

Technical Memorandum



To: File, Oyster Bay Sewerage Basin pre-design
From: Bill Davis, P.E.
Ned Lever, P.E.
Date: October 14, 2016
Re: Oyster Bay Sewerage Basin, Area 2 Alternative Selection

Introduction

The City of Bremerton's Oyster Bay Basin (OBB) has a history of problems, ranging from broken laterals discharging raw wastewater onto the beach to flooding homes with wastewater during storm events. The City retained HDR in 2014 to evaluate the OBB and consider alternatives to address these problems. Their work culminated in technical memorandum ("Oyster Bay Sewerage Pre-Design Alternatives" – October 10, 2016) which identified project alternatives, costs, and non-cost factors for review.

HDR divided the OBB into three sub-areas. Of these three areas, the most significant area of concern is Area 2. Figure 1 shows Area 2 and associated infrastructure. This area receives all the up-basin flow from sewage pump stations OB-2 to OB-7. There are two beach mains which include a 10" dedicated force main laid at the bottom of Oyster Bay, and a 12" gravity-pressure main on the beach along the west edge of Oyster Bay. There are 53 commercial and residential lateral connections to the gravity pressure sewer on the beach which are extremely difficult to access for maintenance. This memorandum will focus on the evaluation of alternatives for Area 2, as the City Engineering and Operations staff strongly believe that sewage utilities should be improved in this area first.

Discussion of Area 2 Alternatives

There are two mains in Area 2 that convey flow from OB-2 to OB-1. The 10" ductile iron dedicated force main is laid directly on the bottom of Oyster Bay. The 12" cast iron gravity-pressure main is buried on the beach at the base of a slope below the OWHL. The OB-2 discharge piping is configured so that each main has a dedicated pump. Valves in the pump station allow the pump discharge to be reconfigured to pump into the either main as needed.

The City evaluated six alternatives for improving the sewage conveyance in Area 2. The alternatives are described in the attached technical memo and are presented in Table 1. Alternatives 2A, 2B, and 2C were the least expensive and included limited modifications to the infrastructure. Of those three, 2C included some modifications to the lateral connections on the beach but still left a majority of the laterals and the gravity-pressure sewer operational. Costs were less than \$1M to complete the modifications for the first three alternatives.

Alternatives 2D, 2E, and 2F eliminated the lateral connections on the beach, which is a high priority for City Operations and Maintenance staff. Alternative 2D created two dedicated force mains for OB-2, while conveying all Area 2 upland flow to OB-1 via grinder pump stations and new piping. Alternatives 2E and 2F eliminated the force mains in the marine environment, moving all the OB-2 discharge to upland force mains, but these alternatives were significantly more expensive than other alternatives (nearly double the cost of 2D).

Selection of Area 2 Alternatives

Each alternative was evaluated for both cost and non-cost factors. The non-cost factors that were considered included the following;

- Difficulty of access for maintenance and repair of pipe and laterals. The majority of the sewer conveyance piping is located below the Ordinary High Water Line (OHWL).
- Elimination of beach lateral connections.
- Risk of single component mechanical failure such as a backwater valve or pump station control valve.
- Coordination with property owners.
- Impact on hydraulic capacity in the mains.
- Increased O&M on grinder pumps.
- Decommissioning of aging infrastructure.
- Potential for sewage discharge into water bodies of the Puget Sound and protection of shellfish beds.
- Potential for sewage discharge into households from surcharged laterals.
- Environmental impact of beach main decommissioning. I.E. excessive excavation to remove decommissioned pipes.

After internal review with the utility stakeholders, the City selected Alternative 2D, which removes all lateral connections off the beach, for the following reasons which balance costs and benefits;

- All laterals removed from the beach will significantly reduce SSO events on the beach.
- Improved access for repair and maintenance as laterals will no longer be submerged in the intertidal zone.
- Improved pipe cleaning process.
- Removal of point discharge into Puget Sound at lateral connections
- Minimize potential for sewage backup into residences and businesses.
- Provides redundancy for OB-2 force main system.
- Beach main remains in service which also minimizes environmental impact due to mandated pipe removal.
- Coordination with property owners will be more difficult but the City has had success on a number of projects with these same issues.

- Grinder pump maintenance is necessary but there are procedures in place to resolve those issues.
- Private easements will be required but this is resolved with the standard pump maintenance agreement.

Improved maintenance and access for repair and maintenance. Buried lateral connections in the beach can often be a source of inflow or outflow since connections degrade and fail over time due to the more severe installation environment. Corrosion, settlement, and movement of beach sediments can be an issue. With 53 lateral connections along approximately 3300 LF of main located along the beach, there is a good chance that some of these connections are starting to fail. Access to the lateral connections and beach main is very difficult due to the high bank waterfront and a beach that is essentially a tide flat. Equipment traveling on the beach will sink into the mud, making it dangerous for the equipment operator and damaging to the aquatic habitat. Currently, the only known access to the beach is at OB-1, and a piece of equipment would need to travel approximately 2800 feet along tide flats to access the furthest lateral. For this reason, the City might have to construct a special road down to the beach, or bring equipment in on a barge in order to access some of the laterals.

According to City sewer operations staff, a special road down to the beach was constructed in 1992 in order to repair one of the laterals. The hole on the beach had to be 40' wide in order to go 10' deep because the material was saturated and would continually slough. There was the additional issue of only being able to work at limited times due to the incoming tide. Upon completion of the repair, a sea wall was built at the road location so the road is no longer accessible. The staff believe that future access would likely require a barge. A recent ordinance passed by the City makes the homeowner responsible for repair of the lateral up to the main, therefore the cost to bring in a barge would likely be borne by the homeowner or their insurance company.

There is also currently no way to clean the main due to the poor access. If the laterals were all disconnected and the pipe turned into a dedicated force main, the City could use a process known as 'pigging' to clean the main, which requires the main to be pressurized.

Removal of possible source of point discharge to Puget Sound. Due to the age of the infrastructure, and environmental conditions, lateral connections to mains can deteriorate and become sources of infiltration or exfiltration. In the case of exfiltration, sewage discharge to the environment can occur. In the case of infiltration, salt water and sediment from the environment enters the main and can increase flow and grit accumulation within the main. Sewer discharging to the environment is costly in terms of both public health and environmental degradation.

Minimize potential for sewage backup into residences and business. When the pumps operate at high pressure and high flow, such as during a large storm event, the beach main operates as a pressure main and flow will surcharge in the laterals. Any additional flow into the laterals will continue to backup, and if the lateral fills, the flow can surcharge into homes or businesses. Of the 53 laterals, it is estimated that backwater valves are installed on an estimated 8 laterals to prevent sewage from surcharging into homes/businesses during these events. However, backwater valves have been known to fail or clog and are not foolproof against preventing sewage discharges. According to

Operations staff, in the early 2000s a backwater valve failure occurred at a residence that was connected to the beach sewer, resulting in considerable damage to the home.

Provides dedicated redundant force mains for OB-2. At OB-2/OB-1, there is currently a single dedicated force main and the gravity-pressure beach main. The proposed alternative will abandon all connections to the beach main and allow it to be converted to a dedicated force main. There will be two dedicated force mains for OB-2, providing redundancy in the event that one of the force mains fails or additional capacity is required.

Additional Coordination and Maintenance Associated with Grinder Pumps While there is added complexity associated with installing grinder pumps on private property, the city has the necessary regulations and procedures in place to accommodate this work. The pumps are owned and maintained by the City, the property owner is subject to an agreement that provides easement access, and the City has a third party maintenance agreement in place that provides for the maintenance and repair of all of the City owned grinder pumps.

Cost Considerations and Intangible Benefits

Table 1 presents the six alternatives and the associated costs. As a capital cost, Alternative 2D is more expensive than Alternatives 2A, 2B, and 2C, but less expensive than 2E and 2F. However, the non-cost benefits made this alternative the most attractive without excessive costs.

CONCLUSION AND RECOMMENDATIONS

Of the six alternatives considered for Area 2, Alternative 2D provides the most significant benefit for the cost. Alternatives 2A, 2B, and 2C are less costly but mostly retain the lateral connections on the beach, which continue to be a significant concern for maintenance and pollution prevention. They also rely mechanical devices to protect residences from flooding. Alternatives 2E and 2F remove the laterals, but these alternatives are significantly more expensive due to abandonment/removal of the mains in the marine environment and the cost to construct extensive upland sewers. By eliminating all lateral connections on the beach and providing reliable and low-maintenance upland grinder pumps which are managed by a third-party vendor, Alternative 2D is a very attractive, high benefit, mid-cost alternative which drastically reduces maintenance requirements and the potential for pollution.



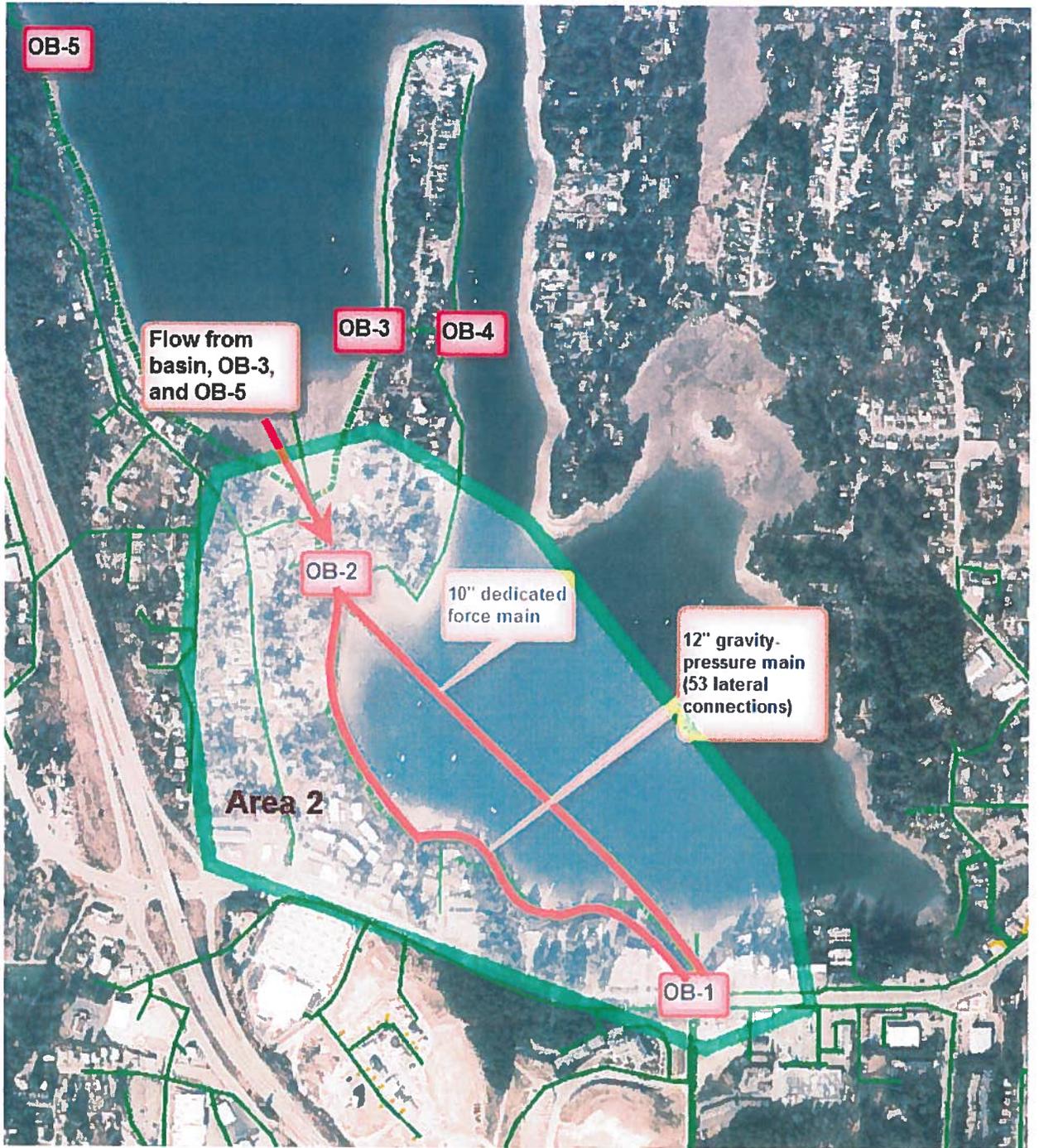


FIGURE 1 – AREA 2 SHOWING OB-2 TO OB-1 SEWER MAINS

Alt. #	Features	Pros	Cons	Estimated Project Cost
2A	"Do Nothing" option. Maintain Backwater Valve program Program	Inexpensive	Risk of BWV failure; does nothing to reduce maintenance limitations on beach or environmental impact.	\$3,000
2B	Automation and control valve at OB-2	Protects properties by limiting HGL in beach main to prevent discharge into homes/businesses	Does nothing to reduce maintenance limitations on beach or environmental impact.	\$56,000
2C	Limited grinder pump stations, slipline and grout existing laterals	Eliminates lateral connections at higher risk of surcharge	Does very little to reduce maintenance limitations on beach or environmental impact.	\$830,000
2D	Grinder pump stations, force mains to 8-inch upland gravity sewer, and cap and seal existing laterals	Eliminates all beach main connections; creates redundant force main system on beach; beach maintenance concerns minimized.	High cost; property coordination for grinder pumps	\$2,510,000
2E	Force main along Shorewood Drive and grinder pump stations	Eliminates all beach mains	Higher cost	\$4,560,000
2F	Alternative 2E and the beach main is removed	Eliminates all beach mains; beach mains are removed.	Highest cost	\$4,690,000

TABLE 1 – SUMMARY OF AREA 2 ALTERNATIVES