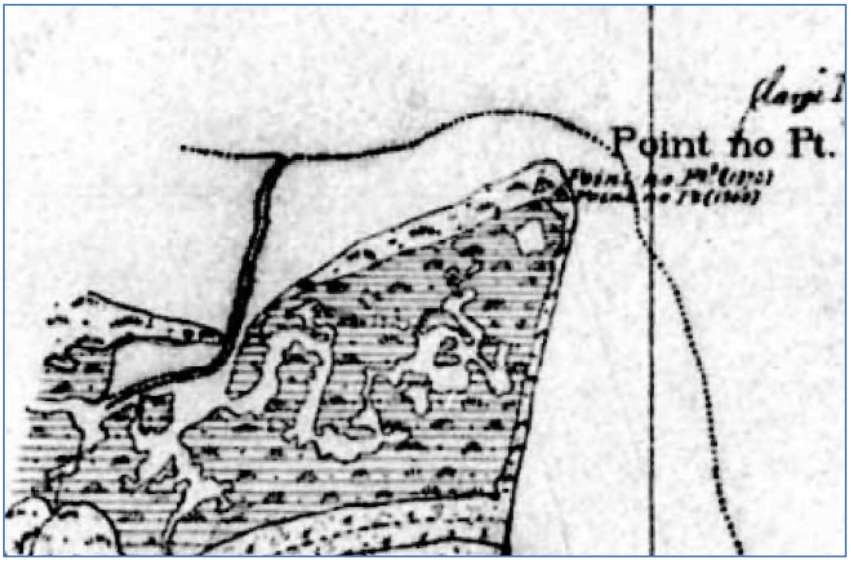
Point-No-Point Tide-Gate & Outfall Replacement Project

Briefing Memo – 2013

This memo provides an initial outline of the proposed Point-No-Point (PNP) Tide-Gate and Outfall replacement project. The current tide-gate and outfall are failing and need to be replaced to prevent local flooding of roads and private property in the PNP community. Along with the replacement of infrastructure, Kitsap County proposes to do restoration work in the PNP wetlands, as well as any mitigation required as part of the project. The annotated photo below shows the existing infrastructure and wetlands at PNP.

This project would replace the existing tide-gate, vault and outfall to the east of the wetlands with a new and larger tide-gate and outfall pipe. In addition, the tide-gate system would be designed to allow a variable amount of backflow of saltwater through the tide gate during the flood tides. This saltwater would mix with the freshwater runoff entering the wetlands. Currently, these wetlands receive freshwater inputs only, but historically were more of a wetland lagoon or "pocket estuary" system that received regular saltwater inflows due to tidal cycles. Alternatively, a new tide-gate vault and outfall could be constructed on the north side of the wetlands at the existing parking area. This is likely the location of the original wetland connection to Puget Sound (see historic map below).

Either of the proposed outfall alternatives would allow the wetland to be filled with seawater to some elevation during each flood tide. The wetland would then drain via the tide-gate during ebb tides. The wetland would fill and drain with the tides similar to the tidal lagoon that existed circa 1850. However the high water level in the lagoon on each tide would be limited to some predefined elevation.



Another alternative that has been considered would be to create an open channel connection between Puget Sound and the existing wetland as existed prior to construction of the lighthouse. Because of the location and elevation of homes in the area and the flooding of these properties that would result during unusually high tides this alternative is likely infeasible at this time. However, this may be a long-term goal for this system provided funding could be obtained in the future.

The proposed tide-gate vault will contain a flow-control device known as a Variable Backflow Flap Gate or VBFG. The VBFG will be open whenever the tidal water level is lower than the water level in the lagoon and the VBFG will remain open as the tide rises to allow some amount of saltwater inflow during the flood tide. The amount of inflow would be controlled to minimize local flooding of properties and infrastructure. The new outfall pipe diameter will be larger than the existing outfall and the operation of the VBFG will be such that nuisance flooding due to rainfall events will be significantly reduced compared to the present system.

In addition to the replacement of the tide-gate and outfall, the existing local roads will need to be modified to help reduce local flooding. Raising the road surfaces at a few low points will allow the wetland to be filled and drained with the tides to a greater depth (elevation of around 11.0 above MLLW) without flooding the road or the adjacent private property. The aerial photo on the following page shows elevations relative to NGVD 29 at various locations. The elevations are based on a recent survey performed by Kitsap County. Road elevations would likely need to be raised to the 5-6 foot level, but further modeling is needed to determine the exact elevations required in all areas. A new cross-culvert would also be needed on the private road that bisects the wetland to allow flows between the two sections of the wetland complex. A number of small flap-gated storm drains will also be needed to convey runoff from the land north of the road, under the road and into the lagoon.

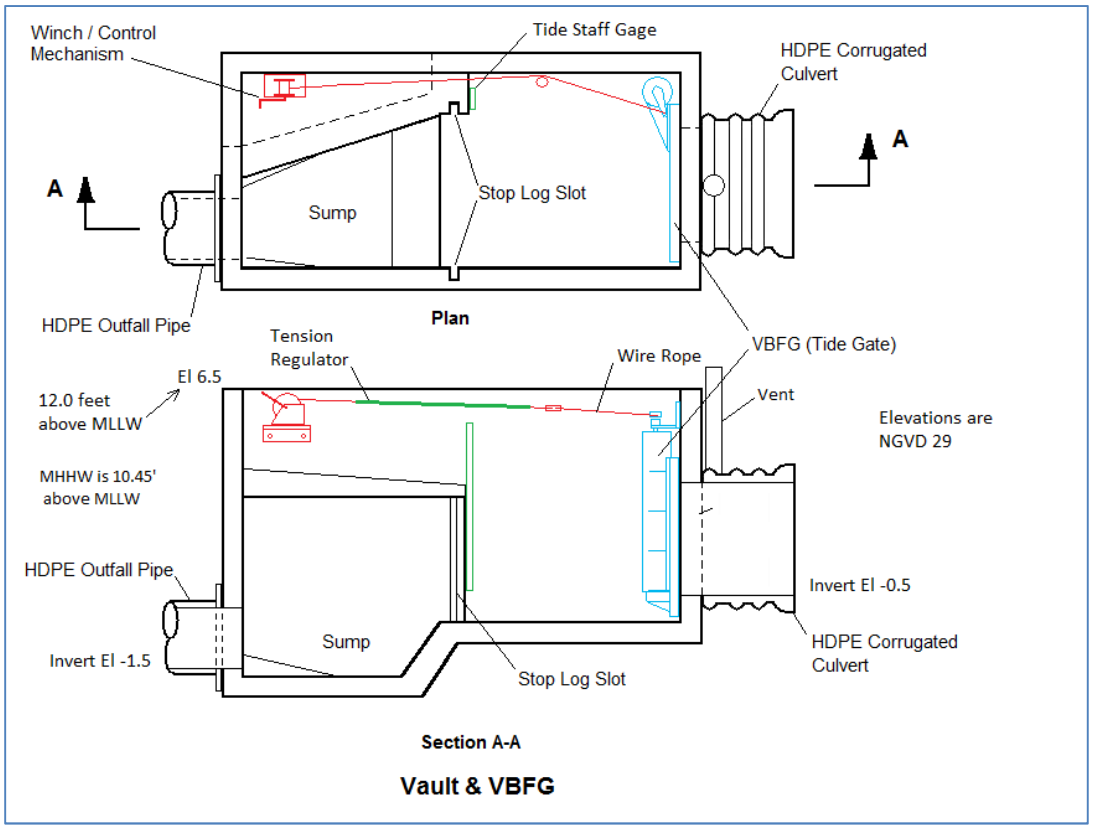
Either location for the outfall and vault could be used. The North beach has the following disadvantages:

1) Existing buried utilities
2) Greater impacts to park users during construction

The east beach has the following disadvantages:

1) Site is confined with little room for material and equipment
2) The vault will be more difficult to access.

A sketch of the proposed tide-gate vault is shown below:



Note that the elevations in the sketch are relative to NGVD 29. Add 5.5 feet to the NGVD elevations for tidal datum (MLLW = 0.0). The vault will be made of fiberglass with a lockable hinged metal diamond plate cover capable of withstanding pedestrian traffic. The vault interior will be shaped to prevent debris from hanging up in the vault. It will also pass water with less head loss compared to a simple rectangular vault. The sump will cause the inlet of the outfall pipe to be submerged most of the time. This will reduce the possibility of air being drawn into the outfall. Air accumulating in the outfall pipe could reduce the conveyance capacity of the outfall.

The VBFG is effectively a spring-loaded side-hinged flap gate that is open by default. It is open in standing water with no head differential (no flow). It only closes when the backflow past the open side-hinged flap gate generates a “draft force” sufficient to draw the flap gate closed. After the VBFG closes, it will remain closed as long as there is some seating head acting on the closed VBFG.

A hand winch is used to increase or decrease the tension in the rigging. If the tension is increased, more backflow will be required to draw the VBFG closed. Since the hinge axis of the VBFG is slightly out of plumb, when there is no tension in the rigging the VBFG will close when there is no outflow. This allows the VBFG to operate like a normal flap gate and allow no backflow – if needed. Any amount of backflow can be accommodated by increasing or decreasing the tension on the rigging.

A hydraulic cylinder will be included which will prevent the VBFG from closing rapidly. If the VBFG closes rapidly, the momentum of the water in the outfall will result in a surge of water in the vault. This surge could fill the entire vault with water and some volume of water would spill from the vault. A vent will prevent water hammer from collapsing the culvert between the vault and the lagoon.

The VBFG will be fabricated using 316 stainless steel and fiberglass. These materials have a long working life in salt water. The VBFG will operate unattended and will open and close automatically with the flooding and ebbing tides. It may be prudent to reduce the amount of tidal backflow into the wetland during the "wet-season" months when more interior storage is needed to accommodate runoff due to rainfall.

In light of the materials used and the nature of the operation of the VBFG, county employees will only sporadically visit the site, open the cover of the vault, and adjust the control mechanism. The accessibility of the vault is not a major concern.

Note that the vault will include slots for stop logs. Stop logs could be inserted to impound water in the lagoon at various times. This could benefit water-fowl and could also be used to help eradicate non-native plants within the inundated pool.

Ecological Changes in the Point No Point Wetland

With the reintroduction of salt water into the wetland, the existing wetland vegetation and aquatic biota will likely change dramatically. Ebb channels will enlarge and meander with the daily ebbing and flooding of the wetland. The vegetation near these ebb channels will be exposed to water with moderate to high levels of salinity. Much of the existing vegetation - including invasive species such as Reed Canary Grass - is not salt-tolerant. Where the salinity is elevated, these plants will die-off and they will be naturally replaced by native salt-tolerant plants. Alternatively, native salt-tolerant plants could be transplanted and/or seeded in the wetland as part of this project.

In a natural pocket estuary, the high water level varies with the daily tidal heights, and the extreme high tides submerge a wide swath of the surrounding vegetation in salt water. At the restored Point No Point wetland, the high water level will be the same regardless of the daily high tides. This results in the natural growth of salt-tolerant plants. The depth and salinity should also be sufficient to suppress non-salt-tolerant plants. As an example, the photograph below shows the thriving salt-tolerant vegetation adjacent to the pocket estuary upstream from the VBFG at Edison Slough in Skagit County.

Wetland restoration could also include the construction of shallow meandering tidal channels. These channels would evolve over time and will have a positive affect the salinity gradient in the restored wetland. Alternatively, the ebb channels could be allowed to form and evolve spontaneously. Because of the daily tidal pulses, the ebb channels will be self-maintaining. The new deeper and wider ebb channels will increase the conveyance of runoff through the wetland during low tides.

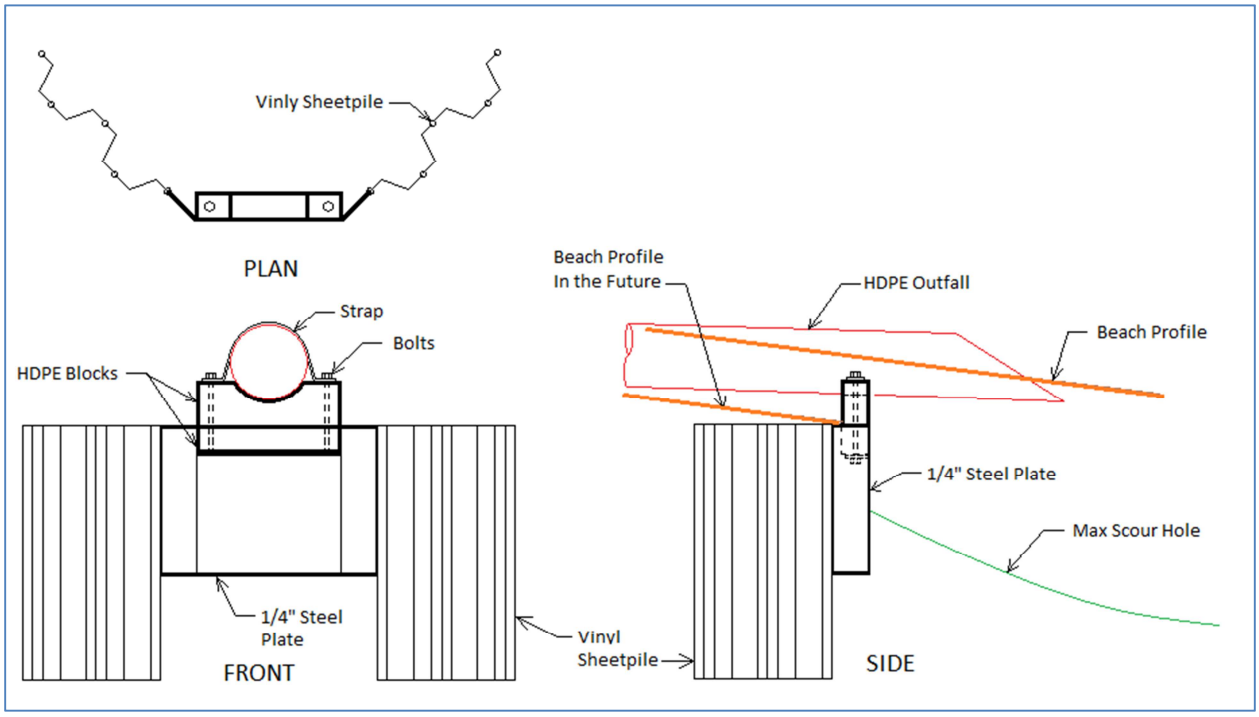
The Outfall Pipe

The outfall pipe will be larger than the existing 18” concrete pipe. This will improve drainage and allow the lagoon to be filled and drained efficiently. The outfall pipe will consist of fused 50-foot lengths of HDPE solid-wall pipe. The pipe will be buried with a minimum of three feet of cover. Manta Earth anchors at 50 foot intervals will secure the buried pipe in the unlikely event that a winter storm lowers the beach and uncovers the pipe. The end of the pipe will be around elevation +2.0 MLLW.

Supporting the end of the outfall pipe is critical to the efficient operation of the VBFG and the outfall pipe. If the outfall pipe becomes completely filled with beach sand and gravel, it will need to be un-plugged manually on regular intervals during low tides – like the existing outfall pipe. If the flow from the outfall creates a large/deep scour hole, the end of the outfall pipe will be undermined and the pipe will not be supported. Since HDPE pipe is flexible, it will droop. As the beach profile changes over time,

the elevation of the end of the outfall will need to be adjusted to accommodate the change and keep the end of the pipe from being buried. If the end of the pipe is too low, a substantial amount of sand and gravel will be ingested and deposited in the lagoon during backflow.

The sketch below shows the proposed design for a buried modular structure which will support the end of the outfall pipe and accommodate adjustments over time.



Under normal conditions, the vinyl sheet piles and most of the ¼" steel plate will be buried. As the beach profile changes over time, HDPE blocks can be inserted or removed to adjust the elevation of the end of the outfall. If the beach profile changes dramatically, the assembly could be reinstalled at a higher or lower elevation as required.

The reintroduced daily tidal exchange will affect the beach profile near the end of the outfall. Based on existing outfalls on this and other beaches, the beach profile is likely to rise. Storms and seasonal variations will cause the beach profile to rise and fall from month to month. In time, the beach profile will approach a new equilibrium with periodic variations due to storms.

A prototype version of the above design could be installed with the new outfall. How the beach responds to the ebbing and flooding flow in the outfall would be observed and the prototype outfall support structure adjusted over time if needed and as required. A permanent structure using stainless steel plate would eventually be installed. The permanent steel plate may be larger or smaller than the prototype and it may have more or fewer sheet piles.

The outfall and vault can be installed in less than a week, so impacts to the park users will have a very short duration. The number of buried utilities is small since they only serve the lighthouse structures. The VBFG will operate without intervention for months at a time. In light of this, either site can be used.

In summary, the benefits of this project include:

1) **Improved drainage and reduced local flooding of roads and property**
2) **A start on the restoration of the historic pocket estuary wetland**
3) **Reduction in O&M burden on Public Works SSWM staff**
4) **Improved fish, wildlife, and waterfowl habitat**
5) **Reduction of invasive Reed Canary Grass**
6) **Tidal flushing will produce organic matter that will benefit the nearshore marine food chain**
7) **Opportunities for public outreach and education, as well as passive recreation**
8) **The constructability of the design will allow the project to be constructed in a short window, which will cause minimal disruption of the environment and park activities**