Appendix G.4

# Middle EBI – Hanford #1

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# Hanford #1 Alternative

## DSN031-STOR-1 (KC) or MEBI-Han-Rain-BV-KC-STOR 1

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## DSN031-STOR-1 (KC) or MEBI-Han-Rain-BV-KC-STOR 1

Alternative DSN031-STOR-1 (KC) controls King County's Hanford@Rainier and Bayview North CSOs by building a storage tank near the Bayview North Overflow Structure. This alternative is an independent alternative and only controls King County CSOs.

### Design Criteria

- King County Storage Volume Requirement: 1.79 MG (Hanford@Rainier and Bayview North)
- King County CSO Peak Flow Rate for Sizing Conveyance from Hanford@Rainier Overflow Structure to Storage: 31.0 MGD (Hanford@Rainier CSOs)
- King County CSO Peak Flow Rate for Sizing Conveyance from Bayview North Overflow Structure to Storage: 55.5 MGD (Bayview North CSOs)
- Storage tank is required to drain within 12 hours of event.

### Description

Alternative DSN031-STOR-1 (KC) consists of a storage tank to control King County Hanford@Rainier and Bayview North CSOs. A CSO control volume of approximately 1.79 MG is required to reduce overflows at the Hanford #1 CSO Outfall to an average of one untreated discharge per year at each outfall. Storage of this volume could be provided with an offline storage tank located within or adjacent to the approximate solid boundary shown in Figure G.4-1. The storage tank could be located anywhere between the Hanford@Rainier Overflow Structure and Bayview North Overflow Structure (indicated as dashed boundary in Figure G.4-1); however, conveyance would need to be re-evaluated if the storage tank moves from assumed location (solid boundary). See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- 1.79-MG offline storage tank with pumps to empty the storage tank.
- Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
- Modifications to the Bayview North Overflow Structure and Hanford@Rainier Overflow Structure.
- Up to approximately 1,000 ft of 16-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate solid boundary shown in Figure G.4-1.
- Up to approximately 2,010 ft of 48-inch-diameter influent gravity sewer to convey Bayview North CSOs from the Bayview North Overflow Structure to the storage tank, depending on the location selected for the offline storage tank within or adjacent to the approximate solid boundary shown in Figure G.4-1.
- Approximately 2,900 ft of 72-inch-diameter influent gravity sewer to convey Hanford@Rainier CSOs from the Hanford@Rainier Overflow Structure to the storage

tank, depending on the location selected for the offline storage tank within or adjacent to the approximate solid boundary shown in Figure G.4-1.

### Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 200 feet long and 80 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

### Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.4-1 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

### Flow Diversion and Discharge

The storage tank is located in the vicinity of the Bayview North Overflow Structure and would store King County flow diverted from the Bayview North Overflow Structure and Hanford@Rainier Overlfow Structure.

One regulator station will be required to divert King County flows (Bayview North CSOs) from the Bayview North Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur just upstream of the Bayview North Overflow Structure. Evaluation of whether flows can be diverted further upstream of the overflow structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 48-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 2,010 feet long based on the criteria and assumptions listed in Section 6.1.

An additional regulator station will be required to divert King County flows (Hanford@Rainier CSOs) from the Hanford@Rainier Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur at the Hanford@Rainier Overflow Structure. Evaluation of whether flows can be diverted further upstream of the overflow structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via approximately 2,900 ft of 72-inch-diameter influent gravity sewer. A drop structure will be required at the upstream end of the influent gravity sewer, immediately adjacent to the Hanford@Rainier Overflow Structure. This drop

structure is required to lower the invert elevation of the influent gravity sewer, so that the water surface elevation at full flow in the sewer is lower than the existing overflow weir elevation in the overflow structure. This drop structure will allow the capacity of the new influent gravity sewer to be fully utilized.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Bayview Tunnel through a 16-inch-diameter force main that is up to approximately 1,000 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

### Construction Assumptions

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

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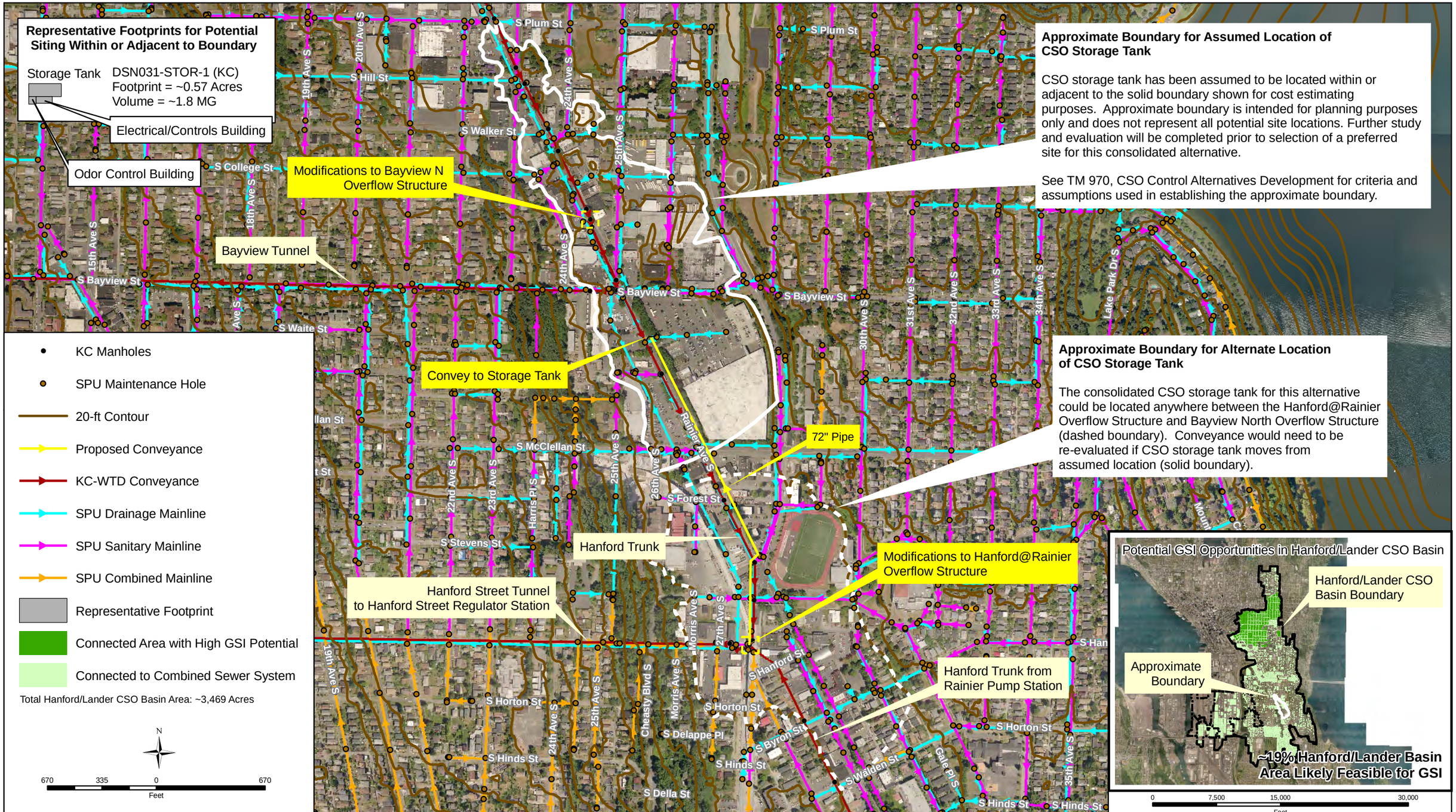


King County
Department of Natural Resources and Parks
**Wastewater Treatment Division**

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**File Name:**

**Data Source:**

Figure G.4-1

**Hanford #1 - DSN031-STOR-1 (KC)**
**Potential Site Boundary and Representative Footprints**

*TM 970, CSO Control Alternatives Development*

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# Alternative DSN031-STOR-1 (KC)

## Escalation Assumptions

| Description | ENR CCI |
|---|---|
| ENR CCI (Seattle), January 2010 | 8645.35 |

## Total Project Cost, 2010 Dollars

| Description | Total Costs (Hanford #1) |
|---|---|
| 1.79-MG Storage Tank Construction Cost = | $9,200,000 |
| Influent Gravity Sewer Construction Cost, from Bayview N Overflow Structure to Storage Tank (2,010 LF of 48-inch-diameter pipe) = | $3,280,000 |
| Influent Gravity Sewer Construction Cost, from Hanford@Rainier Overflow Structure to Storage Tank (2,900 LF of 72-inch-diameter pipe) = | $8,640,000 |
| Force Main Construction Cost (1,000 LF of 16-inch-diameter pipe) = | $470,000 |
| Modifications to Hanford@Rainier Overflow Structure Construction Cost = | $490,000 |
| Modifications to Bayview North Overflow Structure Construction Cost = | $490,000 |
| SDOT Street Use Permit Fee Cost = | $670,000 |
| Total Construction Cost = | $23,240,000 |
| | |
| Sales Tax (10% of Construction Cost) = | $2,320,000 |
| [1]Allied Costs (46.07% of Construction Cost) = | $10,710,000 |
| Property Cost = | $2,580,000 |
| Subtotal of Project Cost = | $38,850,000 |
| | |
| [1]Construction Contingency (10% of Construction Cost) = | $2,320,000 |
| [1, 2]Project Contingency = | $9,340,000 |
| **Total Project Cost, 2010 Dollars =** | **$50,500,000** |

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

# STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 01/27/2011

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
Storage Capacity: 1.79 Mgal
Facility Footprint: 25030 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Surface Restoration | 2,780.00 | SY | $43 | $120,000 |
| Dewatering | 1 | LS | $1,030,000 | $1,030,000 |
| Odor Control | 1 | LS | $300,000 | $300,000 |
| Effluent Pump Station | 1 | LS | $237,000 | $237,000 |
| Construction Cost | 1.8 | Mgal | 4,000,000 | $7,160,000 |
| | | | Year 2008 Subtotal | $8,850,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $9,200,000 |

# CONVEYANCE FROM BAYVIEW N TO STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 01/27/2011

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: 2010 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: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 48 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 4.83 | ft |
| Trench Width | 8.78 | ft |
| Excavation Depth | 15.8 | ft |
| Complete Surface Rest. Width | 10.8 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 10,400.00 | CY | $13 | $135,000 |
| Backfill | 5,880.00 | CY | $34 | $200,000 |
| Complete Pavement Restoration | 2,410.00 | SY | $86 | $207,000 |
| Overlay Pavement Restoration | 7,420.00 | SY | $28 | $208,000 |
| Trench Safety | 63,600.00 | SF | $17 | $1,080,000 |
| Spoil Load and Haul | 10,400.00 | CY | $16 | $166,000 |
| Pipe Unit Material Cost | 2,010.00 | lf | $123 | $247,000 |
| Pipe Installation | 2,010.00 | lf | $60 | $121,000 |
| Place Pipe Zone Fill | 3,100.00 | CY | $34 | $105,000 |
| Manholes | 5 | MH | $12,600 | $62,800 |
| Existing Utilities | 2,010.00 | lf | $166 | $334,000 |
| Dewatering | 2,010.00 | lf | $107 | $215,000 |
| Traffic Control | 2,010.00 | lf | $36 | $72,400 |
| | | | Year 2008 Subtotal | $3,150,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $3,280,000 |

Year 2010 Total: $3,280,000

# CONVEYANCE FROM HANFORD@RAINIER TO STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Conveyance from Hanford@Rainier to Bayview North
Printed date : 01/28/2011

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: 2900 ft
Conduit Type: Gravity
Depth of Cover: 18 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 72 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 7.29 | ft |
| Trench Width | 12 | ft |
| Excavation Depth | 26.3 | ft |
| Complete Surface Rest. Width | 14 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 33,800.00 | CY | $13 | $440,000 |
| Backfill | 21,900.00 | CY | $34 | $744,000 |
| Complete Pavement Restoration | 4,500.00 | SY | $86 | $387,000 |
| Overlay Pavement Restoration | 9,670.00 | SY | $28 | $271,000 |
| Trench Safety | 152,000.00 | SF | $17 | $2,590,000 |
| Spoil Load and Haul | 33,800.00 | CY | $16 | $541,000 |
| Pipe Unit Material Cost | 2,900.00 | lf | $346 | $1,000,000 |
| Pipe Installation | 2,900.00 | lf | $109 | $316,000 |
| Place Pipe Zone Fill | 7,470.00 | CY | $34 | $254,000 |
| Manholes | 6.00 | MH | $24,200 | $145,000 |
| Existing Utilities | 2,900.00 | lf | $360 | $1,040,000 |
| Dewatering | 2,900.00 | lf | $147 | $426,000 |
| Traffic Control | 2,900.00 | lf | 50 | $145,000 |
| | | | Year 2008 Subtotal | ######### |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $8,640,000 |

# FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 01/27/2011

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: 1000 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
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: Standard
Pipe Diameter: 16 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 1.45 | ft |
| Trench Width | 4.38 | ft |
| Excavation Depth | 8.45 | ft |
| Complete Surface Rest. Width | 6.39 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 1,370.00 | CY | $13 | $17,800 |
| Backfill | 812 | CY | $34 | $27,600 |
| Complete Pavement Restoration | 709 | SY | $86 | $61,000 |
| Overlay Pavement Restoration | 1,730.00 | SY | $28 | $48,600 |
| Trench Safety | 16,900.00 | SF | $1 | $8,960 |
| Spoil Load and Haul | 1,370.00 | CY | $16 | $22,000 |
| Pipe Unit Material Cost | 1,000.00 | lf | $75 | $75,000 |
| Pipe Installation | 1,000.00 | lf | $27 | $27,000 |
| Place Pipe Zone Fill | 499 | CY | $34 | $17,000 |
| Existing Utilities | 1,000.00 | lf | $42 | $42,000 |
| Dewatering | 1,000.00 | lf | $87 | $87,000 |
| Traffic Control | 1,000.00 | lf | $16 | $16,000 |
| | | | Year 2008 Subtotal | $450,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $468,000 |

Year 2010 Total: $468,000

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# MODIFICATIONS TO HANFORD@RAINIER OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 01/13/2011

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
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

# MODIFICATIONS TO BAYVIEW NORTH OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station
Printed date : 01/13/2011

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
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

# PROPERTY AND PERMITTING COSTS

## Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

| Uncontrolled CSO Basin | Average Cost per Square Foot for Industrial Land and Building ($/SF) | Average Cost per Square Foot for Industrial Land ($/SF) |
|---|---|---|
| DSN031 Hanford #1 | $103.22 | $22.12 |

## Land Costs, 2010 Dollars

| Description | Footprint (SF) | Land Cost Assumption ($/SF) | Assumed Percentage of Market Value (%) | Estimated Land Costs ($) |
|---|---|---|---|---|
| Storage Tank | 18,900 | $103.22 | 100% | $1,950,858 |
| Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.) | 6,130 | $103.22 | 100% | $632,739 |
| | | | **Total Land Costs** | $2,583,597 |

## SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

| | | |
|---|---|---|
| Closure of construction area will occur in phases. Assumed construction phasing in: | 1,000 | ft segments |
| Assumed production rate during working days = | 15 | LF/d |
| For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula. | 22 | ft |
| For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula. | 44 | ft |

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

## SDOT Street Use Permit Fee Estimation, 2010 Dollars

| Description | Diameter of Pipe (in) | Length (ft) | Width of Construction Area (ft) | Estimated Construction Area (SF) | Construction Duration (Calendar Days) | Number of 10-Day Periods | Use Fee ($/SF) | Estimated Permit Costs |
|---|---|---|---|---|---|---|---|---|
| Regulator Station Upgrade at Hanford@Rainier Overflow Structure | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Regulator Station Upgrade at Bayview North Overflow Structure | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Installation of Influent Gravity Sewer from Bayview North Overflow Structure to Storage Tank, First Phase of Construction | 48 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of Influent Gravity Sewer from Bayview North Overflow Structure to Storage Tank, Second Phase of Construction | 48 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of Influent Gravity Sewer from Bayview North Overflow Structure to Storage Tank, Third Phase of Construction | 48 | 10 | 44 | 440 | 0.9 | 1 | $0.10 | $44 |
| Installation of Influent Gravity Sewer from Hanford@Rainier Overflow Structure to Storage Tank, First Phase of Construction | 72 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of Influent Gravity Sewer from Hanford@Rainier Overflow Structure to Storage Tank, Second Phase of Construction | 72 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of Influent Gravity Sewer from Hanford@Rainier Overflow Structure to Storage Tank, Third Phase of Construction | 72 | 900 | 44 | 39,600 | 84.0 | 9 | $2.10 | $83,160 |
| Installation of Force Main | 16 | 1,000 | 22 | 22,000 | 93.3 | 10 | $2.90 | $63,800 |
| | | | | | | | **Total SDOT Street Use Fee Estimation:** | $670,404 |

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# Operations and Maintenance Cost Estimate Summary

**Basin Name:** **Hanford @ Rainier - Bayview**

**Alternative Name:** **MEBI-Han-Rain-BV -KC-STOR 1**

| | |
|---|---|
| *Current ENR* | **8645.4** |
| *Power Cost (per kwh)* | **0.065** |
| *Labor rate (loaded) /hr* | **51.17** |
| *SPU Water Cost $/CCF* | **4.50** |
| *Carbon Cost/Lb* | **2.00** |

| | |
|---|---|
| *Acres of Raingarden for GSI* | **0.00** |
| *Annual Overflow Vol (MG)* | **0.10** |
| *Annual Vol Capture* | **1.79** |
| *Annual Events* | **1** |
| *Stor Vol* | **1.79** |
| *Peak Flow Rate* | **46.70** |
| *ENR 1994* | 5747 |

## Annual Costs

| **Components** | **Annual Maintenance & Inspection Cost** | **Annual Operation Cost** | **Annual Energy Cost** | **Annual Chemical Cost** |
|---|---|---|---|---|
| Gravity Sewer/Combined Sewers | $7,414 | | | |
| Force Mains | $36 | | | |
| Regulator/Flow Control Structures | $0 | | | |
| Deep/Shallow Tunnels | $0 | | | |
| Off-Line Storage Pipes | $0 | | | |
| River Outfalls | $0 | | | |
| Pump Stations | $0 | $0 | $0 | |
| Rectangular Storage Facilities | $40,390 | $4,253 | $10,158 | $33,503 |
| High Rate Treatment | $0 | $0 | $0 | $0 |
| Additonal Secondary Treatment | NA | $1,176 | NA | NA |
| Green Stormwater Infrastructure | $0 | | | |
| **Annual Cost Subtotals:** | **$47,840** | **$5,428** | **$10,158** | **$33,503** |

**Total Annual O&M**

| | |
|---|---|
| **General** | **$86,771** |
| **Energy** | **$10,158** |
| **Total** | **$96,929** |

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# WTD Business Case Evaluation Results

## Hanford@Rainier CSO Control

### Lower Bound Discount Rate (WTD Borrowing Cost) (1)

| Scenario | Lifetime | Initial Capital Outlay | Total Project Life Costs (2) | Total Project Life Benefits | Net Project Life Costs | Average Project Annual Cost | Annual Costs over(under) Status quo |
|---|---|---|---|---|---|---|---|
| Alternatives | | | | | | | |
| MEBI-Han-Rain-BV - KC-STOR 1 | 50 | $50,500,000 | $51,593,635 | $0 | $51,593,635 | $1,706,183 | $1,706,183 |

### Upper Bound Discount Rate (OMB, Private Rate of Return) (3)

| Scenario | Lifetime | Initial Capital Outlay | Total Project Life Costs (2) | Total Project Life Benefits | Net Project Life Costs | Average Project Annual Cost | Annual Costs over(under) Status quo |
|---|---|---|---|---|---|---|---|
| Alternatives | | | | | | | |
| MEBI-Han-Rain-BV - KC-STOR 1 | 50 | $50,500,000 | $40,398,687 | $0 | $40,398,687 | $1,335,970 | $1,335,970 |

| | | | |
|---|---|---|---|
| First Year of Construction | 2010 | Additional inflation rate > 3% | 1.00% |

Notes:

(1) WTD Discount rate based on recent WTD borrowing costs net of 3% annual inflation. 2.18%

(2) Costs include risk and uncertainty, if estimated.

(3) Discount rate net of inflation, per the King County Budget Office. 7.00%

The option with the largest net equivalent annualized cost is the financially preferred option.

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# Hanford #1 Alternative

## DSN031-STOR-4 (KC) or MEBI-Han-Rain-BV-KC-STOR 2

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## DSN031-STOR-4 (KC) or MEBI-Han-Rain-BV-KC-STOR 2

Alternative DSN031-STOR-4 (KC) controls King County's Hanford@Rainier and Bayview North CSOs by building two storage tanks, one near the Hanford@Rainier Overflow Structure and one near the Bayview North Overflow Structure. This alternative is an independent alternative and only controls King County CSOs.

### Design Criteria

- Hanford@Rainier
  - King County Storage Volume Requirement: 1.02 MG
  - King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 31.0 MGD
- Bayview North
  - King County Storage Volume Requirement: 0.77 MG
  - King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 55.5 MGD
- Storage tank is required to drain within 12 hours of event.

### Description

Alternative DSN031-STOR-4 (KC) consists of two storage tanks to control King County Hanford@Rainier and Bayview North CSOs. A CSO control volume of approximately 1.02 MG for Hanford@Rainier and 0.77 MG for Bayview North is required to reduce overflows at the Hanford #1 CSO Outfall to an average of one untreated discharge per year at each outfall. Storage of this volume could be provided with two offline storage tanks located within or adjacent to the approximate boundaries shown in Figure G.4-2. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- Hanford@Rainier
  - 1.02-MG offline storage tank with pumps to empty the storage tanks.
  - Facilities building to house electrical/control/odor control equipment and standby generators.
  - Modifications to Hanford@Rainier Overflow Structure.
  - Up to approximately 660 ft of 12-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.4-2.
  - Up to approximately 1,320 ft of 42-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.4-2.
- Bayview North
  - 0.77-MG offline storage tank with pumps to empty the storage tanks.

- Facilities building to house electrical/control/odor control equipment and standby generators.
- Modifications to Bayview North Overflow Structure.
- Up to approximately 1,000 ft of 12-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.4-2.
- Up to approximately 2,010 ft of 48-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.4-2.

#### Storage Tanks

The CSO control volume for King County could be stored in buried, rectangular structures. The storage tank located near the Hanford@Rainier Overflow Structure (to control Hanford@Rainier CSOs) would be approximately 160 feet long and 60 feet wide with a sidewater depth of approximately 20 feet. The storage tank located near the Bayview North Overflow Structure (to control Bayview North CSOs) would be approximately 140 feet long and 50 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tanks during a wet-weather event. The tanks may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

#### Facilities Buildings

Facilities buildings would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the buildings will be determined during preferred alternative development. The representative footprints shown in Figure G.4-2 for this alternative locate the facilities buildings adjacent to the storage tanks for conservative purposes; however, the facilities buildings could be located above the storage tanks to minimize space requirements.

#### Flow Diversion and Discharge

The storage tanks are located near the Hanford@Rainier Overflow Structure and the Bayview N Overflow Structure, and would store King County flow diverted from each of the overflow structures.

### *Hanford@Rainier*

One regulator station will be required to divert King County flows (Hanford@Rainier CSOs) from the Hanford@Rainier Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur at the Hanford@Rainier Overflow Structure. Evaluation of whether flows can be diverted upstream of the overflow structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location

of the storage tank via a 42-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,320 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Hanford Street Tunnel through a 12-inch-diameter force main. The force main can be up to approximately 660 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

#### *Bayview North*

One regulator station will be required to divert King County flows (Bayview North CSOs) from the Bayview North Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur at the Bayview North Overflow Structure. Evaluation of whether flows can be diverted upstream of the overflow structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 48-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 2,010 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Bayview Tunnel through a 12-inch-diameter force main. The force main can be up to approximately 1,000 feet in length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

### Construction Assumptions

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

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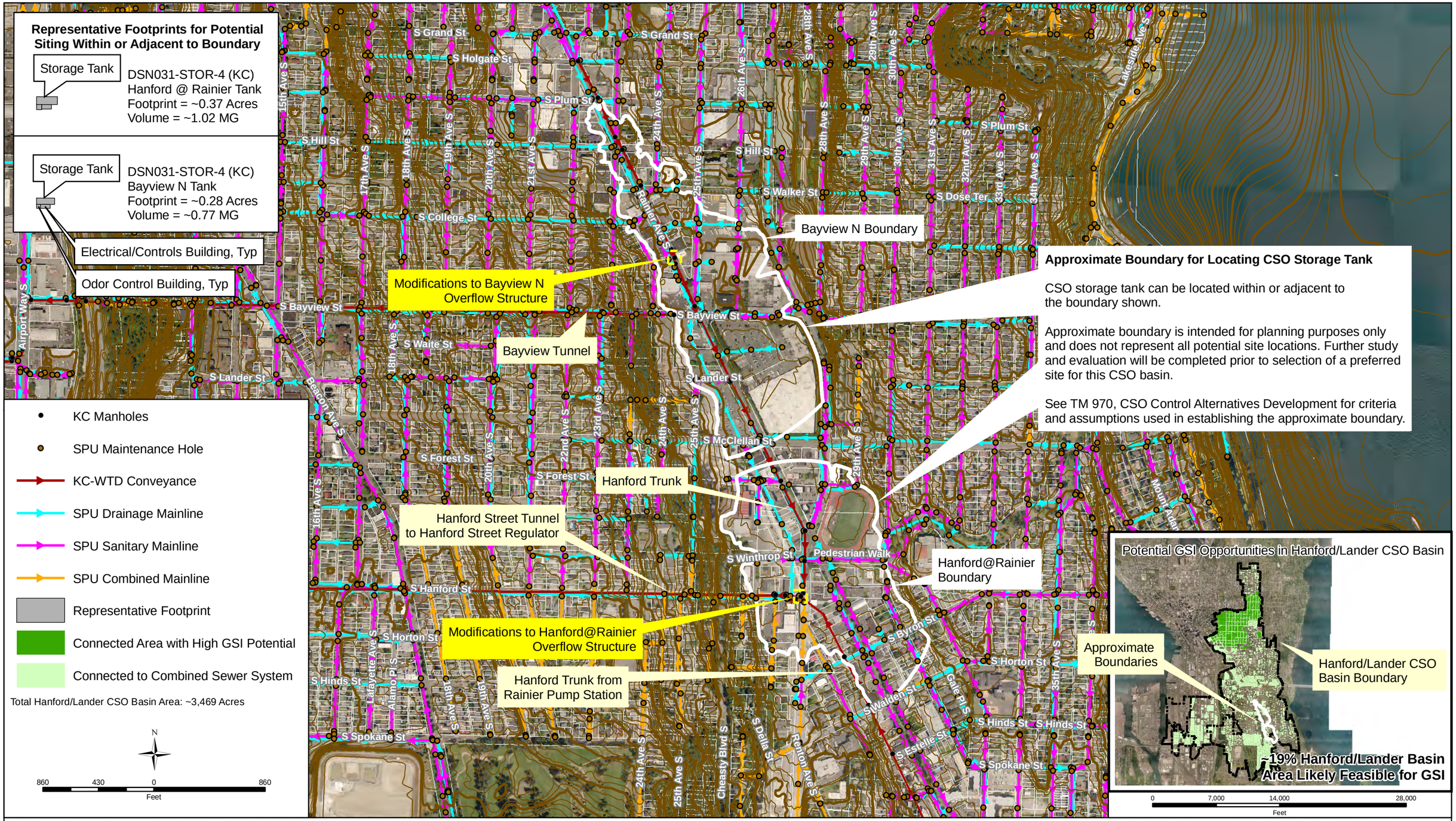


King County
Department of Natural Resources and Parks
**Wastewater Treatment Division**

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**File Name:**

**Data Source:**

Figure G.4-2

**Hanford #1 - DSN031-STOR-4 (KC)**
**Potential Site Boundary and Representative Footprints**

*TM 970, CSO Control Alternatives Development*

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# Alternative DSN031-STOR-4 (KC)

## Escalation Assumptions

| Description | ENR CCI |
|---|---|
| ENR CCI (Seattle), January 2010 | 8645.35 |

## Total Project Cost, 2010 Dollars

| Description | Total Costs (Hanford #1) |
|---|---|
| 1.02-MG Hanford@Rainier Storage Tank Construction Cost = | $5,730,000 |
| 0.77-MG Bayview North Storage Tank Construction Cost = | $4,590,000 |
| Hanford@Rainier Influent Gravity Sewer Construction Cost (1,320 LF of 42-inch-diameter pipe) = | $1,920,000 |
| Bayview North Influent Gravity Sewer Construction Cost (2,010 LF of 48-inch-diameter pipe) = | $3,280,000 |
| Hanford@Rainier Force Main Construction Cost (660 LF of 12-inch-diameter pipe) = | $270,000 |
| Bayview North Force Main Construction Cost (1,000 LF of 12-inch-diameter pipe) = | $410,000 |
| Modifications to Hanford@Rainier Regulator Construction Cost = | $490,000 |
| Modifications to Bayview N Regulator Construction Cost = | $490,000 |
| SDOT Street Use Permit Fee Cost = | $480,000 |
| Total Construction Cost = | $17,660,000 |
| | |
| Sales Tax (10% of Construction Cost) = | $1,770,000 |
| [1]Allied Costs (46.07% of Construction Cost) = | $8,140,000 |
| Property Cost = | $2,910,000 |
| Subtotal of Project Cost = | $30,480,000 |
| | |
| [1]Construction Contingency (10% of Construction Cost) = | $1,770,000 |
| [1, 2]Project Contingency = | $7,370,000 |
| **Total Project Cost, 2010 Dollars =** | **$39,600,000** |

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

# HANFORD@RAINIER STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility - Hanford @ Rainier
Printed date : 01/27/2011

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
Storage Capacity: 1.02 Mgal
Facility Footprint: 16205 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Surface Restoration | 1,800.00 | SY | $43 | $77,400 |
| Dewatering | 1 | LS | $959,000 | $959,000 |
| Odor Control | 1 | LS | $177,000 | $177,000 |
| Effluent Pump Station | 1 | LS | $216,000 | $216,000 |
| Construction Cost | 1 | Mgal | 4,000,000 | $4,080,000 |
| | | | Year 2008 Subtotal | $5,510,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $5,730,000 |

# BAYVIEW NORTH STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility - Bayview N
Printed date : 01/28/2011

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
Storage Capacity: 0.77 Mgal
Facility Footprint: 12025 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Surface Restoration | 1,340.00 | SY | $43 | $57,500 |
| Dewatering | 1 | LS | $936,000 | $936,000 |
| Odor Control | 1 | LS | $137,000 | $137,000 |
| Effluent Pump Station | 1 | LS | $209,000 | $209,000 |
| Construction Cost | 0.8 | Mgal | 4,000,000 | $3,080,000 |
| | | | Year 2008 Subtotal | $4,420,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $4,590,000 |

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# HANFORD@RAINIER INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity) - Hanford @ Rainier
Printed date : 01/27/2011

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: 1320 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: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 42 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 4.25 | ft |
| Trench Width | 8.03 | ft |
| Excavation Depth | 15.3 | ft |
| Complete Surface Rest. Width | 10 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 5,980.00 | CY | $13 | $77,800 |
| Backfill | 3,530.00 | CY | $34 | $120,000 |
| Complete Pavement Restoration | 1,470.00 | SY | $86 | $126,000 |
| Overlay Pavement Restoration | 4,980.00 | SY | $28 | $140,000 |
| Trench Safety | 40,300.00 | SF | $17 | $684,000 |
| Spoil Load and Haul | 5,980.00 | CY | $16 | $95,700 |
| Pipe Unit Material Cost | 1,320.00 | lf | $86 | $114,000 |
| Pipe Installation | 1,320.00 | lf | $52 | $68,600 |
| Place Pipe Zone Fill | 1,760.00 | CY | $34 | $59,800 |
| Manholes | 3 | MH | $9,720 | $29,200 |
| Existing Utilities | 1,320.00 | lf | $120 | $158,000 |
| Dewatering | 1,320.00 | lf | $107 | $141,000 |
| Traffic Control | 1,320.00 | lf | $24 | $31,700 |
| | | | Year 2008 Subtotal | $1,850,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $1,920,000 |

Year 2010 Total: $1,920,000

# BAYVIEW NORTH INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity) - Bayview N
Printed date : 01/28/2011

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: 2010 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: Full Width - Arterial (44 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: Seattle
Trench Safety: Special Shoring
Pipe Diameter: 48 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 4.83 | ft |
| Trench Width | 8.78 | ft |
| Excavation Depth | 15.8 | ft |
| Complete Surface Rest. Width | 10.8 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 10,400.00 | CY | $13 | $135,000 |
| Backfill | 5,880.00 | CY | $34 | $200,000 |
| Complete Pavement Restoration | 2,410.00 | SY | $86 | $207,000 |
| Overlay Pavement Restoration | 7,420.00 | SY | $28 | $208,000 |
| Trench Safety | 63,600.00 | SF | $17 | $1,080,000 |
| Spoil Load and Haul | 10,400.00 | CY | $16 | $166,000 |
| Pipe Unit Material Cost | 2,010.00 | lf | $123 | $247,000 |
| Pipe Installation | 2,010.00 | lf | $60 | $121,000 |
| Place Pipe Zone Fill | 3,100.00 | CY | $34 | $105,000 |
| Manholes | 5 | MH | $12,600 | $62,800 |
| Existing Utilities | 2,010.00 | lf | $166 | $334,000 |
| Dewatering | 2,010.00 | lf | $107 | $215,000 |
| Traffic Control | 2,010.00 | lf | $36 | $72,400 |
| | | | Year 2008 Subtotal | $3,150,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $3,280,000 |

Year 2010 Total: $3,280,000

# HANFORD@RAINIER FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main - Hanford @ Rainier
Printed date : 01/27/2011

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: 660 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
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: Standard
Pipe Diameter: 12 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 1.1 | ft |
| Trench Width | 3.93 | ft |
| Excavation Depth | 8.1 | ft |
| Complete Surface Rest. Width | 5.93 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 778.00 | CY | $13 | $10,100 |
| Backfill | 480 | CY | $34 | $16,300 |
| Complete Pavement Restoration | 435 | SY | $86 | $37,400 |
| Overlay Pavement Restoration | 1,180.00 | SY | $28 | $33,000 |
| Trench Safety | 10,700.00 | SF | $1 | $5,670 |
| Spoil Load and Haul | 778.00 | CY | $16 | $12,500 |
| Pipe Unit Material Cost | 660 | lf | $48 | $31,700 |
| Pipe Installation | 660 | lf | $25 | $16,500 |
| Place Pipe Zone Fill | 275 | CY | $34 | $9,340 |
| Existing Utilities | 660 | lf | $32 | $21,100 |
| Dewatering | 660 | lf | $80 | $52,800 |
| Traffic Control | 660 | lf | $16 | $10,600 |
| | | | Year 2008 Subtotal | $257,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $267,000 |

Year 2010 Total: $267,000

# BAYVIEW NORTH FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main - Bayview N
Printed date : 01/27/2011

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: 1000 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
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: Standard
Pipe Diameter: 12 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 1.1 | ft |
| Trench Width | 3.93 | ft |
| Excavation Depth | 8.1 | ft |
| Complete Surface Rest. Width | 5.93 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 1,180.00 | CY | $13 | $15,300 |
| Backfill | 728 | CY | $34 | $24,700 |
| Complete Pavement Restoration | 659 | SY | $86 | $56,700 |
| Overlay Pavement Restoration | 1,790.00 | SY | $28 | $50,000 |
| Trench Safety | 16,200.00 | SF | $1 | $8,590 |
| Spoil Load and Haul | 1,180.00 | CY | $16 | $18,900 |
| Pipe Unit Material Cost | 1,000.00 | lf | $48 | $48,000 |
| Pipe Installation | 1,000.00 | lf | $25 | $25,000 |
| Place Pipe Zone Fill | 416 | CY | $34 | $14,100 |
| Existing Utilities | 1,000.00 | lf | $32 | $32,000 |
| Dewatering | 1,000.00 | lf | $80 | $80,000 |
| Traffic Control | 1,000.00 | lf | $16 | $16,000 |
| | | | Year 2008 Subtotal | $389,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $405,000 |

Year 2010 Total: $405,000

# MODIFICATIONS TO HANFORD@RAINIER OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station - Hanford @ Rainier
Printed date : 01/13/2011

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
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

# MODIFICATIONS TO BAYVIEW NORTH OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station - Bayview N
Printed date : 01/13/2011

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
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

# PROPERTY AND PERMITTING COSTS

## Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)

| Uncontrolled CSO Basin | Average Cost per Square Foot for Industrial Land and Building ($/SF) | Average Cost per Square Foot for Industrial Land ($/SF) |
|---|---|---|
| DSN031 Hanford #1 | $103.22 | $22.12 |

## Land Costs, 2010 Dollars

| Description | Footprint (SF) | Land Cost Assumption ($/SF) | Assumed Percentage of Market Value (%) | Estimated Land Costs ($) |
|---|---|---|---|---|
| Hanford@Rainier Storage Tank | 11,900 | $103.22 | 100% | $1,228,318 |
| Bayview North Storage Tank | 9,000 | $103.22 | 100% | $928,980 |
| Hanford@Rainier Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.) | 4,305 | $103.22 | 100% | $444,362 |
| Bayview North Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.) | 3,025 | $103.22 | 100% | $312,241 |
| | | | **Total Land Costs** | $2,913,901 |

## SDOT Street Use Permit Fee Assumptions

Construction is located on arterial.

Closure of construction area will occur in phases. Assumed construction phasing in: 1,000 ft segments

Assumed production rate during working days = 15 LF/d

For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula. 22 ft

For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula. 44 ft

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

## SDOT Street Use Permit Fee Estimation, 2010 Dollars

| Description | Diameter of Pipe (in) | Length (ft) | Width of Construction Area (ft) | Estimated Construction Area (SF) | Construction Duration (Calendar Days) | Number of 10-Day Periods | Use Fee ($/SF) | Estimated Permit Costs |
|---|---|---|---|---|---|---|---|---|
| Regulator Station Upgrade at Hanford@Rainier Overflow Structure | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Regulator Station Upgrade at Bayview North Overflow Structure | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Installation of H@R Influent Gravity Sewer, First Phase of Construction | 42 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of H@R Influent Gravity Sewer, Second Phase of Construction | 42 | 320 | 44 | 14,080 | 29.9 | 3 | $0.30 | $4,224 |
| Installation of BN Influent Gravity Sewer, First Phase of Construction | 48 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of BN Influent Gravity Sewer, Second Phase of Construction | 48 | 1,000 | 44 | 44,000 | 93.3 | 10 | $2.90 | $127,600 |
| Installation of BN Influent Gravity Sewer, Third Phase of Construction | 48 | 10 | 44 | 440 | 0.9 | 1 | $0.10 | $44 |
| Installation of H@R Force Main | 12 | 660 | 22 | 14,520 | 61.6 | 7 | $1.30 | $18,876 |
| Installation of BN Force Main | 12 | 1,000 | 22 | 22,000 | 93.3 | 10 | $2.90 | $63,800 |
| | | | | | | | **Total SDOT Street Use Fee Estimation:** | $482,744 |

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# Operations and Maintenance Cost Estimate Summary

**Basin Name:** **Hanford @ Rainier - Bayview**

**Alternative Name:** **MEBI-Han-Rain-BV-KC-STOR 2**

| | |
|---|---|
| *ENR 1994* | 5747 |
| *Current ENR* | **8645.4** |
| *Power Cost (per kwh)* | **0.065** |
| *Labor rate (loaded) /hr* | **51.17** |
| *SPU Water Cost $/CCF* | **4.50** |
| *Carbon Cost/Lb* | **2.00** |

| | |
|---|---|
| *Acres of Raingarden for GSI* | **0.00** |
| *Annual Overflow Vol (MG)* | **0.10** |
| *Annual Vol Capture* | **1.79** |
| *Annual Events* | **1** |
| *Stor Vol* | **1.02** |
| *Peak Flow Rate* | **46.70** |

plus second @

## Annual Costs

| **Components** | **Annual Maintenance & Inspection Cost** | **Annual Operation Cost** | **Annual Energy Cost** | **Annual Chemical Cost** |
|---|---|---|---|---|
| Gravity Sewer/Combined Sewers | $4,983 | | | |
| Force Mains | $60 | | | |
| Regulator/Flow Control Structures | $0 | | | |
| Deep/Shallow Tunnels | $0 | | | |
| Off-Line Storage Pipes | $0 | | | |
| River Outfalls | $0 | | | |
| Pump Stations | $0 | $0 | $0 | |
| Rectangular Storage Facilities | $45,712 | $4,253 | $12,340 | $33,503 |
| High Rate Treatment | $0 | $0 | $0 | $0 |
| Additonal Secondary Treatment | NA | $1,176 | NA | NA |
| Green Stormwater Infrastructure | $0 | | | |
| **Annual Cost Subtotals:** | **$50,755** | **$5,428** | **$12,340** | **$33,503** |

**Total Annual O&M**

| | |
|---|---|
| **General** | **$89,686** |
| **Energy** | **$12,340** |
| **Total** | **$102,025** |

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# WTD Business Case Evaluation Results

## Hanford@Rainier CSO Control

### Lower Bound Discount Rate (WTD Borrowing Cost) (1)

| Scenario | Lifetime | Initial Capital Outlay | Total Project Life Costs (2) | Total Project Life Benefits | Net Project Life Costs | Average Project Annual Cost | Annual Costs over(under) Status quo |
|---|---|---|---|---|---|---|---|
| Alternatives | | | | | | | |
| MEBI-Han-Rain-BV-KC-STOR 2 | 50 | $39,600,000 | $41,855,107 | $0 | $41,855,107 | $1,384,133 | $1,384,133 |

### Upper Bound Discount Rate (OMB, Private Rate of Return) (3)

| Scenario | Lifetime | Initial Capital Outlay | Total Project Life Costs (2) | Total Project Life Benefits | Net Project Life Costs | Average Project Annual Cost | Annual Costs over(under) Status quo |
|---|---|---|---|---|---|---|---|
| Alternatives | | | | | | | |
| MEBI-Han-Rain-BV-KC-STOR 2 | 50 | $39,600,000 | $32,073,703 | $0 | $32,073,703 | $1,060,666 | $1,060,666 |

| | | | |
|---|---|---|---|
| First Year of Construction | 2010 | Additional inflation rate > 3% | 1.00% |

Notes:

(1) WTD Discount rate based on recent WTD borrowing costs net of 3% annual inflation. 2.18%

(2) Costs include risk and uncertainty, if estimated.

(3) Discount rate net of inflation, per the King County Budget Office. 7.00%

The option with the largest net equivalent annualized cost is the financially preferred option.

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# Hanford #1 Alternative

## DSN031-CON-1 (KC) or MEBI-Han-Rain-BV-KC-CONV/STOR

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## DSN031-CON-1 (KC) or MEBI-Han-Rain-BV-KC-CONV/STOR

Alternative DSN031-CON-1 (KC) controls King County's Hanford@Rainier and Bayview North CSOs by installing new conveyance pipe from the Bayview North Overflow Structure to the Bayview Tunnel[1] and building a storage tank near the Hanford@Rainier Overflow Structure. This alternative is an independent alternative and only controls King County CSOs.

### Design Criteria

- Hanford@Rainier
  - King County Storage Volume Requirement: 0.343 MG
  - King County CSO Peak Flow Rate for Sizing Conveyance to Storage: 9.6 MGD
  - Storage tank is required to drain within 12 hours of event.
- Bayview North
  - King County CSO Peak Flow Rate for Sizing Conveyance to Bayview Tunnel: 55.5 MGD

### Description

Alternative DSN031-CON-1 (KC) consists of a conveyance pipe and storage tank to control King County Hanford@Rainier and Bayview North CSOs. A CSO control volume of approximately 0.343 MG at Hanford@Rainier and conveyance from Bayview North Overflow Structure to the Bayview Tunnel are required to reduce overflows at the Hanford #1 CSO Outfall to an average of one untreated discharge per year. Storage could be provided with an offline storage tank located within or adjacent to the approximate boundary shown in Figure G.4-3. See Section 6.1 Planning-Level Sizing Assumptions for criteria and assumptions used in establishing the approximate boundary.

The main components of this alternative would include:

- Hanford@Rainier
  - 0.343-MG offline storage tank with pumps to empty the storage tank.
  - Facilities building(s) to house electrical/control/odor control equipment and a standby generator.
  - Modifications to the Hanford@Rainier Overflow Structure.
  - Up to approximately 660 ft of 8-inch-diameter force main, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.4-3.
  - Up to approximately 1,320 ft of 27-inch-diameter influent gravity sewer, depending on the location selected for the offline storage tank within or adjacent to the approximate boundary shown in Figure G.4-3.
- Bayview North

[1] Hydraulic modeling determined that the tunnel is currently not fully utilized and has available capacity.

- Conveyance from Bayview North Overflow Structure to Bayview Tunnel
    - Approximately 50 ft of dual 30-inch-diameter conveyance pipes (100 ft total) as shown in Figure G.4-3.
    - Approximately 510 ft of 48-inch-diameter conveyance pipe as shown in Figure G.4-3. Approximately 380 ft of the 48-inch-diameter conveyance pipe is within a 72-inch-diameter casing installed by microtunnelling due to the excavation depths.
- Modifications to the existing Bayview North Overflow Structure.
- Connection to the Bayview Tunnel.

### Storage Tank

The CSO control volume for King County could be stored in a buried, rectangular structure, approximately 100 feet long and 40 feet wide with a sidewater depth of approximately 20 feet.

Flows would enter the storage tank during a wet-weather event. The tank may be configured with multiple chambers, so that only those chambers required to store the volume of the wet-weather event would be used. Storage of flows would start in the first chamber and as that chamber fills and reaches capacity, flows would be transferred into subsequent chambers until either the wet-weather event ends or the capacity of the storage tank is reached. Each chamber would contain equipment for flushing and self-cleaning, and only chambers used in a wet-weather event would require flushing. Control of odors and sediment in the storage chambers may require regularly-scheduled cleaning between events.

### Facilities Building(s)

Facilities building(s) would be located above or below ground level and would contain an odor control system, electrical controls, and a standby generator. The actual contents of the building(s) will be determined during preferred alternative development. The representative footprint shown in Figure G.4-3 for this alternative locates the facilities buildings adjacent to the storage tank for conservative purposes; however, the facilities buildings could be located above the storage tank to minimize space requirements.

### Flow Diversion and Discharge

One regulator station will be required to divert King County flows (Hanford@Rainier CSOs) from the Hanford@Rainier Overflow Structure to the storage tank. For this planning phase, it is assumed that the diversion would occur just upstream of the Hanford@Rainier Overflow Structure. Evaluation of whether flows can be diverted further upstream of the overflow structure will be completed during preferred alternative development. Diverted King County flow would discharge to the location of the storage tank via a 27-inch-diameter influent gravity sewer. The length of the influent gravity sewer will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development. The influent gravity sewer can be up to 1,320 feet long based on the criteria and assumptions listed in Section 6.1.

After a wet-weather event, the chambers inside the storage tank would drain to a common sump. Submersible pump(s) would transfer stored sewage from the sump back into the King County Hanford Trunk through an 8-inch-diameter force main that is up to approximately 660 feet in

length. The length of the force main will vary depending on the selected location of the offline storage tank, which will be evaluated during preferred alternative development.

### Conveyance Upgrade

One regulator station will be required to divert King County flows (Bayview North CSOs) from the Bayview North Overflow Structure to the Bayview Tunnel. For this planning phase, it is assumed that the diversion would occur just upstream of the Bayview North Overflow Structure. Evaluation of whether flows can be diverted further upstream of the overflow structure will be completed during preferred alternative development. Diverted King County flow would discharge to the Bayview Tunnel via approximately 560 ft of conveyance pipe. Hydraulic modeling determined that the tunnel is currently not fully utilized and has available capacity. This conveyance upgrade increases flows to the Hanford and Lander Street Regulator Stations. Additional modeling will be required to determine the impact of the increased flows to the downstream regulator stations and proposed CSO control facilities. For this planning stage, it is assumed that the increased flows from the Bayview North Overflow Structure would minimally impact the size of the proposed CSO control facilities for the Hanford and Lander Street Regulator Stations.

A drop structure will be required at the upstream end of the conveyance pipe, immediately adjacent to the Bayview North Overflow Structure. This drop structure is required to lower the invert elevation of the conveyance pipe, so that: (1) the water surface elevation at full flow in the sewer is lower than the existing overflow weir elevation in the overflow structure, and (2) the pipe can cross under the existing 96-inch-diameter storm drain, which is located approximately 35 feet west of the Bayview North Overflow Structure. This drop structure will allow the capacity of the new conveyance pipe to be fully utilized as well as allow the conveyance pipe to cross under the existing storm drain.

In addition to the drop structure, approximately 50 ft of dual 30-inch-diameter pipes (100 ft total in length) are required to cross under the existing storm drain. Smaller diameter pipes are required to provide adequate clearance between the new pipes and existing storm drain. The dual 30-inch-diameter pipes would convey flows to approximately 510 ft of 48-inch-diameter pipe, which connects to the Bayview Tunnel. Approximately 380 ft of the 48-inch-diameter conveyance pipe is within a 72-inch-diameter casing installed by microtunneling due to excavation depths.

King County has identified an abandoned 48-inch-diameter private sewer located underneath Bartell Drugs, located on the northwest corner of the South Bayview Street and Rainier Avenue South intersection. It appears that this pipe was previously the trunk line between the Bayview North Overflow Structure and the Bayview Tunnel but was abandoned when the 96-inch-diameter storm drain was installed in Rainier Avenue South. It may be possible to use this existing 48-inch-diameter private sewer to convey flows from the Bayview North Overflow Structure to the Bayview Tunnel instead of installing the new conveyance pipe. Further evaluation of the pipe condition and ownership disposition is required before a decision can be made regarding the use of this existing pipe.

### Construction Assumptions

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

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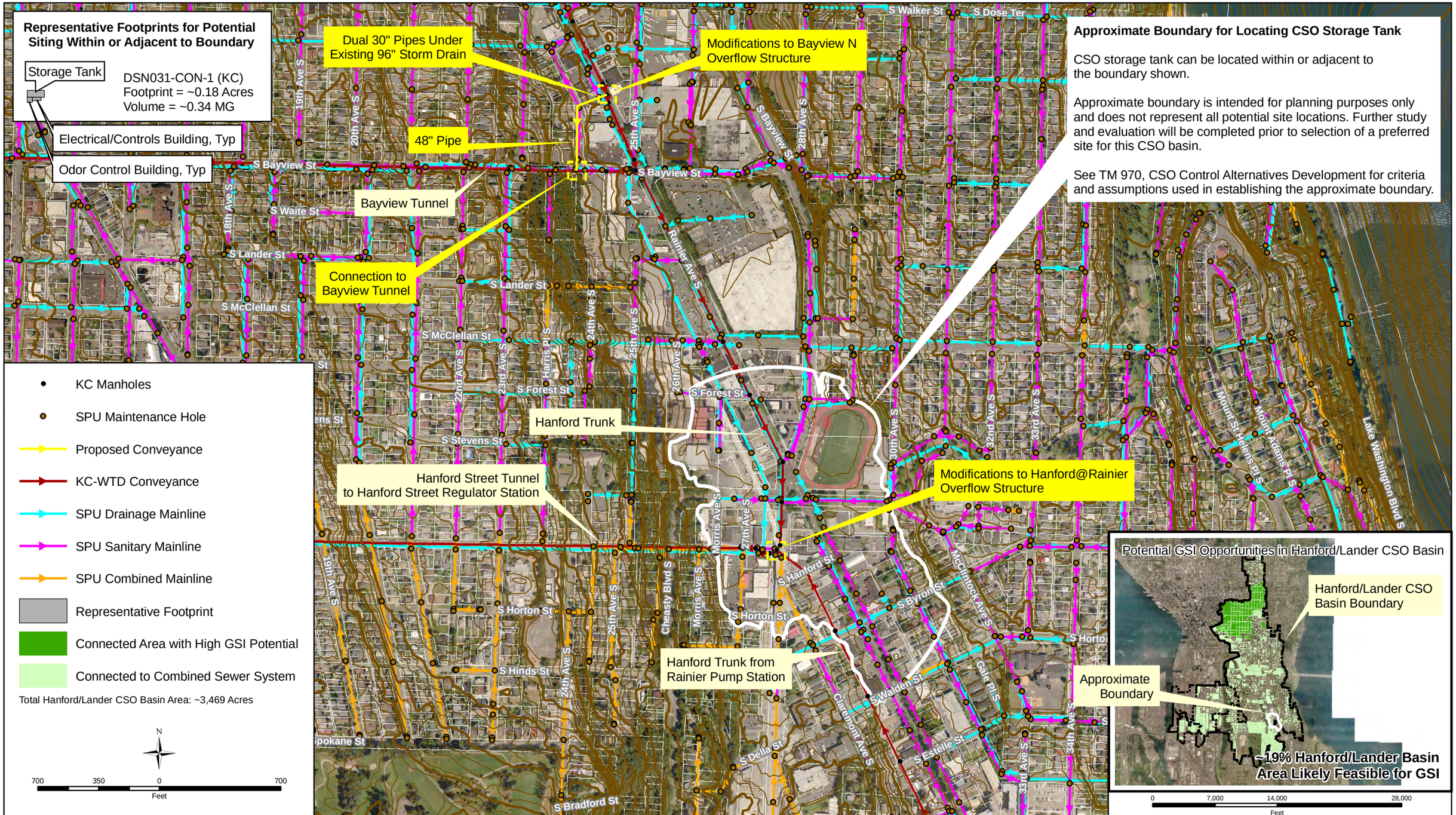


King County
Department of Natural Resources and Parks
**Wastewater Treatment Division**

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**File Name:**

**Data Source:**

Figure G.4-3

**Hanford #1 - DSN031-CON-1 (KC)**
**Potential Site Boundary and Representative Footprints**

*TM 970, CSO Control Alternatives Development*

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# Alternative DSN031-CON-1 (KC)

## Escalation Assumptions

| Description | ENR CCI |
|---|---|
| ENR CCI (Seattle), January 2010 | 8645.35 |

## Total Project Cost, 2010 Dollars

| Description | Total Costs (Hanford #1) |
|---|---|
| 0.343-MG Storage Tank Construction Cost = | $2,310,000 |
| Dual Conveyance Pipe Construction Cost, Installed by Open Cut Construction (Two 30-inch-diameter pipes at 50 LF each = 100 LF) = | $170,000 |
| Conveyance Pipe Construction Cost, Installed by Open Cut Construction (130 LF of 48-inch-diameter pipe) = | $330,000 |
| Conveyance Pipe Construction Cost, Installed by Dual Pass Microtunneling (380 LF of 48-inch-diameter pipe in 72-inch-diameter casing) = | $2,600,000 |
| Influent Gravity Sewer Construction Cost (1,320 LF of 27-inch-diameter pipe) = | $1,450,000 |
| Force Main Construction Cost (660 LF of 8-inch-diameter pipe) = | $240,000 |
| Modifications to Hanford@Rainier Overflow Structure Construction Cost = | $490,000 |
| Modifications to Bayview North Overflow Structure Construction Cost = | $490,000 |
| Connection to Bayview Tunnel Construction Cost = | $490,000 |
| SDOT Street Use Permit Fee Cost = | $60,000 |
| Total Construction Cost = | $8,630,000 |
| | |
| Sales Tax (10% of Construction Cost) = | $860,000 |
| [1]Allied Costs (50.97% of Construction Cost) = | $4,400,000 |
| Property Cost = | $910,000 |
| Subtotal of Project Costs = | $14,800,000 |
| | |
| [1]Construction Contingency (10% of Construction Cost) = | $860,000 |
| [1, 2]Project Contingency = | $3,580,000 |
| **Total Project Cost, 2010 Dollars =** | **$19,200,000** |

[1] King County allied costs and contingency used. Allied cost percentage is based on the type of construction and total construction cost.

[2]Project Contingency = Total Contingency (30% of Subtotal of Project Costs) - Construction Contingency (10% of Construction Cost)

# STORAGE TANK - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Storage Facility: Storage Facility
Printed date : 01/27/2011

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
Storage Capacity: 0.5 Mgal
Facility Footprint: 7825 SF
Land Acquisition: None
Surface Restoration: Pavement
Dewatering: Significant
Construction Method: CastinPlace
Outflow Operations: Pump
Odor Control: true

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Surface Restoration | 869.00 | SY | $43 | $37,400 |
| Dewatering | 1 | LS | $911,000 | $911,000 |
| Odor Control | 1 | LS | $93,400 | $93,400 |
| Effluent Pump Station | 1 | LS | $201,000 | $201,000 |
| Construction Cost | 0.5 | Mgal | 4,000,000 | $2,000,000 |
| | | | Year 2008 Subtotal | $3,240,000 |
| Mobilization/Demobilization at 6% | 1.06 | | | |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 | | | |
| Effective Multiplier | 1.04 | | | |
| Construction Year 2010 Subtotal | $3,370,000 | | | |
| Construction Year 2010 Subtotal - for 0.343 MG Tank | $2,311,820 | | | |

# DUAL CONVEYANCE PIPES (30 INCHES IN DIAMETER) - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Dual 30" Pipes
Printed date : 01/28/2011

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: 50 ft
Conduit Type: Gravity
Depth of Cover: 17 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Close (250 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Special Shoring
Pipe Diameter: 30 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 3.08 | ft |
| Trench Width | 6.51 | ft |
| Excavation Depth | 21.1 | ft |
| Complete Surface Rest. Width | 8.51 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 254.00 | CY | $13 | $3,300 |
| Backfill | 193.00 | CY | $34 | $6,560 |
| Complete Pavement Restoration | 47.30 | SY | $86 | $4,070 |
| Overlay Pavement Restoration | 75.00 | SY | $28 | $2,100 |
| Trench Safety | 2,110.00 | SF | $17 | $35,800 |
| Spoil Load and Haul | 254.00 | CY | $16 | $4,070 |
| Pipe Unit Material Cost | 50.00 | lf | $51 | $2,550 |
| Pipe Installation | 50.00 | lf | $38 | $1,900 |
| Place Pipe Zone Fill | 47.40 | CY | $34 | $1,610 |
| Manholes | 1 | MH | $12,400 | $12,400 |
| Existing Utilities | 50.00 | lf | $58 | $2,900 |
| Dewatering | 50.00 | lf | $100 | $5,000 |
| Traffic Control | 50.00 | lf | $24 | $1,200 |
| | | | Year 2008 Subtotal | $83,500 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $86,800 |
| Dual Pipes, Construction Year 2010 Subtotal | $173,600 |

# CONVEYANCE PIPE (48 INCHES IN DIAMETER) - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Single 48" Pipe
Printed date : 01/28/2011

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: 130 ft
Conduit Type: Gravity
Depth of Cover: 25 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Full Width - Residential Street (28 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Special Shoring
Pipe Diameter: 48 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 4.83 | ft |
| Trench Width | 8.78 | ft |
| Excavation Depth | 30.8 | ft |
| Complete Surface Rest. Width | 10.8 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 1,300.00 | CY | $13 | $17,000 |
| Backfill | 1,010.00 | CY | $34 | $34,500 |
| Complete Pavement Restoration | 156.00 | SY | $86 | $13,400 |
| Overlay Pavement Restoration | 249.00 | SY | $28 | $6,960 |
| Trench Safety | 8,020.00 | SF | $17 | $136,000 |
| Spoil Load and Haul | 1,300.00 | CY | $16 | $20,900 |
| Pipe Unit Material Cost | 130.00 | lf | $123 | $16,000 |
| Pipe Installation | 130.00 | lf | $60 | $7,800 |
| Place Pipe Zone Fill | 201.00 | CY | $34 | $6,820 |
| Manholes | 1 | MH | $21,300 | $21,300 |
| Existing Utilities | 130.00 | lf | $166 | $21,600 |
| Dewatering | 130.00 | lf | $107 | $13,900 |
| Traffic Control | 130.00 | lf | $36 | $4,680 |
| | | | Year 2008 Subtotal | $321,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $334,000 |

# MICROTUNNEL FOR 48" PIPE (72 INCHES IN DIAMETER) - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Microtunnel: Microtunnel for 48" Pipe
Printed date : 02/21/2011

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: 60 in.
Length: 380 ft
Dewatering: Significant
Launch Shaft Existing Utilities: Complex
Launch Shaft Excavation Depth: 35 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 48 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Existing Utilities: Complex
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: true
Number of Intermediate Shafts: 0
Land Adjustment Factor: King County Average
Intermediate Shaft Existing Utilities: Average
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

| | | |
|---|---|---|
| Outer Diameter | 7.29 | ft |
| Spoils Volume | 587 | CY |
| Casing Pipe Diameter | 72 | in |

Launch Shaft Geometry

| | | |
|---|---|---|
| Width | 20.00 | ft |
| Length | 33.00 | ft |
| Footprint | 660.00 | SF |
| Volume | 856.00 | CY |
| Easement Footprint | 5,810.00 | SF |

Retrieval Shaft Geometry

| | | |
|---|---|---|
| Width | 24.00 | ft |
| Length | 24.00 | ft |
| Footprint | 576 | SF |
| Volume | 1,020 | CY |
| Easement Footprint | 5,480 | SF |

Miscellaneous

| | | |
|---|---|---|
| Spoils Loads | $59 | loads |

Intermediate Shaft Geometry

| | | |
|---|---|---|
| Width | 20 | ft |
| Length | 33 | ft |
| Footprint | 660 | SF |
| Volume | 856 | CY |
| Easement Footprint | 5,810 | SF |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Spoils Haul | 587 | CY | 33 | 19,400 |
| Launch Shaft Excavation | 856 | CY | 25 | 21,400 |
| Launch Shaft Shoring | 3,710.00 | SF | 74.8 | 277,000 |
| Launch Shaft Existing Utilities | 660 | SF | 13 | 8,580 |
| Launch Shaft Backfill | 856 | CY | 4 | 3,420 |
| Launch Shaft Surface Restoration | 73.3 | SY | 74 | 5,430 |
| Retrieval Shaft Excavation | 1,020.00 | CY | 25 | 25,600 |
| Retrieval Shaft Shoring | 4,610.00 | SF | 98.8 | 455,000 |
| Retrieval Shaft Existing Utilities | 576 | SF | 13 | 7,490 |
| Retrieval Shaft Backfill | 1,020.00 | CY | 4 | 4,100 |
| Retrieval Shaft Surface Restoration | 64 | SY | 74 | 4,740 |
| Cased Carrier Pipe Cost | 380 | ft | 542 | 206,000 |
| MTBM Fixed Costs | 1 | LS | 727,000.00 | 727,000 |
| Microtunnel Boring | 380 | ft | 1,750.00 | 664,000 |
| Tunnel Dewatering | 1 | LS | 55,300.00 | 55,300 |
| Traffic Control | 2 | shaft | 27,600.00 | 55,200 |
| Reduction in Carrier Pipe Cost (60 in to 48 in) | 380 | LS | -97 | ($36,900) |
| | | | Year 2008 Subtotal | $2,500,000 |
| | | | | |
| Mobilization/Demobilization at 6% | 1.06 | | | |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 | | | |
| Effective Multiplier | 1.04 | | | |
| | | | | |
| Construction Year 2010 Subtotal | $2,600,000 | | | |

# INFLUENT GRAVITY SEWER - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Influent Pipe (Gravity)
Printed date : 01/27/2011

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: 1320 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: 27 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 2.79 | ft |
| Trench Width | 6.13 | ft |
| Excavation Depth | 13.8 | ft |
| Complete Surface Rest. Width | 8.13 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 4,130.00 | CY | $13 | $53,700 |
| Backfill | 2,700.00 | CY | $34 | $91,700 |
| Complete Pavement Restoration | 1,190.00 | SY | $86 | $103,000 |
| Overlay Pavement Restoration | 2,030.00 | SY | $28 | $57,000 |
| Trench Safety | 36,400.00 | SF | $17 | $619,000 |
| Spoil Load and Haul | 4,130.00 | CY | $16 | $66,100 |
| Pipe Unit Material Cost | 1,320.00 | lf | $46 | $60,700 |
| Pipe Installation | 1,320.00 | lf | $36 | $47,500 |
| Place Pipe Zone Fill | 1,140.00 | CY | $34 | $38,600 |
| Manholes | 3 | MH | $7,390 | $22,200 |
| Existing Utilities | 1,320.00 | lf | $58 | $76,600 |
| Dewatering | 1,320.00 | lf | $100 | $132,000 |
| Traffic Control | 1,320.00 | lf | $24 | $31,700 |
| | | | Year 2008 Subtotal | $1,400,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $1,450,000 |

Year 2010 Total: $1,450,000

# FORCE MAIN - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Pipe: Force Main
Printed date : 01/27/2011

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: 660 ft
Conduit Type: Force Main
Depth of Cover: 6 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
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: Standard
Pipe Diameter: 8 in.

Geometry

| | | |
|---|---|---|
| Outer Diameter | 0.754 | ft |
| Trench Width | 3.48 | ft |
| Excavation Depth | 7.75 | ft |
| Complete Surface Rest. Width | 5.48 | ft |

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Excavation | 660.00 | CY | $13 | $8,580 |
| Backfill | 425 | CY | $34 | $14,500 |
| Complete Pavement Restoration | 402 | SY | $86 | $34,600 |
| Overlay Pavement Restoration | 1,210.00 | SY | $28 | $33,900 |
| Trench Safety | 10,200.00 | SF | $1 | $5,430 |
| Spoil Load and Haul | 660.00 | CY | $16 | $10,600 |
| Pipe Unit Material Cost | 660 | lf | $30 | $19,800 |
| Pipe Installation | 660 | lf | $22 | $14,500 |
| Place Pipe Zone Fill | 223 | CY | $34 | $7,600 |
| Existing Utilities | 660 | lf | $32 | $21,100 |
| Dewatering | 660 | lf | $80 | $52,800 |
| Traffic Control | 660 | lf | $16 | $10,600 |
| | | | Year 2008 Subtotal | $234,000 |

| | |
|---|---|
| Mobilization/Demobilization at 6% | 1.06 |
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | 0.98 |
| Effective Multiplier | 1.04 |
| Construction Year 2010 Subtotal | $243,000 |

Year 2010 Total: $243,000

# HANFORD@RAINIER OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station - Hanford at Rainier
Printed date : 01/13/2011

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 SDOT Street Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

# BAYVIEW NORTH OVERFLOW STRUCTURE - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Regulator Station - Bayview North
Printed date : 01/13/2011

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 SDOT Street Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

# CONNECTION TO BAYVIEW TUNNEL - OUTPUT FROM TABULA 3.1.2

Cost Calculations for Regulator Station: Connection to Bayview Tunnel
Printed date : 01/13/2011

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 SDOT Street Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2010
Above Grade Structure: Yes

Unit Costs (Basis 2008)

| Item | Quantity | Unit | Unit Cost | Item Cost |
|---|---|---|---|---|
| Site/Civil | 1 | LS | $180,000 | $180,000 |
| Electrical/Instrumentation | 1 | LS | 195,000 | $195,000 |
| Architectural/Structural | 1 | LS | 40,000 | 40,000 |
| Mechanical | 1 | LS | 80,000 | 80,000 |
| | | | Year 2008 Subtotal | $495,000 |

| | |
|---|---|
| Multiplier from ENRCCI 8815 (2008) to 8645 (2010) | $1 |
| Effective Multiplier | 0.98 |
| Construction Year 2010 Subtotal | $485,000 |

Year 2010 Total: $485,000

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# PROPERTY AND PERMITTING COSTS

**Land and Building Cost, Average Cost per Square Foot (January 2007 to August 2010)**

| Uncontrolled CSO Basin | Average Cost per Square Foot for Industrial Land and Building ($/SF) | Average Cost per Square Foot for Industrial Land ($/SF) |
|---|---|---|
| DSN031 Hanford #1 | $103.22 | $22.12 |

**Land and Easement Acquisition Costs, 2010 Dollars**

| Description | Footprint (SF) | Land Cost Assumption ($/SF) | Assumed Percentage of Market Value (%) | Estimated Land and Easement Acquisition Costs ($) |
|---|---|---|---|---|
| Storage Tank | 5,500 | $103.22 | 100% | $567,710 |
| Ancillary Facilities (Electrical/Controls/Standby Generator, Odor Control, etc.) | 2,325 | $103.22 | 100% | $239,987 |
| 20-ft-wide Permanent Easement for Conveyance Pipe (Parcel Number 5394600175) | 2,000 | $103.22 | 30% | $61,932 |
| 40-ft-wide Temporary Construction Easement for Conveyance Pipe (Parcel Number 5394600175) | 4,000 | $103.22 | 10% | $41,288 |
| | | | **Total Costs** | $910,917 |

**SDOT Street Use Permit Fee Assumptions**

| | | |
|---|---|---|
| Construction is located on arterial. | | |
| Closure of construction area will occur in phases. Assumed construction phasing in: | 1,000 | ft segments |
| Assumed production rate for open cut construction during working days = | 15 | LF/d |
| Assumed production rate for microtunneling during working days = | 20 | LF/d |
| Assumed number of calendar days for set-up of MTBM and slurry plant = | 42 | calendar days |
| Assumed number of calendar days for excavation of the retrieval shaft = | 21 | calendar days |
| Assumed number of calendar days for restoration of microtunneling shafts = | 14 | calendar days |
| For pipe diameters less than or equal to 36 inches, assume half width of road will be closed during construction. Width is based on the half width for arterial pavement restoration in Tabula. | 22 | ft |
| For pipe diameters greater than 36 inches, assume full width of road will be closed during construction. Width is based on the full width for arterial pavement restoration in Tabula. | 44 | ft |

Source of methodology for estimating permit fees: http://www.seattle.gov/transportation/cams/CAM2115.pdf

**SDOT Street Use Permit Fee Cost =**

| Description | Diameter of Pipe (in) | Length (ft) | Width of Construction Area (ft) | Estimated Construction Area (SF) | Construction Duration (Calendar Days) | Number of 10-Day Periods | Use Fee ($/SF) | Estimated Permit Costs |
|---|---|---|---|---|---|---|---|---|
| Regulator Station Upgrade at Hanford@Rainier Overflow Structure | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Regulator Station Upgrade at Bayview North Overflow Structure | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Connection to Bayview Tunnel | NA | NA | NA | 5,000 | 60.2 | 7 | $1.30 | $6,500 |
| Open Cut Installation of Dual Pipes to Bayview Tunnel | 30 | 100 | 22 | 2,200 | 9.3 | 1 | $0.10 | $220 |
| Launch Shaft for Microtunneling | NA | NA | NA | 5,810 | 83 | 9 | $2.10 | $12,201 |
| Retrieval Shaft for Microtunneling | NA | NA | NA | 5,480 | 62 | 7 | $1.30 | $7,124 |
| Installation of Influent Gravity Sewer, First Phase of Construction | 27 | 1,000 | 22 | 22,000 | 31.8 | 4 | $0.50 | $11,000 |
| Installation of Influent Gravity Sewer, Second Phase of Construction | 27 | 320 | 22 | 7,040 | 10.2 | 2 | $0.20 | $1,408 |
| Installation of Force Main | 8 | 660 | 22 | 14,520 | 21.0 | 3 | $0.30 | $4,356 |
| | | | | | | | **Total SDOT Street Use Fee Estimation:** | $55,809 |

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# Operations and Maintenance Cost Estimate Summary

**Basin Name:** **Hanford @ Rainier - Bayview**

**Alternative Name:** **MEBI-Han-Rain-BV-KC-CONV/STOR**

| | |
|---|---|
| *Analysis Period:* | **20** |
| *Net Discount Rate (O&M):* | **2.18%** |
| *Net Discount Rate (Energy):* | **2.18%** |
| *Current ENR* | **8654.4** |
| *Power Cost (per kwh)* | **0.065** |
| *Labor rate (loaded) /hr* | **51.17** |
| *SPU Water Cost $/CCF* | **4.50** |
| *Carbon Cost/Lb* | **2.00** |

| | |
|---|---|
| *Annual Overflow Vol (MG)* | **0.10** |
| *Annual Vol Capture* | **1.79** |
| *Annual Events* | **1** |
| *Stor Vol* | **0.34** |
| *Peak Flow Rate* | **46.70** |
| *ENR 1994* | 5747 |

## Annual Costs

| **Components** | **Annual Maintenance & Inspection Cost** | **Annual Operation Cost** | **Annual Energy Cost** | **Annual Chemical Cost** |
|---|---|---|---|---|
| Gravity Sewer/Combined Sewers | $2,341 | | | |
| Force Mains | $24 | | | |
| Regulator/Flow Control Structures | $0 | | | |
| Deep/Shallow Tunnels | $429 | | | |
| Off-Line Storage Pipes | $0 | | | |
| River Outfalls | $0 | | | |
| Pump Stations | $0 | $0 | $0 | |
| Rectangular Storage Facilities | $12,041 | $815 | $1,946 | $6,420 |
| High Rate Treatment | $0 | $0 | $0 | $0 |
| Additonal Secondary Treatment | NA | $1,176 | NA | NA |
| Green Stormwater Infrastructure | | | | |
| **Annual Cost Subtotals:** | **$14,835** | **$1,991** | **$1,946** | **$6,420** |

**Total Annual O&M**

| | |
|---|---|
| **General** | **$23,246** |
| **Energy** | **$1,946** |
| **Total** | **$25,192** |

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# WTD Business Case Evaluation Results

## Hanford@Rainier CSO Control

### Lower Bound Discount Rate (WTD Borrowing Cost) (1)

| Scenario | Lifetime | Initial Capital Outlay | Total Project Life Costs (2) | Total Project Life Benefits | Net Project Life Costs | Average Project Annual Cost | Annual Costs over(under) Status quo |
|---|---|---|---|---|---|---|---|
| Alternatives | | | | | | | |
| MEBI-Han-Rain-BV-KC-CONV/STOR | 50 | $19,200,000 | $18,989,467 | $0 | $18,989,467 | $627,975 | $627,975 |

### Upper Bound Discount Rate (OMB, Private Rate of Return) (3)

| Scenario | Lifetime | Initial Capital Outlay | Total Project Life Costs (2) | Total Project Life Benefits | Net Project Life Costs | Average Project Annual Cost | Annual Costs over(under) Status quo |
|---|---|---|---|---|---|---|---|
| Alternatives | | | | | | | |
| MEBI-Han-Rain-BV-KC-CONV/STOR | 50 | $19,200,000 | $15,182,593 | $0 | $15,182,593 | $502,083 | $502,083 |

| First Year of Construction | 2010 | Additional inflation rate > 3% | 1.00% |
|---|---|---|---|

Notes:

(1) WTD Discount rate based on recent WTD borrowing costs net of 3% annual inflation. 2.18%

(2) Costs include risk and uncertainty, if estimated.

(3) Discount rate net of inflation, per the King County Budget Office. 7.00%

The option with the largest net equivalent annualized cost is the financially preferred option.

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