stormwater Compliance on Future Development Projects: SPU should consider the use of the South Detention Facility as a regional detention facility and allow road projects and property development projects to "buy in" on a case-by-case basis, depending on the level of benefits expected from additional storage in each case. This approach would only apply to facilities within the CSO Basins served by the CSO detention facility (Madison, University, Washington, and Vine).

This approach will avoid both the upfront and O&M cost of additional storage when benefits from additional storage are not commensurate. Developers, SDOT, and WSDOT could "buy into" the facility rather than construct additional decentralized storage facilities to attain stormwater code compliance.

If the AMC concurs with this recommendation, SPU will coordinate efforts for such a program in the AWVSRP area with concurrent work planned for the South Park area, including a structured program for administering cost sharing and criteria for Alternative Compliance.

AMC Decision: SPU should consider the AWVSRP South End Detention Facility a regional facility on a case by case basis. However, SPU will need to figure out a method of tracking future development and create a system by which developers pay into a fund which ensures that the dollars get back to SPU. It is recommended that a team, headed by Drainage and Wastewater Line of Business Division Director Trish Rhay, come to the AMC in the near future with a proposal for setting up such a permanent system. This proposal should include a timeline for completion and responsible parties.

4.1.3 Additional Stormwater Treatment in Separated Areas using Green Alternatives

Water quality in Elliott Bay could be further improved by reducing CSOs below the regulatory requirement, or by additional treatment of stormwater runoff in areas of separated sewer. The project team has not recommended going beyond regulatory requirements in CSO control, nor has it compared the marginal benefit to marginal cost ratio of additional storage for CSO control to additional stormwater treatment. Nevertheless, keen interest in green alternatives in the downtown area has prompted the team to gauge the AMC's interest in pursuing additional stormwater treatment to highlight the use of green alternatives in the downtown area.

Stormwater treatment of existing separated stormwater systems in the Central Business District may be combined with any of the alternatives. Although treating these areas would not reduce CSOs, the additional stormwater treatment would assist in improving water quality in Elliott Bay. WSDOT will be treating stormwater within the AWVSRP project area; however, SPU may opt to implement additional stormwater treatment in areas outside of the AWVSRP project area. Within the AWVSRP area, existing upstream separated stormwater systems flow through the project area and discharge to Elliott Bay untreated. The AWVSRP does not trigger any codes that require a change of the existing condition, however, SPU could choose to intercept and treat this stormwater to improve water quality. Treating existing separated stormwater that is not triggered as part of the transportation project will assist with the Endangered Species Act consultation for this project. Additionally, it will model green technology for our city and citizens. See Appendix O for the pollutant loading study results.

AMC Decision 4: Should SPU reserve space and further analyze the opportunity for green treatment of existing untreated stormwater outside of the AWVSRP Transportation footprint?

Recommendation for Treating Stormwater in the Separated Areas of the Project: The stormwater from the AWVSRP project in separated sewer areas should be treated per code requirements using green stormwater infrastructure to the extent possible and where cost-effective. This would include swales in Alaskan Way and could extend into Western Avenue depending on the selected transportation alternative. If AMC concurs with this recommendation, the lead transportation agency will be informed of that decision and will be asked to include designs for green stormwater treatment infrastructure to the extent possible and where cost-effective.

In addition, the AMC may want SPU to explore implementation of limited additional stormwater treatment for existing separated areas near the AWVSRP project area. SPU will work with WSDOT to optimize the stormwater treatment swale or other treatment facility sizes to take advantage of additional areas adjacent to the project for treatment of currently separated offsite stormwater areas. If AMC wishes to pursue further consideration and analysis of treatment beyond regulatory requirements for stormwater flows from downtown using green technology, then SPU will request that the lead transportation agency reserve space for expansion of stormwater treatment options and SPU will conduct further analysis into the feasibility, costs and benefits of this potential opportunity.

If AMC wants to pursue this approach, a request for $50,000 to perform additional analysis for cost-benefit is requested. Results of analysis will be presented to AMC for decision making and direction which supports the aggressive AWVSRP Transportation Project schedule.

AMC Decision: It is unlikely that SPU will have funding for improvements that include additional space in the corridor off-site water quality treatment. SPU should not perform additional analysis to determine the cost-effectiveness of providing additional water quality treatment in the corridor. SPU should coordinate with the City of Seattle Department of Development and Planning Waterfront Core Team and the City Center Interdisciplinary Team on several issues including Seattle Department of Transportation water quality banking, enhanced water quality to Elliott Bay, habitat, and landscape design.