

Appendix I: Oyster Bay Sewerage Pre-Design Alternatives

DRAFT

Technical Memorandum



To: Bill Davis, Ned Lever
From: Kenneth Packard; Eric Bergstrom, PE
Date: October 10, 2016
Subject: Oyster Bay Sewerage Pre-Design Alternatives

Introduction

The primary sewage conveyance pipelines within the Oyster Bay sewer basin are pressure gravity sewer mains installed within the beaches of Oyster and Ostrich Bay (referred to throughout as beach mains). A series of pump stations in the sewer basin convey flow through the beach mains to pump station OB-1 which pumps sewage to the wastewater treatment plant.

Another aspect of the Oyster Bay sewer basin is that many residential and commercial properties discharge sewage through sewer lateral connections into the beach mains. Sewage flows by gravity from these property connections. In the past during periods of high sewage flow where the pump stations are operating at or near their capacity, sewer overflows were reported at several properties. The suspected cause of the sewer overflows is the hydraulic grade in the beach mains rising to the elevation of the properties. In response to sewer overflow events, backwater valves were installed (BWV) to protect properties from sewer overflows. Since installing backwater valves and reconfiguring the discharge piping at OB-2, the City has not received any reports of sewer overflows since approximately the mid 2000s.

This technical memorandum (TM) focuses on three study areas described below and shown in Figure 1.

1. Area 1 – Pump Station OB-5 to OB-2: Pump Station OB-5 discharges to a 10-inch beach main along the southwestern beach of Ostrich Bay which conveys flow to OB-2. There are 15 residential gravity sewer connections to the beach main.
2. Area 2 – Pump Station OB-2 to OB-1: Pump Station OB-2 contains two pumps. Each pump in OB-2 is hydraulically independent of the other. Pump 1 is dedicated to a 12-inch beach main along the western beach of Oyster Bay which conveys flow to OB-1. There are approximately 53 residential and commercial gravity sewer connections to the 12-inch beach main. Pump 2 is dedicated to a parallel force main through Oyster Bay conveying flow to OB-1. The majority of the force main is 10-inch pipe with a segment of 18-inch pipe on either side of Oyster Bay. There are no residential or commercial gravity sewer connections to the force main beneath Oyster Bay.
3. Area 3 – Pump Station OB-3 to OB-2: Pump Station OB-3 discharges to an 8-inch beach main along the southwestern beach of Madrona Point which conveys flow to OB-2. There are 17 residential gravity sewer connections to the 8-inch main.

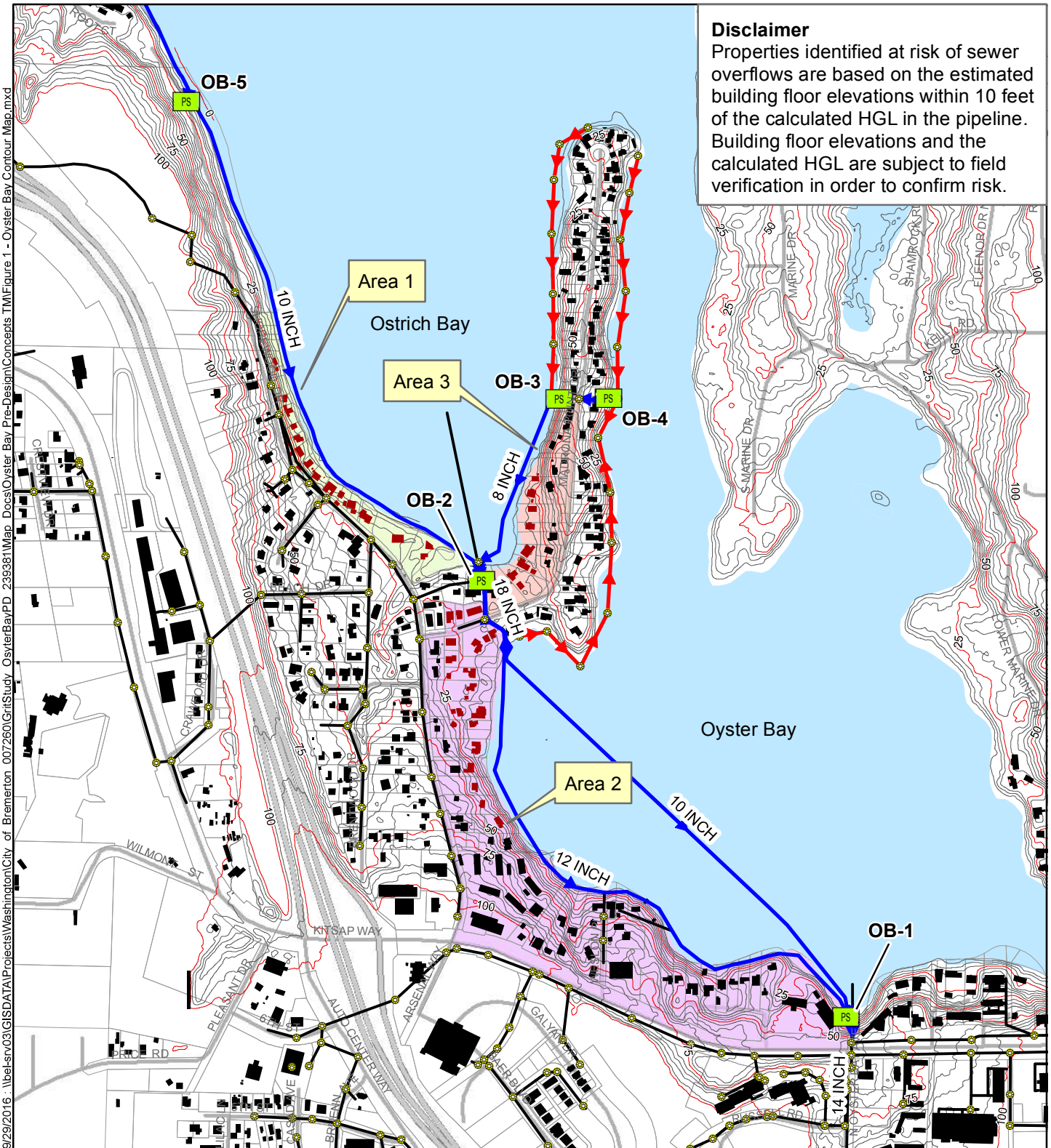
Purpose

The purpose of this TM is (1) to evaluate alternatives to reduce the risk of sewer overflows to private properties, and (2) to evaluate alternatives to abandon or remove the beach mains within the study area. One driver to implement improvements in the basin is to reduce the risk of sewer overflows. Backwater valves have been installed on certain customer connections in the past. This TM evaluates additional alternatives and the cost and benefit of each that could reduce the risk of sewer overflows. Another driver is the anticipated regulatory requirement to remove the sewer pipelines from the beach, thus alternatives are evaluated that would enable the beach mains to either be abandoned in place or removed.

The objective of this TM is to provide the City with information to plan for future sewer improvements to the Oyster Bay sewer basin in order to address the two regulatory drivers described above. The following sections provide a hydraulic evaluation of the beach mains, describe alternatives, provide planning level cost estimates, and summarize benefits for each alternative.

Disclaimer

Properties identified at risk of sewer overflows are based on the estimated building floor elevations within 10 feet of the calculated HGL in the pipeline. Building floor elevations and the calculated HGL are subject to field verification in order to confirm risk.



Legend

Study Areas

- Area 1
- Area 2
- Area 3

Potential Sewer Overflow Risk by Structure

- No
- Yes



Existing Pump Stations



Existing Manhole



Existing Upland Gravity Main



Existing Gravity Beach Main



Force Main/Pressure Gravity



Water Body



Highway



Streets

Contour (ft)

25 feet

5 feet

Source of Data:

- 1) Kitsap County GIS
- 2) City of Bremerton GIS



0 125 250 500 Feet

Figure 1
Oyster Bay Basin
Site Map
CITY OF BREMERTON
OYSTER BAY ALTERNATIVES

Hydraulic Evaluation

A hydraulic evaluation was conducted of the beach mains and force main facilities in each of the three study areas to identify properties with a potential risk of sewer overflows. The evaluation to identify the potential sewer overflow risk was conducted in the following steps.

- The hydraulic grade line (HGL) in the beach mains was estimated based on the operation of the pumping facilities and the physical characteristics of the pipelines. Hazen-Williams C factors of 70 for the cast iron beach mains and 100 for the ductile iron force main were assigned based on standard values for the material and age of the pipe. Pump discharge pressures were recorded at pump station OB-2 and OB-5 on Sep 9th and Oct 15th 2015. The pressure readings were used to verify the HGL calculations.
- Property elevations were estimated based on the GIS location of each building footprint and contour elevations. The actual property elevations are subject to field verification.
- Potential risk of sewer overflows was identified for properties with an estimated building floor elevation within 10 feet above the calculated HGL. Figure 1 depicts the location of properties identified with a potential risk of sewer overflows.

The estimated number of potential risk properties is used as a basis for developing alternatives and planning level project cost estimates in the following sections. The actual risk of sewer overflow to private properties is subject to field verification to confirm the assumptions of building flooring elevation and the HGL in the pressure mains.

Area 1 – Pump Station OB-5 to OB-2

Pump station OB-5 discharges to a 10-inch cast iron beach main, with an estimated 15 connections, conveying flow to OB-2. The pump station contains two pumps that operate as lead and lag during normal flows but during periods of high flow, operate simultaneously. Table 1 provides information on the study area facilities.

Figure 2 depicts the hydraulic grade line (HGL) in the 10-inch cast iron beach main for single and dual pump operation. The approximate property elevations depicted in the figure are based on the GIS location of the building footprints and contour elevations. The actual home and basement floor elevations are subject to field verification.

Table 1. Summary of Area 1 Facilities and Operation

	Operation
Rated Capacity ¹	550 gpm at 47 feet TDH (2 pumps)
Estimated Combined Pumping Rate ²	850 gpm
Pump Discharge Pressure ³	12 psi, Elev. 19 feet
Discharge Pipe ⁴	3,160 LF of 10-inch Cast Iron
Gravity Sewer Connections ⁵	15 residential properties
Connections with Potential Sewer Overflow Risk ⁶	15 properties

1. Table 3-7 of 2014 Wastewater Comprehensive Plan.

2. Estimated from system curve developed for the force main and pump curves.

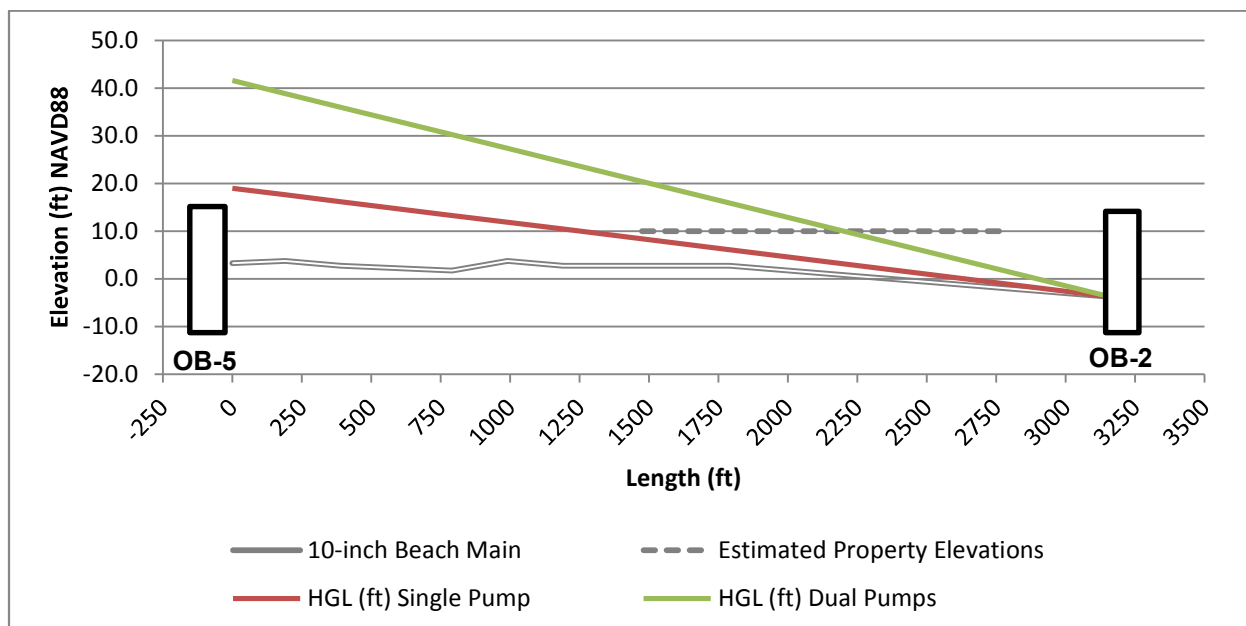
3. Pump discharge pressure recorded at Pump 1 4-inch outlet on 10/15/2015. Approximate gauge elevation is -9 feet NAVD88. A pressure reading with both pumps operating was not obtained in the field.

4. Based on as-built drawings

5. Approximate number based on GIS data for properties adjacent to the beach main.

6. Approximate number of properties located where the surcharge elevation in the pipe is within 10 feet of the building floor elevation. The actual home and basement floor elevations are subject to confirmation.

Figure 2. Area 1 10-inch Beach Main Hydraulic Grade Line



Area 2 – Pump Station OB-2 to OB-1

Pump station OB-2 contains two pumps. Each pump is currently dedicated to a single force main, but valving in the station allows the flexibility to switch force mains or have both pumps discharge into a single force main. Currently, Pump 1 discharges into a 12-inch cast iron beach main, with an estimated 53 lateral connections, installed along the beach of Oyster Bay. Pump 2 discharges into a 10-inch ductile iron force main installed across Oyster Bay. Both pipelines convey flow to OB-1. Table 2 provides information on the facilities in the study area. Figure 3 depicts the hydraulic grade line (HGL) in the 12-inch cast iron beach main. Figure 4 depicts the hydraulic grade line (HGL) in the 10-inch ductile iron force main. The approximate property elevations depicted in the figure are based on the GIS location of the building footprints and contour elevations. The actual home and basement floor elevations are subject to field verification.

Table 2. Summary of Area 2 Facilities and Operation

	Operation
Rated Capacity ¹	750 gpm at 65 feet TDH (2 pumps)
Pump 1 Discharge Pressure ²	16.5 psi, Elev. 29 feet (12-inch beach main)
Pump 2 Discharge Pressure ²	14 psi, Elev. 23 feet (10-inch force main)
Pump 1 Discharge Pipe ³	3,650 LF of 12-inch Cast Iron
Pump 2 Discharge Pipe ³	2,700 LF of 10-inch Ductile Iron and 500 LF of 18-inch Cast Iron
Gravity Sewer Connections ⁴	53 residential and commercial properties
Connections with Potential Risk of Sewer Overflow ⁵	21 properties

1. Table 3-7 of 2014 Wastewater Comprehensive Plan.

2. Pump discharge pressure recorded at pump outlet on 9/9/2015. Approximate gauge elevation is -9 feet NAVD88.

3. Based on as-built drawings

4. Based on GIS data for properties adjacent to the beach main

5. Approximate number of properties located where the surcharge elevation in the pipe is within 10 feet of the building floor elevation. The actual home and basement floor elevations are subject to confirmation.

Figure 3. Area 2 12-inch Beach Main Hydraulic Grade Line

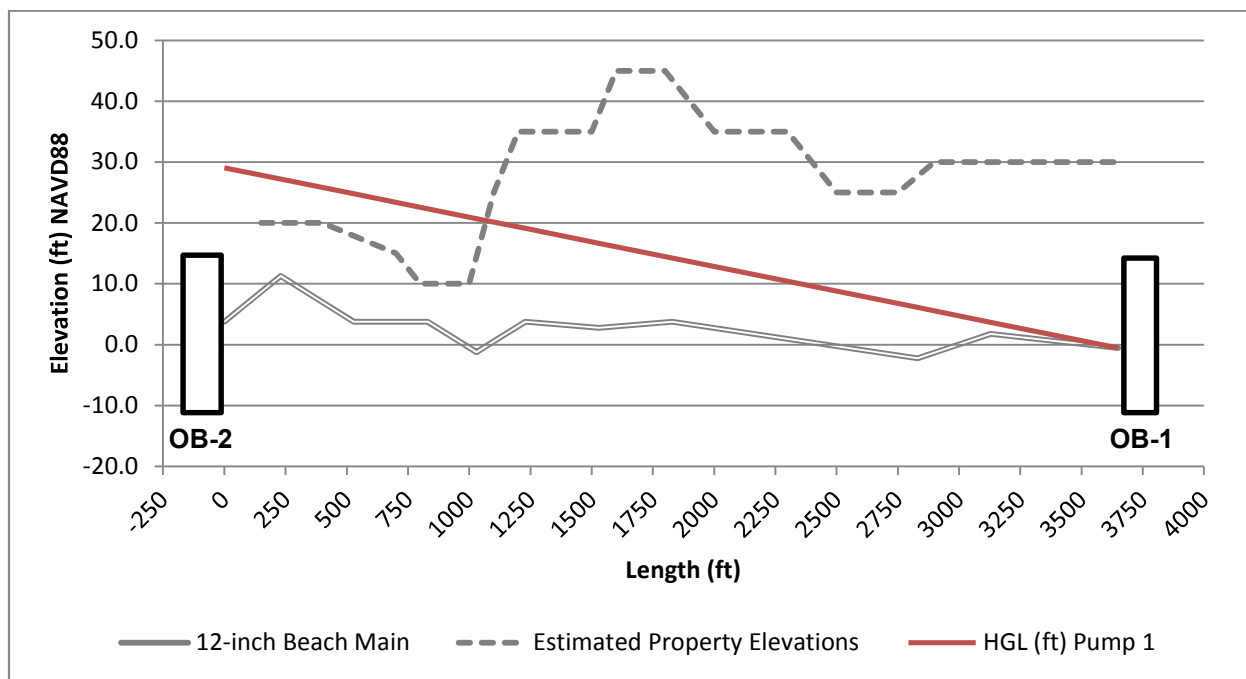
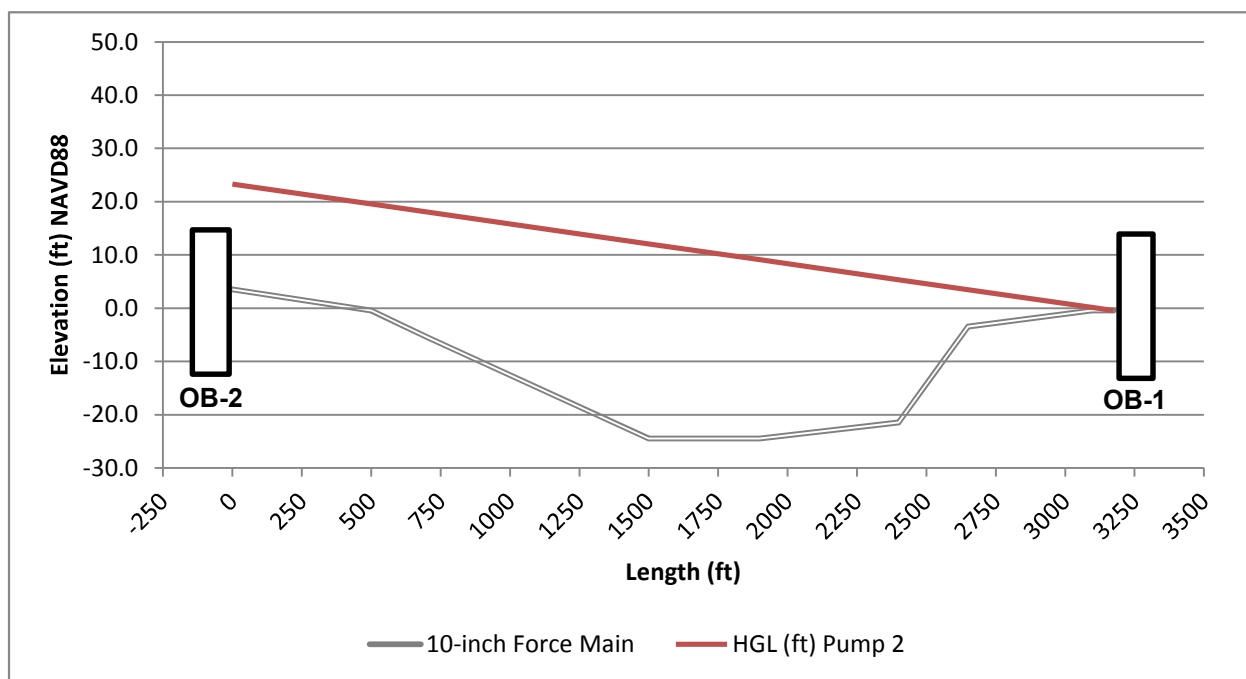


Figure 4. Area 2 10-inch Force Main Hydraulic Grade Line



Area 3 – Pump Station OB-3 to OB-2

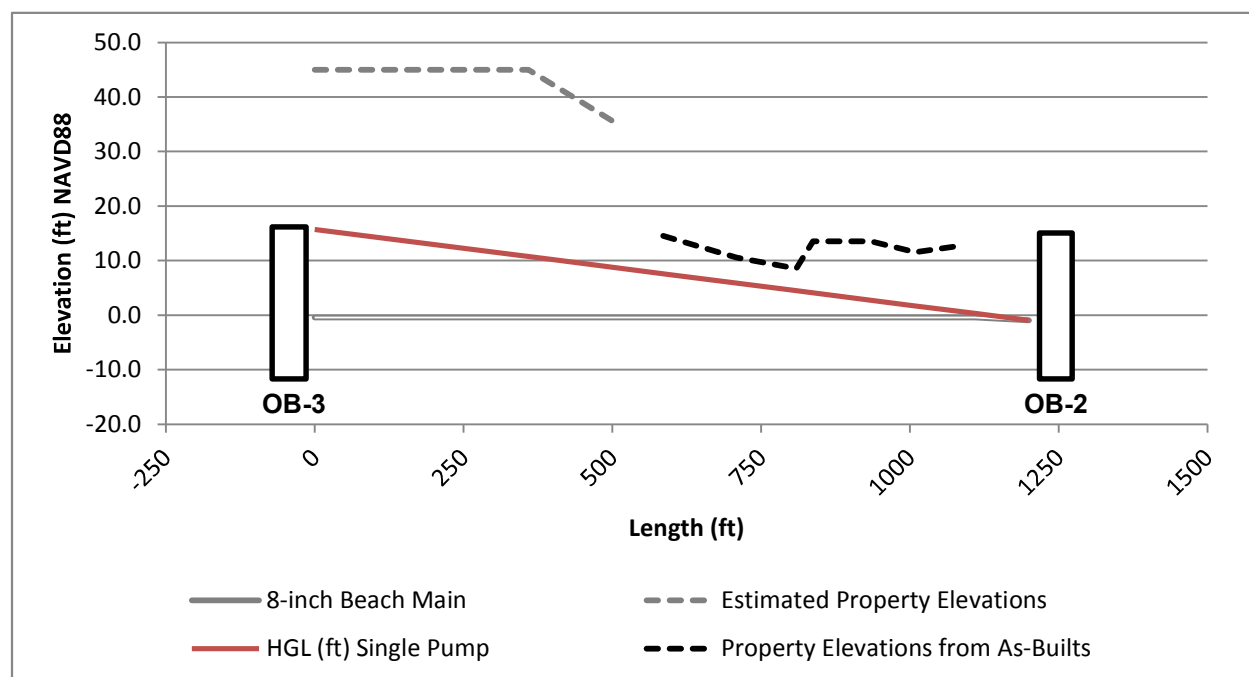
Pump station OB-3 discharges to an 8-inch cast iron beach main, with an estimated 17 lateral connections, conveying flow to OB-2. The pump station contains two pumps that operate as lead and lag. Table 3 provides information on the facilities in the study area. Figure 5 depicts the hydraulic grade line (HGL) in the 8-inch cast iron beach main. The approximate property elevations are also depicted in the figure based on the GIS location of the building footprints and contour elevations. The properties with the lowest elevations are provided in the as-built drawings for the gravity pressure main.

Table 3. Summary of Area 3 Facilities and Operation

	Operation
Rated Capacity ¹	400 gpm at 13 feet TDH (2 pumps)
Pump Discharge Pressure ²	Not collected in the field
Discharge Pipe ³	1,200 LF of 8-inch Cast Iron
Gravity Sewer Connections ⁴	17 residential properties
Connections with Potential Risk of Sewer Overflow ⁵	7 properties

1. Table 3-6 of 2014 Wastewater Comprehensive Plan.
2. No pressure readings obtained in the field.
3. Based on plan drawings
4. Based on GIS data for properties adjacent to the beach main. Basement flow elevations are provided in the plan drawings for 8 properties with the lowest elevations.
5. Approximate number of properties located where the surcharge elevation in the pipe is within 10 feet of the building floor elevation. The actual home and basement floor elevations are subject to confirmation.

Figure 5. Area 3 8-inch Beach Main Hydraulic Grade Line



Alternative Improvements

This section presents alternatives for each study area, a summary of benefits, and planning level cost estimates.

Costs are based on engineering estimates and contractor bid tab estimates from similar engineering and construction work. Costs include a construction contingency factor of 40 percent, sales tax of 8.7 percent, and an allowance for engineering, permitting, and administrative fees (allied costs) of 20 percent. Estimated costs are in 2015 dollars and based on Engineering News-Record's (ENR) material and building cost index for Seattle in January 2015 (10,388). Project cost estimates are at a Class 5 concept screening level as defined by the Association for the Advancement of Cost Engineering (AACE). The expected accuracy range is (-)25 percent to (+)50 percent. Those ranges are applied to the project cost estimates and reported in the following tables. The Appendix contains the details for each cost estimate

Area 1 Alternatives

There are fifteen residences with gravity sewer connections to the 10-inch beach main installed on the beach in Ostrich Bay conveying flow to pump station OB-2. Based on the hydraulic evaluation, all 15 properties have a potential risk of sewer overflows when the operation of OB-5 causes the beach main to surcharge. Four conceptual alternatives have been identified to improve the sewer system. Table 4 presents a summary of the Area 1 alternatives and planning level cost estimates.

Alternatives to Address Driver #1: Sewer Overflow Risks

- **Alternative 1A – Backwater Valve Program.**¹ The City continues its program of notifying property owners that they are required to install backwater valves (per BMC 15.03.120) at properties with a potential risk of sewer overflows through sewer lateral connections to the beach main. Ten letters are sent out per month (120 per year) to property owners and City operations staff will visit homeowners as requested to answer questions.
- **Alternative 1B – Install Grinder Pumps for At-Risk Properties.** Install grinder pumps at all 15 properties along the alignment that have a potential risk of sewer overflows. Grinder pump force mains would be sliplined through the existing service lateral and grouted into the existing gravity beach sewer.
- **Alternative 1C – Connect to Existing Upland Gravity Sewer and Convert Beach Main to Force Main.** Grinder pumps would be installed at all 15 properties along the alignment. New grinder pump force mains would be routed to the existing 8-inch gravity upland sewer on Shorewood Drive. The beach main would be converted to a dedicated force main by capping and sealing the existing lateral connections to the beach main.

¹ The City began their backwater valve notification program three years ago. The cost to the City for alternatives 1A, 2A, and 3A is minimal and places the requirement for installing a backwater valve on the property owner. The program consists of sending out 10 letters per month which notifies customers that they are required to install backwater valves per BMC 15.03.120. Additionally, City operations staff will visit home owners to provide site-specific recommendations upon request. The City does not install the backwater valve or conduct maintenance.

15.03.120 BACKWATER VALVES. When a premises discharges wastewater into a force main or pressure main or wherever a situation exists involving an unusual danger of backflow, a backwater valve shall be required and shall be installed in a manner accessible for maintenance. The installation and effective operation of the backwater valve shall be the sole responsibility of the owner connecting to the wastewater system. The installation shall meet the requirements of the Engineering Design and Construction Standards. (Ord. 5250 §1 (in part), 2014; Ord. 4309 §2 (in part), 1991)

Alternatives to Address Driver #2: Potential Regulatory Requirement to Abandon/Remove Beach Mains

- Alternative 1D – Connect to Existing Upland Gravity Sewer, Install Upland Force Main, and Abandon Beach Main.** A parallel force main would be installed along Shorewood Drive from PS OB-5 to PS OB-2. Flows from OB-5 would be routed to the proposed upland force main. Grinder pumps would be installed at every property currently connected to the beach main and convey flow to the existing upland gravity sewer. The existing beach main would be abandoned in place.
- Alternative 1E – Connect to Existing Upland Gravity Sewer, Install Upland Force Main, and Remove Beach Main.** All provisions in Alternative 1D except the existing beach main would be removed from the beach.

Table 4. Area 1 Alternative Summary and Estimated Costs

Alternative	Features	Pros	Cons	Estimated Project Cost
1A	Backwater Valve Program	<ul style="list-style-type: none"> Inexpensive protection from sewer overflows Very low cost 	<ul style="list-style-type: none"> Risk of BMW failure 	\$3,000
1B	Grinder pump stations, slipline and grout existing laterals connections	<ul style="list-style-type: none"> Pressure connections to beach main Sliplining reduces cost 	<ul style="list-style-type: none"> Connections to beach main Property coordination Pump maintenance Access easement 	\$530,000
1C	Grinder pump stations, force mains to 8-inch upland gravity sewer, and cap and seal existing laterals	<ul style="list-style-type: none"> No beach main connections 	<ul style="list-style-type: none"> Property coordination Pump maintenance Access easement 	\$690,000
1D	Force main along Shorewood Drive, grinder pump stations, abandon beach main	<ul style="list-style-type: none"> Beach main no longer in service Maintenance access improved 	<ul style="list-style-type: none"> Pump maintenance Property coordination Access easement New force main 	\$2,000,000
1E	Alternative 1D and beach main is removed	<ul style="list-style-type: none"> Beach main no longer in service Maintenance access improved 	<ul style="list-style-type: none"> Pump maintenance Property coordination Access easement New force main Beach main removal 	\$2,130,000

Area 2 Alternatives

There are 53 estimated residential and commercial property gravity connections to the existing 12-inch beach main along Oyster Bay from OB-2 to OB-1. Based on the hydraulic evaluation, 21 properties have a potential risk of sewer overflows when the operation of OB-2 causes the beach main to surcharge. Five conceptual alternatives are presented below to reduce the risk of sewer overflows to these services. Table 5 presents a summary of the Area 2 alternatives and planning level cost estimates.

Alternatives to Address Driver #1: Sewer Overflow Risks

- **Alternative 2A – Backwater Valve Program.** The City continues its program of notifying property owners that they are required to install backwater valves (per BMC 15.03.120) at properties with a potential risk of sewer overflows through sewer lateral connections to the beach main. Ten letters are sent out per month (120 per year) to property owners and City operations staff will visit homeowners as requested to answer questions.
- **Alternative 2B – Install control valve in OB-2.** Automation and a control valve would be installed in OB-2 to limit flows to the 12-inch main by diverting these flows to the 10-inch force main through Oyster Bay. Flow diversion would prevent the surcharge depth in the beach main from backing up into private side sewer connections. Currently one pump is dedicated to each force main.
- **Alternative 2C – Install Grinder Pumps for At-Risk Properties.** Install grinder pumps at 21 properties along the alignment with a potential risk of sewer overflows. Grinder pump force mains would be sliplined through the existing service lateral and grouted into the existing gravity beach sewer.
- **Alternative 2D – Connect to Existing Upland Gravity Sewer and Convert Beach Main to Force Main.** Grinder pumps would be installed at all 53 properties. Grinder pump force mains would connect to the existing 8-inch gravity upland sewer on Shorewood Drive and Kitsap Way. The main would become a dedicated force main for OB-2.

Alternatives to Address Driver #2: Potential Regulatory Requirement to Abandon/Remove Beach Mains

- **Alternative 2E – Connect to Existing Upland Gravity Sewer, Install Upland Force Main, and Abandon Beach Main.** A new force main would be installed along Shorewood Drive and Kitsap Way to OB-1. Flows from OB-2 would be routed to the upland force main. Grinder pumps would be installed at every property currently connected to the beach main and convey flow to the existing upland gravity sewer. The existing 12-inch beach main and 10-inch force main would be abandoned in place.
- **Alternative 2F – Connect to Existing Upland Gravity Sewer, Install Upland Force Main, and Remove Beach Main.** All provisions in Alternative 2D and the existing 12-inch beach main would be removed from the beach.

Table 5. Area 2 Alternative Summary and Estimated Costs

Alternative	Features	Pros	Cons	Estimated Project Cost
2A	Backwater Valve Program	<ul style="list-style-type: none"> Inexpensive protection from sewer overflows Very low cost 	<ul style="list-style-type: none"> Risk of BWV failure 	\$3,000
2B	Automation and control valve at OB-2	<ul style="list-style-type: none"> Protects properties by limiting HGL in beach main No property coordination 	<ul style="list-style-type: none"> Connections to beach main Dual pumping to force main decreases combined capacity 	\$56,000
2C	Limited grinder pump stations, slipline and grout existing laterals	<ul style="list-style-type: none"> Pressure connections to beach main Sliplining reduces cost Limited grinder pumps 	<ul style="list-style-type: none"> Connections to beach main Property coordination Pump maintenance Access easement 	\$830,000
2D	Grinder pump stations, force mains to 8-inch upland gravity sewer, and cap and seal existing laterals	<ul style="list-style-type: none"> No beach main connections 	<ul style="list-style-type: none"> Property coordination Pump maintenance Access easement 	\$2,510,000
2E	Force main along Shorewood Drive and grinder pump stations	<ul style="list-style-type: none"> Beach main and force main no longer in service Maintenance access improved 	<ul style="list-style-type: none"> Pump maintenance Property coordination Access easement New force main 	\$4,560,000
2F	Alternative 2E and the beach main is removed	<ul style="list-style-type: none"> Beach main and force main no longer in service Maintenance access improved 	<ul style="list-style-type: none"> Pump maintenance Property coordination Access easement New force main Beach/force main removal 	\$4,690,000

Area 3 Alternatives

There are 17 residential gravity sewer connections to the 8-inch beach main between pump stations OB-3 and OB-2. No sewer overflows were reported in this area and no back water valves have been installed. The City identified this area for an improvement to the gravity connections to the beach main but it is a lower priority area since there have been no recorded overflows to residences. Based on the hydraulic evaluation, 7 properties have a potential risk of sewer overflows when the operation of OB-3 causes the beach main to surcharge. Three conceptual alternatives have been identified for this area. Table 6 presents a summary of the Area 3 alternatives and planning level cost estimates.

Alternatives to Address Driver #1: Sewer Overflow Risks

- **Alternative 3A – Backwater Valve Program.** The City its program of notifying property owners that they are required to install backwater valves (per BMC 15.03.120) at properties with a potential risk of sewer overflows through sewer lateral connections to the beach main. Ten letters are sent out per month (120 per year) to property owners and City operations staff will visit homeowners as requested to answer questions.
- **Alternative 3B – Install Grinder Pumps for At-Risk Properties.** Install grinder pumps at 7 properties with a potential risk of sewer overflows. Grinder pump force mains would be sliplined through the existing service lateral and grouted into the existing gravity beach sewer.

Alternatives to Address Driver #2: Potential Regulatory Requirement to Abandon/Remove Beach Mains

- **Alternative 3C – Connect to Existing Upland Gravity Sewer, Install Upland Force Main, and Abandon Beach Main.** Grinder pumps would be installed at each property along the alignment. Grinder pump force mains would be routed to discharge to a new low pressure force main installed along Madrona Point. The new low pressure force main would be sized to convey flows from OB-3 to OB-2. The existing beach main would be abandoned in place.
- **Alternative 3D – Connect to Existing Upland Gravity Sewer, Install Upland Force Main, and Remove Beach Main.** All provisions in Alternative 3C and the existing 8-inch beach main would be removed from the beach.

Table 6. Area 3 Alternative Summary and Estimated Costs

Alternative	Features	Pros	Cons	Estimated Project Cost
3A	Backwater Valve Program	<ul style="list-style-type: none"> Inexpensive protection from sewer overflows Very low cost 	<ul style="list-style-type: none"> Risk of BWV failure 	\$3,000
3B	Grinder pump stations and slipline and grout existing laterals	<ul style="list-style-type: none"> Pressure connections Sliplining reduces cost Limited grinder pumps 	<ul style="list-style-type: none"> Connections to beach main Property coordination Pump maintenance Access easement 	\$280,000
3C	Grinder pump stations, new force main, cap and seal existing laterals, abandon beach main	<ul style="list-style-type: none"> Beach main no longer in service Maintenance access improved 	<ul style="list-style-type: none"> Pump maintenance Property coordination Access easement New force main 	\$1,480,000
3D	Alternative 3C and the beach is removed	<ul style="list-style-type: none"> Beach main no longer in service Maintenance access improved 	<ul style="list-style-type: none"> Pump maintenance Property coordination Access easement New force main Beach main removal 	\$1,450,000

Summary

The objective of this TM is to provide information for the City to evaluate the alternatives presented in the preceding section. At this time, the backwater valve program continues to be successful in protecting properties from sewer overflows and additional improvements such as installing grinder pumps or disconnecting sewer lateral connections from the beach main may not be warranted. It is uncertain if the driver to abandon or remove the beach main pipelines will be a future requirement. In the event the requirement to remove beach mains is enforced, a funding source would need to be identified to construct those improvements.

Eric C. M. Bergt
10/18/16

A circular professional engineer seal for the State of Washington. The outer ring contains the text "ERIC C.M. BERGT" at the top and "PROFESSIONAL ENGINEER" at the bottom. The inner circle contains "STATE OF WASHINGTON" at the top, "27347" in the center, and "REGISTERED" at the bottom. The seal is partially obscured by a handwritten signature "Eric C. M. Bergt" and the date "10/18/16".

Appendix

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City of Bremerton
Oyster Bay Alternatives TM
Class 5 Cost Estimate
September 2016

Alternative 1A
Backwater Valve Program

Item	Quantity	Unit	Unit Cost	Total	Comment
Backwater Valves	1	LS	\$ 3,000	\$ 3,000	Continue program of notifying property owners that they are required to install backwater valves (per BMC 15.03.120)
Subtotal				\$ 3,000	
Low (-25%)				\$ 2,000	
High (+50%)				\$ 5,000	

City of Bremerton
Oyster Bay Alternatives TM
Class 5 Cost Estimate
September 2016

Alternative 1B
Install grinder pumps for at-risk properties

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	15	EA	\$ 2,500	\$ 37,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	15	EA	\$ 9,000	\$ 135,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	1500	LF	\$ 25	\$ 37,500	100 LF per grinder pump
Lateral Sliplining	15	EA	\$ 1,000	\$ 15,000	Roto-Rooter Quote for lateral inspection and moderate root removal to install each lateral
Beach Excavation and Restoration	15	EA	\$ 500	\$ 7,500	10 CY of Excavation including Haul and Gravel Backfill per grinder pump
Wet tap beach main	15	EA	\$ 2,750	\$ 41,250	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	15	EA	\$ 1,000	\$ 15,000	Per grinder pump
Subtotal				\$ 288,750	
Construction Contingency (40%)				\$ 115,500	
Subtotal Construction Costs				\$ 404,250	
Sales Tax (8.7%)				\$ 35,200	
Allied Costs (20%)				\$ 80,900	
Total Project Cost				\$ 530,000	
Low (-25%)				\$ 400,000	
High (+50%)				\$ 800,000	

City of Bremerton
Oyster Bay Alternatives TM
Class 5 Cost Estimate
September 2016

Alternative 1C

Connect to existing upland gravity sewer and convert beach main to force main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	15	EA	\$ 2,500	\$ 37,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	15	EA	\$ 9,000	\$ 135,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	3000	LF	\$ 20	\$ 60,000	200 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	15	EA	\$ 1,000	\$ 15,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	75	SY	\$ 110	\$ 8,250	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	120	HRS	\$ 110	\$ 13,200	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	15	EA	\$ 2,750	\$ 41,250	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Remove and Cap Lateral	15	EA	\$ 2,500	\$ 37,500	Excavation and native backfill, remove and dispose of lateral, install cap on lateral
Shoring and Dewatering	30	EA	\$ 1,000	\$ 30,000	Per beach main lateral and grinder pump
Subtotal				\$ 377,700	
Construction Contingency (40%)				\$ 151,080	
Subtotal Construction Costs				\$ 528,780	
Sales Tax (8.7%)				\$ 46,100	
Allied Costs (20%)				\$ 105,800	
Total Project Cost				\$ 690,000	
Low (-25%)				\$ 520,000	
High (+50%)				\$ 1,040,000	

City of Bremerton
Oyster Bay Alternatives TM
Class 5 Cost Estimate
September 2016

Alternative 1D

Connect to existing upland gravity sewer, install upland force main, and abandon beach main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	15	EA	\$ 2,500	\$ 37,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	15	EA	\$ 9,000	\$ 135,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	3000	LF	\$ 20	\$ 60,000	200 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	15	EA	\$ 1,000	\$ 15,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	75	SY	\$ 110	\$ 8,250	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	120	HRS	\$ 110	\$ 13,200	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	15	EA	\$ 2,750	\$ 41,250	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	30	EA	\$ 1,000	\$ 30,000	Per beach main lateral and grinder pump
10-inch Force main	3500	LF	\$ 185	\$ 647,500	Bid Tabs from Gorst Improvements adjusted to 2015 dollars, incl excation, backfill, and restoration
Fill and Abandon Beach Main	3200	LF	\$ 10	\$ 32,000	Estimate to fill and abandon from Seattle Seawall Improvements
Remove and Cap Lateral	15	EA	\$ 2,500	\$ 37,500	Excavation and native backfill, remove and dispose of lateral, install cap on lateral connection to Beach Main
DNR Leasing	1	LS	\$ 50,000	\$ 50,000	Estimate of DNR lease costs related to abandoned utilities in the beach.
Subtotal				\$ 1,107,200	
Construction Contingency (40%)				\$ 442,880	
Subtotal Construction Costs				\$ 1,550,080	
Sales Tax (8.7%)				\$ 134,900	
Allied Costs (20%)				\$ 310,100	
Total Project Cost				\$ 2,000,000	
Low (-25%)				\$ 1,500,000	
High (+50%)				\$ 3,000,000	

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Alternative 1E

Connect to existing upland gravity sewer, install upland force main, and remove beach main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	15	EA	\$ 2,500	\$ 37,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	15	EA	\$ 9,000	\$ 135,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	3000	LF	\$ 20	\$ 60,000	200 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	15	EA	\$ 1,000	\$ 15,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	75	SY	\$ 110	\$ 8,250	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	120	HRS	\$ 110	\$ 13,200	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	15	EA	\$ 2,750	\$ 41,250	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	30	EA	\$ 1,000	\$ 30,000	Per beach main lateral and grinder pump
10-inch Force main	3500	LF	\$ 185	\$ 647,500	Bid Tabs from Gorst Improvements adjusted to 2015 dollars, incl excation, backfill, and restoration
Remove laterals	15	EA	\$ 2,000	\$ 30,000	Excavation and native backfill, remove and dispose of lateral
Remove beach main	3200	LF	\$ 50	\$ 160,000	Estimated from Washington Avenue Sewer Project
Subtotal				\$ 1,177,700	
Construction Contingency (40%)				\$ 471,080	
Subtotal Construction Costs				\$ 1,648,780	
Sales Tax (8.7%)				\$ 143,500	
Allied Costs (20%)				\$ 329,800	
Total Project Cost				\$ 2,130,000	
Low (-25%)				\$ 1,600,000	
High (+50%)				\$ 3,200,000	

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Alternative 2A
Backwater valve program

Item	Quantity	Unit	Unit Cost	Total	Comment
Backwater Valves	1	LS	\$ 3,000	\$ 3,000	Continue program of notifying property owners that they are required to install backwater valves (per BMC 15.03.120)
Subtotal				\$ 3,000	
Low (-25%)				\$ 2,000	
High (+50%)				\$ 5,000	

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Alternative 2B
Install control valve in OB-2

Item	Quantity	Unit	Unit Cost	Total	Comment
Mobilization	1	LS	\$ 1,500	\$ 1,500	5% of construction cost
Motor Actuators	2	EA	\$ 5,000	\$ 10,000	Cost of motor actuator delivered to site
Pressure Transducer	1	LS	\$ 2,500	\$ 2,500	Cost of transducer
Installation	1	LS	\$ 12,000	\$ 12,000	One week labor for 4 person crew
Electrical I&C Allowance	1	LS	\$ 5,000	\$ 5,000	Extension of existing on-site power supply and controls to motor actuators
Subtotal				\$ 31,000	
Construction Contingency (40%)				\$ 12,400	
Subtotal Construction Costs				\$ 43,400	
Sales Tax (8.7%)				\$ 3,800	
Allied Costs (20%)				\$ 8,700	
Total Project Cost				\$ 56,000	
Low (-25%)				\$ 42,000	
High (+50%)				\$ 84,000	

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Alternative 2C
Install grainder pumps for at-risk properties

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	21	EA	\$ 2,500	\$ 52,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Ginder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	21	EA	\$ 9,000	\$ 189,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	5250	LF	\$ 20	\$ 105,000	250 LF per grinder pump
Lateral Sliplining	21	EA	\$ 1,000	\$ 21,000	Roto-Rooter Quote for lateral inspection and moderate root removal to install each lateral
Beach Excavation and Restoration	21	EA	\$ 500	\$ 10,500	10 CY of Excavation including Haul and Gravel Backfill per grinder pump
Wet tap beach main	21	EA	\$ 2,750	\$ 57,750	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	21	EA	\$ 1,000	\$ 21,000	Per grinder pump
Subtotal				\$ 456,750	
Construction Contingency (40%)				\$ 182,700	
Subtotal Construction Costs				\$ 639,450	
Sales Tax (8.7%)				\$ 55,700	
Allied Costs (20%)				\$ 127,900	
Total Project Cost				\$ 830,000	
Low (-25%)				\$ 630,000	
High (+50%)				\$ 1,250,000	

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Alternative 2D

Connect to existing upland gravity sewer and convert beach main to force main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	53	EA	\$ 2,500	\$ 132,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	53	EA	\$ 9,000	\$ 477,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	13250	LF	\$ 20	\$ 265,000	250 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	53	EA	\$ 1,000	\$ 53,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	265	SY	\$ 110	\$ 29,150	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	424	HRS	\$ 110	\$ 46,640	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	53	EA	\$ 2,750	\$ 145,750	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Remove and Cap Lateral	53	EA	\$ 2,500	\$ 132,500	Excavation and native backfill, remove and dispose of lateral, install cap on lateral connection to Beach Main
Shoring and Dewatering	106	EA	\$ 1,000	\$ 106,000	Per beach main lateral and grinder pump
Subtotal				\$ 1,387,540	
Construction Contingency (40%)				\$ 555,016	
Subtotal Construction Costs				\$ 1,942,556	
Sales Tax (8.7%)				\$ 169,100	
Allied Costs (20%)				\$ 388,600	
Total Project Cost				\$ 2,510,000	
Low (-25%)				\$ 1,890,000	
High (+50%)				\$ 3,770,000	

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Alternative 2E

Connect to existing upland gravity sewer, install upland force main, and abandon beach main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	53	EA	\$ 2,500	\$ 132,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	53	EA	\$ 9,000	\$ 477,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	13250	LF	\$ 20	\$ 265,000	250 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	53	EA	\$ 1,000	\$ 53,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	265	SY	\$ 110	\$ 29,150	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	424	HRS	\$ 110	\$ 46,640	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	53	EA	\$ 2,750	\$ 145,750	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	98	EA	\$ 1,000	\$ 98,000	Per beach main lateral and grinder pump
12-inch Force main	4800	LF	\$ 200	\$ 960,000	Bid Tabs from Gorst Improvements adjusted to 2015 dollars
Fill and Abandon Beach Main	3700	LF	\$ 10	\$ 37,000	Estimate to fill and abandon from Seattle Seawall Improvements
Remove and Cap Lateral	53	EA	\$ 2,500	\$ 132,500	Excavation and native backfill, remove and dispose of lateral, install cap on lateral connection to Beach Main
DNR Leasing	1	LS	\$ 50,000	\$ 50,000	Estimate of DNR lease costs related to abandoned utilities in the beach. City to verify.
Replace Pumps	1	LS	\$ 100,000	\$ 100,000	\$80,000 for two 72 HP pumps and appurtenances plus \$20,000 installation
Subtotal				\$ 2,526,540	
Construction Contingency (40%)				\$ 1,010,616	
Subtotal Construction Costs				\$ 3,537,156	
Sales Tax (8.7%)				\$ 307,800	
Allied Costs (20%)				\$ 707,500	
Total Project Cost				\$ 4,560,000	
Low (-25%)				\$ 3,420,000	
High (+50%)				\$ 6,840,000	

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Alternative 2F

Connect to existing upland gravity sewer, install upland force main, and remove beach main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	53	EA	\$ 2,500	\$ 132,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	53	EA	\$ 9,000	\$ 477,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	13250	LF	\$ 20	\$ 265,000	250 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	53	EA	\$ 1,000	\$ 53,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	265	SY	\$ 110	\$ 29,150	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	424	HRS	\$ 110	\$ 46,640	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	53	EA	\$ 2,750	\$ 145,750	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	98	EA	\$ 1,000	\$ 98,000	Per beach main lateral and grinder pump
12-inch Force main	4800	LF	\$ 200	\$ 960,000	Bid Tabs from Gorst Improvements adjusted to 2015 dollars
Remove beach main	3700	LF	\$ 50	\$ 185,000	Estimated from Washington Avenue Sewer Project
Remove laterals	53	EA	\$ 2,000	\$ 106,000	Excavation and native backfill, remove and dispose of lateral
Replace Pumps	1	LS	\$ 100,000	\$ 100,000	\$80,000 for two 72 HP pumps and appurtenances plus \$20,000 installation
Subtotal				\$ 2,598,040	
Construction Contingency (40%)				\$ 1,039,216	
Subtotal Construction Costs				\$ 3,637,256	
Sales Tax (8.7%)				\$ 316,500	
Allied Costs (20%)				\$ 727,500	
Total Project Cost				\$ 4,690,000	
Low (-25%)				\$ 3,520,000	
High (+50%)				\$ 7,040,000	

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Alternative 3A
Backwater valve program

Item	Quantity	Unit	Unit Cost	Total	Comment
Backwater Valves	1	LS	\$ 3,000	\$ 3,000	Continue program of notifying property owners that they are required to install backwater valves (per BMC 15.03.120)
Subtotal				\$ 3,000	
Low (-25%)				\$ 2,000	
High (+50%)				\$ 5,000	

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Alternative 3B
Install grinder pumps for at-risk properties

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	7	EA	\$ 2,500	\$ 17,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	7	EA	\$ 9,000	\$ 63,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	1750	LF	\$ 20	\$ 35,000	250 LF per grinder pump
Lateral Sliplining	7	EA	\$ 1,000	\$ 7,000	Roto-Rooter Quote for lateral inspection and moderate root removal to install each lateral
Beach Excavation and Restoration	7	EA	\$ 500	\$ 3,500	10 CY of Excavation including Haul and Gravel Backfill per grinder pump
Wet tap beach main	7	EA	\$ 2,750	\$ 19,250	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	7	EA	\$ 1,000	\$ 7,000	Per grinder pump
Subtotal				\$ 152,250	
Construction Contingency (40%)				\$ 60,900	
Subtotal Construction Costs				\$ 213,150	
Sales Tax (8.7%)				\$ 18,600	
Allied Costs (20%)				\$ 42,700	
Total Project Cost				\$ 280,000	
Low (-25%)				\$ 210,000	
High (+50%)				\$ 420,000	

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Alternative 3C

Connect to existing upland gravity sewer, install upland force main, and abandon beach main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	17	EA	\$ 2,500	\$ 42,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	17	EA	\$ 9,000	\$ 153,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	4250	LF	\$ 20	\$ 85,000	250 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	17	EA	\$ 1,000	\$ 17,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	85	SY	\$ 110	\$ 9,350	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	136	HRS	\$ 110	\$ 14,960	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	17	EA	\$ 2,750	\$ 46,750	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	34	EA	\$ 1,000	\$ 34,000	Per beach main lateral and grinder pump
8-inch Force main	1500	LF	\$ 175	\$ 262,500	Bid Tabs from Gorst Improvements adjusted to 2015 dollars
Fill and Abandon Beach Main	1100	LF	\$ 10	\$ 11,000	Estimate to fill and abandon from Seattle Seawall Improvements
Remove and Cap Lateral	17	EA	\$ 2,500	\$ 42,500	Excavation and native backfill, remove and dispose of lateral, install cap on lateral connection to Beach Main
DNR Leasing	1	LS	\$ 50,000	\$ 50,000	Estimate of DNR lease costs
Replace Pumps	1	LS	\$ 50,000	\$ 50,000	\$35,000 for two 15 HP pumps and appurtenances plus \$15,000 installation
Subtotal				\$ 818,560	
Construction Contingency (40%)				\$ 327,424	
Subtotal Construction Costs				\$ 1,145,984	
Sales Tax (8.7%)				\$ 99,800	
Allied Costs (20%)				\$ 229,200	
Total Project Cost				\$ 1,480,000	
Low (-25%)				\$ 1,110,000	
High (+50%)				\$ 2,220,000	

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Alternative 3D

Connect to existing upland gravity sewer, install upland force main, and remove beach main

Item	Quantity	Unit	Unit Cost	Total	Comment
General Items	17	EA	\$ 2,500	\$ 42,500	Minor Change SPCC Plan, Property Restoration, Mobilization, Obstruction Removal, Landscaping, Erosion Control per Grinder Pump from Gorst Collection System Improvements Bid Tab adjusted to 2015 dollars
Grinder Pumps	17	EA	\$ 9,000	\$ 153,000	From Gorst Bid Tab adjusted to 2015 dollars
PE LPS Main 1.25 In. Diam.	4250	LF	\$ 20	\$ 85,000	250 LF per grinder pump, Unit Cost from bid tab
Excavation and Restoration	17	EA	\$ 1,000	\$ 17,000	25 CY Excavation and Gravel Backfill per grinder pump
Asphalt Replacement	85	SY	\$ 110	\$ 9,350	5 SY of pavement restoration per lateral, Tabula unit cost
Traffic Control	136	HRS	\$ 110	\$ 14,960	8 hrs of traffic control per grinder pump, Tabula unit cost
Upland Sewer Wet Tap	17	EA	\$ 2,750	\$ 46,750	Pipe Repair (Romac quote) and corp stop etc (Speer Taps)
Shoring and Dewatering	34	EA	\$ 1,000	\$ 34,000	Per beach main lateral and grinder pump
8-inch Force main	1500	LF	\$ 175	\$ 262,500	Bid Tabs from Gorst Improvements adjusted to 2015 dollars
Remove beach main	1100	LF	\$ 50	\$ 55,000	Estimated from Washington Avenue Sewer Project
Remove laterals	17	EA	\$ 2,000	\$ 34,000	Excavation and native backfill, remove and dispose of lateral
Replace Pumps	1	LS	\$ 50,000	\$ 50,000	\$35,000 for two 15 HP pumps and appurtenances plus \$15,000 installation
Subtotal				\$ 804,060	
Construction Contingency (40%)				\$ 321,624	
Subtotal Construction Costs				\$ 1,125,684	
Sales Tax (8.7%)				\$ 98,000	
Allied Costs (20%)				\$ 225,200	
Total Project Cost				\$ 1,450,000	
Low (-25%)				\$ 1,090,000	
High (+50%)				\$ 2,180,000	

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