Perrinville Creek Bypass
Fish Exclusion Assessment
and Concept Design
Edmonds, Washington

October 25, 2013

SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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Submitted To:
Mr. Jerry Shuster, P.E.
Stormwater Engineering Program Manager
City of Edmonds
121 5th Avenue N
Edmonds, Washington 98020

By:
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, Washington 98103

21-1-12428-001

October 25, 2013

Mr. Jerry Shuster, P.E.
Stormwater Engineering Program Manager
City of Edmonds
121 5th Avenue N
Edmonds, WA 98020

RE: PERRINVILLE CREEK BYPASS FISH EXCLUSION ASSESSMENT AND CONCEPT DESIGN, EDMONDS, WASHINGTON

Dear Mr. Shuster:

In accordance with our scope of work with the City of Edmonds (City) dated June 10, 2013, we have conducted an assessment of the existing Perrinville Creek bypass outfall system. The primary purpose of this project was to conduct a screening-level assessment of the impact of the existing bypass system on fish populations. This includes fish potentially being "washed out" of the creek via the bypass diversion structures into Puget Sound and migratory fish potentially being "trapped" in the existing diversion pipe that leads to Puget Sound. We also have identified and evaluated three conceptual-level options for potential fish exclusion. This letter report provides an overview of our assessment and a comparison of the conceptual-level options.

BACKGROUND

A vicinity map of the project site is shown in Figure 1. Perrinville Creek drains approximately 920 acres in northern Edmonds and western Lynnwood (Herrera Environmental Consultants, Inc. [Herrera], 2012). The creek flows into Browns Bay in the Puget Sound. The last 650 feet of the creek flows through a culvert underneath Talbot Road, along a natural channel, and through a culvert underneath the BNSF Railway Company (BNSF) railroad tracks, where it outfalls to Puget Sound.

Previous pebble counts in the lower reach of Perrinville Creek have characterized the sediment as predominantly coarse gravel in a size range that can support salmonid spawning habitat (Herrera, 2012). However, no signs of spawning activity have been observed and the quality of this reach as spawning habitat has been reduced by the high sediment loads (Pentec Environmental, 2002). The shoreline where the bypass pipe outfall is located is part of a littoral drift cell labeled SN-2, which is characterized by a general direction of sediment movement from south to north (Johannessen, 2010). The drift cell originates approximately 1,000 feet north of the Edmonds ferry terminal and extends approximately 10.7 miles to just beyond Elliott Point in Mukilteo. Sediment supply to this shoreline has been highly modified by the BNSF seawall (Johannessen and others, 2005).

Existing Infrastructure

A flood overflow bypass system consisting of two diversion structures and piping to Puget Sound was constructed in the Perrinville Creek channel by the City of Edmonds in 1994 just downstream of the Talbot Road crossing. The design, construction, and operation of this system were conducted with the approval of the appropriate environmental agencies including a permit from the Washington Department of Fish and Wildlife (WDFW) (Jerry Shuster, Personal Communication, October 11, 2013). The purpose of the bypass system was to reduce the frequency of flooding of downstream residential properties. These structures, shown in Figure 2, consist of a pair of overflow weir boxes to the north and the south of a weir structure that control the amount of flow passed downstream in the Perrinville Creek channel. The structures convey flow to a 36-inch Advanced Drainage Systems high-density polyethylene pipe that connects to a manhole located approximately 110 feet downslope to the northwest. The manhole connects to a 40-inch ductile iron (DI) pipe (38-inch inner diameter) that extends downslope for an additional 115 feet. The DI pipe passes under the BNSF embankment and outlets into Puget Sound approximately 100 feet north of the Perrinville Creek main outfall and approximately 23 feet from the western toe of the BNSF embankment.

Historically, stormwater runoff from approximately one-half mile of Talbot Road and approximately 120 acres upstream was directly discharged to Perrinville Creek with no connection to the bypass structure. However, in 2012, this stormwater runoff was rerouted and is now conveyed through a 30-inch polyvinyl chloride (PVC) pipe that ties into the bypass system at a manhole located immediately south of the southern overflow diversion structure.

The bypass system was designed to operate as follows: when the creek is at a high stage from a large storm event, part of the flow goes over the diversion structure weirs and directly into Puget Sound via the diversion pipe. The main channel of the creek then carries the remaining flow downstream at a level that reduces the frequency of flooding for the downstream properties.

Maintenance Concerns

Due the steepness of the upper reaches of the creek, the large amounts of stormwater runoff that have been directed to the creek, and the easily erodible streambed and banks, sediment and colluvium frequently collect at the diversion structures (they are at a relatively flat spot in the creek). Once the rocks and sediment have accumulated above a certain elevation, the diversion structures will “engage,” even in small storm event. Keeping these diversion structures operating properly is a continuing challenge for the City’s maintenance crew due to the nature of the creek. Two days of sediment removal work in the basin can be overwhelmed by the next storm (Jerry Shuster, Personal Communication, October 11, 2013) as shown in the photos provided in Appendix A. This would indicate that the sediment basin is undersized from a maintenance perspective. The City implements fish exclusion measures prior to the removing rocks and sediment from the structures and the creek as part of periodic maintenance in accordance with the City’s Hydraulic Project Approval (HPA) permit with the WDFW (Mike Johnson, Personal Communication, July 10, 2013).

Fish Use and Potential Impacts

Downstream of Talbot Road, Perrinville Creek has been noted to support coho salmon and potentially other anadromous fish (Herrera, 2012), although no recent data collection or observations have been performed to support or refute this. The City’s 2002 Stream Inventory and Assessment (Pentec Environmental, 2002) notes that Perrinville Creek may have supported anadromous fish historically, but no longer does so, and that there was no evidence to indicate historic or current use of Perrinville Creek by chinook salmon or bull trout. Cutthroat trout have been found near the overflow diversion structures during maintenance activities and removed as part of the fish exclusion process (Jerry Shuster, Personal Communication, October 11, 2013). Also, juvenile chum were reported to have been previously released in to the creek by school students, but no adult returns have been reported (Pentec Environmental, 2002). The 30-inch concrete culvert beneath Talbot Road, located approximately 250 feet upstream of the bypass diversion structures, is a documented barrier to fish passage (Herrera, 2012). Upstream of the Talbot Road culvert, the upper reaches of Perrinville Creek have been reported to support resident cutthroat trout (Herrera, 2012).

There is a reported concern that the diversion and bypass system could create a fish attraction into the outfall of the bypass pipe during storm overflows. No documentation regarding instances of fish attraction or stranding was available for review.

Tidal fluctuations at the site typically range between a Mean Higher High Elevation (MHHW) elevation of +9.0 feet North American Vertical Datum of 1988 (NAVD88) and a Mean Lower Low Water elevation of -2.3 feet NAVD88 (National Oceanic and Atmospheric Administration [NOAA], 2013). As shown in the existing site profile provided in Figure 2, the invert elevation at the bypass outfall is at elevation +5.44 feet NAVD88. Fish could potentially access the bypass pipe outfall only when tides are above this invert elevation, during approximately 40 percent of each daily tidal cycle.

The upstream invert elevation of the 40-inch DI bypass pipe at its connection with the manhole is approximately +9.66 feet NAVD88, which is above MHHW. Thus, it appears that the tide would only reach the manhole infrequently, during extreme high tides that are 0.66 foot higher than MHHW.

Overall, based on the data reviewed, it appears that fish attraction to enter the bypass outfall from Puget Sound and migrate upstream is relatively unlikely. Even if an extreme high tide above +9.66 feet NAVD88 were to reach the manhole, there would not necessarily be a coincident overflow event or flow from the recently installed 30-inch PVC pipe conveying stormwater to attract fish to the enter through the bypass outlet, nor a coincident fish migration period. Because the outflow through the Perrinville Creek bypass pipe is typically small in comparison to the Perrinville Creek outflow, the main Perrinville Creek outfall would appear to be more likely to be a more significant and consistent source of fish attraction than flows through the bypass outfall.

Even if fish were to enter the outfall and migrate upstream, it is unclear whether stranding within the bottom of the manhole or within the bypass system upstream of the manhole would actually occur. Rather, fish egress through the outlet appears to be feasible under most conditions.

SITE VISIT

A site visit was conducted on July 10, 2013, at 1:00 p.m. during low tide conditions. Allison MacEwan, P.E., and Alexander Hallenius, P.E., of Shannon & Wilson, were accompanied at the site by Mike Johnson, representing the City. Photos from the site visit are included in Appendix B. Weather conditions during the site reconnaissance were warm and slightly cloudy.

No fish were observed to be present at the bypass inlet or outlet during the site visit. A few inches of sediment was observed to have accumulated within the north and south bypass overflow diversion structures. More significant sediment accumulation was observed upstream of the existing weir structure within the main channel of Perrinville Creek. The depth and composition of this sediment were not measured, but gravels and cobbles were observed.

Less than 1 inch of water was observed to be flowing through the bypass at its outlet, with an estimated flow velocity of less than 0.5 cubic foot per second. The source was not overflow from Perrinville Creek and was presumed to be from local stormwater runoff conveyed from Talbot Road through the bypass structure.

The BNSF railroad embankment was observed to have 1.5 Horizontal to 1 Vertical sideslopes. There was approximately 9 to 10 feet of railroad embankment material covering the DI pipe.

Approximately 1 foot of sediment was observed to have accumulated in the bottom of the DI pipe at the bypass outfall. The tide was approximately -3.54 feet NAVD88 (NOAA, 2013). Along the south side of the culvert exterior, a significant accumulation of deposition of beach sands was observed (see Appendix A, Photo 5).

At the time of the site visit, the edge of Puget Sound's waters was approximately 300 feet west of the bypass outfall location. No defined channel from the bypass outfall to the water was observed.

During the site visit, the main Perrinville Creek outfall was also observed. Perrinville Creek outfalls to Browns Bay via a 30-inch-diameter concrete pipe with an invert at 7.7 feet NAVD88 located at the western toe of the BNSF embankment (Duane Hartman & Associates, Inc. [DHA], 2011). Approximately 6 to 10 inches of sediment were observed in the pipe, and creek flow was approximately 2 to 4 inches deep.

ANALYSIS APPROACH

A literature review of was conducted to identify potential options for fish exclusion at the Perrinville Creek bypass outfall and at the diversion boxes. Three concepts are described in greater detail below. Other concepts considered but not evaluated in detail included: use of behavioral barriers (such as bubble screens or electric fields) to deter fish from entering the pipe, and modification of the manholes within the pipe system to eliminate low areas where fish entering the pipe could potentially be stranded. These other concepts were believed to offer poorer fish exclusion than the concepts presented below.

CONCEPT DESCRIPTIONS

Concept 1: Tide Gate

A tide gate could be installed at the outlet of the overflow pipe, such as the example tide gate structures shown in Figure 3. A tide gate is a water control device that prevents backflow through a culvert from a tidally influenced body of water. Tide gates are typically single-hinge flap gates that are installed on the downstream end of culverts. The gates open and close due to differences between upstream and downstream water levels. Tide gates can typically only open in one direction, away from the culvert. This movement allows upstream water to flow out of the culvert while preventing backflows into the culvert when the outfall is inundated by higher tides.

Exclusion Performance

A properly functioning tide gate would provide a high level of fish exclusion, if properly maintained and kept free of sediment and other obstructions. However, during periods when the tide gate is open, fish could still potentially enter the outlet of the bypass pipe. This could occur during an overflow event, or any time that sediment accumulation was to impede proper tide gate closure during tides above the pipe outlet invert (+5.44 feet NAVD 88). Given the sediment accumulation observed at the pipe outlet and along the south side of the bypass outfall pipe, it appears likely that sedimentation could adversely impact the functionality of the tides gate concept option.

Constructability

Construction of a tide gate would require modifications at the bypass pipe outlet. Due to the location of the DI pipe outlet, access for installation may require use of a barge. Some minor modifications at the DI pipe outlet may be required to facilitate attachment of the tide gate. Excavation and clearing of sediment around the pipe outlet, below the ordinary high water (OHW), would be required during installation to provide a free range of movement for the tide gate.

Maintenance Requirements

As discussed above, sediment deposition within the DI pipe and at the face of the outfall could limit free movement of the tide gate and adversely affect its performance. Sediment deposition within the pipe is likely to occur during overflow events, which will usually only occur during a 50 percent annual exceedance probability (two-year) storm event or greater, and also from long-term shoreline sediment draft conditions. Collectively, these conditions indicate that ongoing and frequent maintenance would be necessary to maintain tide gate function.

Other Considerations

Use of a tide gate could restrict flow during a 1 percent annual exceedance probability (100-year) storm event. Based on the calculations provided for the overflow structure (Fiene, 1994), flow in the outlet pipe controls the design during the 100-year storm event, rather than weir flow at the entrance to the overflow structure. The potential for flow restriction due to the presence of the tide gate must be evaluated during future phases of design.

Concept 2: Fish Screens

Fish screens could be installed at the overflow inlet and the pipe outlet. Example fish screen structures and materials are shown in Figure 4. Fish screens physically prevent the passage of fish through water diversion structures. Vertical flat plate screens are typically used in the Pacific Northwest for gravity diversion structures (WDFW, 2009). They typically consist of a perforated metal plate or wire mesh with small openings (between 0.094 to 0.252 inch in size) that preclude fish passage, yet allow water to pass though. Vertical flat plate screens do not include mechanical moving parts; however, many do have mechanical cleaning mechanisms to remove debris deposited on the screen.

Use of a fish screen as an exclusion device would require installation at both the inlet and outlet ends of the bypass diversion structure as shown in Figure 4. Installation at the outlet of the bypass pipe would prevent fish from entering the pipe during high tide. However, if a screen was not installed at the inlets of the overflow diversion structures, downstream migrants could potentially pass through the bypass and have their egress blocked by the fish screen at the exit.

Exclusion Performance

Proper design and installation of fish screens could provide full fish exclusion from entering the overflow system while minimizing fish entrainment on the screen. However, the feasibility of this fish exclusion concept needs to be examined in greater detail. Design of the fish screen configurations at the inlet and outlet would require a hydraulic analysis to account for approach velocities in the forebay of the structure and sweep velocities along the face of the screen. Approach velocity is the velocity perpendicular to the screen that may trap or impinge a fish against a screen, causing injury. Sweep velocity is the velocity parallel to the face of the fish screen. The sweep velocity should always exceed the approach velocity so that fish are swept off the face of the screen without injury (National Conservation Resource Service [NRCS], 2007).

Constructability

Installation of fish screens would require modifications to both the bypass inlet and outlet structures. Screens could be attached to the overflow inlet with small equipment and hand labor. Similar to installation of a tide gate, a barge could be required to access and install screens at the pipe outlet.

Maintenance Requirements

As previously stated, Perrinville Creek has a significant sediment bedload. Sediment deposition is a large concern at the overflow diversion structure inlets and within the outfall pipe. The presence of a fish screen at the inlets could increase the amount of fine sediment deposition at the inlet and reduce the effectiveness of the screen exclusion. Frequent maintenance would be required at regular intervals (possibly monthly or more frequently) and after storm events to remove sediment at the inlet and within the outfall pipe. The potential benefits, costs, and feasibility of incorporating mechanical screen cleaning devices into the design should be considered as part of the design process.

Other Considerations

Typical fish screens have between 25 to 40 percent open area for water flow. As a result, the vertical fish screen could reduce the inlet capacity of the diversion structures and result in decreased bypass performance during flood events. This capacity could be further compromised by the accumulation of sediment.

Flow restriction at the pipe outlet due to screen obstruction could similarly decrease the overall capacity of the bypass during high flow events. Instead of covering the outlet of the pipe with a flat plate screen, a cylindrical fish screen that provides increased surface area for water outflow, as shown in Figure 4, could potentially be installed to enhance outflow capacity.

However, it could be very difficult to keep these structures free of sediment, given the littoral drift conditions and regular tidal inundation.

Concept 3: Raised Outlet Pipe

The outlet pipe could be raised above the normal high tide level to preclude fish from entering the pipe. Approximately 120 feet of existing 40-inch DI pipe, between the bypass outlet and the nearest manhole, would need to be replaced to raise the invert of the outlet above the MHHW water level (+9 feet NAVD). Figure 5 shows the conceptual profile of the raised pipe. This concept would raise the invert of the pipe from elevation +5.44 feet NAVD88 to elevation +10.0 feet NAVD88.

Exclusion Performance

Raising the bypass pipe outlet could provide a high level of fish exclusion by placing the pipe above the MHHW tide level. The outlet would only be inundated during extreme high tides, for short periods of time and, if fish were to enter the pipe, egress should be possible with the ebbing of the tide. A tide gate could be installed at the raised outlet pipe to further improve fish exclusion at extreme high tides. Installation of the tide gate at a higher invert elevation is more feasible as the pipe is located above the littoral drift deposits.

Constructability

Raising the outlet pipe will require removal of the existing pipe and installation of a new pipe. Portions of the pipe could also potentially be abandoned in place. Pipe jacking would likely be required to install a new pipe through the existing BNSF embankment to minimize disruptions to the railroad operations. Permits and close coordination with BNSF would be required, as well as the use of a flagger during construction.

Maintenance Requirements

The raised pipe option should require minimal maintenance compared to the other concepts presented. Sediment removal within the pipe should be similar to the effort required for the existing overflow system and would reduce littoral drift deposits.

Other Considerations

This option would require significant coordination with BNSF regarding permitting, operations, and right-of-way issues. It could also entail installation of improvements to the railway embankment armoring.

Raising the bypass pipe would change the overall hydraulics within the bypass, which could potentially impact the capacity of the bypass structure and the potential for sedimentation within the raised outfall pipe. A detailed hydraulic analysis would be required to assess the overall performance of the bypass if the DI pipe were to be raised.

PERMITTING CONSIDERATIONS

Permitting requirements would be similar for each of the project options. Each would likely involve work below the MHHW or OHW associated with Puget Sound at the bypass outlet and, as applicable, below the OHW of Perrinville Creek at the upstream end of the bypass. A Joint Aquatic Resource Permit Application would need to be completed to apply for a U.S. Army Corps of Engineers Section 404 permit, a Washington Department of Ecology (Ecology) 401 Water Quality Certification, a WDFW HPA and potentially shoreline, critical areas, and State Environmental Policy Act exemptions from the City. Local clearing and grading permits may also be required, depending on the quantity of material that would be removed. For the pipe raise Concept #3, these permits would also be required for the removal of the existing 40-inch DI pipe, although portions of the pipe could be abandoned in place. Depending on the fish species present within Perrinville Creek, coordination under the Endangered Species Act for permitting with the NOAA's National Marine Fisheries Service and/or the U.S. Fish and Wildlife Service would also likely be needed.

COMPARISON OF ALTERNATIVES

An evaluation of each conceptual alternative for fish exclusion on the basis of its anticipated fish exclusion performance, constructability, maintenance requirements is presented in Table 1 below.

TABLE 1
COMPARISON OF CONCEPTUAL FISH EXCLUSION ALTERNATIVES

Concept	Exclusion Performance	Constructability	Maintenance Requirements	Order of Magnitude Preliminary Cost
#1 – Tide Gate	Medium	High	High	$82,000
#2 – Fish Screens	High	Medium	High	$151,000
#3 – Raised Pipe	High	Medium	Low	$360,000

Note:
[1] Does not include ongoing maintenance costs.

RECOMMENDATIONS

Both concepts #1 (Tide Gate) and #2 (Fish Screens) would only add to the already difficult maintenance issues at the diversion structures and are, therefore, not recommended.

Concept #3 (Raised Pipe) would work well in preventing any migratory fish from entering the diversion pipe from Puget Sound. This concept, though, would not prevent fish (if any) from being washed out into Puget Sound via the diversion structures, and has a reliably high cost of implementation.

Rather than modifying outdated infrastructure, a better approach would be for the City to use its existing funding and any available grant funding to find a replacement system that would meet the following goals:

- Provide an appropriate level of flood protection to residents downstream of Talbot Road.
- Accommodate current fish use and enhance fish use for the appropriate migratory species.
- Significantly reduce maintenance considerations (i.e., a larger sediment basin).

The City is currently working on a flow reduction plan for Perrinville Creek with funding from Ecology (Jerry Shuster, Personal Communication, October 11, 2013). This plan has the goals of reducing stormwater flows into the creek and reducing the amount of sediment and rocks that are transported and deposited in the lower reach. Implementing this flow reduction plan along with either a better-designed diversion system or a new or a redesigned creek outlet to Puget Sound could be a solution that meets the City's goals.

LIMITATIONS

The recommendations contained in this letter report are based upon a single site reconnaissance, and not a comprehensive stormwater or fish passage study, and represent the site conditions as they existed at the time this letter report was prepared. Within the limitations of the scope, schedule, and budget, the alternatives, engineer opinion of cost, and recommendations presented in this letter report were developed in accordance with generally accepted professional engineering practice for reconnaissance-level studies in this area at the time this letter report was prepared. No warranty, express or implied, is made.

If conditions are encountered or observed that are different from conditions described in this letter report, we should be advised at once so that we can review those conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between the submission of this letter report and the start of any future work at the site, or if conditions have changed because of natural forces or operations at or adjacent to the site, we recommend that this letter be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

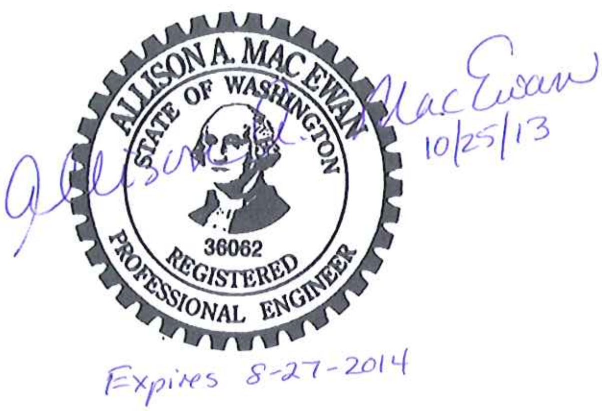
Shannon & Wilson, Inc. has included Appendix C entitled, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our reports.

Mr. Jerry Shuster
City of Edmonds
October 25, 2013

We appreciate the opportunity to be of service. Please contact me at (206) 695-6691 with questions or comments.

Sincerely,

SHANNON & WILSON, INC.



Allison A. MacEwan, P.E.
Associate

AAM:DRC/oth

Enc: References
Figure 1 – Vicinity Map
Figure 2 – Existing Conditions Plan and Profile
Figure 3 – Tide/Flap Gate Concept Examples
Figure 4 – Fish Screen Concept Examples
Figure 5 – Raised Bypass Pipe Concept Plan and Profile
Appendix A – Sediment Accumulation and Maintenance Photographs
Appendix B – Site Photographs
Appendix C – Important Information About Your Geotechnical/Environmental Report

REFERENCES

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0 1 2

Approximate Scale in Miles

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, reproduced by permission granted by Google Earth ™ Mapping Service.

Perrinville Creek Bypass
Edmonds, Washington

VICINITY MAP

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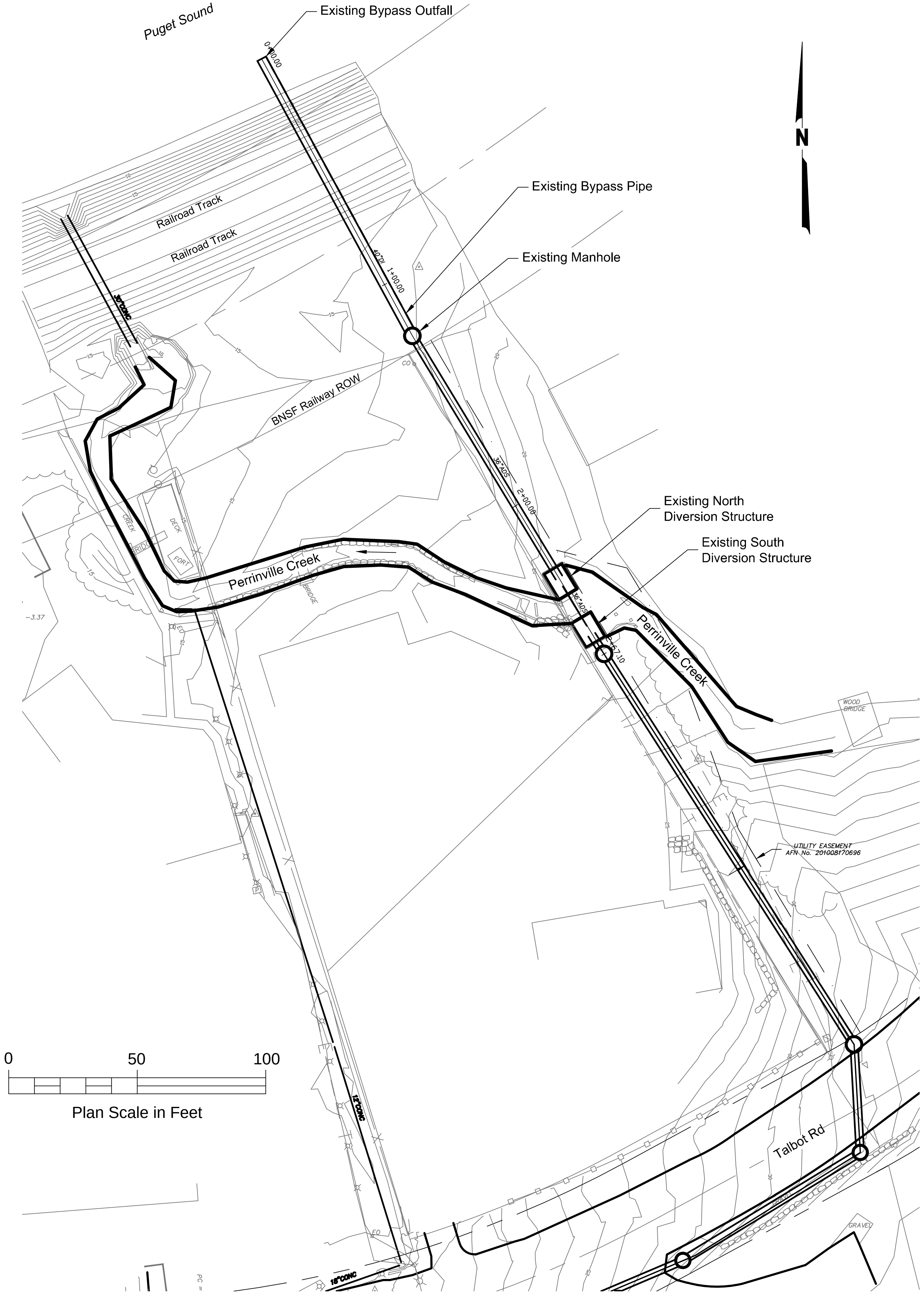
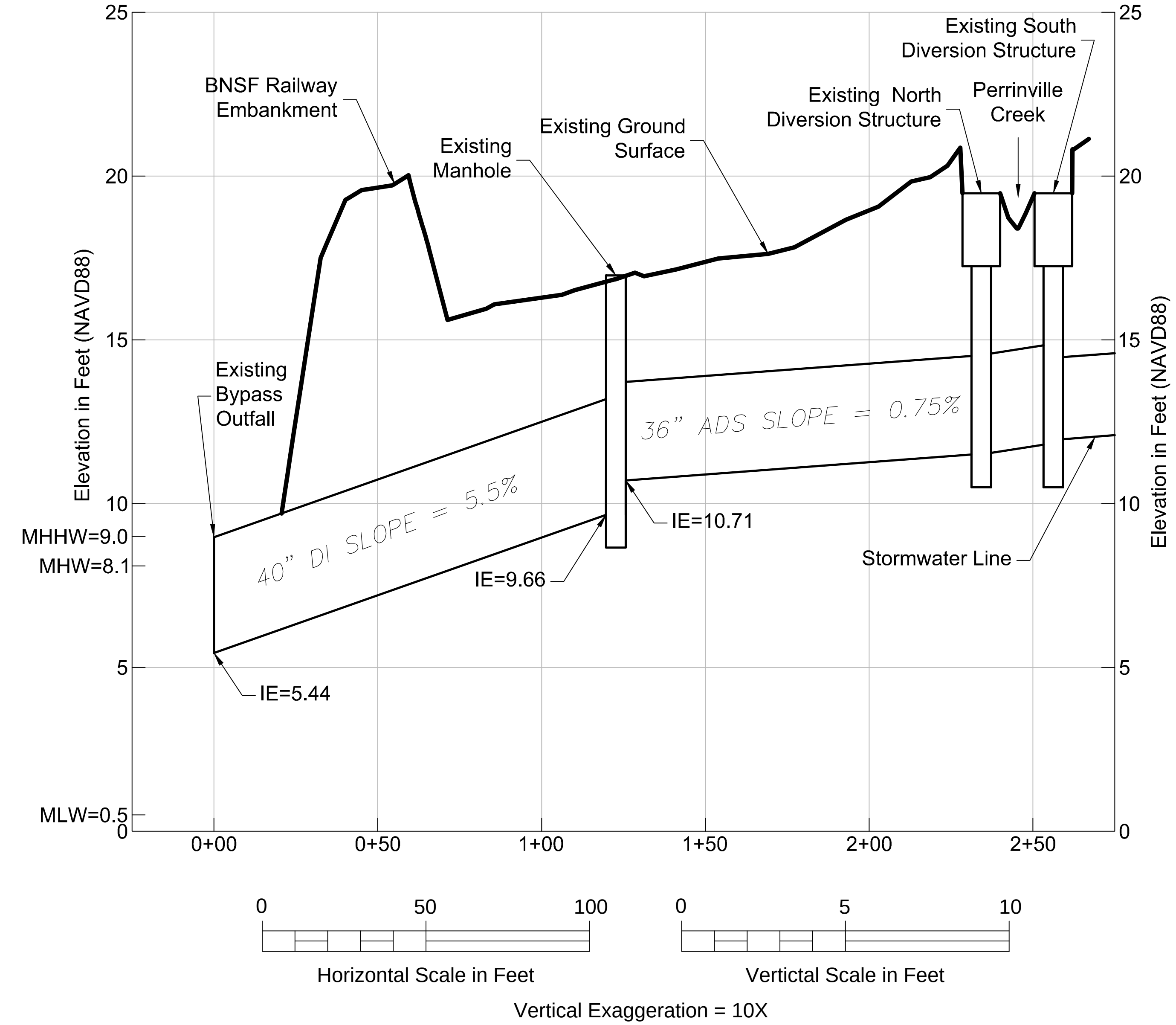
FIG. 1

Filename: J:\211\12428-001\21-1-12428-001 Fig 1 Vic Map.dwg Date: 10-17-2013 Login: SAC





NOTES

1. This figure is based on Duane Hartman & Associates, Inc. survey file, *survey.dwg*, titled *City of Edmonds Perrinville Creek Alt#4*, dated March 21, 2011, received 7-10-2013 from the City of Edmonds.
2. Tidal elevations based on NOAA Station 9447130, Seattle, WA.
   MHHW = Mean Higher High Water
   MHW = Mean High Water
   MLW = Mean Low Water
   IE = Invert Elevation

Perrinville Creek Bypass
Edmonds, Washington

EXISTING CONDITIONS PLAN AND PROFILE

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FIG. 2

File: J:\211\12428-001\21-1-12428-001 Plan-Profile.dwg Date: 10-17-2013 Author: SAC

Flap Style Gate[1]

Flap Style Gate[2]

NOTES

1. Source: Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual, Washington Department of Fish & Wildlife (2009).

2. Source: Hydro Gate, Flapgates, FLAP1106, not dated. Available: http://www.hydrogate.com/products/literature/Flap%20Gates.pdf . Accessedd August 2013.

Perrinville Creek Bypass
Edmonds, Washington

TIDE/FLAP GATE CONCEPT EXAMPLES

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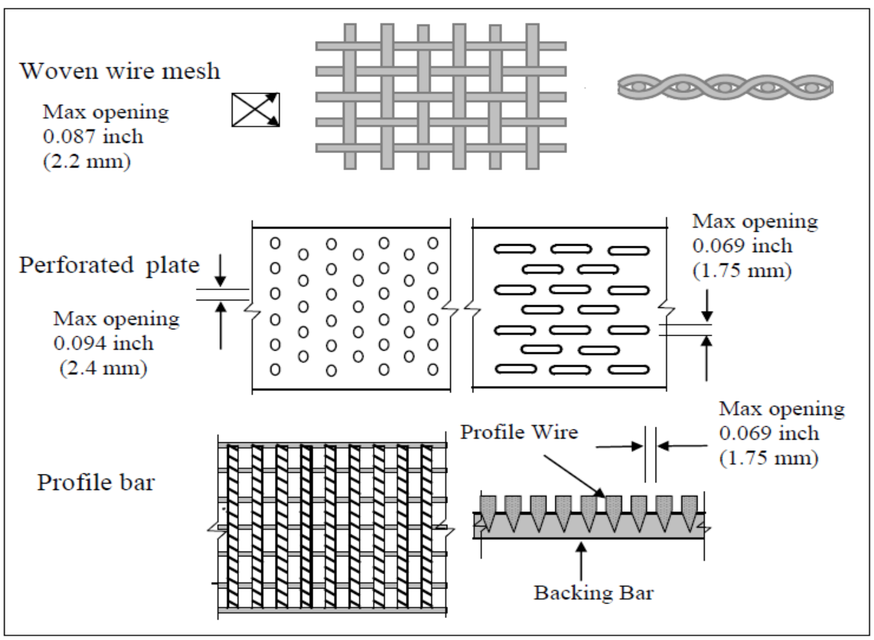
FIG. 3

Example Inlet Screen Concepts: Vertical Plate and Cone[1]

Example Outlet Screen Concepts[1]



Example Fish Screening Materials[2]

NOTES

1. Source of lower photo: https://secure.rco.wa.gov/prism/search/projectsnapshot.aspx?ProjectNumber=08-2185. Accessed August 2013.
2. Source: Washington State Recreation and Conservation Office Diversion Screen Bypass, PRISM Project #08-2195.

Perrinville Creek Bypass
Edmonds, Washington

FISH SCREEN CONCEPT EXAMPLES

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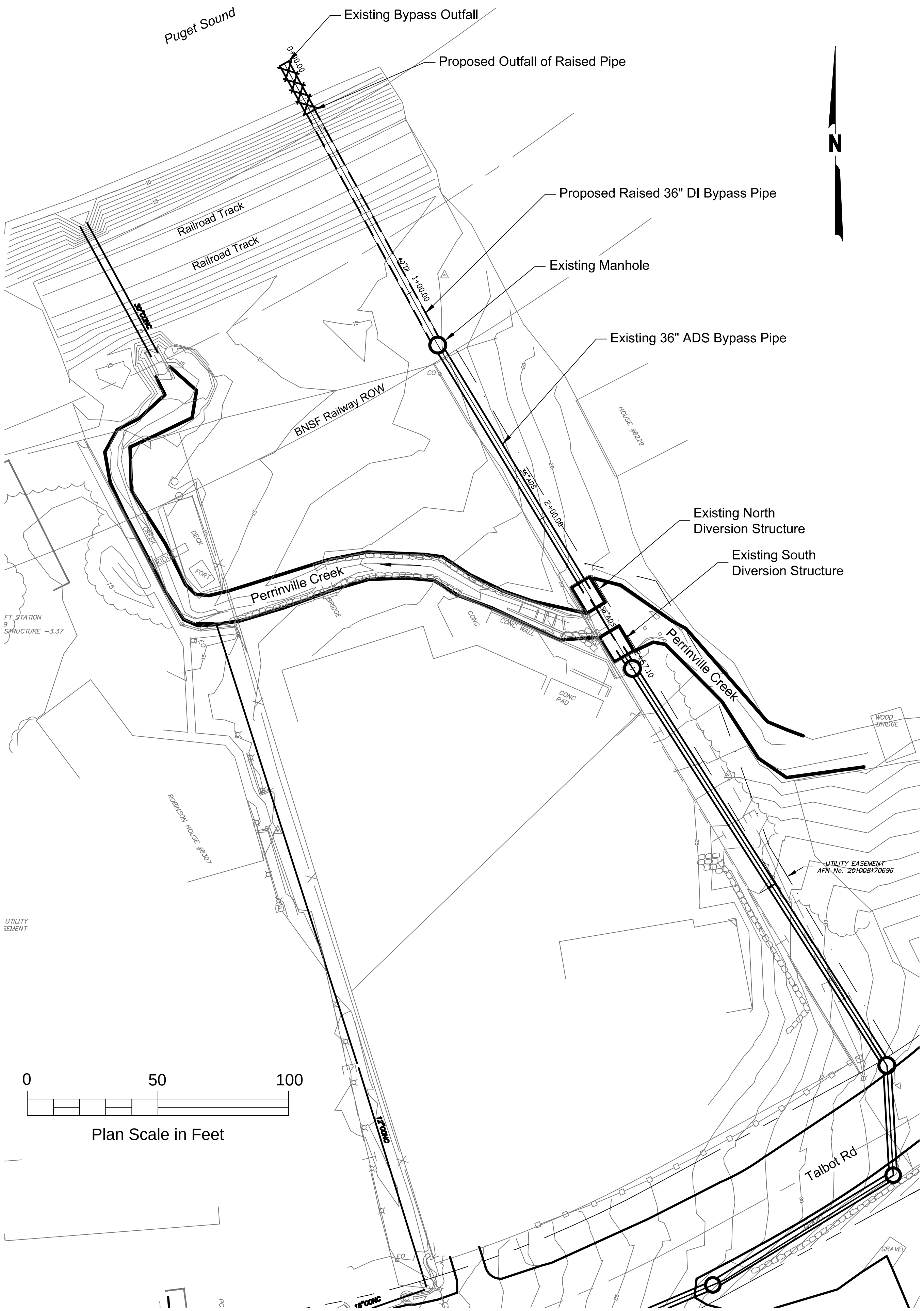
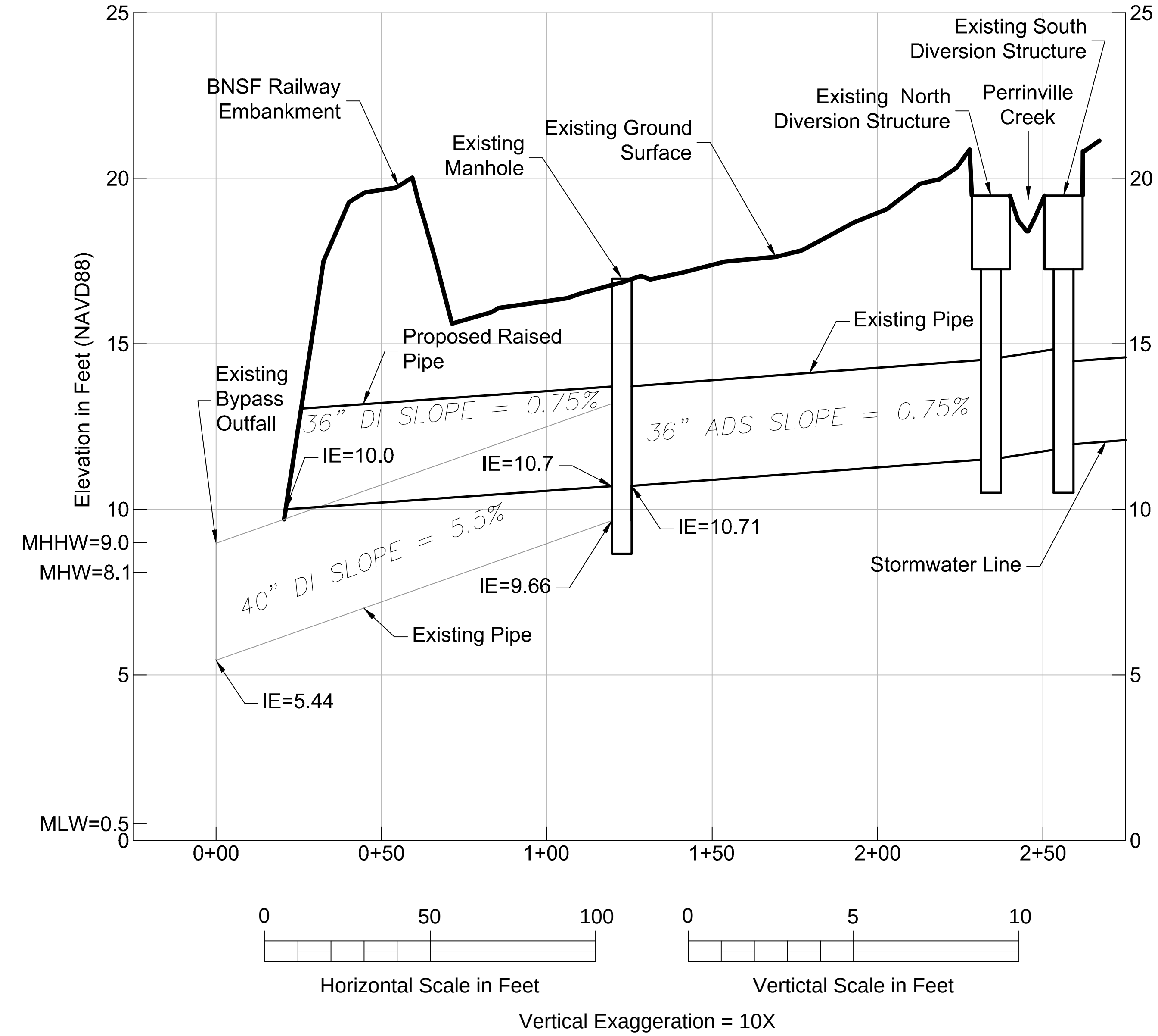
FIG. 4





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2. Tidal elevations based on NOAA Station 9447130, Seattle, WA.
   MHHW = Mean Higher High Water
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Perrinville Creek Bypass
Edmonds, Washington

RAISED BYPASS PIPE CONCEPT PLAN AND PROFILE

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Geotechnical and Environmental Consultants

FIG. 5

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APPENDIX A

SEDIMENT ACCUMULATION AND MAINTENANCE PHOTOGRAPHS

Photo 1. Sediment accumulation at the Perrinville Creek bypass structure on September 16, 2013, following a storm event (photo provided by the City of Edmonds).

Photo 2. Perrinville Creek bypass structure on July 11, 2012, after a typical sediment removal (photo provided by the City of Edmonds).

Photo 3. Sediment re-accumulation at the Perrinville Creek bypass structure on October 1, 2013, after subsequent storm event (photo provided by the City of Edmonds).

APPENDIX B

SITE PHOTOGRAPHS

Photo 1. Perrinville Creek bypass structure. The weir regulates downstream flow within the creek and to the north and south overflow diversion structures.

Photo 2. Northern overflow bypass diversion structure.

Photo 3. Manhole located approximately 110 feet west of the bypass structure.

Photo 4. Looking west from manhole towards the BNSF Railway embankment.

Photo 5. Looking east towards the 40-inch ductile iron bypass pipe outfall.


Photo 6. Looking west from the bypass outfall towards Puget Sound during low tide.

Photo 7. Perrinville Creek Outfall.


Photo 8. Looking east towards the main Perrinville Creek outfall (right) and the Perrinville Creek bypass outfall (left).

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

Date: October 25, 2013
To: Mr. Jerry Shuster, P.E.
City of Edmonds

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland