



Utility Advisory Committee Eagle Harbor Sewer Beach Main Replacement Project

Recommendations

Background

The City of Bainbridge Island Sewer Utility has experienced a series of recent breakages of raw sewage pipelines located adjacent to Eagle Harbor in corrosive soils. The City has engaged engineering advisors who have developed a series of five possible sewer replacement projects. All of the pipelines investigated in these studies were installed during 1976-1978. All are made of ductile iron and were installed without corrosion protection systems. Two of these pipelines have broken in the recent past. In May and June of 2010 the 12-inch diameter Highway 305 force main (FM), which carries approximately one half of all of the sewage treated at the Winslow wastewater treatment plant (WWTP), broke resulting in release of several hundred thousand gallons of untreated sewage into Eagle Harbor. In 2008 several breakages of the Wing Point Pump Station (PS) FM resulted in release of a smaller amount of raw sewage into Eagle Harbor. Force mains are raw sewage pump station pipelines discharging under pressure.

With this background City staff hired a series of engineering consultants to evaluate the causes of the ruptures and to develop alternatives for replacement of sewage pipelines in beach or underwater locations. Consultants have recommended that protection of the pipelines by installation of corrosion-protective wrapping or by cathodic protection systems would not ensure against future breakage because of the extensive corrosion that has already occurred in the pipelines. Five replacement projects were identified:

- Highway 305 Pump Station FM: replacement of the 12-inch diameter raw sewage FM from the Highway 305 PS, 2,600 feet along the beach and 600 feet upland to the WWTP. Six alternatives were considered; 3 beach routing alternatives: A) Open cut, B) Pipe bursting, and C) slip-lining; two upland alternatives: D) Open cut and E) HDD; and a hybrid beach and upland route: F) Open cut. The recommended alternative was the third lowest cost alternative, \$1.64 million open cut along the beach. This was recommended as an alternate to the hybrid alternative (\$1.48 million)

and over the lowest cost alternative (slip-lining) because of concerns over feasibility of slip-lining.

- Wing Point Pump Station FM: replacement of the 6-inch FM, 3,100 feet along the beach and 600 feet upland to the WWTP. Five alternatives were considered; three beach routings: A) Open-cut, B) Pipe bursting, and C) Pipe Insertion and two upland: D) Open-cut / horizontal directional drilling (HDD), and E) HDD. The lowest cost alternative, C, was selected for \$.62 million. This alternative would require replacement of the WWTP effluent FM. If the effluent FM is not replaced, the next lowest cost alternative is A, \$1.59 million.
- WWTP effluent FM: replacement of 16-inch treated and disinfected effluent FM from the WWTP along 4,900 feet along the beach and connecting across Wing Point with the WWTP outfall in Puget Sound. Two alternatives were considered: A) open cut and B) Upland mix of open-cut and HDD. Recommended alternative: A, \$2.54 million.
- Puget Sound outfall extension: 1,500 foot extension of existing WWTP 16-inch concrete cylinder pipe outfall with 20-inch HDPE to ensure integrity of existing Geoduck Tract Areas. Estimated cost: \$1.18 million
- Gravity influent lines to Lovell Pump Station: replacement of 10-inch diameter gravity sewer lines, 1300 feet from the East and 900 feet from the north. Alternatives for replacement were all beach routing: A) open-cut, B) pipe bursting, and C) cured-in-place pipe. No upland alternatives were considered. Recommended replacement alternative: D) Open cut. Estimated cost: \$1.13 million.

It is the conclusion of City staff and the Utility Advisory Committee (UAC) that several of these pipelines urgently need replacement to prevent future rupture and additional contamination of Eagle Harbor by raw sewage.

UAC Consideration of the Projects

City staff forwarded to the Council the following recommendations:

- Recommend that council review the BHC/Tetra Tech report and assign it to the Utility Advisory Committee (UAC) for additional commentary.
- Specifically, useful to staff is to learn of the UAC's thoughts and ideas on how aggressively to pursue the construction phase or phasing of the project; e.g. is this one large project or a series of individual projects with multiple funding strategies.
- This community perspective will be helpful to know and will assist staff and the council in developing a successful funding strategy to pay for the work.

The UAC has met on several occasions to review and discuss these potential projects. We have prioritized the projects according to five criteria:

- 1) Whether the pipelines under consideration were carrying raw sewage or treated effluent. Pipelines that carried raw sewage were given a higher priority since there is a more serious threat to public health from their breakage than with effluent that has been treated and disinfected.

- 2) Whether the pipelines had a history of failure. Pipelines with a history of failure were given a higher priority.
- 3) Whether the pipelines were pressure sewers or gravity sewers. Pressure sewers were given a higher priority since a breakage in these pipelines would be more likely to cause discharge to the environment.
- 4) Whether the pipeline flows were large or small. Pipelines with large flows were given a higher priority.
- 5) Whether the pipelines were in soils that were known to be corrosive. Pipelines in known corrosive soils were given a higher priority.

The ranking of the five projects by the UAC is shown in Table 1. Projects were scored on an un-weighted scale with a value of 1 for higher priority and zero for lower priority. The highest priority project was the Highway 305 Pump Station FM project. This project was ranked high priority based on all five of the ranking criteria. The next highest ranked project was the Wing Point Pump Station FM project. This project ranked positively on four out of five ranking criteria. The third-ranked project was the WWTP Effluent FM project. The last two project rankings were for the WWTP Outfall Extension and the Lovell Sewers projects.

Table 2 presents a summary of estimated costs developed by City consultants. The consultants have evaluated alternative alignments and construction methods for each of the pipeline replacement projects. In each case the most economical and preferred alignment was replacement along a beach alignment by corrosion resistant high density polyethylene (HDPE) pipelines. In Table 2 we have presented alternative costs depending on how the Wing Point FM and WWTP Effluent FM projects were constructed. Three different construction methods are identified for each of the last four projects:

- 1) Combined WP FM with WWTP FM
- 2) Beach open cut
- 3) Upland open-cut / HDD

The consultants assumed that the Wing Point FM would be constructed by inserting it into the existing WWTP Effluent FM and replacing the Effluent FM using an open-cut, beach alignment. The cumulative cost of these three projects was estimated at \$4.8 million. If only the two highest rated projects were constructed immediately, the cumulative cost for these projects would be either \$3.23 million, if constructed in the beach or \$3.83, if constructed along an upland route. If the Effluent FM project were constructed at a later time, the cumulative cost of the three highest rated projects would be \$5.77 million, in the case where the Effluent FM was constructed using an open-cut beach alignment, or \$7.07 million, in the case where an upland alignment was chosen in the future for the Effluent FM. The table shows that if the last two-rated projects were constructed in the future, the least expensive cumulative cost would be \$7.11 million (in current dollars), if the WP FM were constructed inside the Effluent FM, or as high as \$9.38 million total if the more expensive alternatives were constructed for the WP and WWTP Effluent FM.

Recommendations

- 1) Based on our rankings of the five projects and further considerations, we recommend that the first two highest-ranked projects, the Highway 305 Pump Station FM and the Wing Point Pump Station FM, be implemented on an accelerated schedule. We consider these projects to have emergency priority. We understand that economies may be realized if the third-ranked project, the WWTP Effluent FM, be implemented at the same time as the Wing Point Pump Station FM project.
- 2) We recommend that studies be immediately undertaken (and prior to final design of the two high priority FM replacements) to consider the following:
 - a. Confirm the expected life of the WWTP effluent FM. If the life of this FM is estimated to be for a considerable time, then we recommend that the first two FM projects be designed for immediate construction and the effluent FM project be delayed. If the estimated life of the effluent FM is short, we recommend that the three highest-rated projects be implemented.
 - b. The Wing Point community has discussed alternative alignments for several pipelines. We recommend that these alternative alignments be investigated by the City prior to final design for the projects.
 - c. The Wing Point community also questioned the availability of easements for the beach alignments. This needs to be confirmed. These questions should all be resolved before the City selects preferred construction alternatives.
- 3) We recommend that the two last-ranked projects not be implemented until further evidence of the need for these projects is developed. In the case of the WWTP Effluent Outfall Extension project we recommend that evidence for the need based on soil corrosivity or the economic value of the extension be further developed. In the case of the Lovell Sewer project, we recommend that further studies be conducted to confirm the corrosivity of the soils and the status of the pipelines.
- 4) The total estimated cost for the three, highest-ranked projects constructed by the least expensive means is approximately \$4.8 million dollars. We recommend that the City proceed with investigations into funding for a project of this magnitude with design to begin in 2011 and construction to begin as soon as possible after completion of design.

Respectfully submitted to the City Council of Bainbridge Island by the Utility Advisory Committee in accordance with a unanimous vote: Arlene Buetow, Randal Samstag, Dan Mallove, Andrew Maron, David Ward, Bob Bosserman, Sarah Lee, and Council members Knobloch and Peters (ex-officio). Doug Dow was absent, and did not vote.

Adopted by the Utility Advisory Committee on July 15, 2011.

David Ward, Chair

X David J. Ward Dated: July 14, 2011

Table 1 Ranking of the Five Potential Replacement Projects

Criterion	305 FM	Wing Point FM	WWTP Effluent FM	WWTP Outfall	Lovell Sewers
Raw Sewage	1	1	0	0	1
History of Failure	1	1	?	?	?
Large Flows	1	0	1	1	0
Pressure Sewer	1	1	1	1	0
Corrosive Soil	1	1	1	?	?
Total	5	4	3	2	1
Priority Ranking	1	2	3	4	5

Table 2 Estimated Costs for Prioritized Projects

Project	UAC Priority	Estimated Cost (\$ Million)	Cumulative Cost (\$ Million)
HW 305 FM	1	\$1.64	\$1.64
Wing Point FM	2		
Combined WP FM with WWTP FM		\$0.62	N/A
Beach open cut		\$1.59	\$3.23
Upland open-cut / HDD		\$2.19	\$3.83
WWTP FM	3		
Combined WP FM with WWTP FM		\$2.54	\$4.80
Beach open cut		\$2.54	\$5.77
Upland open-cut / HDD		\$3.24	\$7.07
WWTP Outfall Extension	4		
Combined WP FM with WWTP FM		\$1.18	\$5.98
Beach open cut		\$1.18	\$6.95
Upland open-cut / HDD		\$1.18	\$8.25
Lovell Sewer Replacement	5		
Combined WP FM with WWTP FM		\$1.13	\$7.11
Beach open cut		\$1.13	\$8.08
Upland open-cut / HDD		\$1.13	\$9.38