Joint King County/Seattle CSO Initiative Work Plan Item 4: Cost-Sharing Method for Joint Capital Projects

Overview

This paper describes the cost sharing approach that will be used to allocate costs of any joint CSO storage and related projects selected by King County and Seattle as part of their development of their current Long-term Control Plans.

The primary issues addressed in the paper are:

- The range of joint projects potentially covered,
- The conceptual basis for joint project cost shares, based on independent project costs,
- Sources of consistent project design parameters and cost assumptions to be used by both parties,
- The project components and the life cycle costs of those components that will be included in cost share calculations,
- Certain key economic assumptions to be used in the calculations,
- The range of joint projects' costs to which the cost shares will apply, and
- The collaborative workshop-based process by which specific project inputs will be selected for each candidate joint project being considered.

1. Background

Context. As part of their joint Combined Sewer Overflow (CSO) planning negotiations under the umbrella of their respective Long-term Control Plans (LTCP), the King County Wastewater Treatment Division (KCWTD) and the Seattle Public Utilities (SPU) - (jointly the "parties") are exploring opportunities for reducing total capital costs by coordinating and combining major capital projects. These savings may be available through economies of scale and other efficiencies from replacing independently designed and executed storage projects with a smaller number of jointly developed storage projects, as well as from other coordinated capital project options.

Objective. The parties aim is to define a method for sharing capital and operating costs in joint projects that ensures "win-win" outcomes, in which associated risks and rewards are apportioned equitably. The cost sharing method should ensure a clear, common understanding of the method. This involves:

- thoroughly defining the basis for calculations,
- identifying the range of potential applications, including project components and costs included and excluded, and
- creating the procedures and formal agreements needed to implement this financial feature of the parties' joint CSO initiative as intended.

Range of the Method's Use and Applications. The cost-sharing method is for the sole purpose of determining cost shares in joint King County/Seattle CSO projects. It contains a level of detail and a set of consistent assumptions designed specifically for this purpose.

The cost-sharing estimation method is not intended to replace normal capital project cost estimating and budgeting procedures, which will proceed to more refined levels of estimation after joint projects have been selected and cost shares in those projects have been defined. These more developed estimates may involve different agency-specific assumptions consistent with normal capital planning practices of the parties.

Other Cost Share Issues. The parties may develop additional cost-sharing arrangements separately to address circumstances and opportunities such as the following:

- Financing. There may be situations in which the cost share requirements or timing of a joint project places burdens on either party, for financing their portion of the joint project in addition to their other independent CSO projects. This issue recognizes that specific arrangements and agreements may be possible to manage financing contributions for specific joint projects in a way that most effectively apportions the defined cost shares of each party over time.

  The goal of these agreements and arrangements would be to maximize each agency's ability to manage the pattern of its sewer rates and critical financial performance parameters. They may include such techniques as changing agencies' schedules of payments for two or more joint project shares while leaving the present value of their shares unaffected, or employing bond financing techniques and structures that address similar concerns.
- Incentive Financing. The nature of CSO-related projects make them good candidates for competitive low-interest loan programs such as those administered by the State Revolving Fund (SRF) and Public Works Trust Funds. For purposes of application and administration of the loan proceeds, one agency may be required to act as lead representative for a project. Such arrangements would be separate from any cost allocation arrangement defined by this methodology, although the financing benefits may be shared in proportions reflective of the joint project cost shares.
- CSO Joint Project Management. In addition to the cost share determination, the parties must agree separately on both project construction management and ongoing project operation and maintenance responsibilities. The cost shares essentially assume shared responsibilities, and changes to that model would be accompanied by review of and potential associated changes to parties' financial contributions.
- CSO Program Trade-Offs. There may be situations in which the parties can trade cost responsibilities across projects or areas through agreements in order to achieve efficiencies that may be gained from each party's competitive advantage. These potential trades may include each utility specializing in particular types of projects or operating activities and reassigning financial responsibilities for certain ongoing functions within each agency, and are being examined as part of a separate task of the joint CSO Initiative.

2. Joint CSO Projects Covered by Cost-Sharing Calculations

The primary purpose of the cost-sharing method is to apportion costs of joint projects between the parties in a way that equitably rewards both agencies for pursuing joint CSO projects that are expected to reduce the combined cost of CSO control or improve water quality performance. The specific joint CSO project candidates to which the cost-sharing method would apply include the following :

- Duwamish River storage and treatment projects;
- Ship Canal/University/Montlake Area joint storage projects;
- A Ship Canal tunnel controlling CSOs of multiple basins; and
- Any LTCP projects of either party for which the costs are reduced by switching from the current independent and separate system operation to a jointly modeled, designed and operated system for CSO control.

[Note: The cost sharing approach of this memo is focused on CSO projects while several other items on the list of KCWTD/SPU negotiation topics may require separate, ad hoc cost sharing and financial arrangements.]

3. Cost-Sharing Method Concept

Synopsis. The proposed cost sharing method is based on three principles:

1. Controlling CSO's through joint multi-basin efforts may be less costly (or otherwise beneficial) than controlling the same CSOs individually for some projects;
2. Both parties should share in the potential savings of such joint action; and
3. Projects or facilities within each party's independent LTCP that are unaffected by the choice of a joint project should remain the responsibility of that party.

That outcome can be ensured if the cost shares of joint action are assigned to each party in proportion to the cost of their particular independent control solution.

More specifically, the independent control solution costs to be included in share calculations for any joint capital project will be each party's estimated cost for the components of its independent control solution that are replaced by the joint project.

The defined cost shares will then be used to apportion the set of actual joint project costs that replaces the avoided individual solution facility components. This is graphically illustrated in **Figure 1**. The top half of **Figure 1** represents the conveyance and facilities that are the responsibility of each utility with independent CSO basin control solutions. The bottom half of

Figure 1 adds the conveyance and storage facilities required for a joint, combined-basin solution (dashed lines).

The cost shares will be based on the parties' respective estimated costs of the facilities (labeled A and B within the King County and SPU ovals in **Figure 1**) that are replaced by the combined facility. These shares will then be used to allocate all of the costs associated with the newly required joint facilities (labeled as C in **Figure 1**). Finally, the initial conveyance (or other unaffected) segments (solid lines) will remain the responsibility of each utility as these facilities would be built under either a joint or an independent solution.

In short, cost shares will be based on facilities that are replaced by joint action; cost shares will be applied to the new joint facilities that replace them.

This approach contrasts with shares determined by either estimated control volume or estimated peak flow because it ensures that each party will realize a proportional financial benefit from an economically superior joint alternative, while the other approaches do not.

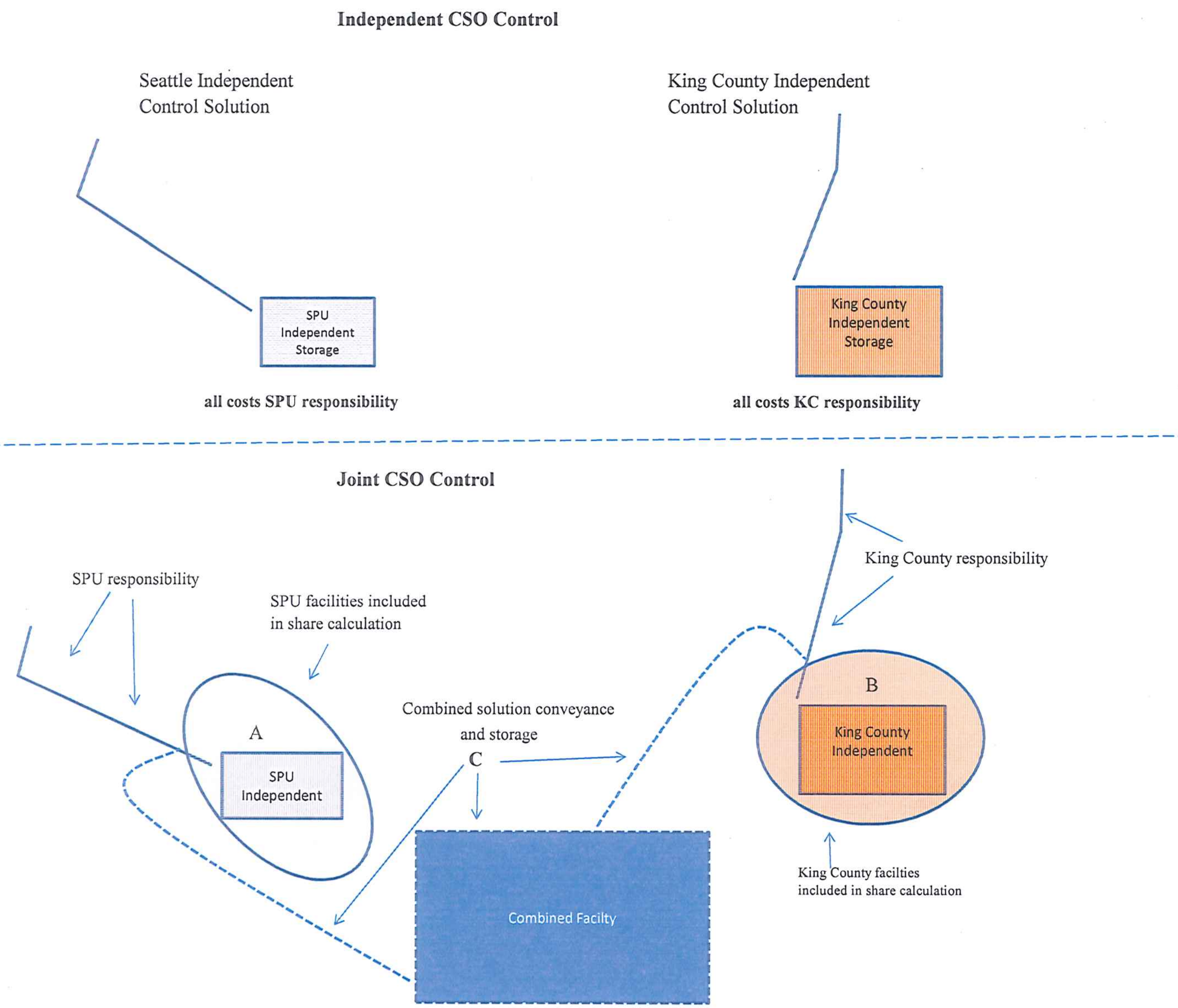
To illustrate, if control volumes (CVs) were used for cost sharing and the CVs of potentially paired basins were split 2/3 for King County and 1/3 for SPU, while independent costs were equal at $50 million each, a potential joint project lowering combined costs to $90 million - a savings of $10 million - would be split $60 million to King County and $30 million to SPU. In that illustrative case, King County would pay more for a lower-cost joint solution.

Basic cost share formula: The basic formula for the proposed cost shares calculation is simple:

$$\text{Share}_{i\text{-joint}} = C_{i\text{-Independent}} / (C_{SPU\text{-Independent}} + C_{KC\text{-Independent}})$$

where: $\text{Share}_{i\text{-joint}}$ is the share of total joint project cost for party "i"
$C_{i\text{-Independent } i}$ is the sum of avoided project costs for party "i"
The denominator is the sum of avoided project costs for both parties.

Figure 1



Total independent cost	A + B	
SPU cost share	A/ (A + B)	Applied to C the cost of
KC cost share	B/ (A + B)	the new combined facilities

Table 1 provides a simple numerical example of the cost share calculation. For Seattle and King County, the potentially avoidable independent costs of controlling CSO's by joint action are shown in their respective columns. In this case:

$C_{\text{SPU-Independent}}$ = \$51.7 million
$C_{\text{KC-Independent}}$ = \$58.3 million

Table 1
Cost Share Calculation Example:
Seattle and King County
Independent CSO Project Costs($m)

Formula Component	Seattle	King County
Tabula Cost	$18.0	$21.0
* Multiplier	2.00	2.00
= Project Cost	$36.0	$42.0
+ Property Acquisition Cost	$6.0	$6.0
+ Replacements (50 yrs)	$6.5	$7.0
+ Life Cycle O&M (50 yrs)	$3.2	$3.3
= Total Cost	**$51.7**	**$58.3**
Joint Project Cost Share	**47.0%**	**53.0%**

The combined cost to both parties of acting independently is <u>$110 million</u> ($51.7 m + $58.3 m). The calculated cost shares each would pay for applicable joint project costs are:

$\textbf{Share}_{\textbf{SPU - joint}}$ = (\$51.7 / \$110.0) = 47.0%
$\textbf{Share}_{\textbf{-KC- joint}}$ = (\$58.3 / \$110.0) = 53.0%

To continue the example, assume the new components of a joint project that completely controls both sets of CSOs have a total cost of <u>$100 million</u>. In this case, SPU would pay $47 million of the total cost, thereby saving $4.7 million while King County would pay $53 million of the total cost thereby saving $5.3 million. In this example, each utility would save 9.1 percent compared to its cost of independently controlling its basin CSOs.

<u>Geographic "units" of cost share calculation</u>. The cost share approach requires the identification of the independent project components that are replaced by a joint project. For example, the joint project candidates listed in Section 2 above include some in which single independent projects for each of the two parties would be replaced with one joint project. Other joint project candidates would replace several independent projects in multiple basins for each party. The proposed cost-sharing method would address each of these applications following the same basic approach however with slight differences.

- In the case of joint projects replacing single independent projects for each agency, as with the paired Ship Canal projects, separate cost shares will be developed for each joint project, with the resulting cost shares applied to the costs of that joint project solution only (i.e., basin-by-basin). For example assume that a joint Montlake project[1] replaces one independent project for each of the agencies to control the same basins. The SPU cost share for the new components of a joint Montlake project would be calculated as:

SPU Joint Montlake Cost Share =

$$\textbf{SPU Montlake } C_{Indep} / (\textbf{SPU Montlake } C_{Indep} + \textbf{KC Montlake } C_{Indep})$$

- In the case where there is one joint project (e.g., a Ship Canal tunnel) replacing a set of independent projects located in multiple basins, cost shares will be calculated based on the sum of the affected facility costs for each agency's independent solutions for all of its basins controlled by the joint project. For example, if a tunnel replaced several independent projects for each agency, the King County share would reflect all of the affected independent projects and would be calculated as:

KC Joint Tunnel Share =

$$(\textbf{KC } C_{Tunnel\ Basins}) / (\textbf{SPU } C_{Tunnel\ Basins} + \textbf{KC } C_{Tunnel\ Basins})$$

Where:

KC $C_{Tunnel\ Basins}$ = sum of avoided components' cost of KC independent solutions for all tunnel basins

SPU $C_{Tunnel\ Basins}$ = sum of avoided components' cost of SPU independent solutions for all tunnel basins

4. Independent Project Components Included in $C_{Independent\ i}$

The independent solution costs included in the cost share calculations will be those avoided by switching to a joint project solution. This will require for each joint initiative the definition of, and agreement on, an identifiable collection of avoided capital facilities and operating and maintenance activities within each party's independent CSO control solution. These may include storage facilities as well as some portions of upstream and downstream conveyance and pumping facilities.

Figure 1 illustrates the principle underlying the definition of independent facilities to be included in the independent solution cost share calculations. A mutually-defined schematic diagram of this sort will be developed for each cost sharing case.

Specific facilities covered (along with their associated O&M and scheduled replacements) may include, but are not limited to:

- storage tanks,
- influent conveyance lines,
- forcemains,
- pump stations,

[1] Montlake is one of three joint projects identified for this area.

- regulators,
- outfalls, and
- any other capital features included in the independent basin solution.

GSI installations represent a special case of costs which will not be included in cost share calculations, but may be included among the joint solution costs to which the shares will apply:

> **Why Exclude GSI Costs**. While these facilities are contemplated as part of the solution for certain basins, for simplification of costing in this application, their cost will not be included as independent costs for cost share calculation. This is consistent with the cost sharing concept because the "grey" project solutions for each agency that would be included in the calculations will be initially sized to manage basin control volumes in the absence of any flow reduction contributions from GSI projects. By not including the independent GSI costs in the share calculation any subsequent cost reduction due to lesser flow from GSI will be reflected in the joint project costs and thereby shared. This will also preserve proportional shares of GSI costs and benefits for each party, and thus maintain economic incentives.

5. Independent Cost Components Included in $C_{\text{Independent } i}$

All estimated major elements of projected life cycle costs will be included in the calculation of the parties' independent solution costs. This will ensure accurate and consistent calculations of shares for independent solutions that may require different proportions of first-costs and ongoing annual costs. [Note: As stated above, the purpose of these estimates is to calculate cost shares on a consistent basis; they are not meant to replace project cost estimates required for other purposes such as later phases of LTCP development or budgeting.]

Standard components of cost estimates, and their inclusion in the proposed cost-sharing method are the following:

- Construction cost. All components of independent CSO control solutions will be included, with the construction costs itemized and estimated at a "feasibility analysis" level and on a consistent basis between the two parties. The parties will convene one or more design workshops prior to actual cost share calculations to select consistent approaches to special construction cost topics, including but not limited to pump design, site demolition and preparation, building requirements, storage sizing relative to control volume requirements, and costing model departures for small projects.
- Contingency. Contingencies will be included in the cost estimates, but only as one of several implicit components of a composite multiplier that also reflects allied costs and sales taxes. The baseline value for this multiplier will be 2.0.[2] The multiplier will be applied to the sum of construction costs, but not to property acquisition costs.

[2] A multiplier is proposed in lieu of more detailed and specific calculations of allied cost components. Each agency has a different means of estimating these costs. By using a single multiplier consistency is ensured.

- Allied costs & sales tax. These costs will also be reflected, along with contingencies, by the single multiplier described above.
- Property acquisition. All land acquisition and assembly will be included, with estimates based on square footage requirements and prices that are differentiated by residential versus commercial land and by area of the City.
- Facility component replacements. Facility component replacement cost estimates and frequencies of replacement will be defined and included in the life cycle cost calculations underlying the cost share calculations. Consistency will be ensured by using stock assumptions by type of facility, which will be reviewed and agreed upon at the joint project definition workshop described above.
- Operation and maintenance. Annual operation and maintenance costs will be estimated on a collaborative basis for avoided components of independent solutions and new components of joint projects, and included at a constant inflation-adjusted level for the period of analysis for the life cycle cost calculations.

The cost calculation formula - reflected in **Table 1** above - is as follows, with all costs expressed as present values over the defined calculation period:

$$TC = (CC * M) + PA + R + O\&M - S$$

where:

TC	= total cost
CC	= construction cost
M	= multiplier (= 2.0)
PA	= property acquisition cost
R	= projected facility component replacement costs in the planning period
O&M	= operation and maintenance costs over the planning period
S	= salvage value, if any

6. Assumptions and Sources of Values for Cost Components

Construction costs. For storage projects and their associated facilities, such as conveyance lines, pump stations, etc., each party will employ the same version of the Tabula cost estimation system, using consistent techniques and assumptions to calculate costs. AACE Class 4 "feasibility-level" estimation (1%-15% design) will be the basis for these costs, and the mid-range values will be used, rather than the +/- range or a weighted average of high/medium/low values[3]. The parties will collaboratively review their respective assumptions for the independent solutions and avoided components to be replaced by all candidate joint projects.

Other cost components. For any costs not estimated by the Tabula tool, the two parties will collaboratively consider and select cost projections and procedures. For example, major

[3] *See Attachment A, King County Draft CSO LTCP Tech Memo 620, for Class 4 description.* http://www.kingcounty.gov/environment/wastewater/CSO/ProgramReview/Plan.aspx#techmemos

maintenance and replacement and annual O&M allowances will be identified and projected separately. Cost allowances deemed to be comparable for all projects and both agencies (e.g., allied costs and contingencies) may be addressed in a simplified fashion. The rationale is that these costs comprise either a small or very similar share of life cycle costs for relevant facility types, so a detailed itemization of these costs would not affect the percentage split for independent solutions and therefore is not critical for the calculations.

7. Life Cycle Cost Calculation Parameters and Assumptions

To capture the full costs of avoided components of independent solutions, life cycle cost estimates will be used. By relying on life cycle costs, independent solutions with different trade-offs between capital and operating costs can be reflected equitably the analysis. These independent solution costs will be calculated over a consistently defined planning period, as noted below. The cost-sharing method will also include other consistently applied parameters to support those calculations. The major assumptions to be used are:

Time horizon. Life cycle costs will be calculated for a 100-year period. [Note: This differs from the 50-year horizon used by King County for CSO project cost estimation in its preliminary Long-Term Control Plan (LTCP) cost projections.] Each pair of independent solution cost calculations will also be calculated for a 50-year horizon, to test for potential impact of considering a shorter planning horizon. In the case of significant differences, the parties will resolve them at a cost share calculation workshop and agree on the preferred assumption and calculation.

Discount rate. Life cycle costs will be converted to present value using a 3% real discount rate. [Note: This differs from the 2.2% value used by King County in its LTCP process and the 5% value currently used (but under review) by SPU for normal asset management analyses.] Calculations will also be performed for each independent solution cost estimate to illustrate the impact of considering higher (5%) and lower (2.2%) real discount rates. Again, in the case of significant differences, the parties will resolve them at a cost share calculation workshop and agree on the preferred assumption and calculation.

Project timing assumption. Cost estimates for each party's independent solution will be escalated to January 2012 using an agreed index, and present values will be calculated based on the same assumed 2013 start date for all projects. They will not be adjusted to reflect different project sequencing that would be part of an actual LTCP.

Project construction phasing. Project construction costs, including the allied cost multiplier and property acquisition cost will be spread over either a 5-year or an 8-year construction period[4]. The parties will, as part of their joint project design workshop(s), agree on the basis for selection of 5-year versus 8-year phasing plans (e.g., dollar thresholds, project type). O&M costs and the actual timing of project component replacements will begin at the on-line date for the specific project.

[4] Other construction periods can be used as long as they are consistent for a particular type of facility.

Level of Precision. Cost shares will be calculated to the nearest tenth of one percent.

Example. **Table 2** presents an illustrative example of the standard life cycle cost calculation template to be used for the independent project costs that would be replaced by each separate candidate project. The life-cycle cost calculations will be used to determine the joint project cost share calculations. The **Table 2** example shows life-cycle cost calculation for one party's independent LTCP solution that would be replaced by a joint KC/SPU project. Note that template provides an "input block" for definition of the key cost parameters required for life cycle cost calculation, along with a highlighted result cell that shows the resulting life cycle cost to be used in cost share calculation.

a. The present value of the project capital cost is calculated in **Section A** of Table 2. It is based on a user input capital cost value that already includes: 1) the base capital cost from Tabula cost estimation, times 2) the 2.0 multiplier factor for allied costs, contingencies and sales tax, plus 3) property acquisition.
b. ***(Attachment B*** contains a Tabula Cost Example for the Stone Way In-line Storage Project, for illustrative detail of the base Tabula cost referred to above.)
c. **Section A** also reflects project phasing, with percentage splits automatically applied for a user-specified contruction period, either5 or 8 years. The Table 2 example shows a split for 5 years.
d. **Section B** calculates the present value of the sum of 1) user-specified annual O&M costs plus 2) major maintenance/replacement components that are projected to be required at 10-, 25- and 50-year intervals.
e. **Section C** shows the annual sums of the preceding cost elements over a 100-year planning horizon, and calculates the composite present value, based on a user-specified discount rate. This final present value result will be the basis for the agency cost in the cost share calculations defined above.

Table 2: Independent CSO Project Life Cycle Cost Calculation Template

Directions: Fill in Construction Period, Capital Cost including soft cost multiplier and property acquisition/preparation, Annual O&M, and Replacements to be made in 10, 25 and 50 years. Select discount rate and the 100-year PV will be calculated.

Input Block	
Construction Period (5- or 8-years)	8
Capital 5 yr construction	$1,000,000
Annual O&M	$1,000
Replacements, 10-year cycle	$10,000
Replacements, 25-year cycle	$25,000
Replacements, 50-year cycle	$50,000
Discount Rate	3%

TOTAL PV OF LIFE CYCLE COST: $ 937,328 *(= Cost Share Calculation Input)*

Independent Option: No XXX (put agency and project name here)

YEAR		2013	2014	2015	2016	2017	2018	2019	2020
	Present Value	1	2	3	4	5	6	7	8
A. CAPITAL COSTS	5-Year Project	8.00%	8.50%	8.50%	36.50%	38.50%	0.00%	0.00%	0.00%
	8-Year Project	6.00%	2.00%	4.25%	8.50%	4.25%	18.25%	36.50%	20.25%
Project Costs	$865,386	60,000	20,000	42,500	85,000	42,500	182,500	365,000	202,500
Project Costs	$0	-	-	-	-	-	-	-	-
Project Commissioning	$0	-	-	-	-	-	-	-	-
	$0	-	-	-	-	-	-	-	-
TOTAL CAPITAL COSTS	**865,386**	60,000	20,000	42,500	85,000	42,500	182,500	365,000	202,500
B. OPERATING COSTS									
Annual O&M	$25,369	-	-	-	-	-	-	-	-
Elect & Inst (10 years)	$21,573	-	-	-	-	-	-	-	-
Mechanical (25 years)	$16,144	-	-	-	-	-	-	-	-
Replacement (50 years)	$8,857	-	-	-	-	-	-	-	-
	$0	-	-	-	-	-	-	-	-
TOTAL OPERATING COSTS	**71,942**	-	-	-	-	-	-	-	-
C. TOTAL COSTS	**$ 937,328**	60,000	20,000	42,500	85,000	42,500	182,500	365,000	202,500

8. Cost Share Estimation, Confirmation and Application Process

Joint project design workshop(s). SPU and King County representatives will meet for one or more workshops to define and agree on the physical requirements for both independent and joint control solutions. This will include both verifying the flow and control parameters involved and agreeing on consistent design parameters for proposed independent solutions. The intent of this physical component of the workshops is to ensure consistency in the size, composition and design of the independent solutions.

As part of these reviews, the initial design workshops will also produce agreements on other cost-related assumptions, including but not limited to the version of Tabula to use, property acquisition and preparation assumptions, replacement requirements and frequencies for each project and annual O&M estimates for each.

Independent cost estimation. Based on independent project design and costing assumption results of the King County-SPU design workshop(s), staff at King County and SPU will develop life cycle cost estimates for the avoided components of their respective independent projects, following the procedures and using the assumptions and parameters defined above. This step, subject to the following review, will form the base for calculating the respective cost shares of the joint facilities.

Cost share calculation and confirmation workshop. King County and SPU representatives will convene another workshop to review and confirm the initial life cycle cost estimates for each party's independent solutions, to ensure consistency and thoroughness, and will agree on the final cost shares to be included in a formal agreement.

The purpose of this workshop will be to identify any areas of inconsistency in the cost estimates or variability in sensitivity analyses, discuss and resolve the inconsistencies, and agree on the proposed final joint project cost shares to submit to the team leaders. The goals of this review are to:

- ensure consistency in the application of the cost estimating procedures,
- review and resolve any issues where results fluctuate for a reasonable range of assumptions, and
- agree on the final cost shares to be included in a formal agreement.

Joint project costs covered. Once the cost shares for each candidate joint project are defined, the two parties will specify the list of actual joint initiative project cost elements to which the cost shares will apply. These will follow the guideline described in Section 3 above. Costs to be included will be those associated with the new components in the joint solution. In cases where the joint solution is enhanced by the inclusion of GSI installations, retrofits of existing system components, or other features, these will be included among the new joint project features. Similarly, if subsequent regulation allows for design or operational efficiencies that change the required size, design or cost of a joint solution, the joint project as revised will be covered.

For any of these new elements of a joint solution, the calculated cost shares will apply, at a minimum, to the following categories of cost:

- design,
- permitting,
- construction,
- agreed levels of overhead,
- post-construction regulatory or other design changes,
- property acquisition,
- post-construction monitoring,
- annual O&M,
- grant proceeds,
- fines or penalties.

The cost shares will be applied consistently to the actual joint project costs incurred, independent of how much savings may or may not be realized by the joint solution.

Form of Agreement. The cost shares and their scope of application will be incorporated in an MOA between the two agencies, defined to remain in effect for a specified project life and to apply to all covered costs that may arise over that period.

Attachment A

Excerpt

Technical Memorandum 620

2012 Comprehensive Combined Sewer Overflow Control Program Review

Cost Estimating Methodology CSO Control Facilities

Technical Memorandum 620

2012 Comprehensive Combined Sewer Overflow Control Program Review

Cost Estimating Methodology for CSO Control Facilities

May 2011

King County

Department of Natural Resources and Parks
Wastewater Treatment Division

King Street Center, KSC-NR-0512
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Seattle, WA 98104

Contents

Appendices

Tables

Figures

4. ACCURACY AND RANGE

The accuracy of an estimate varies depending on the methods used, the amount of project information available, and the time available to prepare the estimate. Using these criteria, the Association for the Advancement of Cost Engineering (AACE) classifies estimates into five types. The primary defining characteristics for each class is the status of various design components, as shown in Table 4-1. The design status of the alternatives in the Program Review is such that the cost estimates are Class 5 estimates. The accuracy range for Class 5 estimates is –50% to +100% as indicated in Figure 4-1..

Table 4-1. Design Status for Determining AACE Cost Estimate Class

	Class 5	Class 4	Class 3	Class 2	Class 1
Project Scope Description	General	Preliminary	Defined	Defined	Defined
Plant Production/Facility Capacity	Assumed	Preliminary	Defined	Defined	Defined
Plant Location	General	Approximate	Specific	Specific	Specific
Soils & Hydrology	None	Preliminary	Defined	Defined	Defined
Integrated Project Plan	None	Preliminary	Defined	Defined	Defined
Project Master Schedule	None	Preliminary	Defined	Defined	Defined
Escalation Strategy	None	Preliminary	Defined	Defined	Defined
Work Breakdown Structure	None	Preliminary	Defined	Defined	Defined
Project Code of Accounts	None	Preliminary	Defined	Defined	Defined
Contracting Strategy	Assumed	Assumed	Preliminary	Defined	Defined

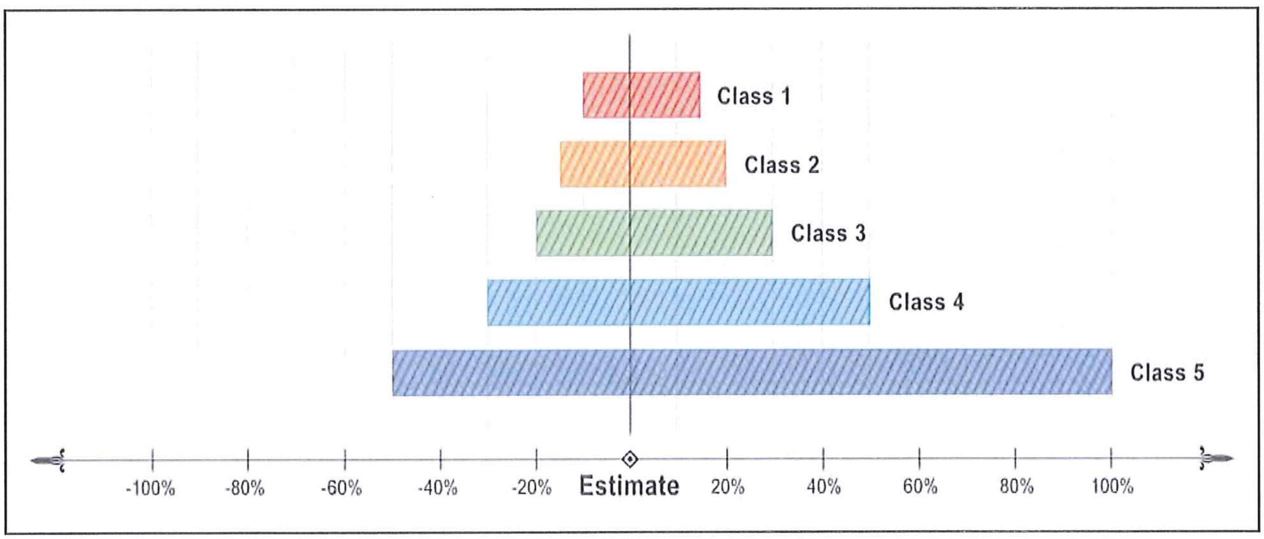

Figure 4-1. Accuracy Range for Cost Estimating Classes under AACE International System

Attachment B

Tabula Cost Example
Stone Way In-line Storage Project

Final Alternatives - N-13a: Joint SPU/King County Storage Upstream of the Fremont Siphon - In-Line Storage in Right of Way

Design Criteria

- SPU Storage Volume requirements: 1.931 MG (NPDES147 Basin), 0.93 MG (NPDES174 Basin), and 0.185 MG (NPDES060 Basin)
- King County Storage Volume Requirements: 4.18 MG (3rd Avenue West Regulator)
- Peak Flows: 15.0 MGD (NPDES147 Basin), 7.5 MGD (NPDES174 Basin), and 29.3 MGD (3rd Avenue West Regulator)
- Average dry weather flows will require continuous pumping to convey flows to the King County system

Description

Alternative N-13 consists of distributed or joint combined sewer overflow (CSO) storage upstream of the Fremont Siphon for SPU NPDES147 and NPDES174 Basins and the King County 3rd Avenue West Regulator. Based on the draft 2010 CSO Reduction Plan, a CSO control volume of 2.86 MG is required to reduce overflows at NPDES147 and NPDES174 Outfalls to an average of one untreated overflow per year. A total maximum storage volume of 7.226 MG is required to control all three outfalls. In-line storage for a portion of this volume could be provided with an in-line storage tunnel and effluent pump station. This would consist of a storage tunnel from the undeveloped commercial property at the intersection of North 40th Street and Stone Way North, located in the middle of NPDES147 Basin to the private commercial property located at North 34th Street and Stone Way North. A layout of the alternative is shown on the attached figure.

The main components of this alternative would include:

- 7.226 MG In-line storage tunnel, 22foot-diameter, 2,560 feet
- 14.45 MGD effluent pump station
- Two diversion structures
- Approximately 250 feet of force main
- Approximately 1,150 feet of gravity conveyance pipes

Storage Tunnel

The control volume for NPDES147 and NPDES174 Basins and the 3rd Avenue West Regulator could be stored in a 22foot-diameter, 2,560 feet long tunnel at a slope of 0.001 ft/ft.

The tunnel boring machine (TBM) would launch from private property at North 34th Street and Stone Way North and bore north towards the undeveloped commercial property at the intersection of North 40th Street and Stone Way North. Typical tunnel design standards require one to two and half times the tunnel diameter of soil/ground cover depending on the type of material being tunneled through. For this phase of alternative development, approximately 2.5 times is assumed. Further research and exploration of the geotechnical conditions may allow the tunnel to have less cover and will be determined during preferred alternative development.

The tunnel would be an in-line facility with flows from the upper part of NPDES147 Basin permanently routed to the tunnel. This would require that the effluent pump station be designed for continuous operation. Flows from the lower portion of NPDES147 Basin would be directed to the tunnel during a storm event. Since the tunnel is deeper than the surrounding existing sewer facilities, all flows that enter the tunnel will need to be pumped to the King County North Interceptor.

Facilities Building

An above grade facilities building would be located on private property at North 34th Street and Stone Way North. These facilities would contain an odor control system, electrical controls, and a stand-by power generator for the tunnel and associated effluent pump station. The actual contents of the building will be determined during preferred alternative development.

Flow Diversion and Discharge

Diverting flows to the beginning of the storage tunnel would require reconfiguring the surrounding combined sewer. Four new structures would divert SPU flow from the upper portion of NPDES147 Basin to the inlet of the tunnel. These structures would be located along Bridge Way North at Woodland Park Avenue North, Midvale Avenue North, and Stone Way North, with one structure on undeveloped commercial property to pick up the sewer flows that bisect the property. Based on flow monitoring data from meters located at Stone Way North and North 40th Street and at NPDES147 Outfall, this gravity diversion would capture approximately 40 percent of the NPDES147 Basin flow.

Flow that enters NPDES147 Basin south of Bridge Way North would be collected by a diversion structure located just upstream of NPDES147 Outfall. From the diversion structure, approximately 250 feet of gravity pipe would carry flow to the downstream end of the storage tunnel located on private property at Stone Way North and North 34th Street.

Since the storage tunnel is located in NPDES147 Basin and is upstream of NPDES174 Outfall, flows from NPDES174 Basin would not be diverted to the storage tunnel. It is assumed that diverting and storing sufficient flow from NPDES147 Basin will allow NPDES174 Basin flows to enter the interceptor that would otherwise overflow to NPDES174 Outfall. This will be confirmed during modeling and the next phase of alternative development.

Construction Assumptions

King County's Tabula cost estimating program was used to develop a Class 5 estimate for this storage facility. The attached documentation lists the construction assumptions used.

LTCP Alternative Analysis
Operation and Maintenance Cost Template

Alternative Number		**N13a**							
Alternative Description		**Fremont/Wallingford/Ballard - Inline Storage in Stone Way**							
12/9/2010									
Cost Element	***Note***	***Type/Condition***	***Quantity***	***Unit***	***Unit Cost/ Base Cost***	***Ann Freq***	***Anticipated Annual Cost***	***Variability Multiplier***	***High End Annual Cost***
Conveyance Pipeline-	7	Typical		LF	$ 1.75	1	$ -	1	$ -
special cleaning		Arterial	1150	LF	$ 2.00	1	$ 2,300	1	$ 2,300
		Lakeline		LF	$ 2.00	1	$ -	1	$ -
		Force Main		LF	$ 2.00	1	$ -	1	$ -
Diversion Structure									
		Type 1 - Basic	2	ea	$ 260	4	$ 2,080	1.5	$ 3,120
	8	Type 2 - Hydrobrake		ea	$ 260	12	$ -	1.5	$ -
		Type 3 - Motorized		ea	$ 1,000	4	$ -	1.5	$ -
Undercrossing									
				LF	$ 2	1	$ -	1.5	$ -
Wet weather Pump Station									
		Type 1 - < 50 HP		ea	$ 6,500	1	$ -	1.25	$ -
		Type 2 - 50 HP & up		ea	$ 11,600	1	$ -	1.25	$ -
	9	Demand charge		HP		1	$ -	1	
Effluent Pump Station									
		Type 1 - <50HP		ea	$ 5,000	1	$ -	1.25	$ -
		Type 2 - 50HP & up	1	ea	$ 9,600	1	$ 9,600	1.25	$ 12,000
		Continuous Operation		ea	$ 2,000	1	$ -	1.25	$ -
	9	Demand charge	487	HP		1	$ 4,489	1	
							$ -		
Storage Tanks	12						$ -		
		Type 1 - < 72-inch pipe		LF	$ 1.75	2	$ -	1.25	$ -
		Type 2 - < 1.5 MG		ea	$ 16,500	1	$ -	1.25	$ -
		Type 3 - > 1.5 MG		MG	$ 2,180	1	$ -	1.5	$ -
		Type 4 - Tunnel	7.226	MG	$ 87,675	1	$ 87,675	1.5	$ 131,512
Tank cleaning equipment									
	11	Motorized gate		ea	$ 1,040	1	$ -	1.25	$ -
		Tipping bucket		ea	$ 1,040	1	$ -	1.5	$ -
Odor Control	12								
			0	MG	$ 1,700	1	$ -	1.25	$ -
Other special O&M requirements									
GSI								1.25	$ -
Retrofit								1	$ -
I/I Reduction								1.5	$ -
Annual O&M							$ 106,143		$ 148,932

Cost Calculations for Project: **Alternative N-13a, In-Line Storage**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Project Year: 2010
Responsible Party:
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2010 Cost
21' Dia Tunnel					
	Tunnel	2010	42,700,000	1.00	42,700,000
14.45 MGD Pump Station					
	Pump Station	2010	4,310,000	1.00	4,310,000
Influent Line for Upper Basin 147					
	Pipe	2010	476,000	1.00	476,000
Influent Line for Lower Basin 147					
	Pipe	2010	652,000	1.00	652,000
Force Main from Pump Station					
	Pipe	2010	218,000	1.00	218,000
			Year 2008 Subtotal		$48,300,000

Year 2010 Total: $48,300,000

Cost Calculations for Tunnel: **21' Dia Tunnel**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Inside Diameter: 18 ft.
Length: 2560 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Average
Launch Shaft Excavation Depth: 70 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 170 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Average
Tunnel Easement Length: 0 ft
Easement Type: None
Land Adjustment Factor: Seattle
Launch Shaft Footprint: Standard
Retrieval Shaft Footprint: Standard

Tunnel Geometry

Outer Diameter	19.5 ft
Spoils Volume	28,300 CY

Launch Shaft Geometry

Width	59 ft
Length	186 ft
Footprint	11,000 SF
Volume	28,500 CY
Easement Footprint	25,700 SF

Retrieval Shaft Geometry

Width	49 ft
Length	69 ft
Footprint	3,380 SF
Volume	21,300 CY
Easement Footprint	11,800 SF

Miscellaneous

Spoils Loads 2,830 loads

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	I
Spoils Haul	28,300.0	CY	12.0	
Launch Shaft Excavation	28,500.0	CY	15.0	
Launch Shaft Shoring	34,300.0	SF	140.0	
Launch Shaft Existing Utilities	11,000.0	SF	6.0	
Launch Shaft Backfill	28,500.0	CY	18.0	
Launch Shaft Surface Restoration	1,220.0	SY	74.0	
Retrieval Shaft Excavation	21,300.0	CY	15.0	
Retrieval Shaft Shoring	40,100.0	SF	325.0	
Retrieval Shaft Existing Utilities	3,380.0	SF	6.0	
Retrieval Shaft Backfill	21,300.0	CY	18.0	
Retrieval Shaft Surface Restoration	376.0	SY	74.0	
Tunnel Dewatering	1.0	LS	80,000.0	
TBM Procurment	1.0	LS	6,190,000.0	
Tunnel Boring	2,560.0	ft	3,530.0	
Additional TBM Procurement to Upsize to 21'	1	LS	360,000.0	
Additional Tunnel Boring to Upsize to 21' dia	2,560	LF	600.0	
Land Aquistion for Launch Shaft Industrial	31,250	SF	31.0	
Land Aquisition for Retrieval Shaft Office/Commericial	45,380	SF	49.0	
Seattle DOT Street Use Fee	56,320	SF	11.7	
			Year 2008 Subtotal	$

Mobilization/Demobilization at 6%
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)

Effective Multiplier

Construction Year 2010 Subtotal $

Year 2010 Total: $42,700,000

Cost Calculations for Pump Station: **14.45 MGD Pump Station**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Capacity: 14.45 mgd
Total Dynamic Head: 98 ft
Excavation Depth: 0 ft

Calculated Parameters

Required Pump Power	487 Hp
Base Architectural/Structural Unit Cost	144,000 $/mgd
Architectural/Structural Unit Cost Adjustment	-43,200 $/mgd
Base Mechanical Unit Cost	71,600 $/mgd
Mechanical Unit Cost Adjustment	-12,400 $/mgd

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Site/Civil	1.0	LS	858,000	858,000
Electrical/Instrumentation	1.0	LS	1,070,000	1,070,000
Architectural/Structural	14.5	mgd	101,000	1,460,000
Mechanical	14.5	mgd	59,200	855,000
Standby Generator 500 kW	1	EA	150,000	150,000
		Year 2008 Subtotal		$4,390,000

Multiplier from ENRCCI 8815 (2008) to 8645 (2010) 0.98

Construction Year 2010 Subtotal $4,310,000

Year 2010 Total: $4,310,000

Cost Calculations for Pipe: **Influent Line for Upper Basin 147**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 750 ft
Conduit Type: Gravity
Depth of Cover: 20 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	22.9 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	3,180.0	CY	13.00	41,300
Backfill	2,630.0	CY	34.00	89,600
Complete Pavement Restoration	583.0	SY	86.00	50,100
Overlay Pavement Restoration	1,250.0	SY	28.00	35,000
Trench Safety	34,400.0	SF	0.53	18,200
Spoil Load and Haul	3,180.0	CY	16.00	50,800
Pipe Unit Material Cost	750.0	lf	24.00	18,000
Pipe Installation	750.0	lf	29.00	21,800
Place Pipe Zone Fill	463.0	CY	34.00	15,700
Manholes	2.0	MH	10,700.00	21,400
Existing Utilities	750.0	lf	42.00	31,500

Dewatering	750.0	lf	24.00	18,000
Traffic Control	750.0	lf	16.00	12,000
Street use fee	16,500	SF	2.10	34,700
			Year 2008 Subtotal	$458,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$476,000

Year 2010 Total: $476,000

Cost Calculations for Pipe: **Influent Line for Lower Basin 147**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 400 ft
Conduit Type: Gravity
Depth of Cover: 10 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.5 ft
Trench Width	5.75 ft
Excavation Depth	13.5 ft
Complete Surface Rest. Width	7.75 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,150.0	CY	13.00	15,000
Backfill	767.0	CY	34.00	26,100
Complete Pavement Restoration	344.0	SY	86.00	29,600
Overlay Pavement Restoration	633.0	SY	28.00	17,700
Trench Safety	10,800.0	SF	17.00	184,000
Spoil Load and Haul	1,150.0	CY	16.00	18,400
Pipe Unit Material Cost	400.0	lf	36.00	14,400
Pipe Installation	400.0	lf	33.00	13,200
Place Pipe Zone Fill	311.0	CY	34.00	10,600
Manholes	1.0	MH	7,390.00	7,390
Existing Utilities	400.0	lf	58.00	23,200

Dewatering	400.0	lf	100.00	40,000
Traffic Control	400.0	lf	24.00	9,600
Diversion Structure	2	EA	100,000.00	200,000
Street use fee	8,800	SF	2.10	18,500
			Year 2008 Subtotal	$627,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$652,000

Year 2010 Total: $652,000

Cost Calculations for Pipe: **Force Main from Pump Station**

Printed date : 12/07/2010

Project year: 2010

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2010
Length: 200 ft
Conduit Type: Force Main
Depth of Cover: 8 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Trench Width
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.15 ft
Trench Width	5.3 ft
Excavation Depth	11.2 ft
Complete Surface Rest. Width	7.3 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	437.0	CY	13.00	5,690
Backfill	275.0	CY	34.00	9,340
Complete Pavement Restoration	162.0	SY	86.00	13,900
Trench Safety	4,460.0	SF	17.00	75,800
Spoil Load and Haul	437.0	CY	16.00	7,000
Pipe Unit Material Cost	200.0	lf	114.00	22,800
Pipe Installation	200.0	lf	33.00	6,600
Place Pipe Zone Fill	136.0	CY	34.00	4,620
Existing Utilities	200.0	lf	58.00	11,600
Dewatering	200.0	lf	100.00	20,000
Traffic Control	200.0	lf	24.00	4,800

Type 205A Manhole	1	EA	25,000.00	25,000
Street use fee	1,200	SF	2.10	2,520
			Year 2008 Subtotal	$210,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 8645 (2010)	0.98
Effective Multiplier	1.04
Construction Year 2010 Subtotal	$218,000

Year 2010 Total: $218,000