DRAFT
CRITICAL AREAS REPORT

HIDDEN LAKE DAM REMOVAL PROJECT
SHORELINE, WASHINGTON

Prepared for
City of Shoreline Public Works Department

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

CRITICAL AREAS REPORT

HIDDEN LAKE DAM REMOVAL PROJECT
SHORELINE, WASHINGTON

Prepared for
City of Shoreline
Public Works Department
17500 Midvale Avenue North
Shoreline, Washington 98133

Prepared by
Herrera Environmental Consultants, Inc.
Contact: Christina Merten, PWS
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206-441-9080

DRAFT
January 29, 2019

CONTENTS

APPENDICES

TABLES

FIGURES

DISCLAIMER

Herrera Environmental Consultants, Inc., has prepared this report for use by the City of Shoreline. The results and conclusions in this report represent the professional opinion of Herrera Environmental Consultants, Inc. They are based upon examination of public domain information concerning the study area, site reconnaissance, and data analysis.

The work was performed according to accepted standards in the field of jurisdictional wetland determination and delineation using the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region* (Environmental Laboratory 2010). In addition, work was conducted according to accepted standards of determining the ordinary high water mark (OHWM) of streams using the definition set forth in Washington Administrative Code 173 22 030(11) and *Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State* (Anderson et al. 2016). However, final determination of jurisdictional wetland and OHWM boundaries pertinent to Section 404 of the Clean Water Act is the responsibility of the Seattle District of the US Army Corps of Engineers. Various agencies of the State of Washington and local jurisdictions may require a review of final site development plans that could potentially affect zoning, buffer requirements, water quality, or habitat functions of lands in question. Therefore, the findings and conclusions in this report should be reviewed by appropriate regulatory agencies before any detailed site planning or construction activities.

HERRERA QUALIFICATIONS

Established in 1980, Herrera Environmental Consultants, Inc. (Herrera) is an innovative, employee-owned, consulting firm focused on three practice areas: water, restoration, and sustainable development. Herrera's interdisciplinary teams of scientists, engineers, and planners provide scientifically defensible and realistic solutions to complex resources challenges facing municipalities, utilities, government agencies, tribes, nonprofits, and businesses. Herrera's philosophy is to integrate protection of environmental, cultural, and economic values into all of our projects.

The following staff authored this report and conducted field work in support of this report. A summary of their qualifications is provided.

Shelby Petro, PWS

Shelby Petro is a wetland scientist and permitting specialist with 10 years of professional experience in environmental consulting, specializing in natural resources management, wetland science, and regulatory compliance for public and private development projects. Shelby delineates wetlands and ordinary high water marks of streams and shorelines; conducts habitat assessments and surveys for special-status plant and wildlife species; prepares technical reports and documentation for Endangered Species Act (ESA) and National and State Environmental Policy Act (NEPA and SEPA) compliance; and prepares wetland and stream delineation reports, critical area reports, and mitigation plans for impacts to wetlands, streams, and buffers. Shelby coordinates with local, state, and federal agencies, completes applications, and obtains permits and approvals for project compliance with regulations including local critical area ordinances, shoreline master programs, the State Hydraulic Code, SEPA, NEPA, ESA, and Clean Water Act Sections 401 and 404.

Credentials

- BS, Biology, Indiana Wesleyan University, 2007
- MESM, Master of Environmental Science and Management, University of California, Santa Barbara, 2014
- Certificate in Wetland Science and Management, University of Washington, 2015
- PWS, Professional Wetland Scientist #2837, Society of Wetland Scientists, 2017

Christina Merten, PE, PWS

Christina Merten is a project manager and senior ecologist with over 20 years of technical experience in the natural resource monitoring, remediation and restoration field with demonstrated ability to perform as a key team member and independently lead projects. She

performs a variety of environmental studies for private and public development projects, which include wetland delineations, stream surveys, and mitigation plans.

Credentials

- BS in Civil Engineering with Environmental Specialty, Texas A&M University, 1997
- Licensed Professional Engineer in Washington #39019, 2002
- Certificate in Wetland Science and Management, University of Washington, 2004
- Stream Restoration Certificate, University of Washington, 2011
- Certified Professional Wetland Scientist (PWS) #2785, Society of Wetland Scientists, 2017

Eliza Spear, WPIT

Eliza Spear is a natural resource scientist with 3 years of experience and background in wetland, forest, and meadow restoration; wetland delineation; invasive species control; and park and trail maintenance and construction. Eliza has worked and trained in wetland delineation in Washington and Virginia. Eliza has experience and training in restoration project planning, implementation, and monitoring in Washington, Oregon, Pennsylvania, and Virginia. Eliza conducts wetland and stream delineations; vegetation monitoring of mitigation and restoration sites; and drafts technical reports to support these projects.

Credentials

- BS, Environmental Science and Ecology, College of William and Mary, 2013
- Certificate in Wetland Science and Management, University of Washington, 2018
- WPIT, Wetland Professional in Training, Society of Wetland Scientists, 2018

EXECUTIVE SUMMARY

Herrera Environmental Consultants, Inc. (Herrera) prepared this wetland and aquatic areas delineation report at the request of the City of Shoreline for the Hidden Lake Dam Removal Project (project) in accordance with current federal, state, and local regulations and guidance. Hidden Lake is a manmade water body impounded by an earthen dam located in the City of Shoreline, east of the intersection of Northwest Innis Arden Way and Tenth Avenue Northwest, partially within Shoreview Park. The City of Shoreline proposes to remove the Hidden Lake dam, to replace the culverts that convey Boeing Creek flows under Northwest Innis Arden Way with a larger culvert structure, and to restore the historical stream channel of Boeing Creek from the upstream end of Hidden Lake to the downstream side of Northwest Innis Arden Way. These efforts aim to eliminate the need for maintenance dredging of sediment carried into Hidden Lake in Boeing Creek flow, reduce flooding risk in the road crossing area, and improve downstream fish habitat by increasing sediment deposition in Boeing Creek and at the Puget Sound Beach delta downstream of the project site.

Wetland delineations were conducted in compliance with the *Regional Supplement to the US Army Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region* (Environmental Laboratory 2010), which is consistent with the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). On October 4, 2018, Herrera biologists delineated nine wetlands along the shores of Hidden Lake and Boeing Creek (Table ES-1). Wetlands A1 through B5 are depressional wetlands along and near the shore of Hidden Lake, and Wetlands C1 and C2 are riverine wetlands on the bank of Boeing Creek. Table ES-1 lists buffer widths for each wetland according to the City of Shoreline's critical areas ordinance.

Hidden Lake has previously been mapped as a wetland. This report evaluates it as a fish and wildlife habitat conservation area. This status should be discussed with regulatory agencies prior to final mitigation design because mitigation ratios and requirements could change. This project is proposing to increase the functional lift of the Boeing Creek system on a landscape scale by removing the artificially created lake and re-establishing the natural Boeing Creek system, which is an atypical type of impact.

Table ES-1. Wetlands Delineated in the Study Area for the Hidden Lake Dam Removal Project.					
Wetland Name	**Size of Wetland (square feet/acre)**	**USFWS Classification[a]**	**Hydrogeomorphic Classification[b]**	**Ecology Rating Category (2014)[c]**	**City of Shoreline Standard Buffer Width (feet)[d]**
A1	2507.91/0.058	PEM/PSS	Depressional	III	165
A2	1385.40/0.032	PEM	Depressional	IV	40
B1	3244.38/0.074	PEM	Depressional	III	165
B2	397.84/0.009	PEM	Depressional	IV	40
B3	652.54/0.015	PEM	Depressional	IV	40
B4	719.76/0.017	PEM	Depressional	IV	40
B5	51.93/0.001	PEM	Depressional	III	165
C1	115.61/0.003	PSS	Riverine	III	165
C2	127.04/0.003	PEM	Riverine	III	165

[a] US Fish and Wildlife Service classification is based on Federal Geographic Data Committee (FDGC 2013): palustrine emergent (PEM), and palustrine scrub shrub (PSS).

[b] Hydrogeomorphic classification is based on Brinson (1993).

[c] Wetland category is based on the Ecology wetland rating system (Hruby 2014), which is required by City of Shoreline Municipal Code (SMC 20.80.320).

[d] Standard wetland buffer widths are based on the Ecology wetland rating, intact wetland buffers, and habitat score (SMC 20.80.330).

Herrera biologists also completed the ordinary high water mark (OHWM) delineation for streams and Hidden Lake within the study area on October 4, 2018. Streams are considered to a type of fish and wildlife habitat conservation area according to SMC 20.80.270. The OHWMs of streams and Hidden Lake were delineated using the definition provided by WAC Section 222-16-10, which has been adopted by the City of Shoreline, and methods in the publication *Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State* (Anderson et al. 2016). Stream A (Boeing Creek) and Stream B (side channel to Boeing Creek and Hidden Lake) are both Type F-nonanadromous streams and are afforded 75-foot buffers (SMC 20.80.280) (Table ES-2). An additional stream not included in the OHWM delineation fieldwork for this study was observed during survey activities downstream of Innis Arden Way. This small, unnamed stream flows southwest into Boeing Creek, and will require delineation in the future to determine whether its regulatory buffer will be susceptible to impacts associated with the project.

The proposed project was in the preliminary design phase at the time this report was written, but is certain to involve draining Hidden Lake and will affect wetlands, streams, significant trees, and critical area buffers. The project will have temporary impacts to streams and critical area buffers during construction; and permanent impacts to Hidden Lake, wetlands, streams, significant trees, and critical area buffers after construction is complete. During final design of the project, impacts to critical areas and their buffers will be calculated, and mitigation will be required (SMC 20.80.300).

Table ES-2. Summary of Regulated Streams in the Study Area for the Hidden Lake Dam Removal Project.			
Name	**WDNR Water Type[a]**	**City of Shoreline Aquatic Area Type**	**City of Shoreline Buffer Width (feet)[b]**
Stream A (Boeing Creek)	F	F-nonanadromous	75
Stream B (side channel to Boeing Creek and Hidden Lake)	F	F-nonanadromous	75

[a] The Washington State Department of Natural Resources water typing system uses definitions outlined in WAC 222-16-031.

[b] The buffer widths for Type F-nonanandromous streams are 75 feet (SMC Table 20.80.280(1)).

INTRODUCTION

The wetland and aquatic area (i.e., stream) delineation described in this report was performed for the City of Shoreline in support of the Hidden Lake Dam Removal Project (hereafter referred to as the project). Hidden Lake is a manmade water body located in the City of Shoreline, east of the intersection of Northwest Innis Arden Way and Tenth Avenue Northwest, partially within Shoreview Park. The installation of a dam across Boeing Creek in the early 20th century created Hidden Lake for the purpose of recreational fishing amid Boeing family estate land. Decades later the lake had filled in completely. King County built a new dam and excavated the lake bed to re-create the lake in its current configuration in the mid-1990s, and that project design explicitly included a sediment trap within the lake to allow maintenance dredging to reduce sedimentation farther downstream in Boeing Creek. Following incorporation as a new city, the City of Shoreline took over ownership and management of the dam and the sediment trap in the lake in the late 1990s. Hidden Lake currently traps larger volumes of sediment carried by Boeing Creek than King County had anticipated in the design, and thus has required repetitive, expensive dredging projects in order to maintain it. Meanwhile, downstream reaches of Boeing Creek lack sufficient volumes of sediment deposition due in large part to the volumes of sediment being trapped in Hidden Lake.

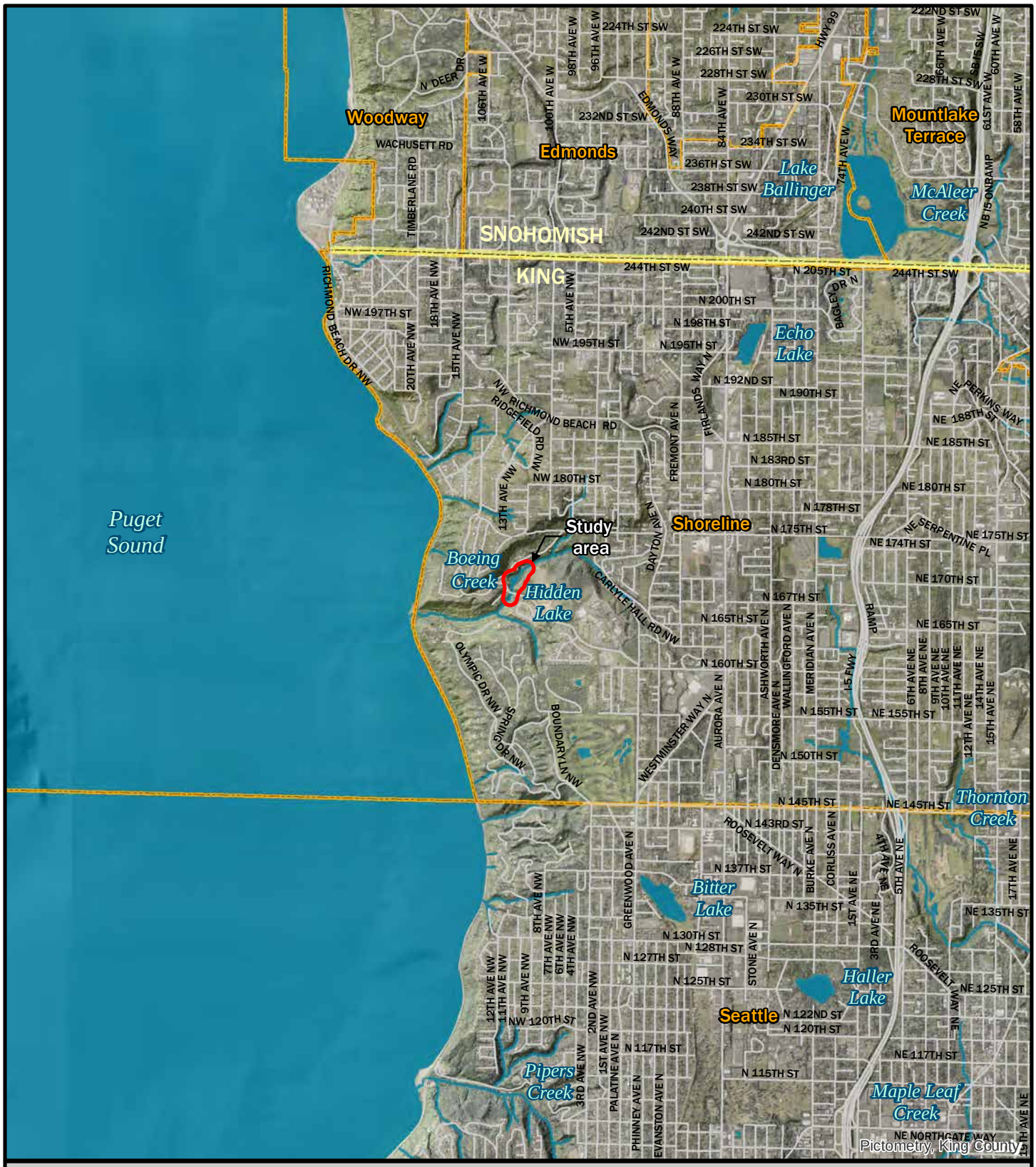
Shoreline's City Council decided to cease further dredging of Hidden Lake in 2013 and to explore options for management of the lake area as a result of that decision. The City of Shoreline proposes to remove the Hidden Lake dam, thus draining the lake entirely, to replace the culverts that convey Boeing Creek flows under Northwest Innis Arden Way downstream of the dam with a larger culvert structure, and restore the historical stream channel of Boeing Creek from the upstream edge of the lake to downstream of Northwest Innis Arden Way. The resultant increase in sediment deposition in downstream reaches of Boeing Creek and at the Puget Sound beach delta is expected to improve fish habitat downstream, and reduce flooding risks in the road crossing area (Appendix A).

Herrera Environmental Consultants, Inc. (Herrera) conducted an assessment of wetlands and fish and wildlife habitat conservation areas (FWHCAs, i.e., streams) within the project study area and vicinity. Herrera inspected the area for the presence of wetlands, lake shore conditions, and streams and delineated those found in the area. This report describes the conditions of wetlands streams, and Hidden Lake in the study area; wetland and stream ratings and required buffer widths; applicable local, state, and federal laws and regulations; and a preliminary analysis of proposed project impacts to critical areas and buffers.

PROJECT SETTING

The study area is in Shoreline, Washington (Figure 1), in Section 12, Township 28 North, Range 3 East of the Willamette Meridian, within the Shell Creek-Frontal Puget Sound subbasin in the western portion of Water Resource Inventory Area (WRIA) 8: Cedar-Sammamish. The study area is within the King County Urban Growth Area (UGA) and the City of Shoreline. The eastern half of Boeing Creek is within the City's Shoreview Park property. The western half of the lake is on private property (four parcels).

The study area is located northeast of the intersection of Northwest 166th Street and Northwest Innis Arden Way. Boeing Creek flows into the study area from the northeast, where it is impounded by a small earthen dam that maintains a near-constant water level in Hidden Lake. Lake outflows pass through a manhole structure and two pipes buried within the dam extending from that manhole structure to a concrete pad at the entrance to two culverts beneath the fill embankment on which Northwest Innis Arden Way was built. Boeing Creek continues southwest of the study area downstream of the Northwest Innis Arden Way crossing and drains into Puget Sound approximately 0.7 mile downstream. Shoreview Park and Boeing Creek Park are located northeast and east of the study area and contain trails, sports fields, forested areas, and an off-leash dog park. Single-family residential development is located south, west, and northwest of the study area.



Legend

- Study area
- City limits
- County limits
- Street
- Waterbody

Figure 1.
Vicinity Map for the Hidden Lake Dam Removal Project.

0 2,000 4,000 8,000 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Report\Fig1_VicinityMap_letter.mxd

Study Objectives

The objectives of the study were to:

- Identify and delineate (flag) all wetlands and streams in the study area.
- Classify vegetation within delineated wetlands using the US Fish and Wildlife Service (USFWS) classification system (FGDC 2013).
- Classify all delineated wetlands using the hydrogeomorphic classification system (Brinson 1993).
- Classify all delineated wetlands and assess their functions using the *Washington State Wetland Rating System for Western Washington: 2014 Update* (Hruby 2014).
- Determine wetland categories and classes; stream types; and applicable wetland and stream buffer widths required by the City of Shoreline's municipal code (SMC).
- Classify all streams within the study area according to the Washington Department of Natural Resources (WDNR) Forest Practices Water Typing system as described in Washington Administrative Code (WAC) 222-16-031 and according to the typing described in SMC 20.80.270.
- Identify all significant trees within the study area that could potentially be subject to removal due to the project according to SMC 20.20.048.
- Identify regulations and guidance applicable to project impacts on wetlands, streams, and buffers set forth by local, state, and federal authorities.
- Conduct a preliminary analysis of anticipated wetland, stream, and buffer impacts to result from preliminary designs of the proposed project.

Applicable Laws and Regulations

Wetlands, lakes, and streams are subject to a variety of federal, state, and local regulations, which will apply to any future activities planned for the project. Federal laws regulating wetlands and streams include Sections 404 and 401 of the Clean Water Act (United States Code, Title 33, Chapter 1344 [33 USC 1344]). Washington State laws and programs designed to control the loss of wetland acreage include the State Environmental Policy Act (SEPA) and Section 401 of the Clean Water Act (administered in Washington by the Washington State Department of Ecology [Ecology], as mandated by the Washington State Water Pollution Control Act). In addition, Washington State laws include the state Hydraulic Code (WAC 220-110). The study area is located within the city limits of Shoreline; therefore, the project is subject to the City's municipal

code, which specifies wetland categories, stream types, required buffer widths, development standards, and mitigation requirements for critical areas within the City's jurisdiction.

Clean Water Act Sections 404 and 401

Section 404 of the Clean Water Act regulates the placement or removal of soil or other fill, grading, or alteration (hydrologic or vegetative) in waters of the United States, including wetlands and streams (33 USC 1344). The Seattle District of the US Army Corps of Engineers (USACE) administers the permitting program under the act. Section 404 permits issued by the USACE include nationwide (general) permits for projects involving small areas of fill, grading, or alteration, and individual permits for projects that require larger areas of wetland disturbance. The USACE does not regulate wetland buffers.

Section 401 of the Clean Water Act requires that proposed dredge (removal) and fill activities permitted under Section 404 be reviewed and certified to ensure that such activities meet state water quality standards. State Section 401 water quality certifications are administered by Ecology for all Section 404 permits. Section 401 certification is granted without the need for a separate permit from Ecology for projects that qualify for a Section 404 nationwide permit, meet specific Section 401 certification conditions of the nationwide permit, and meet Ecology's Section 401 General Conditions. If that is not the case, Ecology requires an Individual Section 401 Water Quality Certification.

Washington State Laws

Washington laws and programs designed to control the loss of wetland acreage include SEPA and Section 401 of the Clean Water Act (a federal law that is implemented in the state by Ecology, as noted above and as mandated by the Washington State Water Pollution Control Act).

WDFW administers the Hydraulic Project Approval (HPA) program under the state Hydraulic Code (WAC 220-110), which was specifically designed to protect fish life. An HPA is required for projects that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state.

City of Shoreline Municipal Code

The City of Shoreline regulates wetlands, fish and wildlife habitat conservation areas, and adjacent buffers within its jurisdiction as critical areas. Buffers are required around critical areas to protect their functions and values.

Wetlands

The City of Shoreline rates wetlands according to the *Washington State Wetland Rating System for Western Washington: 2014 Update* (SMC 20.80.320; Hruby 2014). Wetlands are rated as Category I, II, III, or IV, according to the level of function they provide and how highly they score on the Ecology rating system. Standard buffer widths defined by SMC 20.80.330 are based on the wetland rating and habitat score.

Fish and Wildlife Habitat Conservation Areas

The City of Shoreline designates fish and wildlife habitat conservation area as critical areas that include: 1) areas where State or Federally designated endangered, threatened, and sensitive species have a primary association; 2) areas where State priority habitats and areas associate with State priority species; 3) commercial and recreational shellfish areas; 4) kelp and eelgrass beds and herring and smelt spawning areas; and 5) Waters of the State (SMC 20.80.270). The City of Shoreline defines stream types in accordance with the WDNR water typing system (WAC 222-16-030; SMC 20.80.270.E). Standard buffer widths are based on stream type (SMC 20.80.280).

METHODS AND MATERIALS

Evaluating the presence, extent, and type of wetlands and streams requires a review of available information about the site (e.g., surveys, studies), followed by an onsite wetland and aquatic area delineation. The following sections describe the research methods and field protocols for the wetland and aquatic area evaluations. More information about the methodology used in the wetland delineation work performed for the project is available in Appendix B.

REVIEW OF AVAILABLE INFORMATION

A literature review was performed to determine the historical and current presence of wetlands and streams in and near the study area. Sources of information included:

- Aerial photographs of the study area (Pictometry International Corp. 2017)
- Topographic map of the study area (PSLC 2016)
- National Wetlands Inventory (NWI) map of wetland areas in the study area (USFWS 2017)
- City of Shoreline Wetland Inventory (City of Shoreline 2018)
- King County iMap Interactive Mapping Tool (King County 2018)
- Hydrographic data (stream locations) for King County (King County 2013)
- Washington State Priority Habitats and Species (PHS) data (WDFW 2018a)
- SalmonScape mapping system (WDFW 2018b)
- Forest Practices Application Mapping Tool (WDNR 2018a)
- Washington State Natural Heritage data (WDNR 2018b)
- Climate data (NRCS 2018a)
- Soil survey maps for the study area (NRCS 2017; NRCS 2018b; NRCS 2018c)
- Boeing Creek Basin Plan (Windward et al. 2013)

Wetland Delineation

Wetland delineation field activities were conducted on October 4, 2018, by Herrera biologists Shelby Petro and Christina Merten. The delineation was performed in accordance with the *Regional Supplement to the US Army Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region* (Environmental Laboratory 2010), which is consistent with the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

The methods in the manuals listed above use a three-parameter approach for identifying and delineating wetlands and rely on the presence of field indicators for hydrophytic vegetation, hydric soils, and hydrology. The methods for evaluating the three parameters are described in Appendix B. The wetland delineation for the project was performed according to procedures specified under the routine wetland determination method (Environmental Laboratory 1987). The methodology for problem areas was also applied to the study area.

To identify potential wetlands, Herrera wetland biologists traversed the study area and noted visual indicators of potential wetland conditions, streams, and other aquatic features. A test plot was established for each area that appeared to have potential wetland characteristics. For each test plot, data on dominant plant species, soil characteristics, and evidence of hydrologic conditions were recorded on wetland determination data forms (Appendix C). Plants, soils, and hydrologic conditions were also analyzed and documented in adjacent uplands. Based on collected data, a determination of wetland or upland was made for each area examined. Observations of wildlife species and signs of their presence were also noted during the field visit.

Following confirmation of wetland conditions in a given area, the wetland boundary was delineated by placing sequentially numbered, pink-and-black-striped flagging along the wetland perimeter. Test plot locations were marked with orange flagging. The locations of wetland boundaries and test plots were subsequently surveyed by Pacific Geomatic Services.

Wetland Classification, Rating, and Functional Assessment

Wetland Classification

Wetlands observed within the study area were classified according to the USFWS classification system (FGDC 2013). That system is based on an evaluation of attributes such as vegetation class, hydrologic regime, salinity, and substrate. The wetlands were also classified according to the hydrogeomorphic system, which is based on an evaluation of attributes such as the position of the wetland within the surrounding landscape, the source and location of water just before it enters the wetland, and the pattern of water movement in the wetland (Brinson 1993).

Wetland Rating

As required by SMC 20.80.320, wetlands were rated using the *Washington State Wetland Rating System for Western Washington-Revised* (Hruby 2004), which is hereafter referred to as the Ecology rating system. The Ecology rating system categorizes wetlands according to specific attributes such as rarity; sensitivity to disturbance; hydrologic, water quality, and habitat functions; and special characteristics (e.g., mature forested wetland, bog). The total score for all functions determines the wetland rating. The rating system consists of four categories, with Category I wetlands exhibiting outstanding functions and/or special characteristics and Category IV wetlands exhibiting minimal functions. The rating categories are used to identify permitted uses in the wetland and its buffer, to determine the width of buffers needed to protect the wetland from adjacent development, and to identify the mitigation ratios required to compensate for potential impacts on wetlands.

Wetland Functional Assessment

Wetland functions are those physical and chemical processes that occur within a wetland, such as the storage of water, cycling of nutrients, and maintenance of diverse plant communities and habitat that benefit wildlife. Wetland functions are grouped into three broad categories: water quality, hydrologic, and habitat.

- Water quality functions include the potential for removing sediment, nutrients, heavy metals, and toxic organic compounds in the water passing through the wetland.
- Hydrologic functions include reducing the velocity of stormwater, recharging and discharging groundwater, and providing flood storage.
- Habitat functions include providing food, water, and shelter for fish, shellfish, birds, amphibians, and mammals. Wetlands also serve as a breeding ground and nursery for numerous species.

Fish and Wildlife Habitat Conservation Area Delineation and Classification

A fish and wildlife habitat conservation area is an area that supports regulated fish or wildlife species or habitats, typically identified by known point locations of specific species, habitat areas, or both. Streams are considered to be one type of fish and wildlife habitat conservation area according to SMC 20.80.270. Wetlands and Hidden Lake are also considered types of fish and wildlife habitat conservation areas.

The ordinary high water marks (OHWMs) of streams and Hidden Lake within the study area were delineated using the definition provided by WAC Section 222-16-10, which has been adopted by the City of Shoreline, and methods in the publication *Determining the Ordinary High Water Mark*

for Shoreline Management Act Compliance in Washington State (Anderson et al. 2016). According to the WAC definition, the OHWM is "the mark found by examining the bed and banks of a stream, lake, pond, or tidal water and ascertaining where the presence and action of waters are so common and long maintained in ordinary years as to mark upon the soil a vegetative character distinct from that of the abutting upland."

To delineate the OHWMs, the bed and adjacent banks of water bodies in the study area were examined for indications of regular high water events. Factors considered when assessing changes in vegetation include:

- Scour (removal of vegetation and exposure of gravel, sand, or other soil substrate)
- Drainage patterns
- Elevation of floodplain benches
- Changes in sediment texture across the floodplain
- Sediment layering
- Sediment or vegetation deposition
- Changes in vegetation communities across the floodplain

Herrera biologists hung blue flags during field investigations on October 5, 2018, to indicate the horizontal location of the OHWM along each water body in the study area. The locations of the OHWM flags were subsequently surveyed by Pacific Geomatic Services.

Streams within the city limits of Shoreline were classified using the WDNR water-typing system based on WAC 222-16-030. That system is based primarily on fish, wildlife, and human use, and consists of four stream types: Type S, F, Np, or Ns. Type S streams are those surface waters that are inventoried as "Shorelines of the State" under the Shoreline Management Master Program for Shoreline, pursuant to Revised Code of Washington (RCW) Chapter 90.58.030. Type F streams and water bodies are those known to be used by fish or meet the physical criteria to be potentially used by fish. Type F streams may or may not have flowing water all year; they may be perennial or seasonal. The City of Shoreline further describes Type F streams as F-anadromous and F-nonanadromous streams (SMC 20.80.260.E). Type F-anadromous streams are those streams where there is naturally recurring use by anadromous fish populations, streams that are fish passable or have the potential to be fish passable by anadromous populations, and streams with planned restoration or removal of dams that will result in a fish passable connection to Lake Washington or Puget Sound. Type F-nonanadromous streams are those streams that contain existing or potential fish habitat but do not have the potential for anadromous fish use due to natural barriers to fish passage. Type Np streams have flow year-round and may have spatially intermittent dry reaches downstream of perennial flow but do not meet the physical criteria of a Type F stream to provide fish habitat. Type Ns streams do not

have surface flow during at least some portion of the year, and do not meet the physical criteria of a Type F stream to provide fish habitat.

Significant Tree Identification

In accordance with the SMC, significant trees were mapped within the study area. Significant trees are classified as evergreen trees that are larger than or equal to 8 inches in diameter at breast height (dbh) and deciduous trees that are larger than or equal to 12 inches dbh (SMC 20.20.048). Pacific Geomatic Services surveyed the locations and noted the diameter of significant trees within the study area. Herrera biologists confirmed species identification in the field following review of the mapped trees meeting the code definitions listed above.

RESULTS

This section describes the results of the wetland and stream delineations. It includes information obtained from various references and an analysis of wetland and stream conditions in the study area as observed during field investigations.

ANALYSIS OF AVAILABLE INFORMATION

The available information compiled for the wetland and stream delineations is summarized in the following subsections.

Previously Mapped Wetlands and Streams

The NWI and the City of Shoreline indicate wetlands within the study area (Figure 2) (USFWS 2017, City of Shoreline 2018). The NWI maps palustrine forested wetlands surrounding Hidden Lake in the study area. The NWI also maps riverine habitat in the riparian areas on both sides of Boeing Creek extending north and south of the study area, and east along Northwest Innis Arden Way south of the study area. The City of Shoreline wetland inventory maps a large wetland including Hidden Lake and surrounding areas in the study area. King County iMap maps Boeing Creek entering the study area from the north, south of Tenth Avenue Northwest, where it enters Hidden Lake before flowing through two culverts under Northwest Innis Arden Way, then to the southwest towards the Puget Sound.

Climate Data

Precipitation characteristics in the weeks and months preceding wetland delineation work for the project are important to understand with respect to potential for drier or wetter than normal wetland conditions on the site. Nearby precipitation gauge records were evaluated for that purpose. Precipitation data were obtained from the Natural Resources Conservation Service WETS database (NRCS 2018a). The historical average measurements were based on data collected in Seattle, Washington (WETS Station Seattle Sand Point WFO, Latitude 47.6872 degrees, Longitude -122.2553) for the period of record 1981 to 2010. The Seattle Sand Point station is approximately 7 miles southeast of the study area.

Legend

- Study area
- Parcel
- Stream (King County)
- Waterbody (King County)
- Wetland (City of Shoreline)

Wetland Type (NWI)

- Freshwater Forested/Shrub Wetland
- Riverine

Figure 2.
Previously Mapped Wetlands and Water Bodies in the Vicinity of the Hidden Lake Dam Removal Project.

N

0 450 900 1,800 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Report\Fig2_PrevMappedWL_letter.mxd

Precipitation was evaluated for a 3-month period (July 1, 2018, to September 31, 2018) prior to field investigations, which occurred on October 4 and 5, 2018. Methods for precipitation assessment are presented in Appendix B. In the 3 months preceding the field investigation, the conditions in July and August 2018 were drier than normal, and the conditions for September 2018 were normal. The resultant precipitation conditions in the 3 months prior to October 2018 were drier than normal (Table 1).

Table 1. Evaluation of Precipitation Conditions for the 3-Month Period Preceding Field Investigations.

Prior Month	WETS Rainfall Percentile (inches)		Measured Rainfall by Month (inches)	Condition: Dry, Wet, Normal	Evaluation of Precipitation Compared to Normal
	30th	70th	2018		
July	0.37	0.88	0.02	Dry	Drier than Normal
August	0.5	1.28	0.28	Dry	
September	0.53	1.76	1.41	Normal	
October	1.97	3.86	3.43	Normal	Normal

Source: WETS Station Seattle Sand Point WFO, Latitude 47.6872 degrees, Longitude -122.2553, 1981–2010; NRCS 2018a.

During the 3-week period leading up to the fieldwork in October 2018, rainfall was slightly more than normal. Between September 13 and September 30, 1.13 inches of rainfall was recorded at the Seattle Sand Point station; and between October 1 and October 3, 0.27 inch of rainfall was recorded (NRCS 2018a). Historical data from 1981 through 2010 average 1.52 inches of rainfall between September 1 and September 30, and 3.41 inches of rainfall between October 1 and October 31; therefore, the 3 weeks preceding fieldwork were slightly wetter than normal when analyzed on a weekly basis (NRCS 2018a).

Soils

Herrera researched available soils information prior to and following field work to identify which soil types were historically present in the study area. The soil survey for King County does not include the City of Shoreline or the study area (NRCS 2018b). Herrera obtained soil information from the City of Shoreline – Shoreline Inventory and Characterization (ESA Adolfson 2010), which indicates that soils in the Boeing Creek basin are primarily of the Alderwood series, which is described below. It is inferred that some or most of the upland areas surrounding Hidden Lake are underlain by this soil type, which is corroborated by observations of shallow groundwater seeps emanating from the hillslope to the east of the lake. Logs from geotechnical borings completed in the area for several purposes (including the current project design) in the past 25 years were also reviewed.

Alderwood gravelly sandy loam is a moderately deep, moderately well drained soil that occurs on glacially modified hills and ridges on glacial drift plains. The parent material is glacial drift and/or glacial outwash over dense glaciomarine deposits. A typical soil profile includes a 7-inch

surface layer composed of very dark grayish brown (10YR 3/2) gravelly sandy loam, a layer of dark yellowish brown (10YR 4/4) very gravelly sandy loam from 7 to 21 inches, and a layer of brown (10YR 4/3) very gravelly sandy loam from 21 to 30 inches (NRCS 2018c). This soil is not hydric (NRCS 2018d).

Geotechnical borings completed in the mid-1990s to inform King County's design for re-creating Hidden Lake and more recent borings completed for dam removal design do not provide clarity on historical soil conditions in the study area because those borings mostly reflect the effects of the Hidden Lake impoundment on increased sand deposition above natural rates. Geotechnical borings in what is now the lake bed and along adjacent shoreline areas show mostly sandy soil characteristics to depths of 5 feet or more below ground surface. Based on site observations in recent years, the lake bed is filling with predominantly sand delivered to the lake from upstream sources in Boeing Creek flows. This sandy bed material, which is present everywhere below the typical water level of the lake and along the lake shoreline, is an important consideration in design of the new stream channel through the lake bed and planting of adjacent riparian areas.

Fish and Wildlife Habitat Use

According to PHS data (WDFW 2018a) and SalmonScape (WDFW 2018b), the study area is mapped for the occurrence and migration of resident coastal cutthroat trout (*Oncorhynchus clarki*).

Analysis of Wetland Conditions

Wetland delineation fieldwork was done by Herrera biologists Shelby Petro and Christina Merten on October 4, 2018. The weather conditions during the fieldwork consisted of daytime high temperatures of approximately 61 degrees Fahrenheit (°F) with consistent rain. It was determined that the delineation took place during the growing season (as defined in Appendix B) because the woody vegetation was growing.

Herrera biologists delineated nine wetlands (A1, A2, B1, B2, B3, B4, B5, C1, and C2) in the study area (Table 2; Figure 3). The biologists completed wetland delineation data forms (Appendix C) and an Ecology wetland rating form (Appendix D) for all wetlands. Wetlands were grouped into associated units (A1; A2, B2, B3, B4; B1, B5; and C) according to methods described in the Ecology rating tool for the purposes of rating (Hruby 2014). Buffer widths for delineated wetlands are shown on Figure 3. A detailed description of all wetland units is provided in Tables 3, 4, 5, and 6. Representative photographs of each group of wetlands are included in Tables 3, 4, 5, and 6.

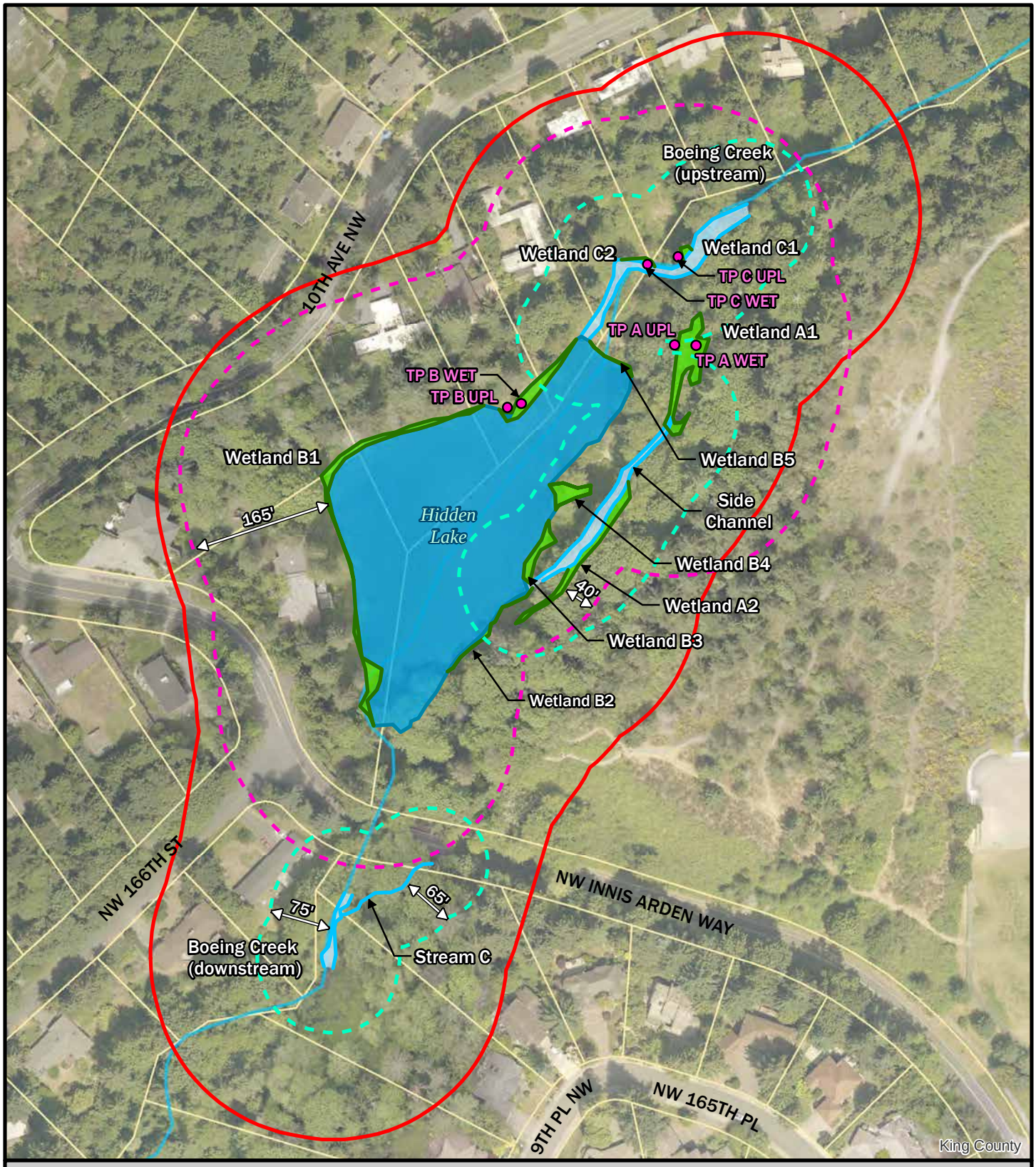
Table 2. Wetlands Delineated in the Study Area for the Hidden Lake Dam Removal Project.					
Wetland Name	**Size of Wetland (square feet/acre)**	**USFWS Classification[a]**	**Hydrogeomorphic Classification[b]**	**Ecology Rating Category (2014)[c]**	**City of Shoreline Standard Buffer Width (feet)[d]**
A1	2507.91/0.058	PEM/PSS	Depressional	III	165
A2	1385.40/0.032	PEM	Depressional	IV	40
B1	3244.38/0.074	PEM	Depressional	III	165
B2	397.84/0.009	PEM	Depressional	IV	40
B3	652.54/0.015	PEM	Depressional	IV	40
B4	719.76/0.017	PEM	Depressional	IV	40
B5	51.93/0.001	PEM	Depressional	III	165
C1	115.61/0.003	PSS	Riverine	III	165
C2	127.04/0.003	PEM	Riverine	III	165

[a] US Fish and Wildlife Service classification is based on Federal Geographic Data Committee (FDGC 2013): palustrine emergent (PEM), and palustrine scrub shrub (PSS).

[b] Hydrogeomorphic classification is based on Brinson (1993).

[c] Wetland category is based on the Ecology wetland rating system (Hruby 2014), which is required by City of Shoreline Municipal Code (SMC 20.80.320).

[d] Standard wetland buffer widths are based on the Ecology wetland rating, intact wetland buffers, and habitat score (SMC 20.80.330).



Legend

- Study area
- Wetland buffer
- Stream buffer
- Test pit
- Parcel
- Stream (King County)
- Wetland boundary
- Lake boundary
- Stream boundary
- Wetland area
- Lake area
- Stream area

Figure 3.
Wetlands, Streams, and Buffers Delineated in the Hidden Lake Dam Removal Project Study Area.

N

0 80 160 320 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Report\Fig3_DelineatedWL_Str_letter.mxd

Table 3. Summary for Wetland Unit A1.			
Wetland Name	Wetland Unit A1		
Location	Wetland A consists of Wetland A1 on Stream B (side channel of Boeing Creek).		
		**Local Jurisdiction**	City of Shoreline
		WRIA	8
		Wetland Unit Rating (2014)	Category III
		City of Shoreline Buffer Width	165 feet
		Cowardin Classification	Palustrine emergent and scrub-shrub
		Hydrogeomorphic Classification	Depressional
Wetland Data Form(s)	Appendix C, TP-A1-WET		
Upland Data Form(s)	Appendix C, TP-A1-UPL		
Size of Wetland Unit	2,508 square feet/0.06 acre		
Dominant Vegetation	Wetland Unit A1 is dominated by emergent and scrub-shrub vegetation communities. The emergent community is dominated by creeping buttercup (*Ranunculus repens*), and the scrub-shrub community is dominated by salmonberry (*Rubus spectabilis*).		
Soils	Soils were examined to a depth of 20 inches at TP-A1-WET and exhibited hydric characteristics. The top 2 inches were very dark brown (10YR 2/2) loamy sand. From 2 to 10 inches below the soil surface, the soil was grayish brown (10YR 5/2) sand with redoximorphic concentrations in the matrix (10YR 5/8, 3 percent). From 10 to 20 inches below the soil surface, the soil was a mixture of dark greenish gray (G2 4/10BG) loamy sand and very dark grayish brown (10YR 3/2) loamy sand with redoximorphic concentrations in the matrix (10YR 3/4, 5 percent). This profile meets the Sandy Gleyed Matrix (S4) and Sandy Redox (S5) indicators. Upland soils were examined to a 15-inch depth and did not exhibit any hydric characteristics. At TP-A1-UPL, the top 2 inches were black (10YR 2/1) sandy loam. From 2 to 15 inches below the soil surface, the soil was brown (10YR 4/3) sand with no redoximorphic features.		
Hydrology	At TP-A1-WET, two primary indicators of wetland hydrology were observed: high water table (A2) and saturation (A3).		
Rationale for Delineation	All three wetland parameters are met.		
Rationale for Local Rating	City of Shoreline Code classifies wetlands according to the Ecology rating system (Hruby 2014), which rates Wetland Unit A as a Category III.		
Buffer Condition	The wetland buffer consists of municipal parkland, Stream B (side channel of Boeing Creek and Hidden Lake) and Hidden Lake. Vegetation consists of western red cedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*), salmonberry, and Indian plum (*Oemleria cerasiformis*). In the areas surrounding Wetland A, there are human and pet disturbances including a footbridge over Stream B.		

Table 4. Summary for Wetland Unit A2, B2, B3, B4.			
Wetland Name	Wetland Unit A2, B2, B3, B4		
Location	Wetland Unit consists of four sub-units (A2, B2, B3, and B4) along the perimeter of Hidden Lake and Stream B.		
		**Local Jurisdiction**	City of Shoreline
		WRIA	8
		Wetland Rating (2014)	Category IV
		City of Shoreline Buffer Width	40 feet
		Cowardin Classification	Palustrine emergent
		Hydrogeomorphic Classification	Depressional
Wetland Data Form(s)	Appendix C, TP-A1-WET		
Upland Data Form(s)	Appendix C, TP-A1-UPL		
Size of Unit Wetland	3,156 square feet/0.07 acre		
Dominant Vegetation	The wetland unit is dominated by an emergent community of small-fruited bulrush (Scirpus microcarpus) and reed canarygrass (Phalaris arundinacea).		
Soils	See Soils described for Wetland Unit A1.		
Hydrology	At TP-B-WET, two primary indicators of wetland hydrology were observed: high water table (A2) and saturation (A3). A secondary indicator, FAC-neutral test (D5), was also observed.		
Rationale for Delineation	All three wetland parameters are met.		
Rationale for Local Rating	City of Shoreline Code classifies wetlands according to the Ecology rating system (Hruby 2014), which rates each of Wetlands A2, B2, B3, and B4 as a Category IV.		
Buffer Condition	The wetland unit buffer consists of municipal parkland (Wetlands A2 and B2–B4), Stream B, and Hidden Lake. Vegetation consists of upland grasses (*Agrostis* and *Poa* spp.), velvet grass (*Holcus lanatus*), field horsetail (*Equisetum arvense*), red clover (*Trifolium pretense*), bracken fern (*Pteridium aquilinum*), reed canarygrass, bittersweet nightshade (*Solanum dulcamara*), western red cedar, and Douglas fir (*Pseudotsuga menziesii*). In the areas surrounding Wetlands A2, B2, B3, and B4, there are human and pet disturbances associated with the park.		

Table 5. Summary for Wetland Unit B1, B5.			
Wetland Name	Wetland Unit B1, B5		
Location	This wetland unit consists of two sub-units (B1 and B5) along the perimeter of Hidden Lake.		
		**Local Jurisdiction**	City of Shoreline
		WRIA	8
		Wetland Rating (2014)	Category III
		City of Shoreline Buffer Width	165 feet
		Cowardin Classification	Palustrine emergent
		Hydrogeomorphic Classification	Depressional
Wetland Data Form(s)	Appendix C, TP-B-WET		
Upland Data Form(s)	Appendix C, TP-B-UPL		
Size Wetland	3,296 square feet/0.08 acre		
Dominant Vegetation	Wetland unit is dominated by an emergent community of small-fruited bulrush (Scirpus microcarpus) and reed canarygrass (Phalaris arundinacea).		
Soils	Soils were examined to a depth of 20 inches at TP-B-WET and exhibited hydric characteristics. The top 2 inches were dark greenish gray (G2 4/5BG) sand with redoximorphic concentrations in the matrix (10YR 6/6, 5 percent). From 2 to 20 inches below the soil surface, the soil was dark greenish gray (G2 4/5BG) sand with redoximorphic concentrations in the matrix (10YR 6/6, 1 percent). This profile meets the Sandy Gleyed Matrix (S4) indicator. Upland soils were examined to a 13-inch depth did not exhibit any hydric characteristics. At TP-B-UPL, the top 2 inches were brown (10YR 5/3) sand. From 2 to 13 inches below the soil surface, the soil was brown (10YR 4/3) sand. No redoximorphic features were present at TP-B-UPL.		
Hydrology	At TP-B-WET, two primary indicators of wetland hydrology were observed: high water table (A2) and saturation (A3). A secondary indicator, FAC-neutral test (D5), was also observed.		
Rationale for Delineation	All three wetland parameters are met.		
Rationale for Local Rating	City of Shoreline Code classifies wetlands according to the Ecology rating system (Hruby 2014), which rates each of Wetlands B1 and B5 as a Category III.		
Buffer Condition	The wetland buffer consists of residential development (Wetland B1), municipal parkland (Wetlands B1 and B5), Stream B, and Hidden Lake. Vegetation consists of upland grasses (*Agrostis* and *Poa* spp.), velvet grass (*Holcus lanatus*), field horsetail (*Equisetum arvense*), red clover (*Trifolium pretense*), bracken fern (*Pteridium aquilinum*), reed canarygrass, bittersweet nightshade (*Solanum dulcamara*), western red cedar, and Douglas fir (*Pseudotsuga menziesii*). In the areas surrounding Wetland B1, human disturbances consist of mowed lawns, and Wetlands B1 and B5 are both affected by recreational activities.		

Table 6. Summary for Wetland Unit C.

Wetland Name	Wetland Unit C
Location	Wetland C consists of two sub-units (C1 and C2) along the northwestern bank of Stream A (Boeing Creek).

Local Jurisdiction	City of Shoreline
WRIA	8
Wetland Rating (2014)	Category III
City of Shoreline Buffer Width	165 feet
Cowardin Classification	Palustrine emergent and scrub-shrub
Hydrogeomorphic Classification	Riverine

Wetland Data Form(s)	Appendix C, TP-C-WET
Upland Data Form(s)	Appendix C, TP-C-UPL
Size Wetland	243 square feet/0.01 acre
Dominant Vegetation	Wetland Unit C is dominated by emergent and scrub-shrub vegetation communities. The emergent community is dominated by creeping buttercup and Kentucky bluegrass (*Poa pratensis*), and the scrub-shrub community is dominated by salmonberry.
Soils	Soils were examined to a depth of 13 inches at TP-C-WET and exhibited hydric characteristics. The top 2 inches were very dark grayish brown (10YR 3/2) loamy sand. From 2 to 6 inches below the soil surface, the soil was very dark gray (10YR 3/1) sand with redoximorphic concentrations in the matrix (7.5YR 3/3, 5 percent) and along pore linings (10YR 5/8, 5 percent). From 6 to 8 inches below the soil surface, the soil was dark grayish brown (10YR 4/2) with redoximorphic concentrations in the matrix (10YR 4/6, 20 percent). From 8 to 13 inches below the soil surface, the soil was bluish gray (G2 5/10B) with redoximorphic concentrations in the matrix (7.5YR 4/6, 5 percent). This profile meets the Sandy Redox (S5) indicator. Upland soils were examined to a 14-inch depth and did not exhibit any hydric characteristics. At TP-C-UPL, the top 3 inches were very dark grayish brown (10YR 3/2) sand. From 3 to 14 inches below the soil surface, the soil was grayish brown (10YR 5/2) sand with no redoximorphic features.
Hydrology	At TP-C-WET, two primary indicators of wetland hydrology were observed: high water table (A2) and saturation (A3).
Rationale for Delineation	All three wetland parameters are met.
Rationale for Local Rating	City of Shoreline Code classifies wetlands according to the Ecology rating system (Hruby 2014), which rates each of Wetlands C1 and C2 as a Category III.
Buffer Condition	The wetland unit buffer consists of residential development, municipal parkland, Stream A (Boeing Creek), and Hidden Lake. Vegetation consists of bigleaf maple, salmonberry, training blackberry (*Rubus ursinus*), and field horsetail. In the areas surrounding Wetlands C1 and C2, human disturbances consist of mowed lawns and recreational activities. A fence crosses Stream A between Wetlands C1 and C2 where Stream A enters residential property.

Evaluation of Wetland Functions

A summary of the function scores, the total wetland score, and the associated rating (category) for all wetlands in the study area is provided in Table 7. Wetland functions for all wetlands in the study area are described below. Rating forms and figures are provided in Appendix D.

Table 7. Individual Wetland Function Scores for Wetlands in the Study Area for the Hidden Lake Dam Removal Project.

Wetland Name	Water Quality Functions Rating[a]			Hydrologic Functions Rating[a]			Habitat Functions Rating[a]			Total Score[b]	Rating Category[c]
	Site Potential	Landscape Potential	Value	Site Potential	Landscape Potential	Value	Site Potential	Landscape Potential	Value		
A1	M	M	L	L	M	L	M	M	H	16	III
A2	M	M	L	L	M	L	L	M	H	15	IV
B1	M	M	L	L	M	L	M	M	H	16	III
B2	M	M	L	L	M	L	L	M	H	15	IV
B3	M	M	L	L	M	L	L	M	H	15	IV
B4	M	M	L	L	M	L	L	M	H	15	IV
B5	M	M	L	L	M	L	M	M	H	16	III
C1	M	H	L	M	M	L	L	M	H	17	III
C2	M	H	L	M	M	L	L	M	H	17	III

[a] Qualitative ratings of H (high), M (moderate), and L (low) are based on the Ecology rating system (Hruby 2014).

[b] Total score is derived by adding all qualitative ratings together. Low ratings are worth 1 point, while Moderate ratings are worth 2 points, and High ratings are worth 3 points.

[c] Wetland category is based on the Ecology rating system (Hruby 2014).

Wetland A1

Wetland A1 has a moderate potential to improve water quality at the site due to its depressional HGM class; intermittently flowing outlet; and dense, herbaceous vegetation. These characteristics increase the retention time of surface water in the wetland so that pollutants are absorbed and filtered. The wetland is located within a park that is heavily used by dogs and pollutants may enter the landscape from this activity, which means that the wetland has a moderate potential to improve water quality within the surrounding landscape. Although Wetland A1 has the capacity to improve water quality, this functionality is of low value to human society because the wetland does not discharge directly to a water body on Ecology's Section 303(d) list of impaired waters, and there is no TMDL for the basin in which the wetland is located (Ecology 2018a, Ecology 2018b).

Wetland A1 has a low potential to improve hydrological functions at the site due to several factors, including an outlet that is intermittently flowing, and the lack of ponding that occurs in the wetland. The lack of storage in the wetland limits the retention time of surface water in the wetland, reducing Wetland A1's capacity to provide hydrological support to the downstream

system. Also, the wetland is relatively small compared to its contributing upland surface drainage area, so the wetland's effect on flood storage is small. The surrounding landscape has a moderate potential to support hydrologic functions at the site because the contributing drainage area of the wetland includes commercial and residential land uses that generate runoff. The hydrologic functions of Wetland A1 have a low value to society because surface flooding is not an issue downstream.

Wetland A1 has a moderate potential to provide important habitat for wildlife because it has a moderate variety and interspersion of vegetation classes, hydroperiods, and two habitat features (amphibian habitat and low invasive species coverage). The surrounding landscape has a moderate potential to support habitat functions in Wetland A1 because of the density of residential and commercial development in the area, which limits opportunities for habitat connectivity. The habitat provided by Wetland A1 has a high value to society because it is near three WDFW priority habitats (biodiversity areas and corridors, riparian, and instream) (WDFW 2018b).

Wetlands A2, B2, B3, and B4

Wetlands A2, B2, B3, and B4 were grouped for rating due to shared functional traits and their adjacent positions along the shorelines of Hidden Lake and its side channel (Stream B). These wetlands have a moderate potential to improve water quality at the site due to their depressional HGM class; slightly constricted, permanently flowing outlet; and dense, persistent herbaceous vegetation. These characteristics increase the retention time of surface water in the wetlands so that pollutants are absorbed and filtered. The input of pollutants to the wetlands from Boeing Creek and from the ducks that reside in Hidden Lake increases their potential to provide water quality functions. Although Wetlands A2, B2, B3, and B4 have the capacity to improve water quality, this functionality is of low value to human society because the wetlands do not discharge directly to a water body on Ecology's Section 303(d) list of impaired waters, and there is no TMDL for the basin in which the wetlands are located (Ecology 2018a, Ecology 2018b).

Wetlands A2, B2, B3, and B4 have a low potential to improve hydrological functions at the site due to several factors, including an outlet that is permanently flowing, and a lack of ponding in the wetlands. This lack of surface storage limits the retention time of surface water in the wetlands, reducing their capacities to provide hydrological support to the downstream system. Also, the wetlands are relatively small compared to the contributing upland surface drainage area, so the wetlands' effects on flood storage is small. The surrounding landscape has a moderate potential to support hydrologic functions at the site because the contributing drainage area of the wetlands includes commercial and residential land uses that generate runoff. The hydrologic functions of Wetlands A2, B2, B3, and B4 have a low value to society because surface flooding is not an issue downstream.

Wetlands A2, B2, B3, and B4 have a low potential to provide important habitat for wildlife because they have a low variety and interspersion of habitat classes, hydroperiods, and habitat

structures (e.g., beaver habitat and large woody debris). The surrounding landscape has a moderate potential to support habitat functions at these wetlands because of the density of residential and commercial development in the area, which limits opportunities for habitat connectivity. The habitat provided by Wetlands A2, B2, B3, and B4 has a high value to society because it is near three WDFW priority habitats (biodiversity areas and corridors, riparian, and instream) (WDFW 2018a).

Wetlands B1 and B5

Wetlands B1 and B5 were grouped for rating due to shared functional traits and their adjacent positions along the shoreline of Hidden Lake. These wetlands have a moderate potential to improve water quality at the site due to their depressional HGM class; slightly constricted, permanently flowing outlet; and dense, persistent herbaceous vegetation. These characteristics increase the retention time of surface water in the wetland so that pollutants are absorbed and filtered. The input of pollutants to the wetlands from Boeing Creek and dogs accompanying park users increases their potential to provide water quality functions. Although Wetlands B1 and B5 have the capacity to improve water quality, this functionality is of low value to human society because the wetlands do not discharge directly to a water body on Ecology's Section 303(d) list of impaired waters, and there is no TMDL for the basin in which the wetlands are located (Ecology 2018a, Ecology 2018b).

Wetlands B1 and B5 have a low potential to improve hydrological functions at the site due to several factors, including an outlet that is permanently flowing, and a lack of ponding in the wetlands. This lack of surface storage limits the retention time of surface water in the wetlands, reducing their capacities to provide hydrological support to the downstream system. Also, the wetlands are relatively small compared to the contributing upland surface drainage area, so the wetlands' effects on flood storage is small. The surrounding landscape has a moderate potential to support hydrologic functions at the site because the contributing drainage area of the wetlands includes commercial and residential land uses that generate runoff. The hydrologic functions of Wetlands B1 and B5 have a low value to society because surface flooding is not an issue downstream.

Wetlands B1 and B5 have a moderate potential to provide important habitat for wildlife because they have a low variety and interspersion of habitat classes and hydroperiods; and several habitat structures (e.g., beaver habitat and large woody debris). The surrounding landscape has a moderate potential to support habitat functions at these wetlands because of the density of residential and commercial development in the area, which limits opportunities for habitat connectivity. The habitat provided by Wetlands B1 and B5 has a high value to society because it is near three WDFW priority habitats (biodiversity areas and corridors, riparian, and instream) (WDFW 2018a).

Wetlands C1 and C2

Wetlands C1 and C2 were grouped for rating due to shared functional traits and their adjacent positions along the shoreline of Boeing Creek. These riverine wetlands have a moderate potential to improve water quality due to dense, herbaceous vegetation that can filter trapped sediments and pollutions; and slow water velocities to increase sediment deposition. The surrounding landscape provides a moderate level of opportunity for the wetlands to provide water quality functions because the contributing drainage basin includes substantial land development, which contributes runoff and pollutants to Boeing Creek before it flows into the areas adjacent to Wetlands C1 and C2. Although the wetlands have the capacity to improve water quality, this functionality is of low value to human society because they do not discharge directly to a water body on Ecology's Section 303(d) list of impaired waters, and there is no TMDL for the basin in which they are located (Ecology 2018a, Ecology 2018b).

Wetlands C1 and C2 have a moderate potential to improve hydrological functions at the site due to their narrow widths and dense vegetation. The dense vegetation slows surface water velocities; however, there is limited potential to capture water during flood events because the wetland widths are small in comparison to the width of Boeing Creek. The surrounding landscape provides moderate support to the hydrological functions at the site because developed areas are located upstream of the wetlands and contribute runoff to Boeing Creek. The hydrologic functions of Wetlands C1 and C2 have a low value to society because surface flooding is not an issue downstream.

Wetlands C1 and C2 have a low potential to provide important habitat for wildlife because they have a low variety and interspersion of habitat classes and hydroperiods; and few habitat structures (e.g., beaver habitat and large woody debris). The surrounding landscape has a moderate potential to support habitat functions at these wetlands because of the density of residential and commercial development in the area, which limits opportunities for habitat connectivity. The habitat provided by Wetlands C1 and C2 has a high value to society because it is near three WDFW priority habitats (biodiversity areas and corridors, riparian, and instream) (WDFW 2018a).

Analysis of Fish and Wildlife Habitat Conservation Area Conditions

Herrera biologists completed the OHWM delineation on October 5, 2018. The OHWMs of Boeing Creek and Hidden Lake (with associated side channel) were delineated in the study area. Stream and Hidden Lake characteristics are summarized in Tables 8, 9, 10, 11, and 12. Buffer widths are shown on Figure 3. Representative photographs of the water bodies are included in Tables 9, 10, 11, and 12.

Table 8. Summary of Regulated Streams in the Study Area for the Hidden Lake Dam Removal Project.			
Name	**WDNR Water Type[a]**	**City of Shoreline Aquatic Area Type**	**City of Shoreline Buffer Width (feet)[b]**
Stream A (Boeing Creek)	F	F-nonanadromous	75
Stream B (side channel to Boeing Creek and Hidden Lake)	F	F-nonanadromous	75
Stream C (side channel to Boeing Creek on downstream side of Northwest Innis Arden Way)	F[c]	Np	65

[a] The Washington State Department of Natural Resources water typing system uses definitions outlined in WAC 222-16-031.

[b] The buffer widths for Type F-nonanandromous streams are 75 feet (SMC Table 20.80.280(1)).

[c] Additional analysis needed to confirm lack of fish usage, and thus Np rating.

Stream A (Boeing Creek) originates to the east of the study area and flows southwest through Hidden Lake and out of the study area. Stream B (side channel to Boeing Creek and Hidden Lake) originates within the eastern portion of the study area and flows into Hidden Lake. Hidden Lake is an artificially impounded water body entirely within the study area. Because Hidden Lake results from artificial impoundment of Boeing Creek, and is mapped as having occurrence and migration of resident coastal cutthroat trout, it is considered as a fish and wildlife habitat conservation area for the purposes of this report. Hidden Lake has previously been characterized as a wetland (Windward et al. 2013; City of Shoreline 2018). This status should be discussed with regulatory agencies based on the artificially created nature of the lake and the goals of the overall re-establishment of the natural Boeing Creek system as part of this project.

Table 9. Summary for Stream A.	
Stream Name	Stream A (Boeing Creek)
Location	Flows from northeast to southwest through the study area
	
Local Jurisdiction	City of Shoreline
DNR Stream Type	F
Local Stream Rating	F-nonanadromous
Local Jurisdiction Buffer Width	75
Documented Fish Use	According to PHS data (WDFW 2018a) and SalmonScape (WDFW 2018b), Stream A is mapped for the occurrence and migration of resident coastal cutthroat trout.
Connectivity	Stream A originates from two tributaries that join upstream of the study area. The northern tributary of Stream A originates in an area of residential development north of the intersection of 4th Avenue Northwest and Northwest 180th Street. The eastern tributary of Stream A originates west of the intersection of Greenwood Avenue N and Carlyle Hall Road N. The north and east tributaries of Stream A join approximately 0.25 mile upstream of the study area. Stream A flows into the study area from the east, and through Hidden Lake before exiting the study area to the southwest, and flowing into the Puget Sound approximately 0.65 mile downstream.
Riparian/Buffer Condition	The riparian buffer for Stream A consists of residential development, municipal parkland, Hidden Lake, and Wetland Unit C. Vegetation consists of bigleaf maple, salmonberry, training blackberry (*Rubus ursinus*), and field horsetail. Areas of disturbance include of mowed lawns, recreational activities in the nearby park, and a fence that crosses the stream between Wetlands C1 and C2.

Table 10. Summary for Stream B.	
Stream Name	Stream B (side channel to Boeing Creek and Hidden Lake)
Location	East of Hidden Lake within the study area
	
Local Jurisdiction	City of Shoreline
DNR Stream Type	F
Local Stream Rating	F-nonanadromous
Local Jurisdiction Buffer Width	75 feet
Documented Fish Use	Stream B is not mapped by PHS (WDFW 2018a) or SalmonScape (WDFW 2018b) however, Stream B shares a direct connection with Hidden Lake and Stream A, which is mapped for resident coastal cutthroat (WDFW 2018a, WDFW 2018b).
Connectivity	Stream B is a short side channel (approx. 300 ft) of Stream A and Hidden Lake that originates northeast of Hidden Lake. Stream B flows in a southwesterly direction and empties in to Hidden Lake on the east side of the lake. Much of Stream B is bordered by Wetland A2. Stream B receives water inputs from groundwater seeps from the forested slope to the east, and overbank flows from Hidden Lake and Stream A.
Riparian/Buffer Condition	Wetlands A1 and A2 are located within the riparian buffer for Stream B. This area contains vegetation characterized by western red cedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*), salmonberry, and Indian plum (*Oemleria cerasiformis*). Areas of disturbance within the riparian buffer include a pedestrian footbridge and a beaver dam along the southeast edge of Wetland A2.

Table 11. Summary for Hidden Lake.	
Stream Name	Hidden Lake
Location	In the central portion of the study area
	
Local Jurisdiction	City of Shoreline
DNR Stream Type	n/a
Local Stream Rating	n/a
Local Jurisdiction Buffer Width	n/a
Documented Fish Use	PHS data (WDFW 2018a) maps the occurrence and migration of resident cutthroat trout.
Connectivity	Stream A (Boeing Creek) flows directly into Hidden Lake on its northwest side. Stream B drains into Hidden Lake along its eastern edge. A constructed earthen dam at the southernmost point of Hidden Lake constricts flow as water enters a manhole structure that serves as the lake outlet. From this manhole, the streamflow is carried in two pipes buried within the dam that discharge the flows on to a concrete pad at the entrance to two culverts beneath Northwest Innis Arden Way. Those two culverts discharge the streamflow into an open channel downstream (south of) Northwest Innis Arden Way. Wetland B1 is adjacent to the west and northwest edges of Hidden Lake; Wetlands B2 and B3 are along the eastern edge of Hidden Lake; and Wetland B4 is along the northeast edge.
Riparian/Buffer Condition	The buffer around Hidden Lake consists of residential development, municipal parkland, Boeing Creek, Stream B, and Wetlands A1 through B5. A small portion of a Northwest Innis Arden Way is near the southernmost edge of Hidden Lake. The vegetation community adjacent to Hidden Lake consists of grasses (*Agrostis* and *Poa* spp.), velvet grass (*Holcus lanatus*), field horsetail (*Equisetum arvense*), red clover (*Trifolium pretense*), bracken fern (*Pteridium aquilinum*), reed canarygrass, bittersweet nightshade (*Solanum dulcamara*), western redcedar, and Douglas fir (*Pseudotsuga menziesii*). Due to the surrounding land uses, human disturbances in the form of mowed lawns and recreational activities have degraded the buffer condition.

Table 12. Summary for Stream C.	
Stream Name	Stream C (side channel to Boeing Creek)
Location	South end of the study area (drains over a steep bank into Boeing Creek on left side of the photo below)
	
Local Jurisdiction	City of Shoreline
DNR Stream Type	Np
Local Stream Rating	Np
Local Jurisdiction Buffer Width	65 feet
Documented Fish Use	none
Connectivity	Stream C flows directly into Boeing Creek from the northeast, on the downstream side of Northwest Innis Arden Way. Its flow appears to come mainly from groundwater discharge as opposed to overland runoff in the roadway corridor. At the confluence with Boeing Creek it spills over a near-vertical bank that is impassable to anadromous or resident fish. Given its very small size and lack of upstream surface drainage area, it likely does not support any fish populations.
Riparian/Buffer Condition	The buffer around Stream C includes riparian areas of Boeing Creek and the Northwest Innis Arden Way stream right of way near the upstream end of the stream.

Analysis of Buffer Conditions

Land use within and surrounding the study area is a mixture of low-density, single-family residential development (to the north, west, and south) and urban parkland (Shoreview Park, to the east). Stream and wetland buffers within the park (Stream B, eastern side of Stream A, and Wetlands A, B2-4, and C1) are dominated by native trees and shrubs, supporting stream and wetland functions. Where streams and wetlands are bordered by residential development (western side of Stream A and Wetlands B1, B5, and C2), conditions are more degraded. Vegetation is a mixture of native and nonnative, invasive species, including Himalayan blackberry. Proximity to residential development increases the likelihood of chemical pollution from lawn runoff and disturbance to wildlife by humans and domestic animals. These degraded buffer areas perform limited buffer functions as compared to the more natural condition of buffer areas within the park.

Analysis of Fish and Wildlife Habitat

PHS data (WDFW 2018a) and SalmonScape (WDFW 2018b) map the study area for the occurrence and migration of resident coastal cutthroat trout (*Oncorhynchus clarki*). During field investigations, biologists did not observe fish within Streams A or B. The prevalence of native vegetation in the study area would support fish and wildlife. Trout (undetermined species) were observed within Hidden Lake during the October field visit.

Analysis of Significant Trees

Thirty-nine significant trees were mapped within the study area. The trees include both coniferous and deciduous species on the right and left banks of Boeing Creek. Species include western red cedar (*Thuja plicata*), Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), western white pine (*Pinus monticola*), big-leaf maple (*Acer Macrophyllum*), and red alder (*Alnus rubra*).

Impact Analysis

The proposed project is still in the preliminary design phase, but is certain to affect wetlands, streams, significant trees, and critical area buffers. The project is likely to have temporary impacts to streams and critical area buffers during construction; and permanent impacts to Hidden Lake, wetlands, streams, significant trees, and critical area buffers after construction is complete. Impacts to buffers are required to be mitigated at a 1:1 ratio per SMC. Mitigation for impacts to significant trees will be recommended at a minimum of a 1:1 replacement ratio. Mitigation ratios for impacts to wetlands within the study area based on SMC 20.80.350 are summarized in Table 13. Mitigation ratios for other types of Fish and Wildlife Habitat Conservation areas are not covered in Shoreline Municipal Code. Impacts to Hidden Lake will be as a result of re-establishing the natural Boeing Creek system by removing the artificial dam

structure that impounds the lake water, so the impact to Hidden Lake will be self-mitigating through this process.

Table 13. Wetland Mitigation Ratios for the Hidden Lake Dam Removal Project.

Wetland Category[a]	Creation or Reestablishment[b]	Rehabilitation[b]	Enhancement[b]	Preservation[b]
Category III	2:1	4:1	8:1	15:1
Category IV	1:5:1	3:1	6:1	10:1

[a] Wetland category is based on the Ecology wetland rating system (Hruby 2014), which is required by City of Shoreline Municipal Code (SMC 20.80.320).

[b] Mitigation ratios are based on requirements in SMC Table 20.80.350(G).

During final design of the project, impacts to critical areas, significant trees, and their buffers will be calculated, and mitigation will be required (SMC 20.80.300). A preliminary estimate of anticipated impacts associated with project construction is included in Table 14.

Table 14. Summary of Estimated Impacts for the Hidden Lake Dam Removal Project.

Impact Type	Permanent Impact (square feet)	Temporary Impact (square feet)
Wetland	1,540	4,815
Stream	3,985	–
Critical Area Buffer	35,525	–

Hidden Lake is classified by the City's critical areas mapping as a wetland. If regulatory agencies believe that Hidden Lake should be classified as a wetland, the permanent impact area listed in Table 14 would increase to include the entire area of Hidden Lake (approximately 74,900 square feet). The rating of all the A and B wetlands along with Stream B would then be lumped together with Hidden Lake for the Ecology rating as a single depressional unit. Based on preliminary rating review, the rating of this system would be a Category IV wetland. The combined, large wetland unit would have an associated buffer of 40 feet.

The project is proposing to re-establish natural habitat conditions by removing Hidden Lake and restoring its buffer and including created wetlands on site. This is an unusual type of impact and therefore discussions should be had with regulatory agencies on appropriate mitigation ratios in order to re-establish a different aquatic system (stream vs. wetland) in this location and the overall functional lift the proposed project will have on the Boeing Creek system on a landscape scale.

REFERENCES

Anderson, P.S., S. Meyer, P. Olson, E. Stockdale. 2016. Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State. Ecology Publication 16-06-029. Washington State Department of Ecology.

Brinson, M.M. 1993. A Hydrogeomorphic Classification for Wetlands. Technical Report WRP-DE-4. US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. August.

City of Shoreline. 2018. Surface Water data. City of Shoreline. Wetlands dataset layer. Accessed December 10, 2018. < http://www.shorelinewa.gov/our-city/maps-gis/download-gis-data>.

Ecology. 2018a. Water Quality Assessment for Washington, 303(d) Map Tool. Washington State Department of Ecology. Accessed November 30, 2018. <https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx>.

Ecology. 2018b. Water Quality Improvement Projects (TMDLs) for WRIA 8: Cedar-Sammamish. Washington State Department of Ecology. Accessed November 30, 2018. <https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx?CustomMap=y&RT=1&Layers=30&Filters=n,y,n,n&F2.1=0&F2.2=0&BBox=-13556317,6018192,-13495216,6034671>.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. January.

Environmental Laboratory. 2010. Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region. Technical Report TR-08-13. US Army Corps of Engineers, Engineer Research and Development Center, Wetlands Regulatory Assistance Program, Vicksburg, Mississippi.

ESA Adolfson. 2010. City of Shoreline – Shoreline Inventory and Characterization. December 2008, revised November 2009 and April 2010. Prepared for City of Shoreline by ESA Adolfson. Seattle, Washington.

FGDC. 2013. Classification of Wetlands and Deepwater Habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and US Fish and Wildlife Service, Washington, DC.

Hruby, T. 2004. Washington State Wetland Rating System for Western Washington—Revised. Washington State Department of Ecology Publication 04-06-025. August.

King County. 2009. Topographic data. Contour shapefile created for townships and the entire county. Created December 1, 2009. King County GIS Center. LiDAR bare-earth digital ground model produced by 3di Technologies. Accessed March 23, 2018. <http://www5.kingcounty.gov/gisdataportal/Default.aspx>.

King County. 2012. Critical Areas Mitigation Guidelines. King County Department of Natural Resources and Parks, Water and Lands Resources Division, Snoqualmie, Washington. November 10.

King County. 2013. Hydrographic data. King County Department of Natural Resources and Parks, Water and Lands Resources Division, King County, Washington. Created September 5, 2013. Accessed March 23, 2018. <http://www.5.kingcounty.gov/sdc/Metadata.aspx?Layer=wtrcrs>.

King County 2018. King County iMap Interactive Mapping Tool. Updated December 5, 2017. Accessed March 23, 2018. <https://www.kingcounty.gov/services/gis/Maps/imap.aspx>.

Link, R. 2005. Living with Wildlife: Elk. Washington Department of Fish and Wildlife. Olympia, Washington.

NRCS. 2017. Soil survey geographic database for King County area, Washington. 2017. US Department of Agriculture, Natural Resources Conservation Service. Accessed December 10, 2018. <https://websoilsurvey.sc.egov.usda.gov>.

NRCS. 2018a. Agricultural Applied Climate Information System. US Department of Agriculture, Natural Resources Conservation Service. Accessed December 20, 2018. <http://agacis.rcc-acis.org/53057/wets/results>.

NRCS. 2018b. Official Soil Series Descriptions. Natural Resources Conservation Services, US Department of Agriculture. Accessed December 20, 2018. <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053587>.

NRCS. 2018c WebSoil Survey. Natural Resources Conservation Services, US Department of Agriculture. Accessed December 20, 2018. <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.

Pictometry International Corp. 2017. Imagery (King County 2017). King County GIS Center. Color orthoimage. Horizontal resolution: 3 inches. Produced 2017. Pictometry International Corp. Accessed July 3, 2018. <https://gismaps.kingcounty.gov/arcgis/services>.

PSLC. 2016. Topographic data. LIDAR bare earth digital elevation model (DEM) created by Quantum Spatial, February 24, 2016, through March 28, 2016. Puget Sound LIDAR Consortium. Accessed December 20, 2018. <http://pugetsoundlidar.ess.washington.edu>.

USFWS. 2017. Raster scan data of National Wetlands Inventory wetlands maps. Digital data created in 2017. US Fish and Wildlife Service. Accessed February 20, 2018. <http://www.fws.gov/wetlands/index.html>.

WDFW. 2018a. Priority Species and Habitat Database. Provided by Washington Department of Fish and Wildlife. Accessed December 4, 2018. <http://wdfw.wa.gov/mapping/phs/>.

WDFW. 2018b. SalmonScape mapping system. Washington Department of Fish and Wildlife. Accessed December 4, 2018. <http://wdfw.wa.gov/mapping/salmonscape/index.html>.

WDNR. 2018a. Forest Practices Application Mapping Tool. Natural Resources Conservation Services. Washington State Department of Natural Resources. Accessed December 20, 2018. <https://www.dnr.wa.gov/programs-and-services/forest-practices/forest-practices-application-review-system-fpars>.

WDNR. 2018b. Washington Natural Heritage Program. Accessed December 20, 2018. <http://www.dnr.wa.gov/NHPwetlandviewer>.

Windward Environmental, Osborn Consulting, and The Watershed Company. 2013. Boeing Creek Basin Plan. Prepared for the City of Shoreline by Windward Environmental, LLC; Osborn Consulting, Inc.; and The Watershed Company; Seattle, Washington.

APPENDIX A

City of Shoreline RFQ

CITY OF SHORELINE
REQUEST FOR STATEMENT OF QUALIFICATIONS
RFQ 8961

Hidden Lake Dam Removal Project
Submit no later than **March 8, 2018,** 4:00 p.m. Pacific Local Time

The City of Shoreline, Washington is soliciting statements of qualifications (SOQ) from individuals or firms interested in providing professional services for the Hidden Lake Dam Removal Project.

Primary Objectives

Contract work will consist of providing engineering design and other support services to remove the earthen dam at Hidden Lake, replace the Boeing Creek culverts crossing NW Innis Arden Way, and restore the Boeing Creek stream channel throughout the existing lake, dam, and culvert area.

Background

Hidden Lake is a man-made lake located east of the intersection of NW Innis Arden Way and 10th Avenue NW, partially within Shoreview Park. The lake originated in the early 20th Century when Boeing Creek was dammed to create a fishing pond and small hatchery near William Boeing's estate. The original dam failed and Hidden Lake was completely sediment-filled by 1970, and overgrown with mature vegetation by 1995. King County constructed the present dam and re-established Hidden Lake in 1996 as an environmental enhancement in relation to impacts of the West Point Sewage Treatment Plant expansion. Re-establishing the lake effectively created a stormwater management facility by constructing a maintainable sediment trap in the upstream end of the lake. Ownership of Hidden Lake is shared between the City of Shoreline (as part of Shoreview Park), four private property owners to the north and west, and a small portion of the west shore of the lake on property owned by the King County Wastewater Treatment Division.

The existing lake configuration traps sediment that would otherwise be carried downstream to replenish sediment-starved downstream reaches of Boeing Creek and near-shore habitat within the Puget Sound at Innis Arden Beach. Sediment deposition within the lake occurs at a high rate and, as a result, the City's Surface Water Utility had been required to remove large volumes of sediment to maintain the lake as an open water feature. From 2002 to 2013, the Surface Water Utility spent over $600,000 to implement seven separate dredging projects which removed a total of nearly 13,000 cubic yards of material. The actual volume of removed material was about six times greater than the deposition volumes estimated by King County in developing the lake re-establishment design in the mid-1990s.

On September 8, 2014, the City Council discussed this issue as presented in the Hidden Lake Management Plan Feasibility Study and authorized staff to cease dredging the lake and begin a phased approach to remove Hidden Lake Dam and re-establish Boeing Creek at Hidden Lake. This decision followed the Hidden Lake Management Plan Feasibility Study and a July 24, 2014 recommendation from the Parks, Recreation and Cultural Services (PRCS)/Tree Board. No sediment removal has occurred since the

summer of 2013. The staff report for the September 8, 2014 City Council discussion, which includes the Hidden Lake Management Plan Feasibility Study, can be found at the following link:
http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2014/staffreport090814-8a.pdf.

On May 23, 2016, City Council discussed the results of the Hidden Lake Dam Removal alternatives analysis and authorized staff to further develop a preferred alternative to maximize restoration efforts along Boeing Creek in addition to Hidden Lake-area dam removal and NW Innis Arden Way culvert replacement. The staff report for the May 23, 2016 City Council discussion, which includes the Hidden Lake Design Alternatives Analysis Report, can be found at the following link:
http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2016/staffreport052316-8a.pdf

On October 2, 2017, City staff updated City Council on continued project pre-design efforts following selection of the preferred alternative, including implementing Boeing Creek streamflow gaging and Hidden Lake sedimentation monitoring programs, completing a Boeing Creek-Puget Sound nearshore habitat gains analysis and follow-up with WRIA 8, and pursuing grants – including a successful application to secure $300,000 from the King County Flood Control District for design of Hidden Lake dam removal and NW Innis Arden Way culvert replacement. Based on the conclusions of a Technical Memorandum for Concept Design Evaluation of Fish Passage Improvements in Lower Boeing Creek, staff recommended discontinuing development of Boeing Creek restoration concepts downstream of NW Innis Arden Way. The staff report for the October 2, 2017 City Council discussion, which includes the Concept Design Evaluation of Fish Passage Improvements in Lower Boeing Creek Technical Memo, can be found at the following link:
http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2017/staffreport100217-8b.pdf

Attachment A is the Technical Memorandum for Hidden Lake Dam Removal and NW Innis Arden Way Culvert Replacement Concept Design. The memo presents the culmination of Phase 1 Pre-Design efforts with design concepts for removing Hidden Lake dam, replacing the NW Innis Arden Way culverts, and restoring Boeing Creek throughout the existing lake, dam, and culvert area. Project design will include some park amenities, including trail relocation, an observation platform, and interpretive signage.

Preliminary Timeline

Hidden Lake Dam removal is currently scheduled for 2020 (with $1,600,000 in construction budget allocated in the City's 2018-2023 Capital Improvement Program (CIP)), as driven by the motivation to minimize increased flood hazard risk from the ongoing sediment in-filling of the lake by natural processes. In order to facilitate dam removal construction in 2020, it is assumed that sixty percent design will be completed and applicable major permits submitted by late 2018, with final design completed by early 2020.

Construction sequence and timing for NW Innis Arden Way culvert replacement, relative to and in addition to dam removal, is to be determined. Timing for culvert replacement

will be based on funding availability, optimal efficiency, in-water work windows, and other constraints and considerations. At this time it is assumed that project permit applications will include both dam removal and culvert replacement work items. Contract work is expected to include further refinement of optimal phasing in consideration of all applicable constraints while developing final designs for both Hidden Lake Dam Removal and NW Innis Arden Way Culvert Replacement.

Estimated Budget
Hidden Lake Dam Removal consulting budget for design is approximately $500,000.

Scope of Work
The Scope of Work is expected to include, but not be limited to, the following tasks:

- Consolidate and review existing information regarding the Project site and basin.
- Previous hydrologic and hydraulic models will be reviewed and may need to be further developed for Project use.
- Continue the Boeing Creek flow monitoring using existing gage upstream of Hidden Lake.
- Identify, coordinate and obtain all required environmental review and permitting.
- Assist in outreach to stakeholders, including possible presentation(s) to and other coordination with neighboring property owners, Park Board, City Council, general public, and others.
- Assist in acquisition of construction and permanent easements as needed.
- Develop/coordinate utility relocation plans
- Assist in acquisition of and coordination with grants and/or other funding, as applicable.
- Develop final design for the Project, including plans, specifications (WSDOT/APWA format), and construction cost estimates (PS&E) for review at 30%, 60%, 90% and Ad Ready levels. Design will include Hidden Lake Dam Removal, NW Innis Arden Way culvert replacement, and restoring Boeing Creek and other restoration and improvement efforts throughout the existing lake, dam, and culvert areas.
- Provide other support as needed to for project success, such as survey, geotechnical/geomorphic, environmental, archeological, structural, construction management support and inspection services, etc.

Submittal Requirements
Five (5) bound copies and one (1) data disc (CD/DVD) or flash drive of the SOQ shall be submitted to the City of Shoreline, City Clerk's Office – SOQ **8961**, 17500 Midvale Avenue North, Shoreline, Washington, 98133-4905. The deadline for proposals by interested parties is **March 8, 2018,** by 4:00 p.m. Exactly Pacific Local Time. Respondents assume the risk of the method of dispatch chosen. The City assumes no responsibility for delays caused by any delivery service. Postmarking by the due date will not substitute for actual receipt of qualifications. Proposals shall not be delivered by facsimile transmission or other telecommunication or electronic means. Questions related to this solicitation may be directed to **John Featherstone, Surface Water Engineer, jfeatherstone@shorelinewa.gov**. Questions related to this RFQ can be submitted no later than 4:00 p.m. (Pacific Local Time) Exactly on March 5, 2018.

Supplemental information, such as brochures, may be submitted if desired. SOQs shall be on 8.5"x11" sheets, single spaced, typewritten (min. 12 point font), and shall total no more than **twenty-two (22)** pages (one page is defined as one side of a sheet of paper). **Resumes do not count toward any page limits**. The data disc/flash drive copy shall be in **PDF** format. The following format and content shall be adhered to by each firm and presented in the following order:

A. **Executive Summary** (**Page limit: Two (2) pages**)
An executive summary letter should include the key elements of the respondent's SOQ and an overview of the consultant team. Indicate the address and telephone number of the respondent's office located nearest to Shoreline, Washington, and the office from which the project will be managed.

B. **Project Approach (Page limit: Eight (8) pages excluding resumes)**

1. Work Plan: Describe a proposed sequence of tasks and methodologies to be used to accomplish this project. Indicate all key deliverables and their contents. Include a list of information required or tasks to be completed by City staff.
2. Team Organization: Provide an organization chart showing all proposed team member roles and responsibilities, including any subcontractor/subconsultants. Identify the respondent's project Lead Consultant/Project Manager. Include a one (1) page maximum resume for each project team member (resumes are excluded from the Approach section and overall SOQ page limits; there is no limit to the number of resumes which can be submitted). The City is seeking a well-balanced team featuring:
    - Breadth of expertise sufficient to accommodate Project needs.
    - Appropriate mix of senior, mid-level, and junior staff to maximize value.
    - Organizational capacity to take on workload necessary for project success.
3. Project Schedule: Provide a schedule for completing each task in the Scope of Work, including deadlines for preparing project deliverables. Note that the initial timeline targets a potentially vigorous project schedule. Demonstrate your team's ability to perform the work requested within an established budget and schedule.

C. **Related Project Experience** (**Page limit: Eight (8) pages**):
Describe recent (within the last ten (10) years) directly related project experience, such as: engineering design, permitting, and public outreach, etc., for projects of similar type and scope including small earthen dam removal, culvert replacement, and stream restoration within a forested corridor and/or park setting. For at least five (5) relevant projects provide the following:
    - Project name,
    - Project client/owner,
    - Project description, including services performed by respondent,
    - Project schedule (rough)
    - Project budget (consulting contract amount and construction budget)
    - Client/owner project director or manager
    - Client/owner project reference contact (provide explanation if different from director/manager), including: Name, title, email address, telephone number, and complete mailing address.

The City reserves the right to contact any organizations or individuals listed.

D. **Expertise and Availability of Project Team** (**Page limit: Four (4) pages**):
Specify the estimated availability of key staff (as a percentage of total estimated workload) throughout the project duration, and identify any other projects the proposed Lead Consultant/Project Manager will be committed to during the same timeline.

Provide evidence of expertise in the tasks and services requested in the Scope of Work. This section allows for further elaboration – with emphasis as chosen by the respondent -- upon the roles, resumes, and related project experience for key project team members, including the Lead Consultant/Project Manager.

SOQ Evaluation Components/Criteria
The City's Evaluation Panel will use the following point system criteria to evaluate each Submittal:

Criteria	**Maximum Points Possible**
➢ Project Approach	50
➢ Related Project Experience	30
➢ Expertise and Availability of Project Team	20
Total	**100**

SOQs will be the initial basis by which interested individuals or firms will be evaluated. Following the City staff evaluation of the qualifications received, selected individuals or firms **may** be invited to make oral presentations before the City's Evaluation Panel, if deemed necessary to distinguish similarly-qualified top applicants. The City's Project Manager will provide additional details outlining the preferred content of the presentation to each firm or team of firms that are invited to participate. Upon completion of evaluations (which may or may not include interviews), the City's Evaluation Panel will determine the most qualified individual or firm based on all materials and information presented. The City will then begin the negotiations for an agreement with the selected individual or firm.

Any individual or firm failing to submit information in accordance with the procedures set forth in the RFQ may be subject to disqualification. The City reserves the right to change the solicitation schedule or issue amendments to the solicitation at any time. The City reserves the right, at its sole discretion, to waive immaterial irregularities contained in the proposals. The City reserves the right to reject any and all proposals at any time, without penalty. The City reserves the right to refrain from contracting with any respondent. Individuals or firms eliminated from further consideration will be notified by mail by the City as soon as practical.

SOQs remain confidential until closing deadline after which proposals are considered a public record subject to public disclosure under RCW 42.56, the Public Records Act. Proposers shall mark as "proprietary" any information that the Proposer believes meets the exemption under RCW 42.56.270(1). This designation will be considered by the City in response to public records requests.

Any SOQ may be withdrawn, either personally or by written request, at any time prior to the time set for the Proposal submittal deadline.

Attachment A: Hidden Lake Dam Removal and NW Innis Arden Way Culvert Replacement Concept Design Report

Attachment B: Sample City of Shoreline Contract for Design Professionals Agreement

HIDDEN LAKE DAM REMOVAL AND NW INNIS ARDEN WAY CULVERT REPLACEMENT CONCEPT DESIGN

SHORELINE, WASHINGTON

Prepared for
City of Shoreline

Prepared by
Herrera Environmental Consultants, Inc.

HERRERA

Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

HIDDEN LAKE DAM REMOVAL AND NW INNIS ARDEN WAY CULVERT REPLACEMENT CONCEPT DESIGN

SHORELINE, WASHINGTON

Prepared for
City of Shoreline
17500 Midvale Avenue North
Shoreline, Washington 98133

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206-441-9080

February 5, 2018

CONTENTS

APPENDICES

TABLES

EXECUTIVE SUMMARY

This report represents the culmination of the Hidden Lake Dam Removal Phase 1 (Pre-Design) and presents design concepts for removing the Hidden Lake dam, replacing the NW Innis Arden Way culverts, and restoring Boeing Creek throughout the existing lake, dam, and culvert areas.

The Boeing Creek channel restoration concept is intended to minimize sediment deposition and flooding while providing habitat. The new creek channel will be created amid the existing lake bed and adjacent areas on the east edge of the lake. As the new channel passes through the existing dam site and NW Innis Arden Way crossing, its bed will be relatively deep below surrounding ground, requiring structural walls on both sides of the creek.

Replacement of the NW Innis Arden Way culverts is complicated by the tall roadway embankment height and utilities. Two options for culvert replacement are described in this report:

1. Completely walled excavation that minimizes excavation and utility impacts but requires a unique, custom culvert installation tied into the vertical shoring walls, or

2. Sloped excavation with minimal use of shoring walls, allowing installation of a precast concrete box culvert.

Both of these options would require a full closure and detour of NW Innis Arden Way during culvert replacement construction. These two approaches can be compared with regard to differences in costs, extents of construction easements needed, utility impacts, and total duration of road closure.

Construction of the culvert replacement, dam removal, and upstream channel restoration will likely require two years. In-water work will be confined to an anticipated time period of July 15 to September 30 each year (per Washington State permitting requirements), which is likely not enough time to complete all in-water work elements in the same year. The project could be sequenced to remove the dam and restore the "lake reach" of the creek in year 1 of construction, then remove and replace the culverts under NW Innis Arden Way in year 2 (or a later year if a longer term delay between phases is necessary), or vice versa.

Table ES-1 highlights potential construction issues that would be affected by project construction sequencing, assuming dam removal occurs in year 1 of construction regardless of whether stream restoration through the lake reach or culvert replacement beneath the road is done in that same year.

Table ES-1. Summary of Construction Issues and Associated Approaches Affected by Project Sequencing.

Construction Issues Affected by Sequence	Work Sequencing Approaches	
	Culvert Reach and Dam Removal Prior to Lake Reach	Lake Reach and Dam Removal Prior to Culvert Reach
Temporary streamflow bypass system	Can use lake to impound excess flows, with potential bypass savings	Need to have higher bypass capacity for higher peak flows
NW Innis Arden Way culvert inlet trash rack(s)	No need to install new trash rack(s) on culvert inlet	Need to install new trash rack(s) on existing culvert inlets
Steep slope stabilization in dam area	Higher efficiency in that retaining walls can be extension of culvert walls	Need to install temporary slope stabilization that is partly or completely replaced as part of new culvert installation
Creating coincident streambed elevation on upstream side of the road	Some additional grading required in year 2 of construction to connect the new streambed through the culvert with the streambed in the vicinity of the existing dam	Additional excavation and streambed lowering needed in year 2 of construction to achieve finished bed elevation that is lower than concrete pad at existing culvert entrance
Disposal of excavation spoils	To minimize earthwork costs, need to stockpile approximately 2,100 cubic yards until lake reach construction occurs	Can be placed directly into the lake bed as backfill

To minimize project uncertainties, the City has requested that the Hidden Lake dam removal and NW Innis Arden Way culvert replacement conceptual design elements be located within the City's Shoreview Park property and the NW Innis Arden Way public right-of-way to the maximum extent possible. However, it is not possible to complete the project without some construction work on private properties. The City has yet to obtain permission of multiple private property owners; this will be an important part of the pending design and construction phases of the project.

Preliminary cost estimates for construction, design, permitting, and postconstruction vegetation management to satisfy anticipated permit requirements for each of the lake and culvert reaches of the project are summarized in Table ES-2. The cost estimates were prepared in 2017 dollars with two years of construction in mind (though not necessarily in successive years). Final project design work should focus on optimizing the sequencing to minimize project costs and duration of road closures.

Table ES-2. Summary of Preliminary Cost Estimates for Final Design, Permitting and Construction.

Project Components	Estimated Total Cost in 2017 Dollars
Remove dam and restore creek channel through existing lake area	$1,440,000 to $1,470,000
Remove and replace culverts beneath NW Innis Arden Way – Option A: vertical shoring walls with cast-in-place culvert	$2,460,000
Remove and replace culverts beneath NW Innis Arden Way – Option B: sloped excavation with precast box culvert	$2,090,000

INTRODUCTION

This report presents the preferred conceptual design for Hidden Lake dam removal, Boeing Creek culvert replacement under NW Innis Arden Way, and Boeing Creek realignment and habitat restoration from upstream of the lake to downstream of the road. This report focuses specifically on project components and associated costs, considerations for construction phasing, geotechnical findings affecting design, and other important considerations for detailed design development.

Existing Conditions Affecting Project Design and Construction

The Hidden Lake Dam Removal Project is being undertaken by the City of Shoreline (City) in response to a City Council decision to cease sediment dredging operations in the lake. Ongoing sediment deposition will eventually fill the lake, at which point the existing dam spillway and outlet works cannot be counted upon to safely pass flows during storm events. The City plans to remove all or part of the dam impounding Hidden Lake, creating a free-flowing stream through the existing lake area.

Several site characteristics constrain the design described herein. These include adjacent private properties, a relatively significant elevation drop through the project area, steep slopes above the creek and lake, accessibility for construction, shallow groundwater in the dam and road crossing area, and completing all of the project work amid an actively flowing stream that does not dry out in the summer months when the construction work would be permitted to occur. The conceptual design seeks to emulate functioning Boeing Creek habitat that can be found upstream of the lake and in the lower reach of Boeing Creek as it approaches the Puget Sound shoreline. In those areas, the stream gradient is on the order of 2 percent. Thus, the design seeks to maximize segments of new and modified stream channel with an approximately 2 percent gradient.

Boeing Creek flows beneath NW Innis Arden Way in two parallel culverts that are estimated to be approximately 60 years old, and nearing the end of their functional life. The City is interested in replacing those culverts with a wider, fish-passable culvert that can also reliably pass wood debris and sediment so that after the dam is removed there is minimal need for maintenance attention in this area of Boeing Creek for decades to come. The earth fill embankment that the road is built upon is deep; the road surface is 30 to 35 feet higher than the existing streambed and culvert invert elevations. There are existing sanitary sewer, water, gas, and cable utility lines buried in the road right-of-way that will need to either be rerouted around the construction area (if feasible) or be supported and protected to ensure continuous operation during and after excavation for culvert removal and replacement.

The project site is at the west edge of Shoreview Park, which is a heavily used public park with trails that extend toward the existing lake through forested areas. Restoring a free-flowing stream through the lake represents a great opportunity to educate the public about ecological restoration and to improve deficiencies in the existing trail network.

Sequencing, phasing, and timing for Hidden Lake dam removal and NW Innis Arden Way culvert replacement work elements are to be determined. Dam removal is tentatively scheduled for 2020 (with $1,600,000 in construction budget allocated in the City's Capital Improvement Program (CIP)), as driven by the motivation to minimize flood risks related to ongoing sediment in-filling of the lake. Sedimentation is largely driven by major storm events and slope failures upstream within the park ravine. The City has seen in the past that one or two major storms in the wet season can cause a large amount of sediment deposition in the lake that greatly reduces

its capacity to store water and sediment. Because the timeframe for lake in-filling is difficult to predict, the City intends to remove the dam and restore a free-flowing stream through the existing lake area comfortably ahead of a point in time when it could otherwise be forced to react in a hurry.

While replacement of the creek culverts beneath NW Innis Arden Way will also reduce flood risks, the need for culvert replacement is largely driven by the condition of the existing culverts. A CCTV inspection of the main (lower elevation) 48-inch-diameter concrete culvert in April 2012 revealed some signs for concern—minor cracking and two small holes—but the overall condition of the culvert appears to be sufficient to remain in place for several more years without significant risk of catastrophic failure. While it would be most efficient to replace the two culverts at the same time as Hidden Lake dam removal, funding limitations may push culvert replacement to a later date. A $300,000 flood reduction grant awarded by the King County Flood Control District will allow the City to develop the NW Innis Arden Way culvert replacement design in combination with the Hidden Lake dam removal design, which will yield better integration of all project elements to achieve the City's objectives and a better understanding of construction approaches and costs for a combined project. However, construction funding for NW Innis Arden Way culvert replacement is not currently allocated in the City's CIP, meaning that additional funding will need to be secured to allow for implementing a combined project or else construction of the culvert replacement components will be phased to occur a year or more later.

This report addresses several issues related to uncertainty in construction sequencing, but generally assumes that the Hidden Lake dam removal and NW Innis Arden Way culvert replacement work elements will be implemented in some kind of combined project effort.

Recommended Design Configuration

The following sections elaborate on the specific project components of the design, including the rationale for using a particular design approach, materials of construction, and design issues to resolve as the project proceeds. The specific design components are creek channel realignment and restoration, dam removal, culvert replacement, and trail realignment. The recommended design configuration was driven by the following factors:

- Minimizing construction elements involving private properties
- Reducing potential for City park users to trespass onto private properties
- Prevailing geological conditions including steep slopes above the lake and creek and soil and groundwater conditions in the dam and road crossing areas
- Potential for future fish passage (an expanded discussion is provided below)
- A desire to replicate and use natural, pre-Hidden Lake historical landscape features
- Avoiding removal of significant trees

Boeing Creek Channel Realignment and Restoration

The design of a restored stream channel through the existing Hidden Lake area is presented in the drawings in Appendix A and includes the following elements:

- Create an engineered, fish-passable channel that is stable during high flows, with an alignment coinciding with what appears to be the pre-Hidden Lake historical alignment of Boeing Creek near the eastern edge of the lake.
- The designed channel width (12 feet at bankfull depth) is based on observed channel conditions in the lower reach of the creek near its mouth.
- Provide sufficient channel gradient and associated hydraulic characteristics in a range of flow conditions to encourage sediment transport, thereby preventing sediment aggradation problems in the project area while also expanding the Boeing Creek delta in Puget Sound, which will improve habitat for Chinook salmon and other aquatic species.
- Emulate channel characteristics that exist near the mouth of Boeing Creek between the railroad crossing and the existing Seattle Golf Club diversion dam.
- Include wood along the new channel banks for aquatic habitat enhancement as well as bank toe scour protection.
- Sections of the new channel with 3 percent gradient have a thicker layer of imported streambed material (cobbles, boulders, gravel, and sand) to act as "streambed

stabilization bands." If the channel bed scours or otherwise deforms in a 2 percent gradient section, any potential downcutting that could compromise a significant length of the channel for fish passage will be contained between 3 percent gradient sections because those 3 percent sections should resist scour and deformation.

- The channel centerline is set back from the toe of the slope on the park (east) side to the maximum extent feasible without requiring removal of several large trees or encroaching on private property, while still being aligned with the apparent historical channel alignment. This alignment provides a buffer between the channel and the toe of the slope, to ensure that restoring the creek channel in that location does not lead to unwanted slope erosion.

- Stream channel banks will not be armored and thus will allow natural channel migration. While significant channel migration is not expected due to the relatively high gradients throughout the site, some migration can occur. If a tree falls in the channel and blocks the flow path, the stream will have space to meander without compromising its intended functions.

- A woody revetment fronting backfill between Stations 9+50 and 10+75 (see design drawings in Appendix A) will block off the current stream channel alignment at the upstream end of the project area, ensuring that the creek flow stays in the new channel alignment during high flows.

- A woody revetment between Stations 3+75 and 4+50 is included in the design to prevent channel migration onto private property.

- Rock/coir wrap embankment toe protection on the left (east) bank of the new channel between Stations 9+50 and 10+75 will prevent destabilization of the slope to the east.

- A soldier pile wall at the toe of an existing near-vertical slope on the right (west) bank between Stations 2+25 and 3+25 will prevent creek flow from triggering a slope failure. This wall will transition into the right sidewall for the new NW Innis Arden Way culvert.

- A soldier pile retaining wall at the toe of the slope on the left (west) side of the creek channel is needed near the entrance to the culvert(s) (existing or new/replaced) to prevent destabilization of the steep slope close to the road. This wing wall will be similar in size and orientation to an existing concrete wing wall in that area.

- A temporary rock buttress at the toe of the steep slope on the left bank between Stations 2+25 and 3+25 will prevent creek flow from eroding and destabilizing the steep slope east of the creek approaching the new culvert wing wall until completion of the culvert reach when design grade is reached.

- A soldier pile wall at the toe of an existing near-vertical slope on the left (east) bank between Stations 3+00 and 3+40 will prevent creek flow from triggering a slope failure.

Hidden Lake Dam Removal

Removal of the dam should be relatively straightforward to accomplish, but the impounded lake water should be drained before commencing dam removal. Before the dam fill material is removed, the existing manhole structure and trash rack that serve as the primary lake outlet will need to removed. Additionally, gabion mattresses (small quarry rock contained in a metal "cage") on the downstream face of the dam will likely need to be "peeled" away before faster dam fill excavation can occur. Two parallel 30-inch-diameter corrugated polyethylene lake outlet pipes (extending approximately 75 feet from the existing lake outlet structure) buried within the dam will also need to be removed as dam fill excavation occurs.

Project construction must consider the need for construction equipment access to the stream work areas through the lake, and how to either make use of the existing dam for a period of time to serve as an access driveway into the upstream work areas around Hidden Lake, or install a separate access driveway if the dam is removed as part of culvert replacement preceding stream channel construction through the existing lake area upstream of the dam.

Culvert Removal and Replacement

Design and construction of the culvert removal and replacement elements of the project are complicated by the height of the earth fill embankment above the existing culverts. Two basic options for the approach to removing the existing culverts and replacing them with a new stream channel contained within a wider culvert structure are described in this report: 1) a completely walled excavation that minimizes the area of excavation radiating away from the culvert/stream alignment and simplifies temporary utility protection but requires a unique, custom culvert installation tied into the vertical excavation shoring walls, and 2) a sloped excavation that minimizes use of shoring walls to contain the lateral extents of the deep excavation and allows installation of a precast concrete box culvert. These two options generally "bookend" the way a construction contractor could conduct the work with varying extents of ground disturbance. Both options would require complete closure of NW Innis Arden Way during excavation, culvert installation, backfilling, and roadway restoration. There are tradeoffs to these approaches, including costs, extents of construction easements needed on adjacent private properties south of the road, extents of utility modifications, and total duration of road closure.

The geotechnical analysis memorandum in Appendix B presents information that was used to create the design layouts of these two design options. The width of the new culvert (16 feet) under either design option for its installation is based on the channel width to be created through the lake area with an additional 2 feet on each side to accommodate placement of boulders against the culvert side walls.

Culvert Design Option A: Vertical Shoring Walls with Cast-In-Place Culvert

Two wall types were considered for the deepest part of the excavation beneath the road, each of which could serve as temporary shoring walls and then be left in place to serve as permanent culvert side walls: secant pile walls and soldier pile walls. Secant pile walls would enable one lane of traffic to be maintained on the road for a portion of the construction duration, whereas soldier pile walls would require complete road closure but would be less expensive. Based on feedback from the City that closure of NW Innis Arden Way is likely acceptable for a longer period of time (minimum 2 months), soldier pile walls were selected.

The lower part of each soldier pile shoring wall (on each side of the restored stream channel) could serve as a permanent culvert wall via using concrete or other durable material fascia panels. A precast or cast-in-place concrete lid, resting on support beams parallel to the channel on each side wall (walers), could form the top of the culvert and support soil backfill above the culvert to road level. With this construction method, the soldier pile walls used for shoring the deep excavation can be left in place permanently. Bracing would be needed between the walls within the excavation because it would not be feasible to install tie backs in the lower part of the wall height given the narrow width of the excavation. Therefore, bracing would be needed between the soldier pile walls to prevent the walls from leaning inward during culvert removal and replacement. It is assumed that an excavator at road level could excavate soil between the shoring walls to approximately mid-depth of the excavation beneath the road; and, thereafter, a contractor would use a bulldozer or other lower-profile equipment to come in from either upstream or downstream to complete the lower part of the excavation (from upstream is likely more feasible given the City's existing easement on the north side of the road can be used for access), and that the equipment would need to fit vertically amid the bracing. Therefore, the lower part of the excavation would likely progress slower (and at greater cost) than the upper part of the excavation. The excavation would also require removing an existing sanitary sewer manhole on the south side of the road, and likely replacing it with a manhole farther away from the new culvert alignment. During the excavation, the existing culverts could be used to pass streamflow through the work area until it is time to remove them and install the new culvert and streambed material within it. Once the existing culverts are removed, the contractor would need to install another flow conveyance/bypass system while completion of streambed excavation, culvert sidewall installation, and streambed material placement occurs.

Available subsurface information (see Appendix B) indicates that there is a glaciolacustrine soil contact sloping down from east to west beneath the road. Borings completed in fall 2017 in the road embankment indicated that groundwater is perched atop this layer; therefore, a seepage face would be encountered as the eastern soldier pile wall is installed. The conceptual design of this option includes a seepage cutoff drain abutting the back side of the eastern soldier pile wall to intercept groundwater and direct it to the upstream and/or downstream sides of the road embankment.

Culvert Design Option B: Sloped Excavation with Precast Box Culvert

As stated previously, this design approach would enable use of a precast concrete box culvert structure (either 3-sided/bottomless on strip footings or 4-sided without need for foundation footings) but would entail a much larger excavation footprint prior to culvert installation. The excavation would require removing an existing sanitary sewer manhole on the south side of the road, and likely replacing it with a manhole farther away from the new culvert alignment, and temporary support for the existing sewer line for a considerable length across the width of the excavation parallel to the road. It is assumed that the water line could either be supported across the wide excavation similar to the sewer line (i.e., a temporary utility bridge), or water service could be shut off and the line partially removed until replaced at the conclusion of backfill placement above the new culvert. It is further assumed that the franchised gas and cable utilities beneath the road could be rerouted around the work area until the conclusion of backfilling.

The geotechnical analysis memorandum in Appendix B presents details on soil characteristics as related to shoring needs, groundwater that would be encountered during excavation, and the angle of repose that can be assumed for sloped excavation.

Construction equipment would need to access the lower part of the excavation. This requires a sloped bench on one or both sides of the excavation. A preliminary assessment of dump truck turning radii indicates that it would be feasible to use the following procedure to remove excavated soil and deliver culvert materials: trucks arrive at the site from NW Innis Arden Way to the west (i.e., via 10th Avenue NW and NW 175th Street), back up into a temporary access driveway extending through the City's easement on the north side of the road (west of the creek), curl around southward into the benched access driveway through the excavation, and load and unload materials before driving out (forward) the way they entered. The proposed site plan in Appendix A shows this construction access route. While this could be a feasible way to complete the excavation and install the new culvert and associated wing walls, it would be relatively slow going, adding to a contractor's costs.

During the excavation, the existing culverts could be used to pass streamflow through the work area. If the bottom of the excavation were 4 feet wider than needed to install the new culvert, one of the existing culverts could be used for a longer period of time to route streamflow through the work area, expediting culvert installation. Widening the bottom of the excavation for this purpose could also be done with Option A, but for either option it would add to the cost.

Streambed Within Culvert

Making the stream profile through the culvert crossing fish-passable is challenging due to the incised channel characteristics downstream of the road. Downstream incision increases the overall elevation drop from upstream of the existing Hidden Lake dam area. A "roughened channel" configuration per Washington Department of Fish and Wildlife (2013) guidelines, which

is a means of transitioning grade through a relatively steep section of channel, is included in the design to minimize the length of channel modifications downstream of the road crossing. The result will be a relatively steep section of channel (10 percent gradient) at the downstream end of the project extent.

In July 2017, the project team completed a memorandum for Concept Design Evaluation of Fish Passage Improvements in Lower Boeing Creek, for a roughly 1,100-foot-long reach of Boeing Creek from NW Innis Arden Way to downstream of the Seattle Golf Club diversion dam (Herrera 2017). Results of this analysis indicated that successful implementation of lower Boeing Creek fish passage improvements would be very difficult as a City-led project, with high costs, substantial risks, and many uncertainties. City staff concluded (with Council concurrence) that such an approach would not be viable for restoring fish passage to the reach of Boeing Creek upstream of Hidden Lake, nor for securing fish passage-oriented grant funding for the Hidden Lake Dam Removal Project. Accordingly, the City has discontinued further development of Boeing Creek restoration concepts downstream of NW Innis Arden Way.

Results of that downstream fish passage analysis were referenced in creating the current NW Innis Arden Way culvert replacement design concept. The conceptual channel bed profile extending through the NW Innis Arden Way crossing in that downstream fish passage analysis (Herrera 2017) was several feet lower than the concept design currently reaches. This is because of the high cost and constructability concerns for deeper streambed elevations from the dam area to downstream of the road. The elevation of the downstream tie-in to the existing creek channel is approximately 172 feet (near Station 1+00 on Drawing C-2 in Appendix A), which is roughly 7 vertical feet higher than the elevation proposed by the "ideal" downstream fish passage restoration concept developed for lower Boeing Creek. Therefore, any potential future attempts to implement fish passage improvements in lower Boeing Creek would need to accommodate greater elevation drop between the outlet of a new culvert beneath NW Innis Arden Way and the mouth of the creek at Puget Sound. Doing so is feasible, but adds to the challenges and very high costs. It should be noted that the conceptual stream channel profile through the road crossing presented in the drawings in Appendix A is consistent with geotechnical engineering findings and recommendations presented in Appendix B, which infer the predevelopment historical channel elevation of Boeing Creek at the roadway crossing.

The Lower Boeing Creek fish passage improvement concepts developed by the City in 2017 could still be implemented as conceived to extend the length of fish passable channel by up to an additional 1,000 feet, including removal of the Seattle Golf Club diversion dam and rock cascade obstructions. Those potential improvements would not be impacted by the higher outlet elevation of the NW Innis Arden Way culvert; however, attempting to extend such downstream fish passage improvements through the NW Innis Arden Way culvert would encounter a short section of channel downstream of the road with a grade that is probably too steep for fish passage, requiring some form of an engineered fishway to enable passage through that section.

Hidden Lake Loop Trail Realignment

The Hidden Lake Loop Trail runs through the northern part of the project area along the northeastern shore of Hidden Lake. The conceptual design of the project includes reconfiguring approximately 300 linear feet of the Hidden Lake Loop Trail alignment through the project area. The proposed trail realignment would shift the trail away from the existing lake shore about 80 feet eastward and 10 to 20 vertical feet up the existing slope. With the lake removed, existing lake access points will no longer be needed. Shifting the trail to the east will keep trail users close to but upslope of the new Boeing Creek alignment, discourage trespassing onto private property on the opposite (west) side of the creek, and eliminate the need for (and cost of) two new trail bridges over the restored creek channel within the project limits. The trail realignment also proposes constructing a small platform at the south end of the new trail section for viewing (from above) the restored stream channel. The viewing area will include educational signage to illustrate Hidden Lake history, stream restoration concepts, and/or other surface water and environmental topics. The trail realignment could also propose installing a small spur trail lower down on the east side of the new Boeing Creek alignment to allow for guided exploration of the newly restored channel.

CONSTRUCTION SEQUENCING

The project design presented in the drawings in Appendix A is likely complex enough to require two years of construction (with in-water work being confined to an anticipated time period of July 15 to September 30 each year per Washington State permitting requirements). This is because the deep excavation beneath NW Innis Arden Way will prolong the time needed for culvert work and simultaneous road closure, making it challenging for a contractor to also be working on the creek channel restoration through the lake area within the same timeframe. The project could be sequenced to remove the dam and restore the "lake reach" of the creek in year 1 of construction, then remove and replace the culverts under NW Innis Arden Way in year 2 (or a later year if a longer term delay between phases is necessary), or vice versa. To minimize repeat construction work in the vicinity of the dam site in year 2 of construction, the dam should be removed in year 1 regardless of whether the lake reach or culvert reach is constructed first.

If the dam is removed in combination with constructing the culvert reach in year 1, Boeing Creek would flow across the former lake bed in a somewhat unpredictable manner until the stream restoration work is constructed in the lake reach in an ensuing year. This scenario would not likely undermine or damage project features constructed at the former dam site and through the improved road crossing, but would be expected to result in unpredictable lake bed topography that a construction contractor would encounter in mobilizing to complete the lake reach work. That unpredictability could induce some added costs to complete the project.

If the culvert replacement work is done first, the dam and lake could possibly be used to impound any "excess" Boeing Creek flow for a period of weeks when the lower-elevation culvert removal and installation work is occurring, which could expedite the contractor's time to complete culvert installation. However, Boeing Creek base flows would need to be allowed to continually pass through to protect aquatic life in the creek downstream of the project area. This approach to controlling creek flows during construction would involve draining the lake (to maximize whatever capacity of water storage remains at that time as related to ongoing sediment accumulation in the lake) and then blocking the existing outlet structure and bypassing a suitable base flow rate to the downstream end of the culvert replacement work area. Saving time for culvert removal and replacement could reduce construction costs and could reduce the duration of road closure for the neighborhood. However, if the dam is removed in the first year of construction as suggested above, it will be necessary to install a full-capacity temporary flow-bypass system through the excavation beneath the road during ensuing culvert removal and replacement. That type of temporary diversion system is common for construction work in creek and river channels.

With dam removal (along with the manhole and pipes that are used to route lake outflows through it) as part of creek restoration work through the lake area in year 1 of construction, a durable trash rack would be needed to protect the upstream entrance to the existing NW Innis Arden Way culverts until they are replaced. This could be a cost and maintenance issue for the City.

Another issue related to the timing of dam removal is stabilizing the toes of the steep slopes on both sides of the creek between the dam and the upstream entrance to the culvert(s) (for both existing and proposed culverts, that entrance is in the same location). With dam removal in the first year of construction, temporary or permanent stabilization measures for the toe of slopes on each side of the new creek channel would be necessary. As currently designed, it would probably be more efficient to construct those features in combination with culvert replacement (for example, the soldier pile wall at the toe of slope on the west side of the lowered stream channel through the dam site is intended to be an extension of the same type of wall built beneath the road under Option A, but the same type of soldier pile wall to protect the right bank could be installed under Option B). The new creek bed in the area just upstream of the road crossing will be slightly lower in elevation than the existing concrete pad that routes flows into the existing culverts; thus, installing permanent slope toe stabilization measures cannot be accomplished completely while the concrete pad remains in place.

Table 1 highlights potential construction issues that would be affected by project construction sequencing, assuming dam removal occurs in year 1 of construction regardless of whether stream restoration through the lake reach or culvert replacement beneath the road is done in that same year.

Table 1. Summary of Construction Issues and Associated Approaches Affected by Project Sequencing.

Construction Issues Affected by Sequence	Work Sequencing Approaches	
	Culvert Reach and Dam Removal Prior to Lake Reach	**Lake Reach and Dam Removal Prior to Culvert Reach**
Temporary streamflow bypass system	Can use lake to impound excess flows, with potential bypass savings	Need to have higher bypass capacity for higher peak flows
NW Innis Arden Way culvert inlet trash rack(s)	No need to install new trash rack(s) on culvert inlet	Need to install new trash rack(s) on existing culvert inlets
Steep slope stabilization in dam area	Higher efficiency in that retaining walls can be extension of culvert walls	Need to install temporary slope stabilization that is partly or completely replaced as part of new culvert installation
Creating coincident streambed elevation on upstream side of the road	Some additional grading required in year 2 of construction to connect the new streambed through the culvert with the streambed in the vicinity of the existing dam	Additional excavation and streambed lowering needed in year 2 of construction to achieve finished bed elevation that is lower than concrete pad at existing culvert entrance
Disposal of excavation spoils	To minimize earthwork costs, need to stockpile approximately 2,100 cubic yards until lake reach construction occurs	Can be placed directly into the lake bed as backfill

A summary of the envisioned construction components for the lake reach and culvert reach phases of the project is provided below.

Lake Reach

1. Implement temporary traffic controls on NW Innis Arden Way to facilitate ready access for construction vehicles and equipment.

2. Install temporary erosion and sediment control (TESC) measures in downstream (south) end of work area.

3. If the dam is still in place (i.e., the lake reach construction work occurs before the culvert reach work), remove it first. Install trash rack at upstream entrance to existing culverts if the culverts have not already been removed in a previous phase of culvert reach construction. Install slope toe stabilization measures in existing dam area if not already installed in a previous phase of culvert reach construction.

4. Place bulk bags at the upstream end of the project where the creek currently enters the lake to divert flow through an existing flow bypass pipe under the lake bed (outlets to the manhole at the upstream end of the dam) and drain the lake. If the flow bypass pipe connecting to the outlet manhole is no longer in place or functional, drain the lake bed and place bulk bags to tie into the eastern berm (see Appendix A, Drawing C-1) to divert flow toward the upstream entrance to the culvert(s) beneath the road (existing or new/replaced), and install other temporary erosion and sediment control features in the lake area.

5. Clear vegetation as needed (within allowed limits of disturbance) and excavate the new creek channel progressing from the existing dam area in the upstream direction.

6. Place and grade excavation spoils on the former lake bed to the west of the new channel.

7. Install wood structures and other instream design features progressively as excavation occurs, or after all channel excavation is complete.

8. Place streambed material.

9. At upstream end of new channel, use excavated rock and soil to plug the existing channel near where it passes west under a fence, permanently blocking that channel path, if this step cannot be undertaken sooner, depending on flow bypass approach.

10. Empty bulk bags with the excavation spoils and remove other temporary streamflow control and TESC measures, cap/abandon flow bypass pipe under the lake bed if it was used, and allow all creek flow to pass through the new channel.

11. Hydroseed and/or place mulch in areas to be planted.

12. Install the permanent trail improvements. (Note: this step can be completed earlier if the contractor mobilizes to the site a few weeks before the permitted in-water work window begins.)

13. Install plantings in late fall after rainy season has commenced.

Culvert Reach

1. Close NW Innis Arden Way to traffic (for minimum 2 months).

2. Install temporary erosion and sediment control measures.

3. Excavate beneath roadway and install soldier pile walls as excavation deepens (with extents of walls depending on which option used for excavation as described previously). Support and/or remove/reroute existing utilities as they become exposed in the upper part of the excavation.

4. Install another means of bypassing or controlling creek flow as existing culverts are removed and the lowest part of the excavation is completed.

5. Install precast concrete box culvert and streambed material within it, or create culvert side walls using concrete fascia panels at the base of soldier pile shoring walls to remain permanently in the ground before placing new streambed material between the side walls.

6. If culvert installation Option A used, install a precast concrete lid (in sections creating the length of the culvert top, lowered through the shoring wall bracing and utilities bridging the open excavation) or cast-in-place concrete for the culvert lid, resting on horizontal beams attached to the side walls (which could double as walers for wall bracing before the culvert lid is installed).

7. If dam was not removed in a previous phase of construction, remove lake outlet manhole and trash rack on the upstream face of the dam, and remove the gabions from the downstream face of the dam.

8. Excavate dam, remove existing lake outlet pipes, and demolish the concrete splash pad at entrance to the existing culverts

9. Complete finished channel grading and toe-of-slope protection measures upstream and downstream of the road.

10. Remove temporary streamflow control/bypass system and allow streamflow to pass through the new channel extents.

11. Backfill the excavation beneath the road (above the new culvert lid) and behind new side walls extending upstream and downstream of the road with salvaged embankment material.

12. Re-pave disturbed road areas, and open the road to traffic.

PRIVATE PROPERTY CONSIDERATIONS

Private properties play an important role in replacing the NW Innis Arden Way culvert and removing the dam impounding Hidden Lake and restoring Boeing Creek through the Hidden Lake area. Project areas with private property considerations include the following:

- An existing 110-foot section of Boeing Creek channel at the upstream end of the lake is entirely on private property.
- Significant portions of Hidden Lake are on four private properties (and also a property owned by the King County Wastewater Treatment Division).
- Part of the dam and the only dam access (and overall Hidden Lake project area access) is on a single private property (on which the City has an easement). In this same area, portions of the existing NW Innis Arden Way culvert inlet and headwall appear to be on the same private property.
- At the downstream end of the new/replaced NW Innis Arden Way culvert, retaining walls and channel restoration are expected to extend approximately 50 feet beyond the public right-of-way onto private property (two separate landowners) on both sides of the creek.

To minimize project uncertainties, the City has requested that the Hidden Lake dam removal and NW Innis Arden Way culvert replacement conceptual design elements be located within the City's Shoreview Park property and the NW Innis Arden Way public right-of-way to the maximum extent possible. However, it is not possible to complete the project without some construction work on private properties, particularly at the upstream and downstream ends of the NW Innis Arden Way culvert, within the existing dam area, and a small area upstream of the lake. Ideally, there will be full cooperation between the City and all neighboring private property owners to allow for project access, efficient construction work, and site restoration to occur in all areas as needed, and as optimal to mitigate the construction impacts including lake removal. However, the City has yet to obtain agreements for any work on private property, and that will be an important part of the pending final design and construction phases of the project.

Assumptions related to private property access, usage, and general proximity to work that were made in developing the conceptual design described in this report include:

1. All project work north of NW Innis Arden Way, including Hidden Lake dam removal, Boeing Creek restoration within the Hidden Lake area, and the upstream end of culvert replacement will utilize the existing maintenance access gate and driveway on private property. This access is currently allowed by a permanent easement.

2. The City will obtain any and all rights-of-entry, temporary construction easements, and/or permanent easements necessary to construct and (if applicable) maintain:

    a. The upstream end of the new NW Innis Arden Way culvert, Hidden Lake dam removal, and Boeing Creek restoration within that area.

    b. The downstream end of the new NW Innis Arden Way culvert.

    c. Boeing Creek channel realignment at the upstream end of Hidden Lake.

    d. Temporary stream bypass system(s) and other temporary erosion and flow diversion features.

3. The City will use excavation spoils (as suitable) to partially fill the dewatered lake bed on Shoreview Park property. Planting restoration will be done only within City right-of-way, Shoreview Park, and portions of private properties (with landowner permission) directly disturbed by construction. For the purposes of cost estimating, planting restoration has been assumed to not extend to private property areas on the west side of the dewatered lake bed.

4. Design concepts were developed to discourage park users from trespassing on private properties in the Hidden Lake area following removal of the lake.

PRELIMINARY COST ESTIMATES

Preliminary cost estimates for construction, design, permitting, and postconstruction vegetation management to satisfy anticipated permit requirements for each of the lake and culvert reaches of the project are summarized in Table 2. Itemized cost estimate tabulations are provided in Appendix C. The cost estimates were prepared in 2017 dollars with 2 years of construction in mind (though not necessarily in successive years), but without including duplicative cost items mentioned above if the culvert work is done after the upstream work in the lake reach (e.g., new trash rack at culvert entrance, partial installation of toe-of-slope stabilization measures). Final project design work should focus on optimizing the sequencing to minimize project costs and duration of road closures. Drawing sheet C-1 in Appendix A shows the dividing line separating costs estimated to be part of the lake reach versus culvert reach, to avoid any double counting or omissions.

Table 2. Summary of Preliminary Cost Estimates for Final Design, Permitting and Construction.

Project Components	Estimated Total Cost in 2017 Dollars
Remove dam and restore creek channel through existing lake area	$1,440,000 to $1,470,000
Remove and replace culverts beneath NW Innis Arden Way – Option A: vertical shoring walls with cast-in-place culvert	$2,460,000
Remove and replace culverts beneath NW Innis Arden Way – Option B: sloped excavation with precast box culvert	$2,090,000

A higher contingency (50 percent) for the construction cost elements is included for the culvert reach due to the complexities of deep excavation and wall installation that are not yet resolved. A lesser contingency (30 percent) is included for the lake reach (including dam removal) construction elements because there should be fewer unknowns and fewer design and construction challenges for that part of the project. If both reaches of the project are included in a single, phased package of design plans with ability to construct both phases without several years of lag time in between (i.e., if the City is able to obtain funding for the culvert reach relatively soon), the permitting level of effort and associated cost should be lesser than the sum of these amounts shown in the two cost tabulations in Appendix C.

REFERENCES

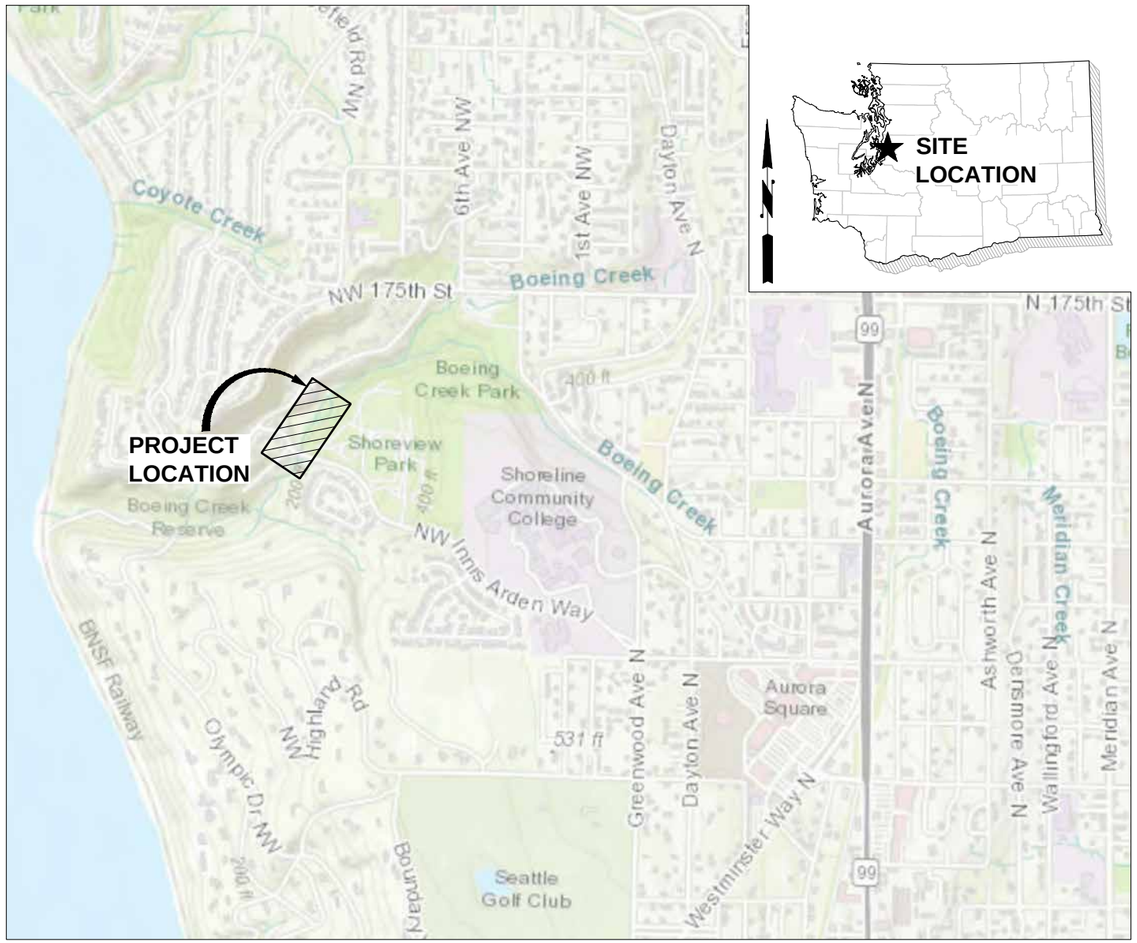
Herrera. 2017. Technical Memorandum: Concept Design Evaluation of Fish Passage Improvements in Lower Boeing Creek. Prepared for John Featherstone, City of Shoreline, by Ian Mostrenko and Mark Ewbank of Herrera Environmental Consultants, Inc., Seattle, Washington. July.

APPENDIX A

Preliminary Design Drawings

HIDDEN LAKE DAM REMOVAL

SHORELINE, WA



VICINITY MAP

SCALE: 1"=1/4 MILE

OWNER:

CITY OF SHORELINE
PUBLIC WORKS DEPARTMENT
SHORELINE CITY HALL - 2ND FLOOR
17500 MIDVALE AVENUE N.
SHORELINE, WA 98133
CONTACT: JOHN FEATHERSTONE, P.E.

ENGINEER:

HERRERA ENVIRONMENTAL CONSULTANTS
2200 SIXTH AVENUE
SUITE 1100
SEATTLE, WA 98121
PHONE: (206) 441-9080
CONTACT: IAN MOSTRENKO, P.E.

SHEET INDEX

SHEET	DRAWING	DESCRIPTION
1	G-1	COVER SHEET
2	G-2	GENERAL NOTES
3	C-1	SITE PLAN
4	C-2	CHANNEL PROFILE
5	C-3	CHANNEL CROSS SECTIONS - CULVERT REACH OPTION A (VERTICAL SHORING WALLS WITH CAST-IN-PLACE CULVERT)
6	C-4	CHANNEL CROSS SECTIONS - CULVERT REACH OPTION B (SLOPED EXCAVATION WITH PRECAST BOX CULVERT)
7	C-5	CHANNEL CROSS SECTIONS - LAKE REACH

1 / C-1 — DETAIL REFERENCE NUMBER; DRAWING ON WHICH DETAIL IS SHOWN

DETAIL — SCALE: NTS — 1 / C-1 — DETAIL REFERENCE NUMBER; DRAWING FROM WHICH DETAIL WAS TAKEN

A / C-4 — SECTION REFERENCE LETTER; DRAWING ON WHICH SECTION IS SHOWN

SECTION/PROFILE — SCALE: NTS — A / C-2 — SECTION/PROFILE REFERENCE LETTER; DRAWING FROM WHICH SECTION/PROFILE WAS TAKEN

"-" INDICATES THAT THE DETAIL/SECTION IS SHOWN ON THE SAME SHEET

"TYP" INDICATES THAT THE DETAIL/SECTION IS UNIFORMLY TYPICAL THROUGHOUT PROJECT EXCEPT WHERE OTHERWISE NOTED

"VAR" SPECIFIES THAT DETAIL/SECTION WAS TAKEN FROM VARIOUS DRAWINGS

NOTE AND DETAIL/SECTION REFERENCING

ORIGINATED BY: / DATE:
CHECKED BY: / DATE:
BACK-CHECKED BY: / DATE:
CORRECTED BY: / DATE:
VERIFIED BY: / DATE:
O:\proj\Y2015\15-05984-000\CAD\Dwg\G-1.dwg | 2/1/2018 2:05 PM | Eric Marshall

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

IAN R. MOSTRENKO — STATE OF WASHINGTON — 36069 — REGISTERED PROFESSIONAL ENGINEER — DRAFT

DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL		
DESIGNED: V. WU	DRAWN: -		
DESIGNED: -	CHECKED: -		
SCALE: AS NOTED	APPROVED: M. EWBANK		

HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

COVER SHEET

DATE: JANUARY 2018
PROJECT NO: 15-05984-000
DRAWING NO: G-1
SHEET NO: 1 OF 7

GENERAL NOTES:

1. THE CONTRACTOR SHALL HAVE THE APPROVED PLANS AND ALL OTHER REQUIRED DOCUMENTS AVAILABLE AT THE JOB SITE.
2. ALL WORK SHALL CONFORM TO THESE APPROVED PLANS AND SPECIFICATIONS, THE SHORELINE MUNICIPAL CODE, THE ENGINEERING DEVELOPMENT MANUAL, 2016 WSDOT/APWA STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION, AND FEDERAL AND STATE REQUIREMENTS.
3. ALL INSTALLATION METHODS AND MATERIALS SHALL MEET THE 2016 WSDOT/APWA STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION.
4. ANY CHANGES FROM THE APPROVED PLANS REQUIRE PRE-APPROVAL FROM THE CITY ENGINEER.
5. CONSTRUCTION HOURS ARE PER SPECIAL PROVISION SECTION 1-08.0(2). APPROVED HOURS FOR LANE CLOSURES ARE IDENTIFIED IN SPECIAL PROVISION SECTION 1-10.2(2).
6. THE CONTRACTOR ASSUMES SOLE RESPONSIBILITY FOR WORKER SAFETY AND DAMAGE FROM CONSTRUCTION OPERATIONS TO STRUCTURES AND OTHER IMPROVEMENTS. ANY DAMAGE SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE CITY.
7. ALL TRENCH EXCAVATION SHALL MEET OR EXCEED ALL APPLICABLE SHORING LAWS. ALL TRENCH SAFETY SYSTEMS SHALL MEET WISHA REQUIREMENTS.
8. SURVEYING FOR PUBLIC FACILITIES SHALL BE PERFORMED UNDER THE DIRECTION OF A WASHINGTON LICENSED LAND SURVEYOR. VERTICAL DATUM SHALL BE NAVD 88. HORIZONTAL DATUM SHALL BE WASHINGTON STATE (GRID) COORDINATES, NORTH ZONE, USING NAD 83/91 SURVEY CONTROL AND ANY TWO CITY OF SHORELINE HORIZONTAL CONTROL MONUMENTS. FOR PROJECTS WITHIN A FLOOD CONTROL ZONE, THE SURVEYOR SHALL PROVIDE CONVERSION CALCULATIONS TO NGVD 1929.
9. REPLACE OR RELOCATE ALL SIGNS, STRIPING, POLES AND OTHER ITEMS IN THE RIGHT-OF-WAY THAT ARE DAMAGED OR REMOVED DURING CONSTRUCTION. USE THERMOPLASTIC ON STOP BARS, CROSSWALKS, AND BICYCLE LANES. ADJUST ALL CASTINGS TO FINISHED GRADE.
10. RETAIN, REPLACE OR RESTORE ALL VEGETATION IN RIGHTS-OF-WAY, EASEMENTS, AND ACCESS TRACTS DISTURBED DURING CONSTRUCTION.
11. THE LOCATIONS SHOWN OF ALL EXISTING UTILITIES SHOWN HEREON HAVE BEEN OBTAINED FROM AVAILABLE CITY OF SHORELINE GIS DATA AND SHOULD THEREFORE BE CONSIDERED APPROXIMATE ONLY AND NOT NECESSARILY COMPLETE. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO INDEPENDENTLY VERIFY THE ACCURACY OF ALL UTILITY LOCATIONS SHOWN, AND TO FURTHER DISCOVER AND AVOID ANY OTHER UTILITIES NOT SHOWN HEREON WHICH MAY BE AFFECTED BY THE IMPLEMENTATION OF THIS PLAN. IMMEDIATELY NOTIFY THE CITY ENGINEER IF A CONFLICT EXISTS.
12. THE EXISTING TOPOGRAPHIC AND PHYSICAL FEATURES SHOWN ON THESE PLANS ARE BASED ON THE CITY OF SHORELINE'S GIS DATA. THE CONTRACTOR MAY ENCOUNTER VARIATIONS BETWEEN ACTUAL CONDITIONS AND THOSE SHOWN IN THE PLANS. THESE VARIATIONS WILL NOT BE THE BASIS FOR A CLAIM FOR EXTRA COMPENSATION.
13. CAUTION- EXTREME HAZARD-OVERHEAD ELECTRICAL SERVICE LINES ARE NOT SHOWN ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXTENT OF ANY HAZARD CREATED BY OVERHEAD ELECTRICAL POWER IN ALL AREAS AND SHALL FOLLOW PROCEDURES DURING CONSTRUCTION AS REQUIRED BY LAW AND REGULATIONS. PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL MEET THE UTILITY OWNERS AND DETERMINE THE EXTENT OF HAZARD AND REMEDIAL MEASURES AND SHALL TAKE WHATEVER PRECAUTIONS MAY BE REQUIRED.
14. THE CITY ENGINEER WILL COORDINATE AND NOTIFY RESIDENTS AND BUSINESSES IN ADVANCE OF ANY WORK AFFECTING ACCESS OR SERVICE AND SHALL MINIMIZE INTERRUPTIONS TO DRIVEWAYS FOR RESIDENTS AND BUSINESSES ADJACENT TO THE PROJECT. CONTRACTOR TO NOTIFY CITY ENGINEER ONE (1) WEEK PRIOR TO COMMENCEMENT OF WORK TO PROVIDE CITY ENGINEER TIME TO NOTIFY RESIDENTS AND BUSINESSES.
15. ALL LAWN AND VEGETATED AREAS DISTURBED BY CONSTRUCTION EQUIPMENT, VEHICLES OR PERSONNEL SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER, AT THE CONTRACTOR'S EXPENSE.
16. THE CONTRACTOR SHALL PREPARE AND SUBMIT TEMPORARY STORMWATER SYSTEM BYPASS PUMPING PLAN. SEE SPECIFICATIONS FOR DETAILS.
17. THE CONTRACTOR SHALL PREPARE UTILITY PROTECTION PLANS ON AN AS-NEEDED BASIS, INCLUDING BUT NOT EXPRESSLY LIMITED TO PROTECTION PLANS FOR WATER MAINS AND SERVICES WITHIN 5 HORIZONTAL FEET OF TRENCH EXTENT SHOWN ON PLAN SHEETS.
18. PROTECT EXISTING CURB, GUTTER, SIDEWALK, DRIVEWAYS, AND SHOULDER (PAVED OR GRAVEL) TO REMAIN FROM DAMAGE. DEMOLISH ONLY THOSE EXISTING FACILITIES INDICATED ON THE PLANS. CONTRACTOR SHALL REPLACE AT THEIR COST ANY FACILITY TO REMAIN THAT IS DAMAGED AS A RESULT OF CONTRACTORS OPERATIONS.
19. ADJUST TO GRADE MANHOLES, CATCH BASINS, VALVES, AND UTILITY CASTINGS IN PUBLIC RIGHTS-OF-WAY OR EASEMENTS AFTER PAVING.

STORM DRAINAGE NOTES (SD):

SD1. INSTALL CITY PROVIDED "NO DUMPING" MEDALLIONS AT ALL CURBSIDE STORM DRAIN INLETS.

SD2. PRIOR TO FINAL INSPECTION, CLEAN AND FLUSH STORM DRAIN PIPES AND VACTOR OUT STRUCTURES TO REMOVE SEDIMENT, TRASH, DEBRIS AND RUBBLE. DO NOT DISCHARGE WASH WATER TO ANY STORM DRAIN SYSTEM OR TO SURFACE WATERS.

SD3. ALL PIPE LENGTHS, INVERTS, INVERT ELEVATIONS AND DRAINAGE STRUCTURE LOCATIONS ARE MEASURED AT THE CENTER OF THE DRAINAGE STRUCTURE UNLESS OTHERWISE NOTED.

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) NOTES:

1. THE CONTRACTOR SHALL PROTECT ALL PUBLIC AND PRIVATE DRAINAGE SYSTEMS FROM POLLUTION. NO VISIBLE OR OTHERWISE MEASURABLE SEDIMENT OR POLLUTANT SHALL BE DISCHARGED TO, OR DEPOSITED INTO ANY WATER BODY OR STORM DRAINAGE SYSTEM ON PUBLIC OR PRIVATE PROPERTY.
2. THE CONTRACTOR SHALL COMPLY WITH ALL LOCAL, STATE, AND FEDERAL WATER QUALITY AND OTHER APPLICABLE EROSION AND SEDIMENT CONTROL STANDARDS.
3. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING, MAINTAINING, MONITORING, REPLACING AND/OR UPGRADING (AS NEEDED) EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMPs) TO ENSURE THAT SEDIMENT OR OTHER POLLUTANTS DO NOT ENTER THE STORM DRAINAGE SYSTEM. SUCH BMPs INCLUDE SILT FENCE, STRAW WATTLES, FILTER FABRIC PROTECTION OF CATCH BASINS, PROTECTION OF DRAINAGE DITCHES, AND OTHER MEASURES AS REQUIRED.
4. THE CONTRACTOR SHALL PERFORM PERIODIC VISUAL MONITORING OF WATER BODIES AND/OR STORM DRAINAGE SYSTEMS IMMEDIATELY DOWNSTREAM OF WORK AREAS TO CONFIRM EFFECTIVENESS OF EROSION AND SEDIMENT CONTROL BMPs INSTALLED.
5. PRIOR TO LEAVING A DISTURBED SITE FOR A PERIOD LASTING OVERNIGHT OR LONGER, THE CONTRACTOR SHALL INSTALL AND/OR SECURE EROSION AND SEDIMENT CONTROL BMPs APPROPRIATE FOR WET WEATHER CONDITIONS, INCLUDING (BUT NOT LIMITED TO) STABILIZATION OF ANY EXPOSED SOILS.
6. THE CONTRACTOR SHALL ENSURE ALL CHEMICAL OR HAZARDOUS MATERIALS ARE CONTAINED AND HANDLED APPROPRIATELY. NO CHEMICAL OR HAZARDOUS MATERIAL SHALL BE DISCHARGED TO THE STORM DRAIN SYSTEM.
7. AFTER COMPLETION OF CONSTRUCTION AND WITH APPROVAL OF THE CITY ENGINEER, THE CONTRACTOR SHALL (1) ENSURE THAT APPROPRIATE LONG-TERM EROSION AND SEDIMENT CONTROL BMPs ARE IN PLACE, AND (2) REMOVE ANY BMPs NO LONGER NEEDED.

TEMPORARY BYPASS NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL FIELD CONDITIONS, INCLUDING STORM DRAIN SYSTEM COMPONENTS AND LOCATIONS, PRIOR TO STARTING ANY TEMPORARY BYPASS PUMPING.
2. TEMPORARY BYPASS PUMPING SYSTEM BE SIZED FOR TO CONVEY MAXIMUM FLOWS THROUGH THE PORTION OF THE EXISTING STORM DRAINAGE SYSTEM BEING BYPASSED.
3. A MINIMUM OF ONE (1) SUFFICIENTLY-SIZED STANDBY PUMP PER ACTIVE WORK LOCATION SHALL BE AVAILABLE ON STANDBY AT ALL TIMES.
4. DIESEL GENERATORS AND DIESEL-DRIVEN PUMPS SHALL BE OPERATED ONLY WHEN CONTAINMENT MEASURES ARE IN PLACE TO PREVENT OIL AND/OR FUEL SPILLS.
5. BYPASSED FLOWS SHALL BE RETURNED TO THE SAME STORMWATER SYSTEM THAT THEY ARE DIVERTED FROM, AND SHALL BE RETURNED TO THAT SYSTEM AT THE NEAREST AVAILABLE LOCATION DOWNSTREAM FROM THE WORK AREA.
6. CONTRACTOR SHALL ENSURE THAT THE BYPASS SYSTEM DOES NOT INTRODUCE ANY CONTAMINANTS OR TURBIDITY INTO THE STORMWATER.
7. CONTRACTOR SHALL USE SANDBAGS, ROCK, AND/OR OTHER MEASURES TO ENSURE THAT ANY BYPASS PUMP SYSTEM INTAKES AND OUTFALLS LOCATED WITHIN DITCHES OR OTHER LANDSCAPED SURFACES DO NOT CAUSE EROSION OR OTHER DAMAGE TO THESE AREAS.
8. BYPASS SYSTEM TO REMAIN ACTIVE FOR THE FULL DURATION REQUIRED BY THE WORK, INCLUDING OUTSIDE OF WORKING HOURS IF NECESSARY.

UTILITY PROTECTION NOTES:

1. CONTRACTOR SHALL EXERCISE CARE WHILE EXCAVATING AND PERFORMING OTHER WORK NEAR ANY UTILITY INFRASTRUCTURE, INCLUDING ABOVE GROUND, OVERHEAD, AND UNDERGROUND FACILITIES.
2. FOR ANY EXCAVATION WITHIN 3 FEET OF EXISTING UNDERGROUND UTILITY LOCATIONS, THE CONTRACTOR SHALL PROTECT EXISTING UTILITY AND EXCAVATE WITH EXTREME CAUTION IN PROXIMITY. CONTACT UTILITY COMPANY (SEE SHEET CV1). LOCATIONS WHICH WERE IDENTIFIED DURING CONSTRUCTION WERE POTHOLED TO CONFIRM LOCATION OF THE UTILITY BEFORE BEGINNING WORK, SEE PLAN SHEETS AND POTHOLING DATA SHEETS IN CONTRACT PROVISION APPENDICES. DESIGN PHASE POTHOLING MAY NOT HAVE IDENTIFIED ALL SUCH UTILITIES, SO CONTRACTOR SHALL PROVIDE POTHOLING IN SUCH CASES.
3. ANY EXCAVATION WITHIN 2 FEET OF EXISTING GAS OR WATER INFRASTRUCTURE SHALL BE BY VACUUM EXCAVATION. SEE PLAN SHEETS.
4. ADDITIONAL PROCEDURES FOR WORKING IN PROXIMITY TO SEATTLE PUBLIC UTILITY (SPU) INFRASTRUCTURE
   - 4.1. CONTRACTOR SHALL NOT REPAIR DAMAGE TO CHARGED WATER MAINS OR SERVICES, BUT SHALL IMMEDIATELY NOTIFY THE SPU EMERGENCY DISPATHER AT (206) 386-1800.
   - 4.2. IF A CAST IRON PIPE (CIP) PIPE BELL IS EXPOSED DURING CONSTRUCTION, CONTRACTOR SHALL CONTACT SPU EMERGENCY DISPATCHER AT (206) 386-1800. A CREW WILL BE DISPATCHED TO INSPECT THE BELL AND DETERMINE IF IT SHOULD BE RE-CAULKED.
   - 4.3. WHEN CROSSING EXISTING UTILITIES, A CONTRACTOR SHALL MAINTAIN 18" MINIMUM VERTICAL CLEARANCE FROM OUTSIDE WALL OF ALL SPU FACILITIES TO THE OUTSIDE WALL OF THE PROPOSED LINE, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
   - 4.4. WHEN EXCAVATING UNDER SPU WATER MAINS, CONTRACTOR SHALL SUBMIT A WATER MAIN SUPPORT AND PROTECTION PLAN. THE PLAN SHALL SHOW HOW THE PIPE WILL BE SUPPORTED AND METHOD OF EXCAVATION AROUND THE PIPE.

TRAFFIC CONTROL (TC) GENERAL NOTES:

TC.1. INTERIM TRAFFIC CONTROL: THE CONTRACTOR SHALL BE RESPONSIBLE FOR INTERIM TRAFFIC CONTROL DURING CONSTRUCTION ON OR ALONG TRAVELED CITY ROADS. REFER TO SPECIAL PROVISION SECTION 1-10.2(2) FOR REQUIREMENTS REGARDING TRAFFIC CONTROL PLANS.

TC.2. TRAFFIC CONTROL SHALL FOLLOW THE GUIDELINES OF SECTION 1-07.23 OF THE WSDOT/APWA STANDARD SPECIFICATIONS.

TC.3. ALL BARRICADES, SIGNS AND FLAGGING SHALL CONFORM TO THE REQUIREMENTS OF THE MUTCD. FOR MORE SPECIFIC REQUIREMENTS FOR BARRICADES, SEE SECTION 5.7 AND DRAWING NO. 5-003 OF KING COUNTY ROAD STANDARDS. SIGNS MUST BE LEGIBLE AND VISIBLE AND SHALL BE REMOVED AT THE END OF EACH WORK DAY IF NOT APPLICABLE AFTER CONSTRUCTION HOURS.

TC.4. TEMPORARY ROAD CLOSURES AND DETOURS: WHEN CITY AGREES THAT TEMPORARY ROAD CLOSURES CANNOT BE AVOIDED THE CONTRACTOR SHALL POST "TO BE CLOSED" SIGNS A MINIMUM OF FIVE DAYS PRIOR TO THE CLOSURE. THE TYPES AND LOCATIONS OF THE SIGNS SHALL BE SHOWN ON A DETOUR PLAN. A DETOUR PLAN MUST BE PREPARED AND SUBMITTED TO THE CITY OF SHORELINE PLANNING AND DEVELOPMENT SERVICES DEPARTMENT AT LEAST 10 WORKING DAYS IN ADVANCE, AND APPROVED PRIOR TO CLOSING ANY CITY ROAD. IN ADDITION, THE CONTRACTOR MUST NOTIFY, IN WRITING, LOCAL FIRE, SCHOOL, LAW ENFORCEMENT AUTHORITIES, METRO TRANSIT, AND ANY OTHER AFFECTED PERSONS AS DIRECTED BY THE ENGINEER AT LEAST FIVE DAYS PRIOR TO CLOSING.

TC.5 ANY INTERRUPTION OF NORMAL TRAFFIC FLOW SHALL REQUIRE TRAFFIC CONTROL - INCLUDING BUT NOT LIMITED TO FLAGGING - WHICH SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF TRAFFIC IMPACT.

TC.6 CONTRACTOR SHALL PROTECT EXISTING TRAFFIC CONTROL SIGNS WITHIN THE LIMITS OF WORK.

TC.7 ALL SITES MUST REVERT TO PASSIVELY FUNCTIONAL (NO FLAGGERS NEEDED, ETC) TRAFFIC LANE CONFIGURATIONS OUTSIDE OF WORK HOURS EXCLUDING WHEN ROAD IS CLOSED FOR CULVERT CONSTRUCTION.

TC.8 MINIMIZE ACCESS IMPACTS TO DRIVEWAYS. CONTRACTOR SHALL NOT BLOCK ANY DRIVEWAY WITHOUT HAVING OBTAINED PRIOR APPROVAL FROM RESIDENT. CONTRACTOR SHALL RESTORE DRIVEWAY ACCESS AT THE END OF EACH WORKING DAY.

TREE PROTECTION NOTES (TP):

1. BEFORE ANY CLEARING OR GRADING OCCURS INSTALL TREE PROTECTION AS REQUIRED.
2. DO NOT ALLOW FILL, EXCAVATION, THE STORAGE OF TOOLS, EQUIPMENT, CONSTRUCTION MATERIALS OR STOCKPILE OIL, OR TRAFFIC OR UTILITY CONSTRUCTION INCLUDING IRRIGATION SYSTEMS WITHIN THE DRIP-LINE AREAS OF TREES THAT ARE TO BE RETAINED EXCEPT AS SHOWN ON THE PLANS.
3. PROTECT AS MUCH OPEN SOIL SURFACE BELOW THE TREE'S CROWN AS POSSIBLE.
4. WHEN TRENCHING WITHIN THE ROOT ZONE OF PROTECTED TREES, THE FOLLOWING PROCEDURE MUST BE FOLLOWED:
   - 4.A. TO THE MAXIMUM EXTENT POSSIBLE, THE HOE SHOULD BE OPERATED TO "COMB" THE MATERIAL IN A DIRECTION AWAY FROM THE TRUNK, AS OPPOSED TO CUTTING ACROSS THE ROOTS.
   - 4.B. TUNNEL UNDER ROOTS GREATER THAN 1" DIAMETER. CLEANLY CUT ANY TORN ROOTS TO THE EDGE OF THE TRENCH. COVER EXPOSED ROOTS WITH VISQUEEN OR LIKE MATERIAL AND KEEP MOIST DURING OPEN GROUND PROCEDURES
   - 4.C. IF ANY ROOTS OF ONE INCH DIAMETER OR GREATER OF THE TREE ARE ACCIDENTALLY DAMAGED BY THE EQUIPMENT, STOP EQUIPMENT OPERATION AND EXCAVATE AROUND THE TREE ROOT BY HAND/SHOVEL AND CLEAN CUT DAMAGED PORTIONS OF THE TREE ROOT WITH LOPPER OR PRUNING SAW. EQUIPMENT OPERATION CAN RESUME, WORKING CAREFULLY AROUND EXPOSED LARGE ROOTS TO BE PROTECTED.
5. INSTALL FLOW DIVERSION MEASURES OUTSIDE OF THE CRITICAL ROOT ZONE OF TREES TO BE PROTECTED. AT NO TIME SHALL CONSTRUCTION STORMWATER BE DIRECTED TOWARD TREES TO BE PROTECTED. CONSTRUCTION STORMWATER SHALL NOT POND WITHIN A TREE'S CRITICAL ROOT ZONE.
6. CONCRETE TRUCKS SHALL NOT DEPOSIT WASTE OR WASH OUT MATERIALS FROM THEIR TRUCKS WITHIN THE TREE PROTECTION ZONE OR AREAS THAT DRAIN TO THE TREE PROTECTION ZONE.
7. ALL TREE WORK, INCLUDING ROOT PRUNING SHALL CONFORM TO CURRENT ADOPTED STANDARDS OF THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) A300. ALL TREE PRUNING SHALL COMPLY WITH THE CURRENT SAFETY STANDARDS ANSI Z133.1 FOR PRUNING.
8. DO NOT ALLOW FILL, EXCAVATION, THE STORAGE OF TOOLS, EQUIPMENT, CONSTRUCTION MATERIALS OR STOCKPILE SOIL OR TRAFFIC OR UTILITY CONSTRUCTIOIN INCLUDING IRRIGATION SYSTEMS WITHIN THE DRIP-LINE AREAS OF TREES THAT ARE TO BE RETAINED.

ORIGINATED BY: / DATE: /
CHECKED BY: / DATE: /
BACK-CHECKED BY: / DATE: /
CORRECTED BY: / DATE: /
VERIFIED BY: / DATE: /

O:\proj\Y2015\15-05984-000\CAD\Dwg\G-2.dwg | 2/1/2018 2:05 PM | Eric Marshall

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE. IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

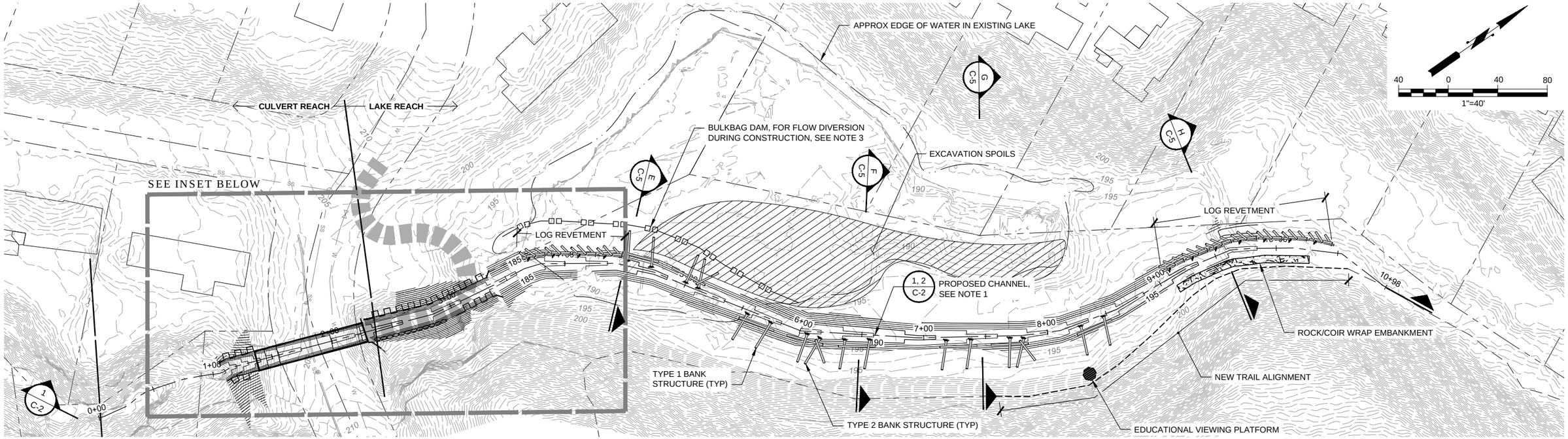
I. R. MOSTRENKO — STATE OF WASHINGTON — 36069 — REGISTERED PROFESSIONAL ENGINEER — DRAFT

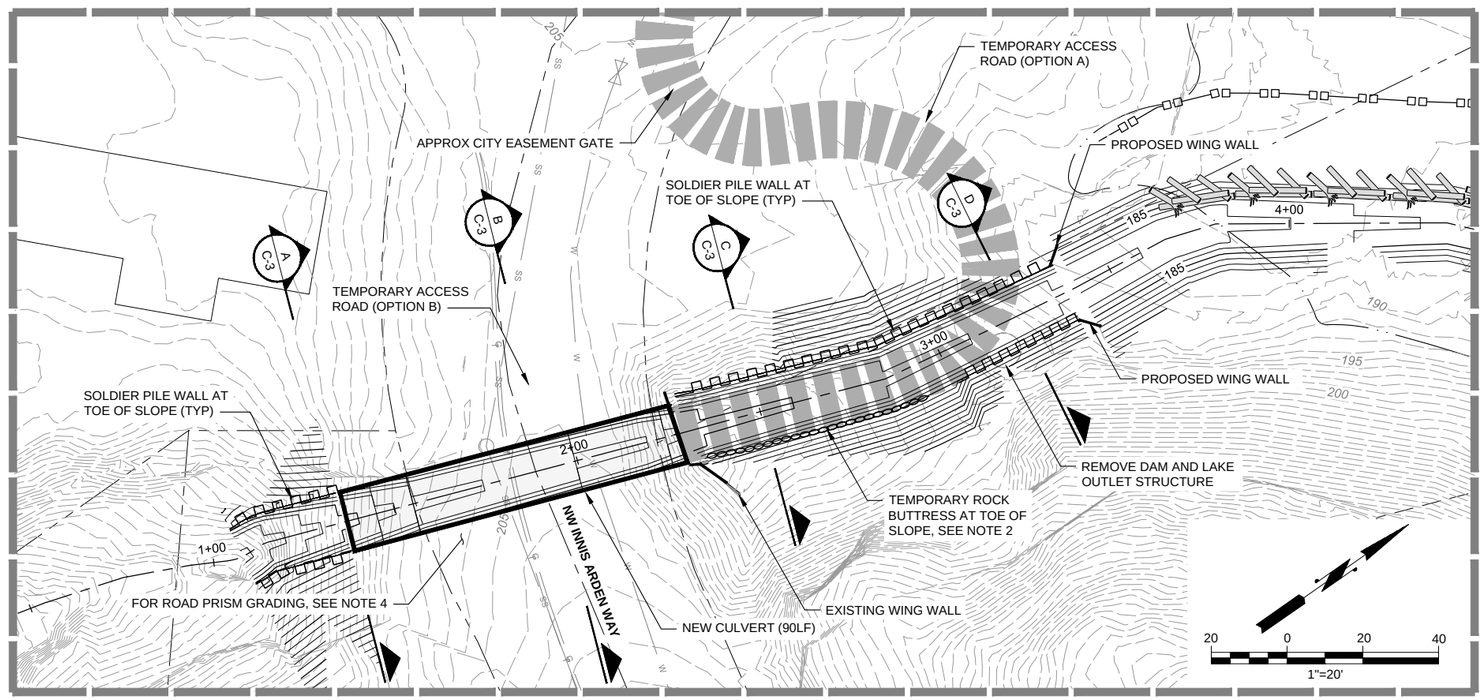
DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL		
DESIGNED: V. WU	DRAWN: -		
DESIGNED: -	CHECKED: -		
SCALE: AS NOTED	APPROVED: M. EWBANK		

HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

GENERAL NOTES

DATE: JANUARY 2018
PROJECT NO: 15-05984-000
DRAWING NO: G-2
SHEET NO: 2 OF 7





NOTES:

1. MEANDER STREAM CENTERLINE WITHIN THE CORRIDOR AS DIRECTED BY THE ENGINEER.
2. PLACE TEMPORARY ROCK BUTTRESS IF LAKE REACH IS CONSTRUCTED BEFORE CULVERT REACH.
3. FLOW BYPASS INDICATED IN THE 1995 KING COUNTY HIDDEN LAKE RESTORATION PLAN SET MAY BE USED FOR FLOW DIVERSION IF IT IS INTACT AND FUNCTIONAL.
4. GRADED CONTOURS NOT SHOWN. EXTENT OF ROAD PRISM GRADING WILL DEPEND ON WHETHER OPTION A OR OPTION B IS SELECTED. SEE SECTION A ON DRAWINGS C-3 AND C-4.

LEGEND:

- PARCEL LINE
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EXISTING TRAIL (APPROX LOCATION)

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

DRAFT

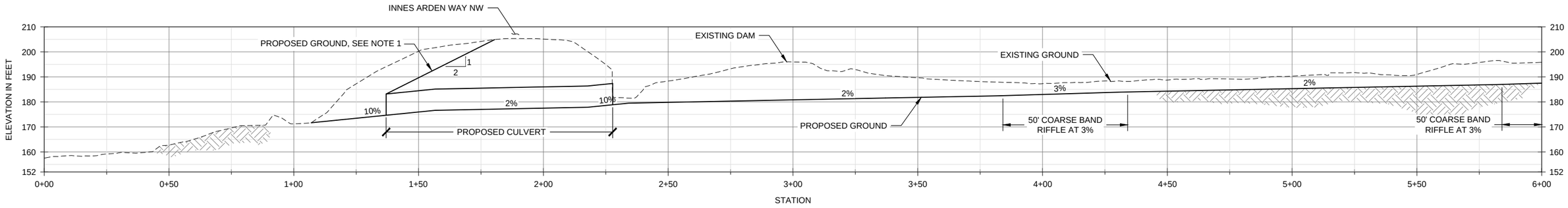
DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL	DATE: JANUARY 2018	
DESIGNED: V. WU	DRAWN: -	PROJECT NO: 15-05984-000	
DESIGNED: -	CHECKED: -	DRAWING NO: C-1	
SCALE: AS NOTED	APPROVED: M. EWBANK	SHEET NO: 3 OF 7	

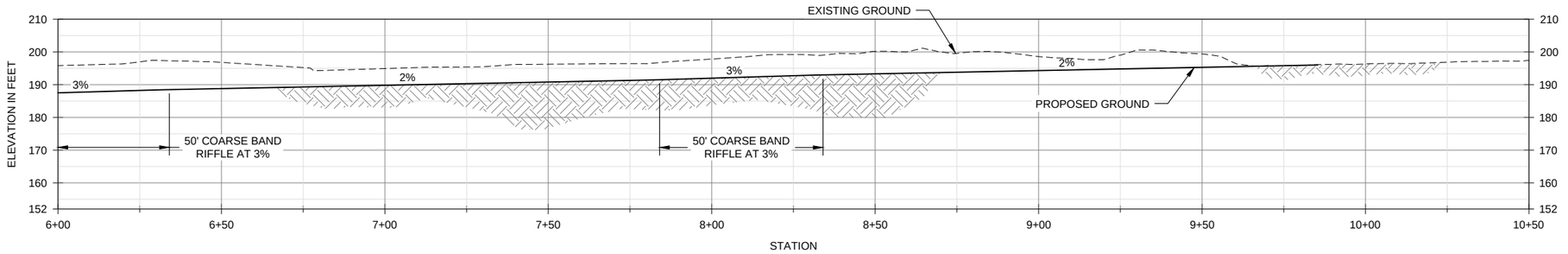
HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

SITE PLAN

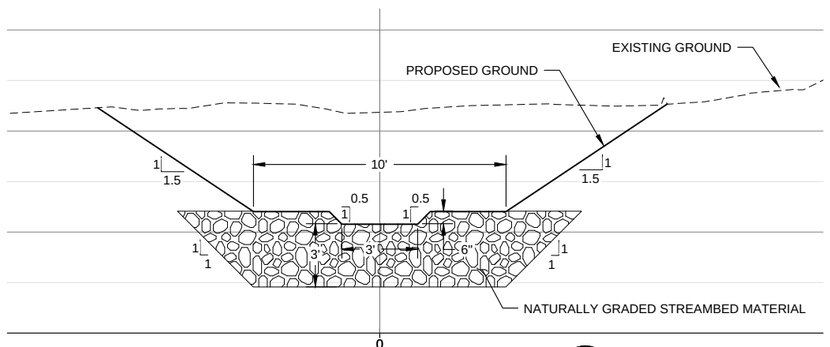
ORIGINATED BY: / DATE: / /
CHECKED BY: / DATE: / /
BACK-CHECKED BY: / DATE: / /
CORRECTED BY: / DATE: / /
VERIFIED BY: / DATE: / /

O:\proj\2015\15-05984-000\CAD\Dwg\C-1.dwg | 2/1/2018 2:05 PM | Eric Marshall

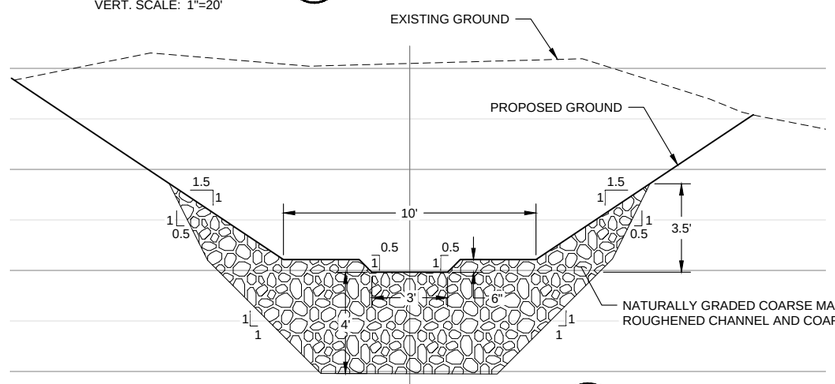




PROFILE - CHANNEL (1 / C-1)
HORIZ. SCALE: 1"=20'
VERT. SCALE: 1"=20'



DETAIL - TYPICAL CHANNEL AT 2% (1 / C-1)
SCALE: NTS



DETAIL - TYPICAL CHANNEL > 2% (2 / C-1)
SCALE: NTS

NOTES:

1. UTILITIES MAY NEED TO BE REALIGNED TO ACCOMMODATE PROPOSED GRADING. EXTENT OF GRADING WILL VARY. SEE NOTE 4 ON DRAWING C-1.

LEGEND:

EXISTING SUBGRADE

STREAMBED SEDIMENT

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

JAMES M. MOSTRENKO — STATE OF WASHINGTON — 36069 — REGISTERED PROFESSIONAL ENGINEER — DRAFT

DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL		
DESIGNED: V. WU	DRAWN: -		
DESIGNED: -	CHECKED: -		
SCALE: AS NOTED	APPROVED: M. EWBANK		

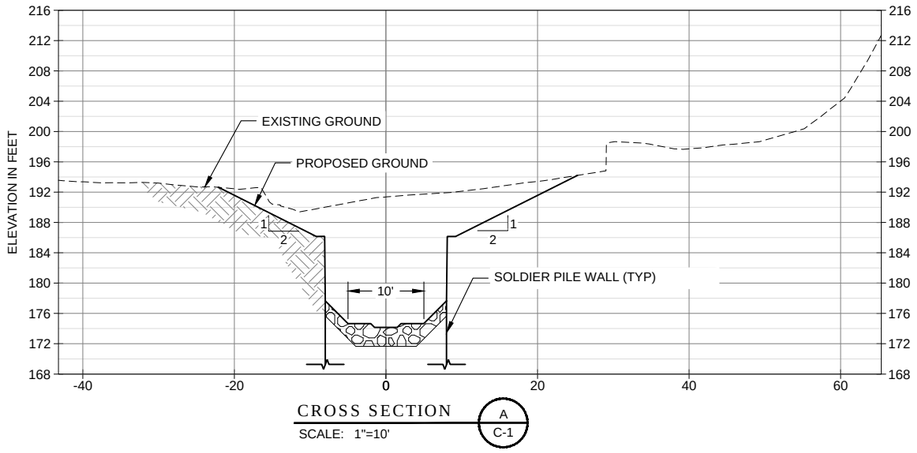
HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

CHANNEL PROFILE

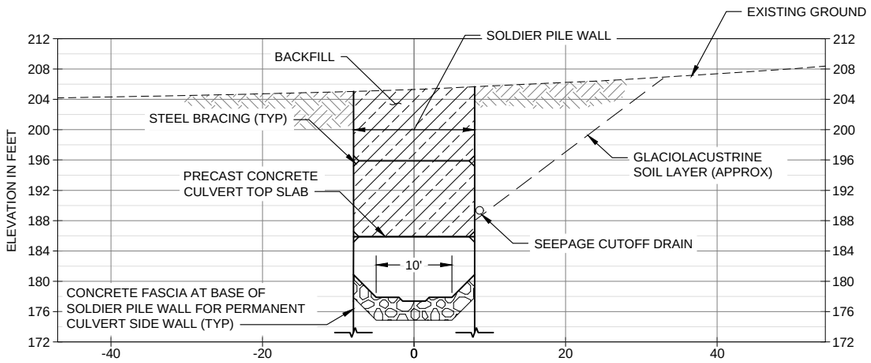
DATE: JANUARY 2018
PROJECT NO: 15-05984-000
DRAWING NO: C-2
SHEET NO: 4 OF 7

ORIGINATED BY: / DATE:
CHECKED BY: / DATE:
BACK-CHECKED BY: / DATE:
CORRECTED BY: / DATE:
VERIFIED BY: / DATE:

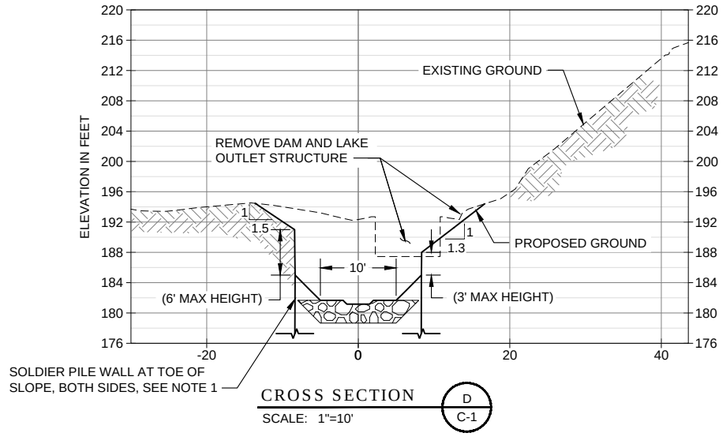
O:\proj\Y2015\15-05984-000\CAD\dwg\C-2.dwg | 2/1/2018 2:05 PM | Eric Marshall



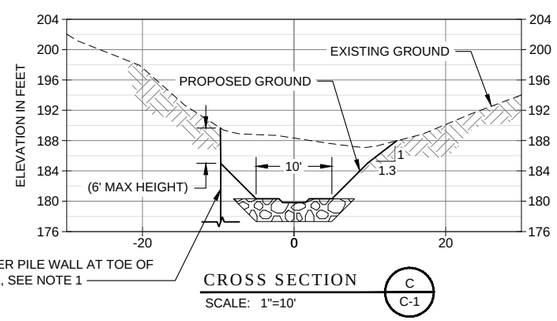
CROSS SECTION A / C-1
SCALE: 1"=10'



CROSS SECTION B / C-1
SCALE: 1"=10'



CROSS SECTION D / C-1
SCALE: 1"=10'



CROSS SECTION C / C-1
SCALE: 1"=10'

TYPICAL SOLDIER PILE SHORING WALL

TYPICAL FISH PASSABLE CULVERT INSTALLATION

CITY OF BELLEVUE COAL CREEK PARKWAY PROJECT
TYPICAL CHANNEL THROUGH CULVERT

TYPICAL SOLDIER PILE WALL AT TOE OF SLOPE

NOTES:

1. SOLDIER PILE WALL USED FOR EXCAVATION SHORING AND PERMANENT CULVERT WALLS. DEPTH OF SHORING NOT SHOWN AND WILL BE DETERMINED AS PART OF FINAL DESIGN.

LEGEND:

EXISTING SUBGRADE

STREAMBED SEDIMENT

ORIGINATED BY: / DATE:
CHECKED BY: / DATE:
BACK-CHECKED BY: / DATE:
CORRECTED BY: / DATE:
VERIFIED BY: / DATE:
O:\proj\Y2015\15-05984-000\CAD\Dwg\C-CROSS SECTIONS.dwg | 2/1/2018 2:05 PM | Eric Marshall

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE. IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

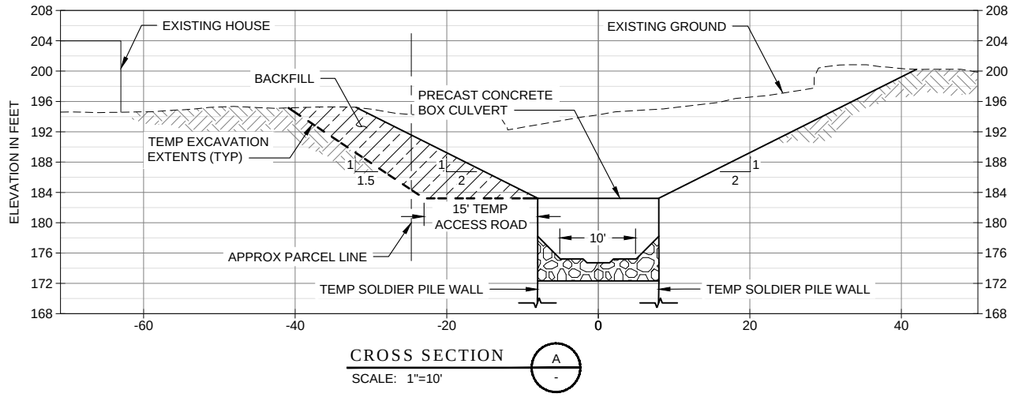
DRAFT

DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL
DESIGNED: V. WU	DRAWN: -
DESIGNED: -	CHECKED: -
SCALE: AS NOTED	APPROVED: M. EWBANK

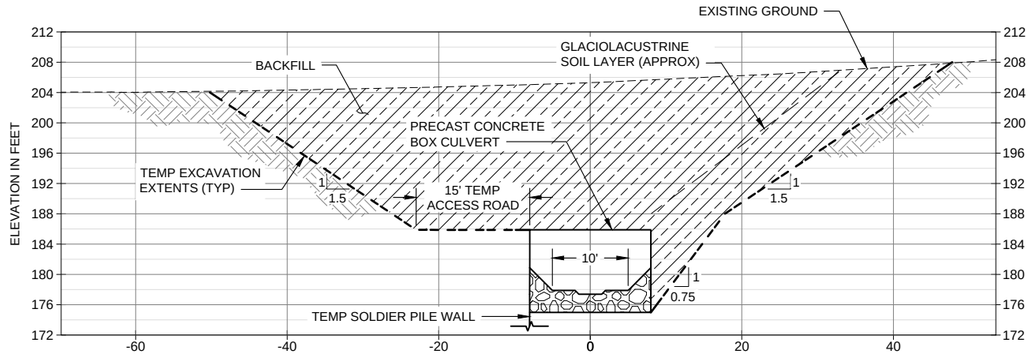
HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

CHANNEL CROSS SECTIONS - CULVERT REACH OPTION A (VERTICAL SHORING WALLS WITH CAST-IN-PLACE CULVERT)

DATE: JANUARY 2018
PROJECT NO: 15-05984-000
DRAWING NO: C-3
SHEET NO: 5 OF 7

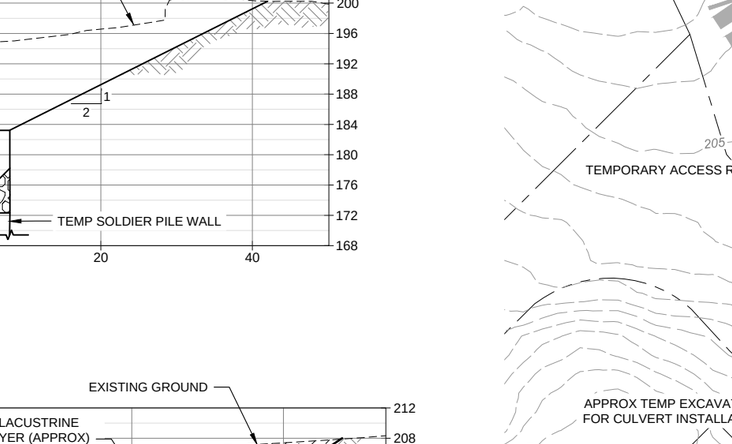


CROSS SECTION A
SCALE: 1"=10'

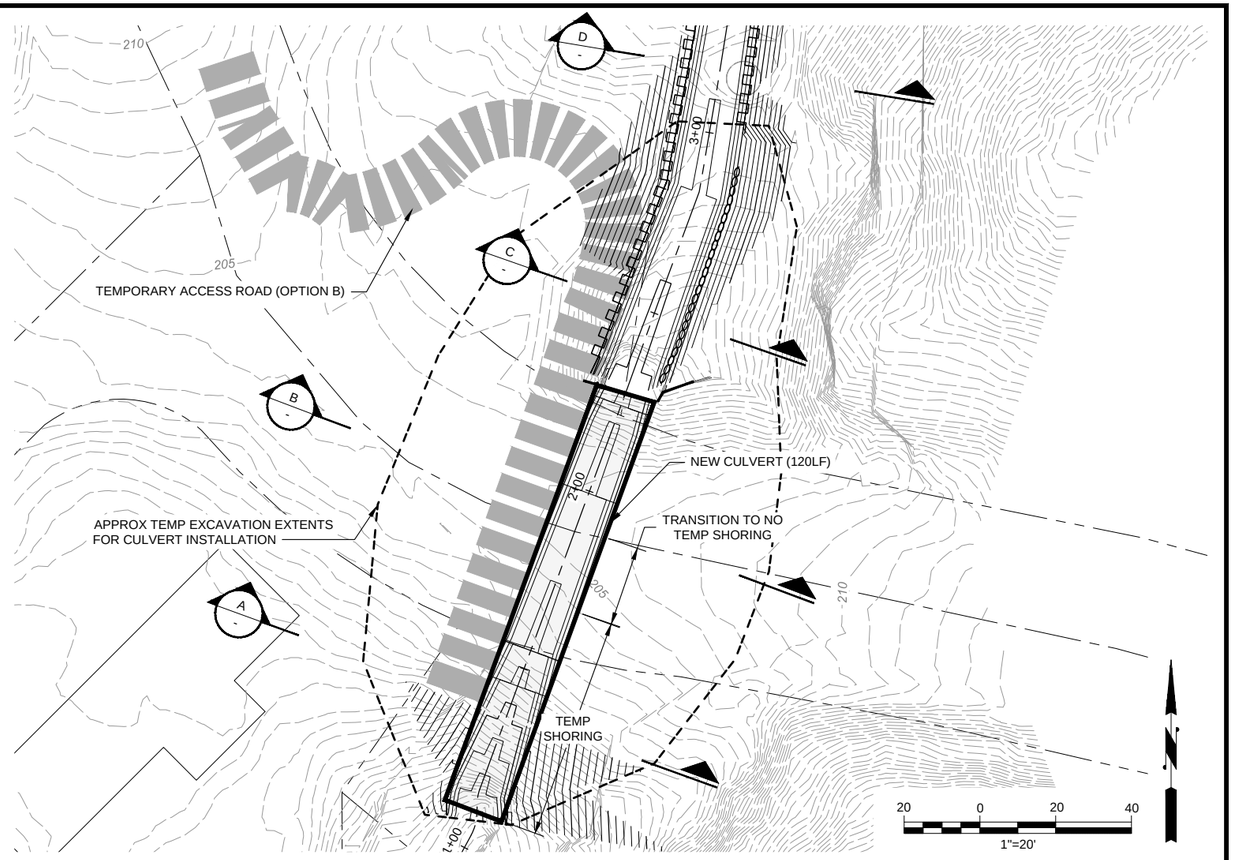


CROSS SECTION B
SCALE: 1"=10'

CROSS SECTION C
SCALE: 1"=10'



CROSS SECTION D
SCALE: 1"=10'



NOTES:

1. SOLDIER PILE WALL USED FOR EXCAVATION SHORING AND PERMANENT CULVERT WALLS. DEPTH OF SHORING NOT SHOWN AND WILL BE DETERMINED AS PART OF FINAL DESIGN.

LEGEND:

EXISTING SUBGRADE

STREAMBED SEDIMENT

TYPICAL PRECAST BOX CULVERT INSTALLATION

ORIGINATED BY: / DATE:
CHECKED BY: / DATE:
BACK-CHECKED BY: / DATE:
CORRECTED BY: / DATE:
VERIFIED BY: / DATE:

O:\proj\Y2015\15-05984-000\CAD\Dwg\C-CROSS SECTIONS.dwg | 2/1/2018 2:05 PM | Eric Marshall

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

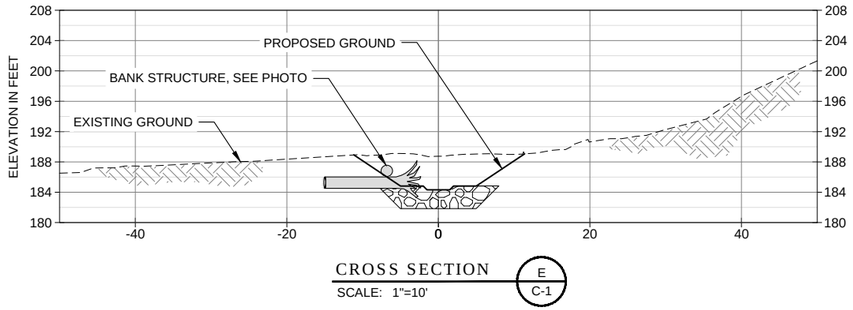
IAN B. MOSTRENKO — STATE OF WASHINGTON — 36069 — REGISTERED PROFESSIONAL ENGINEER — DRAFT

DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL		
DESIGNED: V. WU	DRAWN: -		
DESIGNED: -	CHECKED: -		
SCALE: AS NOTED	APPROVED: M. EWBANK		

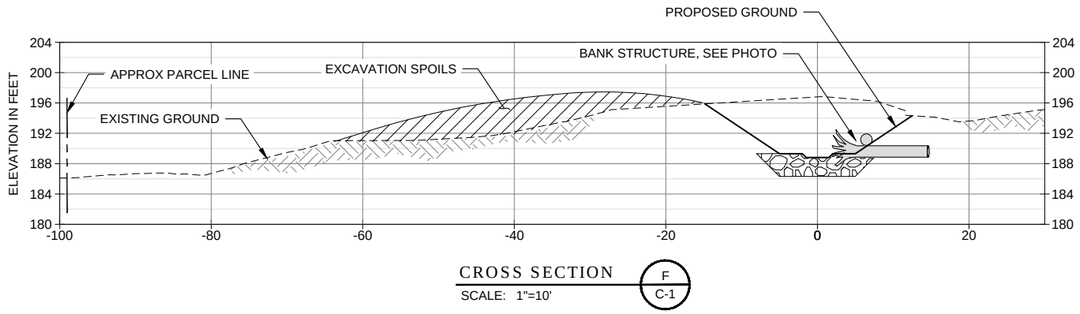
HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

CHANNEL CROSS SECTIONS - CULVERT REACH OPTION B
(SLOPED EXCAVATION WITH PRECAST BOX CULVERT)

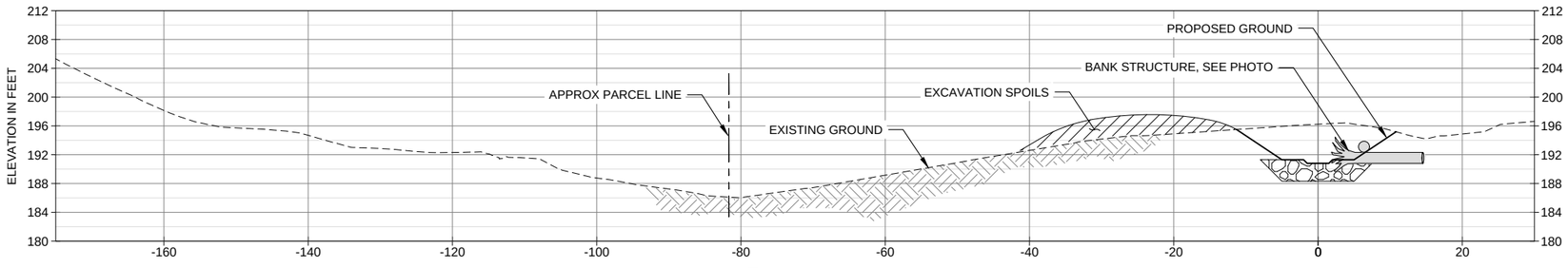
DATE: JANUARY 2018
PROJECT NO: 15-05984-000
DRAWING NO: C-4
SHEET NO: 6 OF 7



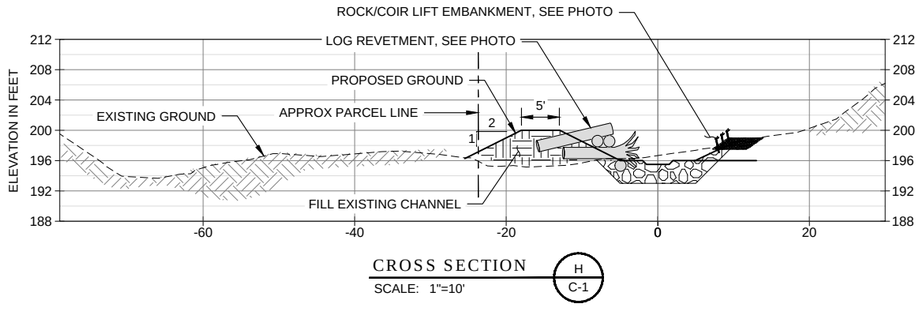
CROSS SECTION E / C-1
SCALE: 1"=10'



CROSS SECTION F / C-1
SCALE: 1"=10'



CROSS SECTION G / C-1
SCALE: 1"=10'



CROSS SECTION H / C-1
SCALE: 1"=10'

LEGEND:

- EXISTING SUBGRADE
- STREAMBED SEDIMENT
- SELECT BERM FILL

TYPICAL BANK STRUCTURE

TYPICAL LOG REVETMENT

TYPICAL ROCK/COIR WRAP EMBANKMENT

ORIGINATED BY: / DATE:
CHECKED BY: / DATE:
BACK-CHECKED BY: / DATE:
CORRECTED BY: / DATE:
VERIFIED BY: / DATE:

O:\proj\Y2015\15-05984-000\CAD\dwg\C-CROSS SECTIONS.dwg | 2/1/2018 2:05 PM | Eric Marshall

CONCEPTUAL DESIGN - NOT FOR CONSTRUCTION

No.	REVISION	BY	APP'D	DATE

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

IAN B. MOSTRENKO — STATE OF WASHINGTON — 56069 — REGISTERED PROFESSIONAL ENGINEER — DRAFT

DESIGNED: I. MOSTRENKO	DRAWN: E. MARSHALL
DESIGNED: V. WU	DRAWN: -
DESIGNED: -	CHECKED: -
SCALE: AS NOTED	APPROVED: M. EWBANK

HIDDEN LAKE
DAM REMOVAL CONCEPTUAL DESIGN

CHANNEL CROSS SECTIONS - LAKE REACH

DATE:	JANUARY 2018
PROJECT NO:	15-05984-000
DRAWING NO:	C-5
SHEET NO:	7 OF 7

APPENDIX B

Geotechnical Analysis Memorandum

HWA GeoSciences Inc.
Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

February 1, 2018
HWA Project No. 2017-096-21

Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121

Attention: Mr. Mark Ewbank, P.E.

SUBJECT: PRELIMINARY GEOTECHNICAL REPORT
HIDDEN LAKE DAM REMOVAL AND STREAM RESTORATION PROJECT
Shoreline, Washington

Dear Mark:

This letter report presents the results of our geologic and geotechnical evaluation for the Hidden Lake Dam Removal and Stream Restoration project in Shoreline, Washington. Herein we provide our interpretations of geology and geomorphology of the project site; preliminary geotechnical recommendations regarding slope stability, temporary shoring, subgrade for structures, and earthwork for removal of the dam north of Innis Arden Way; and replacement of the culverts beneath Innis Arden Way.

PROJECT SCOPE AND AUTHORIZATION

Our work was performed in general accordance with our proposal letter dated September 12, 2017. Written authorization to proceed was provided by Mark Ewbank in an e-mail on October 3, 2017. Our work thus far has consisted of review of previous subsurface exploration data, geologic and geomorphic reconnaissance of the slopes, drilling four borings, evaluating conceptual design considerations for dam removal and replacement of the culverts beneath the road, and preparation of this preliminary geotechnical report.

PROJECT BACKGROUND

We understand the City of Shoreline is exploring the option to remove the existing dam that has created Hidden Lake. Along with dam removal, preliminary design is also considering the feasibility of replacing the existing twin 48-inch diameter reinforced concrete culverts below Innis Arden Way with a larger, fish-friendly box culvert.

The site is located within the Boeing Creek valley at the southern end of Hidden Lake, west of Shoreline Community College and Shoreview Park (see Figure 1).

21312 30th Drive SE
Suite 110
Bothell, WA 98021.7010

Tel: 425.774.0106
Fax: 425.774.2714
www.hwageo.com

We understand the lake was initially created as an amenity to the Boeing estate by damming Boeing Creek. During the 1950s to 1970s development upstream of the lake resulted in greater storm water flows leading to persistent erosion issues. The original earthen dam failed, and the lake had filled with sediment by the 1970s. In 1996, King County rebuilt the dam and recreated the lake. In 1997, a sinkhole formed due to ruptured sewer lines near 175th Street and the lake filled in with sediment again requiring that the lake be re-excavated. The lake has been maintained since then; however, sediment deposition into the lake has been of the order of a thousand cubic yards per year. The City has elected to stop dredging to maintain the lake. Without periodic removal of sediment, the lake will fill with sediment and could impact other utilities and the infrastructure in the road. To mitigate these risks, the City is exploring the options for removing the dam and upsizing and/or lowering the culverts that flow under Innis Arden Way.

FIELD INVESTIGATION

HWA performed a reconnaissance of the site to assess the stability of slopes and evaluate surficial soil conditions in the vicinity of the dam and culvert. The depths of weathered soil on slopes (colluvium) were determined at selected locations using a ½-inch diameter steel T-handled probe. Observations were made of soil exposures, seepage zones and other features indicating relative slope stability.

Two boreholes (designated BH-1 and BH-2) were drilled on the slope east of the culverts downstream of the dam on October 31, 2017. Drilling was performed by Geologic Drill Explorations, Inc. under subcontract to HWA. They were drilled with a Bobcat Mini-track drill rig to depths of 31.5 feet. Two additional boreholes (designated BH-3 and BH-4) were drilled within the Innis Arden Way road prism on November 9, 2017 by Environmental Drilling, Inc. also under subcontract to HWA. These were drilled with a truck-mounted Mobile B-61 rig to depths of 49 feet. Locations of the borings, along with previous borings by others, are shown on the Site and Exploration Plan, Figure 2.

Soil samples were collected at 2½- to 5-foot depth intervals using Standard Penetration Test (SPT) sampling methods. SPT testing consisted of using a 2-inch outside diameter, split-spoon sampler driven with a 140-pound hammer. For BH-1 and BH-2, the SPT was performed using a rope and cathead with safety hammer. For BH-3 and BH-4, the SPT was performed using an automatic hammer. During the test, each sample was obtained by driving the sampler up to 18 inches into the soil with the hammer free-falling 30 inches per blow. The number of blows required for each 6 inches of penetration was recorded. The standard penetration resistance of the soil was calculated as the number of blows required for the final 12 inches of penetration. If a total of 50 blows was recorded within a single 6-inch interval, the test was terminated, and the blow count was recorded as 50 blows/number of inches of penetration. This resistance provides

an indication of the relative density of granular soils and the relative consistency of cohesive soils.

All explorations were drilled under the full-time supervision and observation of an HWA engineering geologist or geotechnical engineer. Soil samples obtained from the explorations were classified in the field and representative portions were placed in plastic bags. These soil samples were then taken to our Bothell, Washington, laboratory for further examination.

Pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and ground water occurrence was recorded and used to develop logs of each of the explorations. A legend of the terms and symbols used on the borehole logs is presented on Figure A-1, and the logs are presented on Figures A-2 through A-5.

The stratigraphic contacts shown on the borehole logs represent the approximate boundaries between soil types. Actual transitions may be more gradual. The ground water conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times.

GENERAL GEOLOGIC CONDITIONS

The project is located within the Puget Lowland. The Puget Lowland has repeatedly been occupied by a portion of the continental glaciers that developed during the ice ages of the Quaternary period. During at least four periods, portions of the ice sheet advanced south from British Columbia into the lowlands of Western Washington. The southern extent of these glacial advances was near Olympia, Washington. Each major advance included numerous local advances and retreats, and each advance and retreat resulted in its own sequence of erosion and deposition of glacial lacustrine, outwash, till, and drift deposits. Between and following these glacial advances, sediments from the Olympic and Cascade Mountains accumulated in the Puget Lowland in lakes and valleys.

Geologic information for the project area was obtained from the *Geologic Map of the Edmonds East and part of the Edmonds West Quadrangles, Washington* (Minard, 1983). Per this map, near-surface deposits in the vicinity of the project alignment consist of soils associated with the Vashon Stade of the most recent continental glaciation (Fraser Glaciation). The geologic map indicates that the project area is underlain by Transitional Beds deposits, which consist of a combination of glaciolacustrine deposits and non-glacial lake deposits. Geomorphology of the Boeing Creek valley indicates it was cut through these deposits (and advance outwash and glacial till on higher slopes) by glacial outwash channels and subsequent non-glacial alluvial processes.

SUBSURFACE CONDITIONS

SOIL CONDITIONS

On the slope east of the creek, between the dam and Innis Arden Way, boreholes BH-1 and BH-2 encountered approximately 7½ feet of soft silt and clay with organics (colluvium) above and below fill closer to the dam (at BH-1) and alluvium closer to Innis Arden Way (at BH-2). These modern deposits were over very stiff to hard, clay and silt (glaciolacustrine deposits). This hard clay/silt unit is exposed in a 15-foot high bluff just above the colluvial slope explored by boreholes BH-1 and BH-2, and on both sides of the stream valley downstream of Innis Arden Way.

The borings within Innis Arden Way encountered from 12½ to 24 feet of fill over alluvium, then glaciolacustrine deposits to the full depths explored.

Descriptions of the soils are given below, and shown on the geologic cross sections (see Figures 3 and 4):

- **Colluvium:** Soft clay with organics and scattered sand was encountered at the ground surface in boreholes BH-1 and BH-2. This recent deposit consists of soils that have moved downslope due to processes of weathering (chemical, mechanical, and biological), gravity, and water. Further weathering of the slope above will add to the thickness of colluvium, with potential periodic slide events contributing material episodically.
- **Fill/Buried Topsoil:** Fill was observed in each of our borings, except BH-2. Boring BH-1 encountered a thin layer of fill above and below the colluvium. Roadway prism fill consisting of loose to medium dense, slightly silty to silty, sand with no to little gravel was encountered in borings BH-3 and BH-4. Below the fill in BH-4, a buried topsoil layer was observed.

  Also, previous borings at the dam by Perrone Consulting (2015; borings B-1 and B-2) encountered dam fill (placed in 1996) consisting of sandy lean clay and silty sand with gravel.
- **Alluvium:** Boreholes BH-3 and BH-4 encountered sand and gravel alluvium beneath the roadway fill, for a thickness ranging from approximately 3½ to 8 feet. This material was saturated and associated with perched ground water above the underlying glaciolacustrine deposits. Borehole BH-2 encountered a thin lens of alluvium sandwiched within the colluvium. Previous explorations also encountered alluvium to various depths, including below the slide debris.
- **Slide Debris:** Although we did not encounter this unit at the locations drilled for this study, previous borings (Shannon & Wilson, 1995) encountered suspected slide

debris toward the western portion of the dam location. This deposit consists of soft to medium stiff, fat clay and silty clay with slickensides and blocky texture.

- **Glaciolacustrine:** This unit consists of very stiff to hard, gray, silty clay, lean clay and fat clay. The glaciolacustrine deposits ranged from massive, to finely laminated, to disturbed with blocky texture. Within the fat clay observed between 31 to 47 feet in BH-3 and 37 to 47 feet in BH-4, slickensides were observed and are likely due to compression forces experienced during the Fraser Glaciation. Glaciolacustrine deposits typically have high shear strength and low permeability, with ground water often perched within more permeable materials on top of the glaciolacustrine deposits.

GROUND WATER CONDITIONS

Ground water was observed during drilling of BH-3 and BH-4, particularly within the alluvium. The highest ground water level in BH-4 was at a depth of 6 feet during drilling, which likely represents perched ground water within the silty fill. Ground water was encountered in most of the previous borings by others within 10 feet of the ground surface. We expect ground water levels will vary depending on location, season, and the relative abundance of precipitation.

CONCLUSIONS & RECOMMENDATIONS

GENERAL

Design for the proposed dam removal and stream restoration will require excavation of the existing materials at the dam and regrading of the slopes along the sides of the channel upstream of Innis Arden Way. Along with dam removal, the City of Shoreline is considering replacing the existing twin 48-inch culverts that flow under Innis Arden Way. The existing culverts would likely be replaced with a pre-cast concrete box structure.

The excavation for culvert replacement will be on the order of 30 feet deep and could be completed as an open cut excavation, although some shoring may be necessary at the base of the excavation. More extensive shoring, such as soldier piles and lagging may be necessary, but only where the excavation would otherwise extend onto adjacent properties or easements. The Contractor will be responsible to provide a safe excavation and design any shoring system used in the excavation.

Grading of the stream channel north of Innis Arden Way will likely require the use of wing walls or toe walls north of the box culvert. These could consist of cast-in-place or soldier pile and lagging walls. Sloping and stream bank stabilization should be provided to limit erosion of the permanent slopes once the dam is removed.

Other construction issues will be the protection of the existing 8-inch diameter sewer line that crosses the site in Innis Arden Way, control of seepage as needed, potential re-use of the excavated materials and protection of the subgrade once the excavation is completed.

EXCAVATION

Installation of the culvert and removal of the dam can likely be accomplished using open cut with minimal shoring. There appears to be adequate room along the west side of the culvert alignment to provide stable, sloped excavations. The dense native soils along the east side of the culvert are likely to be stable at relatively steep slopes after removal of the overlying loose colluvial soils. Where adequate room is not available, shoring such as soldier pile and lagging may be required to provide protection for workers.

The upper 15 feet to 30 feet of soils below Innis Arden Way consist of silty sand interpreted to be fill and alluvial soils. The fill is generally thicker on the west side of the culverts (32 feet in BH-4) when compared with the east side (17 feet in BH-3). These soils classify as Type C soils in accordance with Part N of the WAC 196-297 and can be sloped no steeper than 1.5H:1V to meet safety requirements for worker access during construction. Below the alluvium is very stiff to hard glaciolacustrine soils that classify as Type A soils and could be sloped as steep as 0:75H:1V. These slopes could be used to estimate the approximate extent of the proposed excavations to determine if there is adequate room for sloped excavations. For the depth of fill observed in BH-4, a horizontal distance of 45 feet measured from the edge of the excavation would be needed to provide a 1.5H:1V slope.

On the east side of the culvert, the dense glaciolacustrine soil is likely to stand nearly vertical for heights on the order of 15 feet or more, as observed by the vertical slope to the east of the existing dam. During construction, a geotechnical engineer could evaluate this cut slope as the soils are exposed to see if slopes steeper than ¾ H:1V could be used while still maintaining worker safety, which would reduce the extent of the open cut. Evaluation and monitoring during excavation is recommended as the depths of the contacts between fill, alluvium, and glaciolacustrine are expected to vary significantly over short distances and conditions may require some limited shoring as the subsurface soils are exposed. In future phases of the design, we recommend drilling explorations on the slope south of Innis Arden Way to provide additional data regarding the approximate depth of the glaciolacustrine layer along the culvert alignment.

Shored Excavation with Internal Bracing

Where an open excavation using the applicable slopes for the soil types will extend a significant distance onto adjacent properties or impact adjacent structures, it may be prudent to consider a more extensive shoring system for the excavation. Shoring could consist of vertical elements such as steel sheet piles or soldier piles and wood lagging and, where necessary, could include the use of internal bracing. Given the hardness of the glaciolacustrine soil, it may be difficult to drive steel sheets a sufficient depth into these soils. This would make soldier piles and lagging the preferred option for vertical shoring.

Soldier pile and lagging walls are typically constructed with 10- to 12-inch diameter H-piles spaced 6 to 8 feet apart along the wall alignment. The piles are placed in vertical drilled holes

and the holes are backfilled with lean concrete. Excavation is made on the inside of the shoring and lagging is installed between the flanges of the piles as the excavation proceeds. Lean concrete must be chipped away to allow lagging installation.

Pre-Cast Concrete Culvert Design

We anticipate that pre-cast concrete box culverts will be used for this project. The foundations of the culvert would be placed on the existing soils at the base of the excavation. Two culvert types are available, one being a four-sided box culvert and the other being a three-sided U-shaped culvert. The advantage of a four-sided box culvert is that it spreads out the load across the bottom of the culvert, reducing the bearing capacity required and limiting differential settlement if materials with differing properties are encountered at the subgrade. It also reduces the potential for scour to undermine the foundations. A U-shaped culvert would require casting a separate footing prior to placement of the precast sections and would be more susceptible to differential settlement, particularly if soft/loose soils are encountered at subgrade elevation along the culvert alignment. The advantage of a three-sided box culvert is that it could reduce the depth of the excavation needed for installation, although there would be potential for added excavation depth needed to encounter suitable subgrade soils. Potential for scour below the footings would also need to be considered.

SLOPES AND RETAINING WALLS

Retaining Walls Upstream of Culvert

Grading for dam removal and culvert installation is expected to deepen and widen the channel when compared with the grades of the site prior to installation of the dam in 1996. Although the existing slopes on the upstream end of the culverts are currently stable, we recommend that retaining walls be considered where additional cut into the surrounding slopes is proposed.

For wall construction, temporary cuts into the slopes could be allowed for forming and casting wing walls integrated into the culvert structure, much like the structure in place today. Where cutting into the existing slope even for a temporary excavation is not desired, soldier piles and lagging could be used.

Slope Grading on Side of Channel

For the purposes of determining permanent grades of the eastern slope north of Innis Arden Way, we evaluated the steepness of the side slopes that will be suitable for streambank stability. Based on the existing topography, the side slopes of the current channel range from 1H:1V to 1.3H:1V. These angles are consistent with our estimate of the angle of repose for the colluvial and alluvial materials observed at the site, indicating that the factors of safety for slope stability are near or slightly above one. To provide for long-term stability, we recommend that the maximum slope angle be 1.5H:1V. Stream bank stabilization measures should also be implemented to reduce scour so that undermining of the slope is reduced.

For the west side of the channel, we understand the City would like to minimize disturbance to this side of channel. The existing slope is at 1.5H:1V and is expected to be in a stable configuration provided walls are constructed where cuts are made into the toe of the slope and erosion protection of the slopes is provided.

RETAINING WALLS DOWNSTREAM OF CULVERT

Retaining walls could be considered on the downstream end of the culvert to reduce the length of the culvert. For a pre-cast concrete culvert, the extent to which separate walls will be cost effective is likely limited. If more extensive shoring, such as soldier piles and lagging walls, are used, permanent cantilever soldier piles could be used. The length of the section where cantilever piles would be used to form an open channel will depend on the maximum steel section that the design team would like to use for the project. In our experience, the maximum height for which cantilever soldier pile walls are cost-effective is about 12 feet of retained height.

SEISMIC DESIGN

Permanent structures at the site will need to be designed to resist the forces imposed on the structure during a seismic event. This will include providing stable slopes during a seismic event for the toe walls and withstanding catastrophic failure of the culvert structure. We anticipate that design for the proposed structures will not be limited by the seismic design requirements. We do not anticipate having to design for the effects of liquefaction as there is only a thin zone of saturated material at the contact between the alluvium and the glaciolacustrine deposits.

CONSTRUCTABILITY CONSIDERATIONS

Utility Protection

Protection of the existing 8-inch sewer line that crosses the site within the roadway embankment will be required. This may require supporting the existing line within the excavation, installing a bypass line to be used for the duration of construction. Feasibility of protecting the existing line without damaging it will depend on the type of pipe and its current integrity. If there is concern that pipe segments could separate if disturbed, it may be advantageous to install a temporary section of pipe, such as HDPE or ductile iron, for conveying the sewer across the project. This line would still need to be supported across the excavation; however, a new, temporary pipe section is less likely to be damaged during construction when compared with the existing line.

Subgrade Protection and Preparation

Hard glaciolacustrine soil is expected to be exposed at the subgrade elevation along most of the proposed culvert alignment. This material will be become soft and unsuitable to support foundations if it is disturbed while wet. We recommend protecting approved subgrades with a layer of crushed rock to provide a working surface and a leveling pad for the culvert.

Reuse of Materials

The granular portions of the existing fill and alluvium observed in our borings may be reused as roadway embankment fill; however, these materials contain a significant amount of silt and will be moisture sensitive. Reuse will likely be suitable only if the construction is performed during the dry summer months and the contractor selectively excavates and stores the granular excavation spoils. The hard glaciolacustrine and clayey and silty colluvium and slide deposits are not suitable for reuse.

CONDITIONS AND LIMITATIONS

We have prepared this report for Herrera Environmental Consultants, Inc. and the City of Shoreline for use for use in preliminary evaluation of this site for the intended purpose. This report is not a detailed geotechnical engineering design report; and geotechnical engineering evaluations were not conducted as part of this work.

Our work scope did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or ground water at this site.

Experience has shown that soil and ground water conditions can vary significantly over small distances. Inconsistent conditions can occur between exploration locations and may not be detected by a preliminary geotechnical evaluation of this nature. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified for review of the recommendations of this report, and revision of such if necessary.

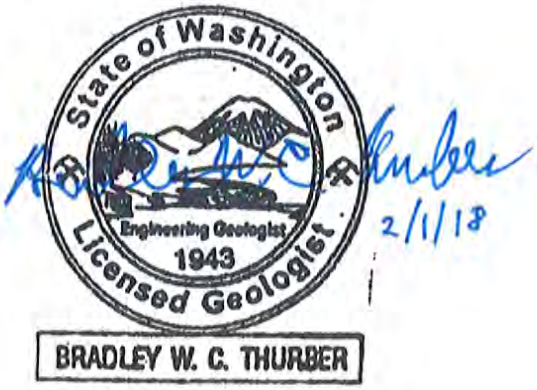
Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology in the area at the time the report was prepared. No warranty, express or implied, is made.

February 1, 2018
HWA Project No. 2017-096-21

We appreciate the opportunity to be of service. Should you have any questions regarding this report, or require additional services, please contact us.

Sincerely,

HWA GEOSCIENCES INC.



Brad W. Thurber, L.G., L.E.G.
Senior Engineering Geologist

JoLyn Gillie, P.E.
Geotechnical Engineer, Principal

Attachments:

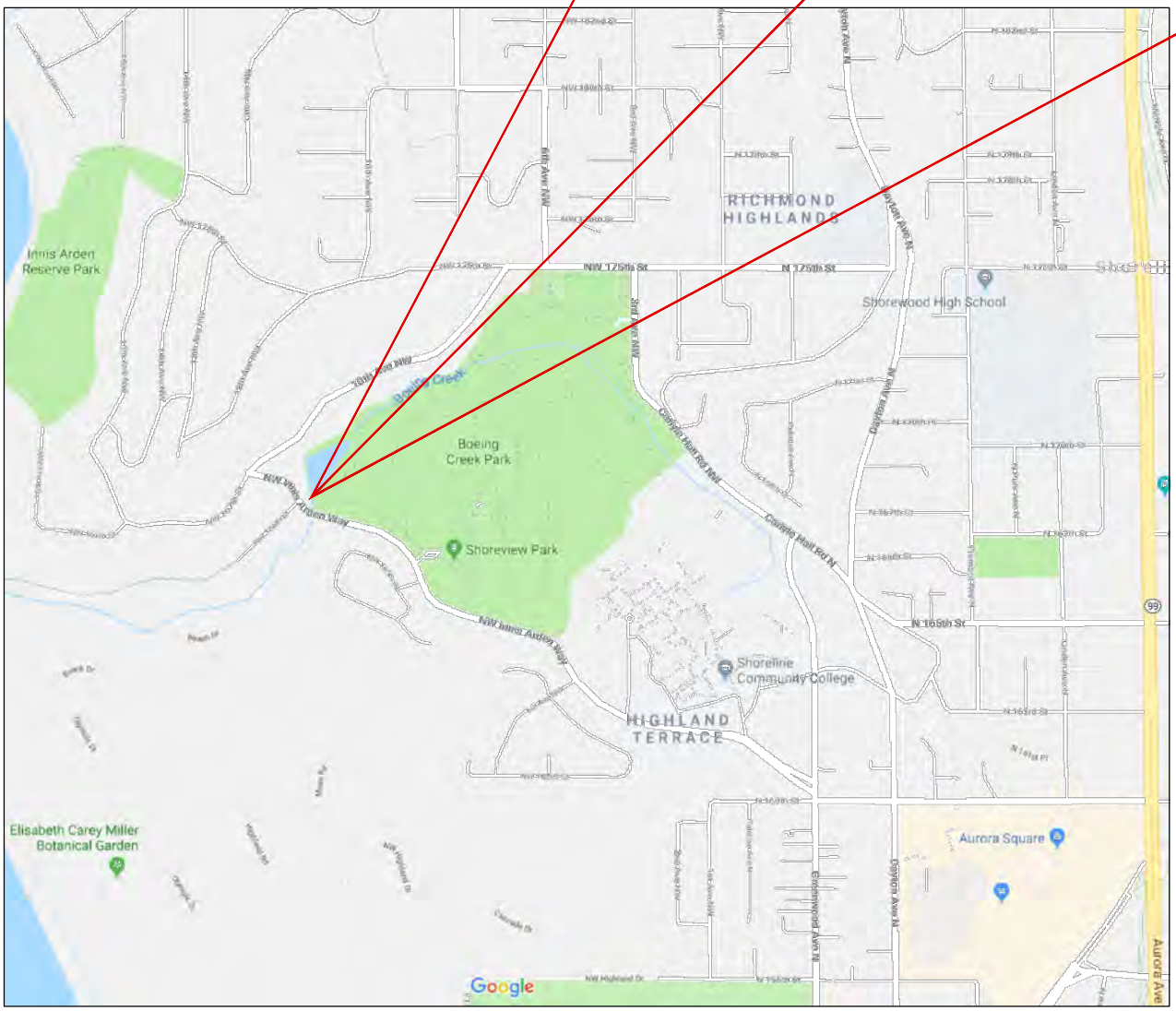
Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Figure 3	Cross Section A-A'
Figure 4	Cross Section B-B'
Appendix A	Borehole Logs
Appendix B	Laboratory Data

REFERENCES:

Minard, J.P., 1983, *Geologic Map of the Edmonds East and part of the Edmonds West Quadrangles, Washington:* USGS Miscellaneous Field Studies Map MF-1541.

Perrone Consulting Inc., October 2015, *Hidden Lake Dam Removal*: Project No. 15126 for Herrera Consultants.

Shannon & Wilson Inc., September 1995, *Geotechnical Engineering Report, Hidden Lake Restoration Project, King County, Washington:* Project No. W-7022-03 for R.W. Beck.



BASE MAP PROVIDED BY: GOOGLE MAPS

HWA GEOSCIENCES INC.

VICINITY MAP

HIDDEN LAKE DAM
SHORELINE, WA.

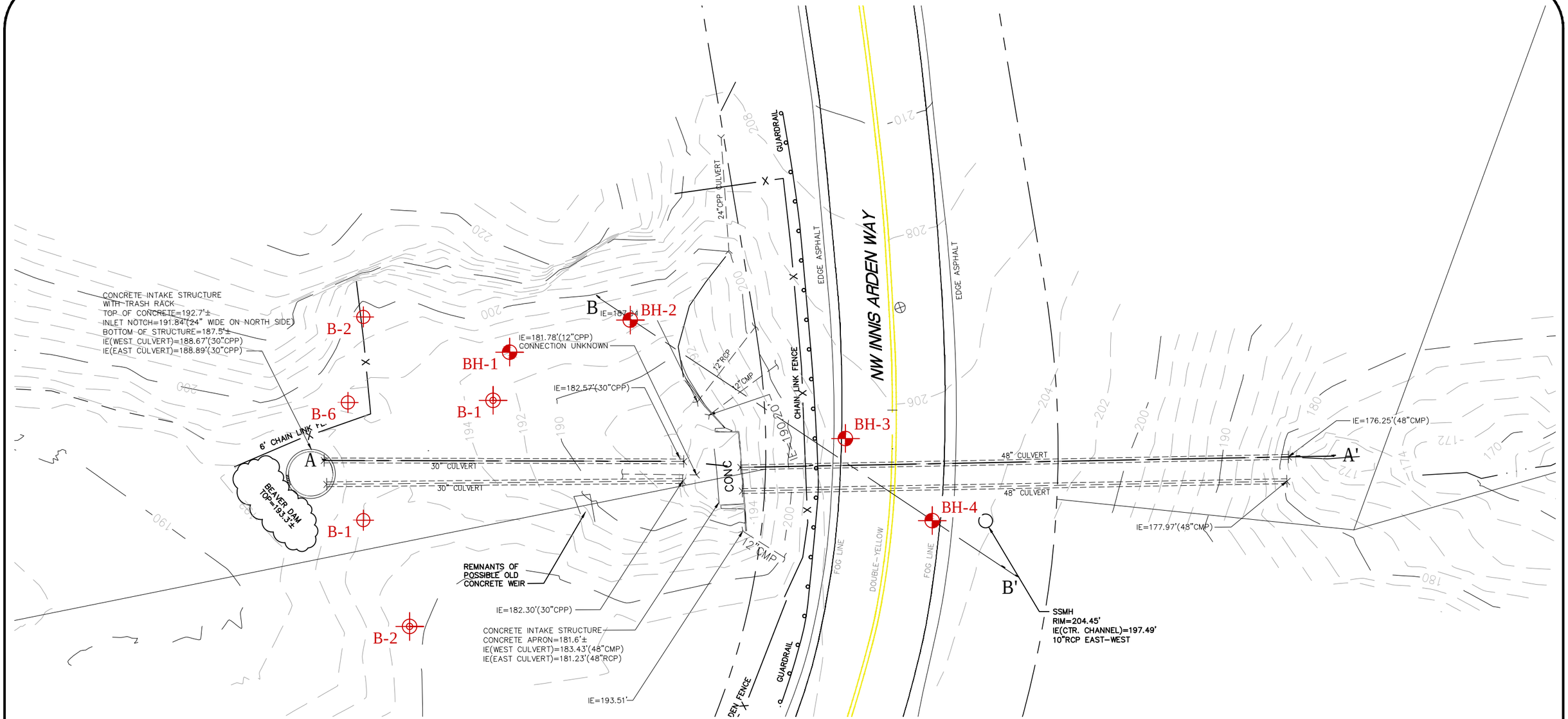
CHECK BY	DRAWN BY
JG	BFM

DATE: 12.04.2017

FIGURE # 1

PROJECT # 2017-096-21

S:\2017 PROJECTS\2017-096-21 HIDDEN LAKE DAM REMOVAL PROJECT\CAD\2017-096-21 HIDDEN LAKE DAM.DWG <Fig 1> Plotted: 12/5/2017 3:30 PM



LEGEND

- BH-1 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION FOR CURRENT STUDY
- B-1 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (PERRONE, 2015)
- B-2 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (SHANNON AND WILSON, 1995)

0 10 20 30 40

BASE SURVEY PROVIDED BY: HERRERA, DATED 10.05.2015

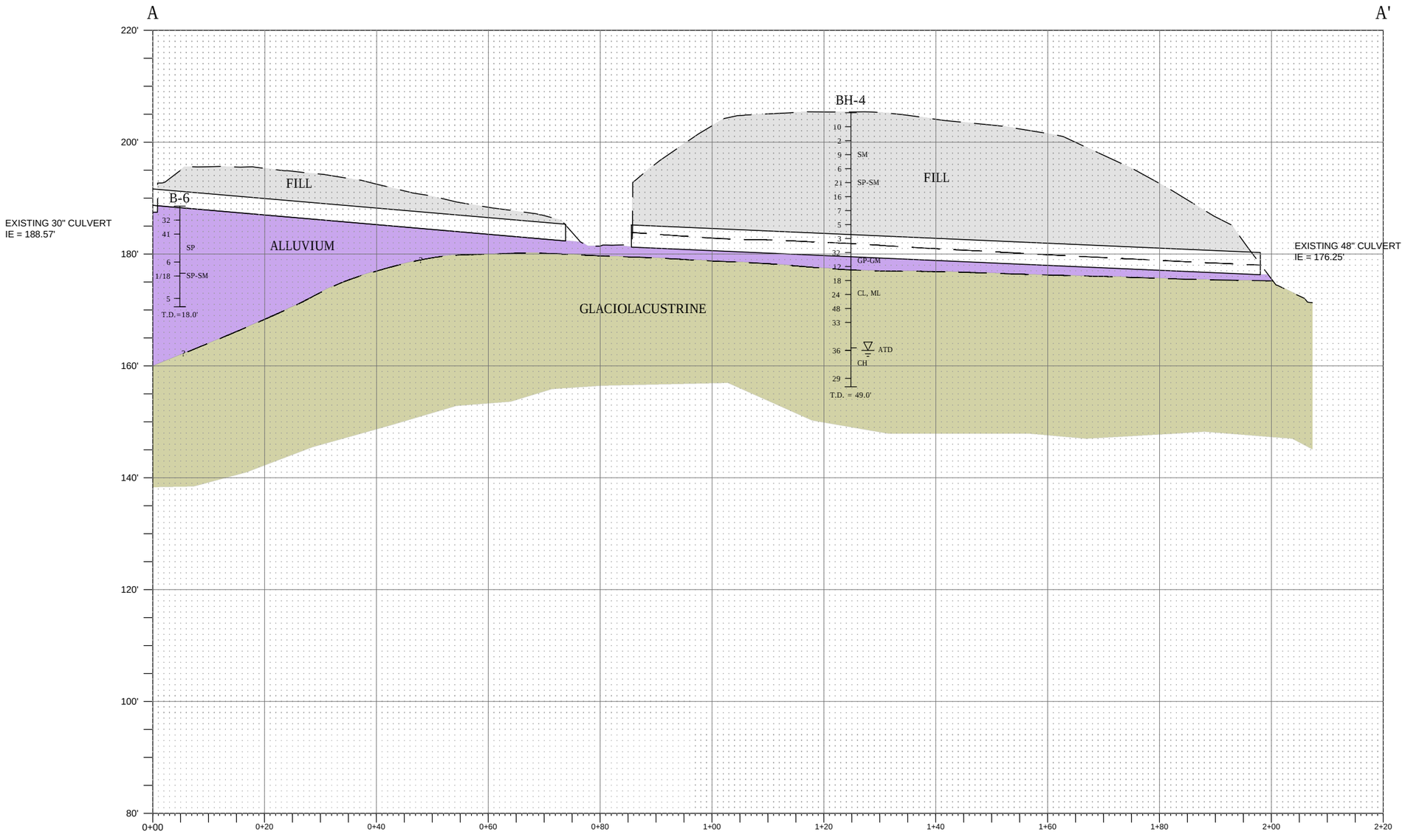
HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL AND STREAM RESTORATION PROJECT SHORELINE, WASHINGTON

SITE AND EXPLORATION PLAN

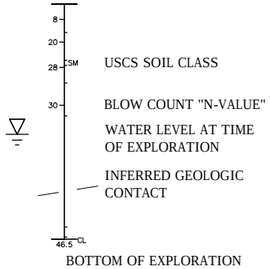
DRAWN BY	BFM
CHECK BY	BT
DATE:	01.05.2018
FIGURE #	2
PROJECT #	2017-096-21

S:\2017 PROJECTS\2017-096-21 HIDDEN LAKE DAM REMOVAL PROJECT\CAD\2017-096-21 HIDDEN LAKE DAM.DWG <Fig 2> Plotted: 1/10/2018 3:51 PM



LEGEND

BH-3 EXPLORATION DESIGNATION



USCS SOIL CLASS

BLOW COUNT "N-VALUE"

WATER LEVEL AT TIME OF EXPLORATION

INFERRED GEOLOGIC CONTACT

BOTTOM OF EXPLORATION

SOIL LEGEND

- FILL: LOOSE TO VERY DENSE SILTY SAND
- ALLUVIUM: LOOSE TO MEDIUM DENSE SAND AND GRAVEL
- GLACIOLACUSTRINE: VERY STIFF TO HARD SILT AND CLAY

The subsurface conditions shown are based on widely spaced borings and should be considered approximate. Further, the contact lines shown between units are interpretive in nature and may vary laterally or vertically over relatively short distances on site.

0 10 20 30 40

BASE SURVEY PROVIDED BY: HERRERA, DATED 10.05.2015

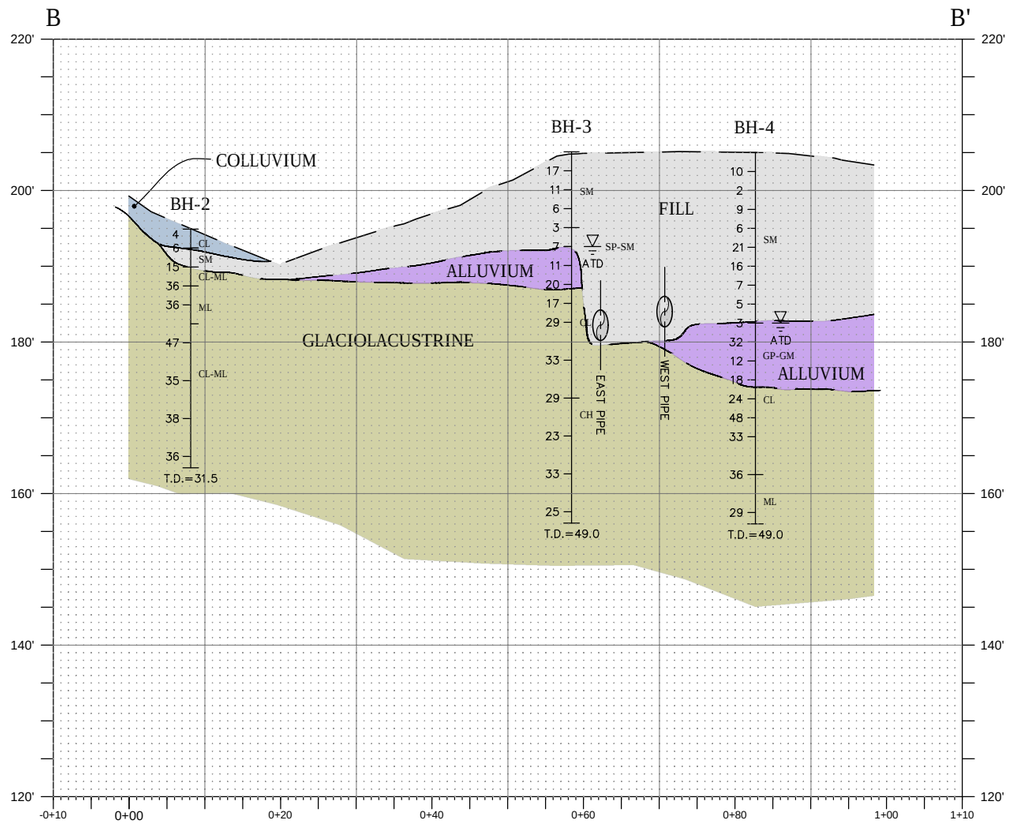
HWA GeoSciences Inc.

HIDDEN LAKE DAM REMOVAL AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

GEOLOGIC CROSS-SECTION A-A'

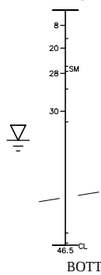
DRAWN BY	BFM
CHECK BY	BT
DATE:	01.05.2018
FIGURE #	3
PROJECT #	2017-096-21

S:\2017 PROJECTS\2017-096-21 HIDDEN LAKE DAM REMOVAL PROJECT\CAD\2017-096-21 HIDDEN LAKE DAM.DWG <Fig 3> Plotted: 1/10/2018 5:44 PM



LEGEND

BH-3 EXPLORATION DESIGNATION



USCS SOIL CLASS

BLOW COUNT "N-VALUE "

WATER LEVEL AT TIME OF EXPLORATION

INFERRED GEOLOGIC CONTACT

BOTTOM OF EXPLORATION

SOIL LEGEND

- SOIL UNIT A - COLLUVIUM: SOFT CLAY WITH ORGANICS AND SCATTERED SAND
- SOIL UNIT B - FILL: LOOSE TO VERY DENSE SILTY SAND
- SOIL UNIT C - ALLUVIUM: LOOSE TO MEDIUM DENSE SAND AND GRAVEL
- SOIL UNIT D - SLIDE DEBRIS: SOFT TO MEDIUM STIFF, FAT CLAY AND SILTY CLAY WITH SLICKENSIDES
- SOIL UNIT E - GLACIOLACUSTRINE: VERY STIFF TO HARD SILT AND CLAY

BASE SURVEY PROVIDED BY: HERRERA, DATED 10.05.2015

The subsurface conditions shown are based on widely spaced borings and should be considered approximate. Further, the contact lines shown between units are interpretive in nature and may vary laterally or vertically over relatively short distances on site.

0 10 20 30 40

HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

GEOLOGIC CROSS-SECTION B-B'

DRAWN BY	BFM
CHECK BY	BT
DATE:	01.09.2018
FIGURE #	4
PROJECT #	2017-096-21

S:\2017 PROJECTS\2017-096-21 HIDDEN LAKE DAM REMOVAL PROJECT\CAD\2017-096-21 HIDDEN LAKE DAM.DWG <Fig 4> Plotted: 1/10/2018 3:54 PM

APPENDIX A

BOREHOLE LOGS

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
More than 50% Retained on No. 200 Sieve Size	50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit, LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- 3-1/4" OD Split Spoon with Brass Rings
- Small Bag Sample
- Large Bag (Bulk) Sample
- Core Run
- Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

- Groundwater Level (measured at time of drilling)
- Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation.
Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

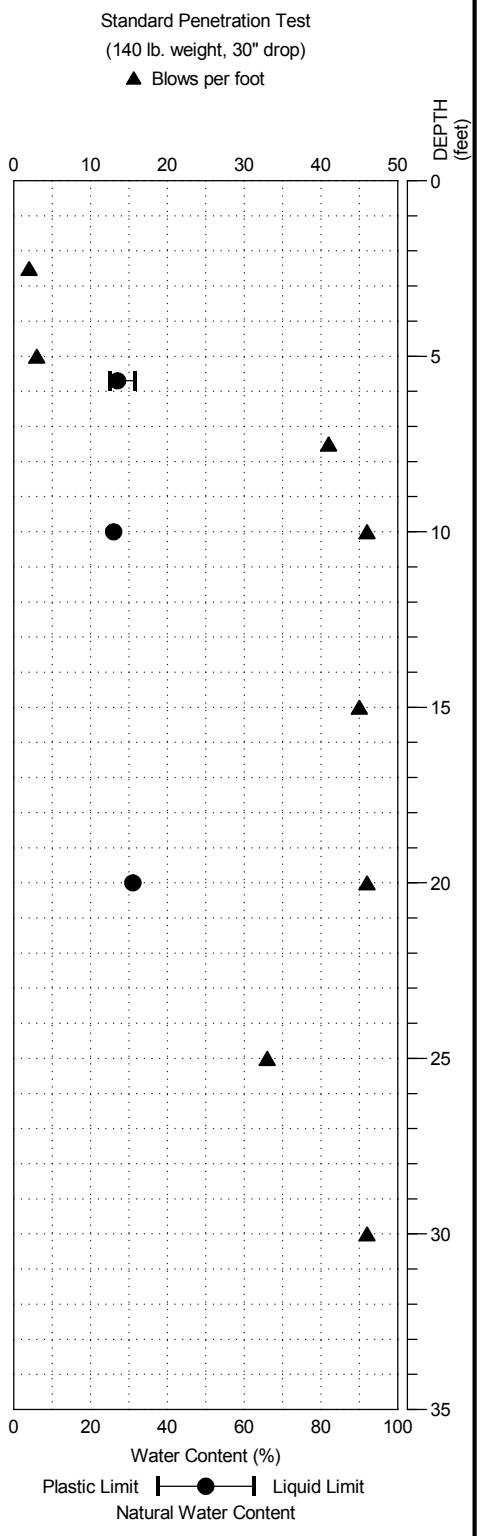
LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2017-096-21 FIGURE: A-1

DRILLING COMPANY: Geologic Drill, Inc.
DRILLING METHOD: HSA, Bobcat minitrack
SAMPLING METHOD: SPT w/ cathead
SURFACE ELEVATION: 194.00 ± feet

LOCATION: See Figure 2
DATE STARTED: 10/31/2017
DATE COMPLETED: 10/31/2017
LOGGED BY: B. Thurber/ S. Khandaker

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
0		ML SM	Loose, dark brown, sandy SILT. **(COLLUVIUM)**					
			Very loose, reddish, ORGANIC SILT, moist. Rotten wood with topsoil.		S-1	3-1-1		
5		GP GM	Very loose, olive brown, slightly silty, slightly sandy, fine GRAVEL, wet. **(FILL)**		S-2a S-2b	1-1-2	AL	
		ML	Soft, gray, SILT, moist. Low plasticity, blocky texture to massive. **(COLLUVIUM)**					
		ML	Hard, gray, SILT, moist. Low plasticity, some bedding; mostly massive. **(GLACIOLACUSTRINE)**		S-3	19-19-22		
10			Hard, gray, SILT, moist. Low plasticity, some bedding; mostly massive, crumbly texture.		S-4	10-16-30		
15			Hard, gray, SILT, moist. Low plasticity. Laminated and finely bedded. Coarse, light gray. silt partings. Crumbly texture.		S-5	12-15-20		
20		CL ML	Hard, gray, silty CLAY, moist. Laminated to finely bedded. Light gray, non plastic, silt partings.		S-6	12-20-26		
25		SM	Dense, gray, silty, fine SAND, moist.		S-7a S-7b	12-12-21		
		CL ML	Hard, gray to dark gray, silty CLAY, moist. Some bedding, mostly massive. Crumbly texture at transition from sand.					
30			Hard, gray, silty CLAY, moist. Laminated, interbedded with, dense, gray, non-plastic silt, wet.		S-8a S-8b	18-16-30		
35			Borehole terminated at 31.5 feet. Minor ground water seepage encountered at 30 feet. Borehole abandoned with bentonite chips.					



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

BORING:
BH-1

PAGE: 1 of 1

PROJECT NO.: 2017-096-21 FIGURE: A-2

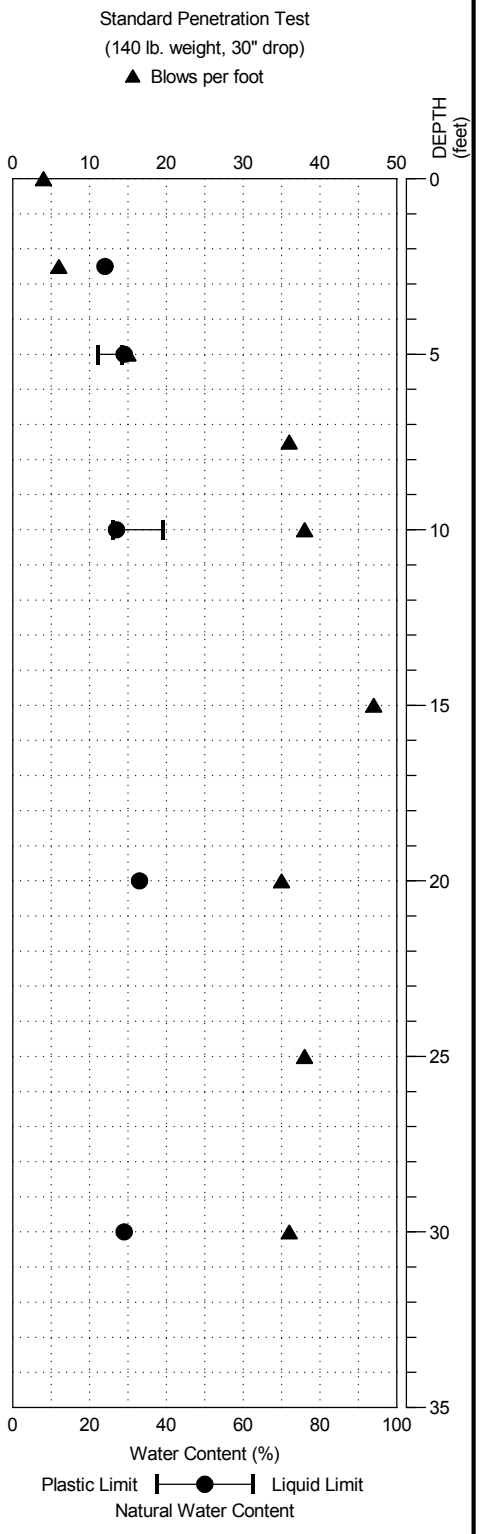
BORING 2017-096-21.GPJ 1/8/18

DRILLING COMPANY: Geologic Drill, Inc.
DRILLING METHOD: HSA, Bobcat minitrack
SAMPLING METHOD: SPT w/ cathead
SURFACE ELEVATION: 195.00 ± feet

LOCATION: See Figure 2
DATE STARTED: 10/31/2017
DATE COMPLETED: 10/31/2017
LOGGED BY: B. Thurber/ S. Khandaker

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
0		CL	Soft, light brown, CLAY, moist. Scattered organics.		S-1	1-2-2	
			(COLLUVIUM)				
		SM	Loose, brown and gray, silty, fine to coarse SAND, wet. Trace gravel.		S-2	2-4-2	GS
5			**(ALLUVIUM)**				
		CL ML	Stiff, gray, silty CLAY, moist to wet. Scattered organics.		S-3	5-6-9	AL
			(COLLUVIUM)				
		ML	Hard, gray, SILT, moist. Laminated with gray silt partings. Crumbly texture.		S-4	10-16-20	
10			**(GLACIOLACUSTRINE)** Hard, gray, SILT, moist. Blocky, disturbed texture.		S-5	10-16-22	AL
		CL ML					
15			Hard, gray and light gray, silty CLAY, moist. Laminated and finely bedded with zones of blocky texture.		S-6	13-18-29	
20			Hard, gray, silty CLAY, moist. Laminated to massive.		S-7	15-15-20	
25			Hard, gray, silty CLAY, moist. Finely bedded, some lamination with zones of blocky texture.		S-8	12-15-23	
30			Hard, gray, silty CLAY, moist. Laminated. Some fine sandy silt at top. Crumbly texture at sandy silt contact.		S-9	10-16-20	
35			Borehole terminated at 31.5 feet. Ground water seepage encountered at 5 feet. Borehole abandoned with bentonite chips.				

GROUNDWATER



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

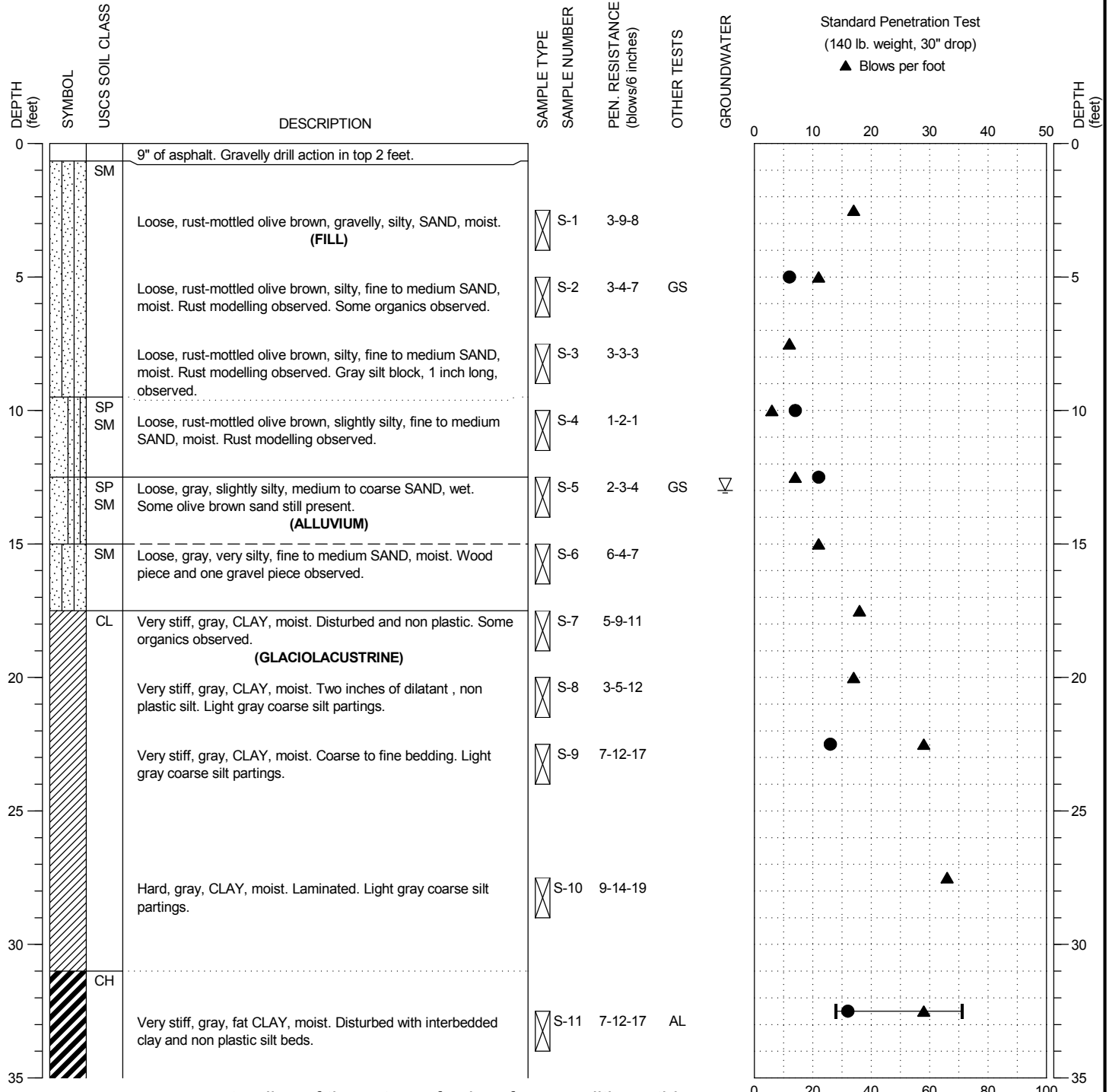
HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

BORING:
BH-2

PROJECT NO.: 2017-096-21 FIGURE: A-3

DRILLING COMPANY: Environmental Drilling Inc.
DRILLING METHOD: HSA, Mobile B-61
SAMPLING METHOD: SPT w/ autohammer
SURFACE ELEVATION: 205.00 ± feet

LOCATION: See Figure 2
DATE STARTED: 11/9/2017
DATE COMPLETED: 11/9/2017
LOGGED BY: S. Khandaker/B. Thurber



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

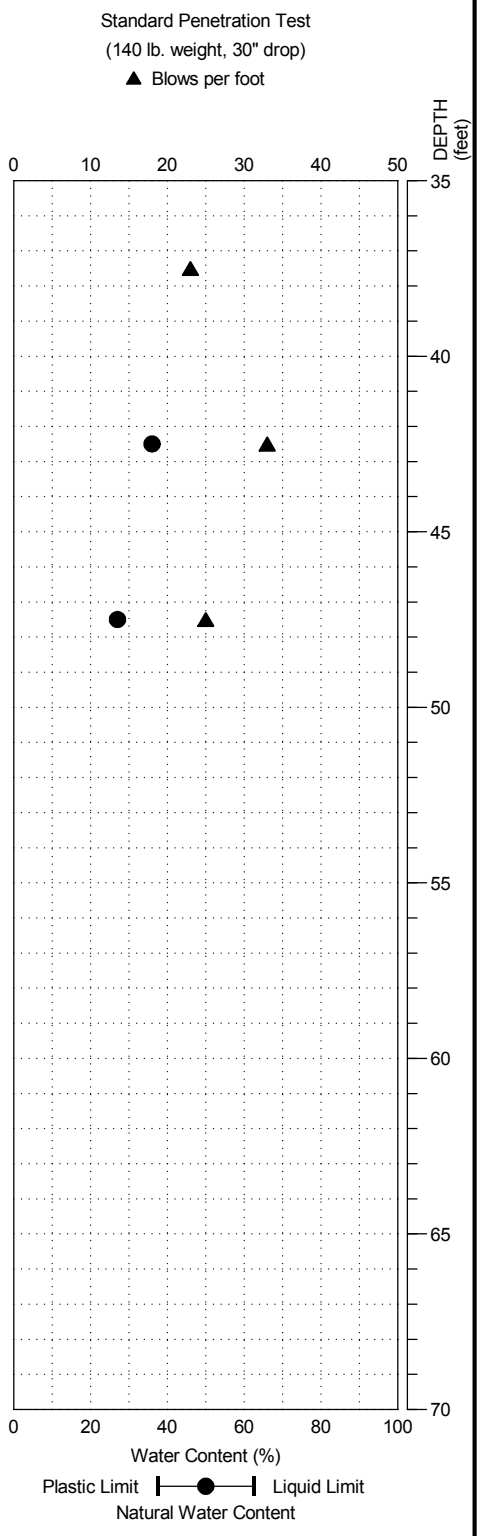
BORING:
BH-3

PROJECT NO.: 2017-096-21 FIGURE: A-4

DRILLING COMPANY: Environmental Drilling Inc.
DRILLING METHOD: HSA, Mobile B-61
SAMPLING METHOD: SPT w/ autohammer
SURFACE ELEVATION: 205.00 ± feet

LOCATION: See Figure 2
DATE STARTED: 11/9/2017
DATE COMPLETED: 11/9/2017
LOGGED BY: S. Khandaker/B. Thurber

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
35			Very stiff, gray, fat CLAY, moist. Laminated. Variable drilling resistance, with slickensides.		S-12	6-9-14		
40			Hard, gray, fat CLAY, moist, with slickensides.		S-13	7-15-18		
45		SP	Very stiff, gray, fat CLAY, moist.		S-14a	7-8-17	GS	
		SM	Medium dense, brown, slightly silty, fine SAND, wet.		S-14b			
50			Borehole terminated at 49 feet. Ground water seepage encountered at 13 and 36 feet. Borehole abandoned with bentonite chips.					
55								
60								
65								
70								



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

BORING:
BH-3

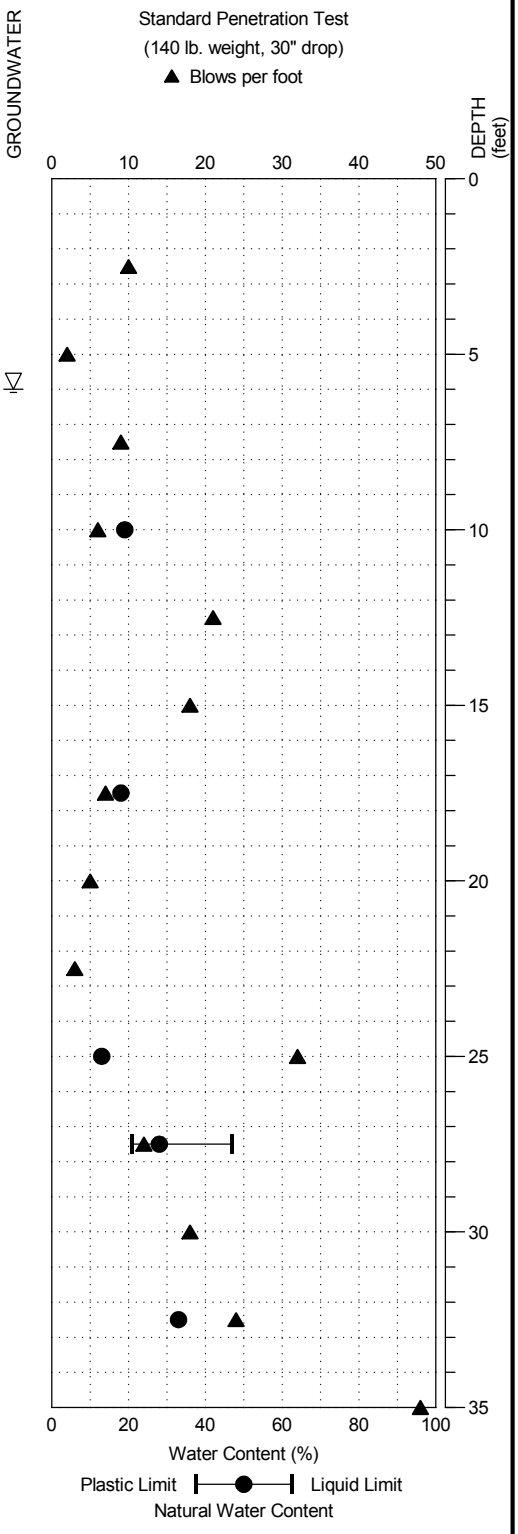
PROJECT NO.: 2017-096-21 FIGURE: A-4

DRILLING COMPANY: Environmental Drilling Inc.
DRILLING METHOD: HSA, Mobile B-61
SAMPLING METHOD: SPT w/ autohammer
SURFACE ELEVATION: 205.00 ± feet

LOCATION: See Figure 2
DATE STARTED: 11/9/2017
DATE COMPLETED: 11/9/2017
LOGGED BY: S. Khandaker

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
0			9.5" of asphalt.				
		SM	Loose, brown, silty to very silty, fine to medium SAND, moist.		S-1a	7-5-5	
		ML	Loose, gray, sandy, SILT, moist. Trace organics. Plastic.		S-1b		
			(FILL)				
5		SM	Loose, olive brown, silty to very silty, fine to medium SAND, moist.		S-2	2-1-1	
			Loose, gray, slightly gravelly, silty, fine to medium SAND, moist, with silt clumps.		S-3	6-5-4	
10			Loose, gray, silty, fine to medium SAND, moist. Dark brown organics observed.		S-4	3-3-3	GS
			Dense, gray, silty, fine to medium SAND, moist, with silt clumps.		S-5	5-10-11	
15			Dense, gray to dark brown, silty, fine to medium SAND, moist, with silt clumps.		S-6	5-7-9	
			Loose, gray, silty, fine to medium SAND, moist. Greenish gray clay piece and wood pieces observed.		S-7	1-3-4	
20			Loose, gray, silty, fine to medium SAND, moist. Decomposed wood at top.		S-8	3-3-2	
			Loose, very dark brown, silty, fine to medium SAND, moist. Organics observed.		S-9	1-1-2	
		GP GM	**(BURIED TOPSOIL)**				
25			Loose, gray, slightly silty, sandy, fine to medium GRAVEL, wet. With dark brown organics pockets. Sampler drove on a rock.		S-10	11-16-16	GS
			(ALLUVIUM)				
		CL	Stiff, gray, CLAY, moist. Low recovery.		S-11	3-5-7	AL
30			Wood.		S-12	21-9-9	
		CL	Very stiff, gray, CLAY, moist. Transition from disturbed to laminated. Wood at the top of the sample.		S-13	7-10-14	
35							

GROUNDWATER ▽



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

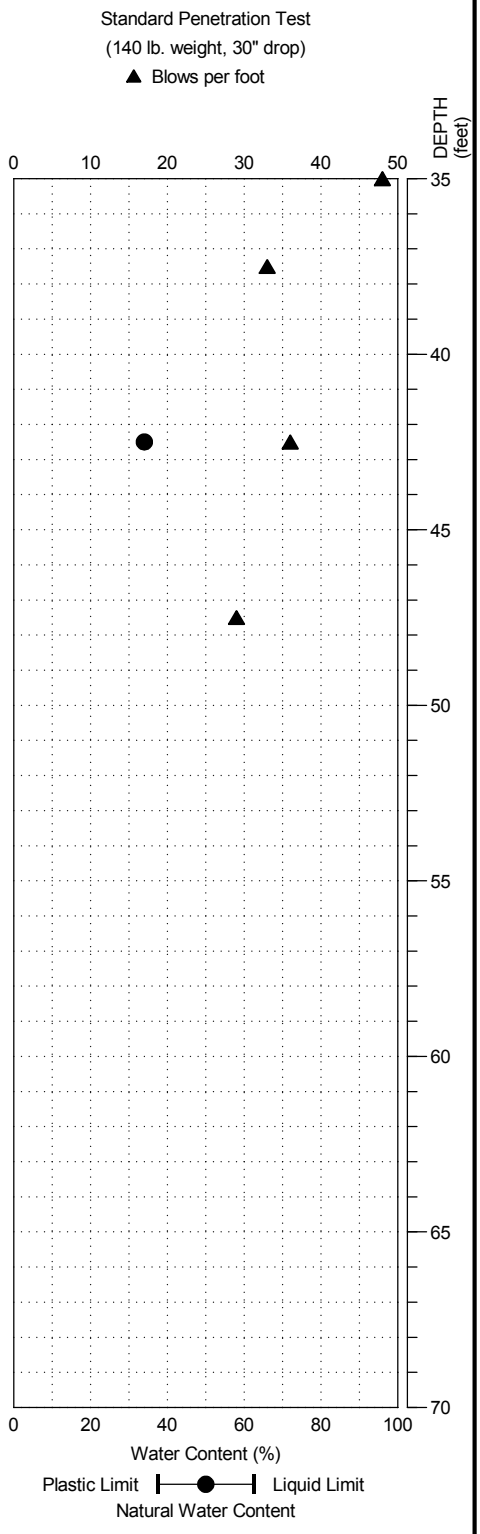
BORING:
BH-4

PROJECT NO.: 2017-096-21 FIGURE: A-5

DRILLING COMPANY: Environmental Drilling Inc.
DRILLING METHOD: HSA, Mobile B-61
SAMPLING METHOD: SPT w/ autohammer
SURFACE ELEVATION: 205.00 ± feet

LOCATION: See Figure 2
DATE STARTED: 11/9/2017
DATE COMPLETED: 11/9/2017
LOGGED BY: S. Khandaker

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
35		ML	Hard, gray, coarse SILT, moist. Non plastic.		S-14	9-17-31		
		CH	Hard, gray, CLAY, moist. Finely bedded/ laminated. Light gray, coarse silt partings, with slickensides.		S-15	11-12-21		
40			Hard, gray, CLAY, moist. Laminated with light gray silt partings, with slickensides.		S-16	7-12-24		
45		SM	Dense, gray, silty, fine SAND, wet.		S-17	7-11-18		
50			Borehole terminated at 49 feet. Ground water seepage encountered at 6 and 43 feet. Borehole abandoned with bentonite chips.					
55								
60								
65								
70								



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

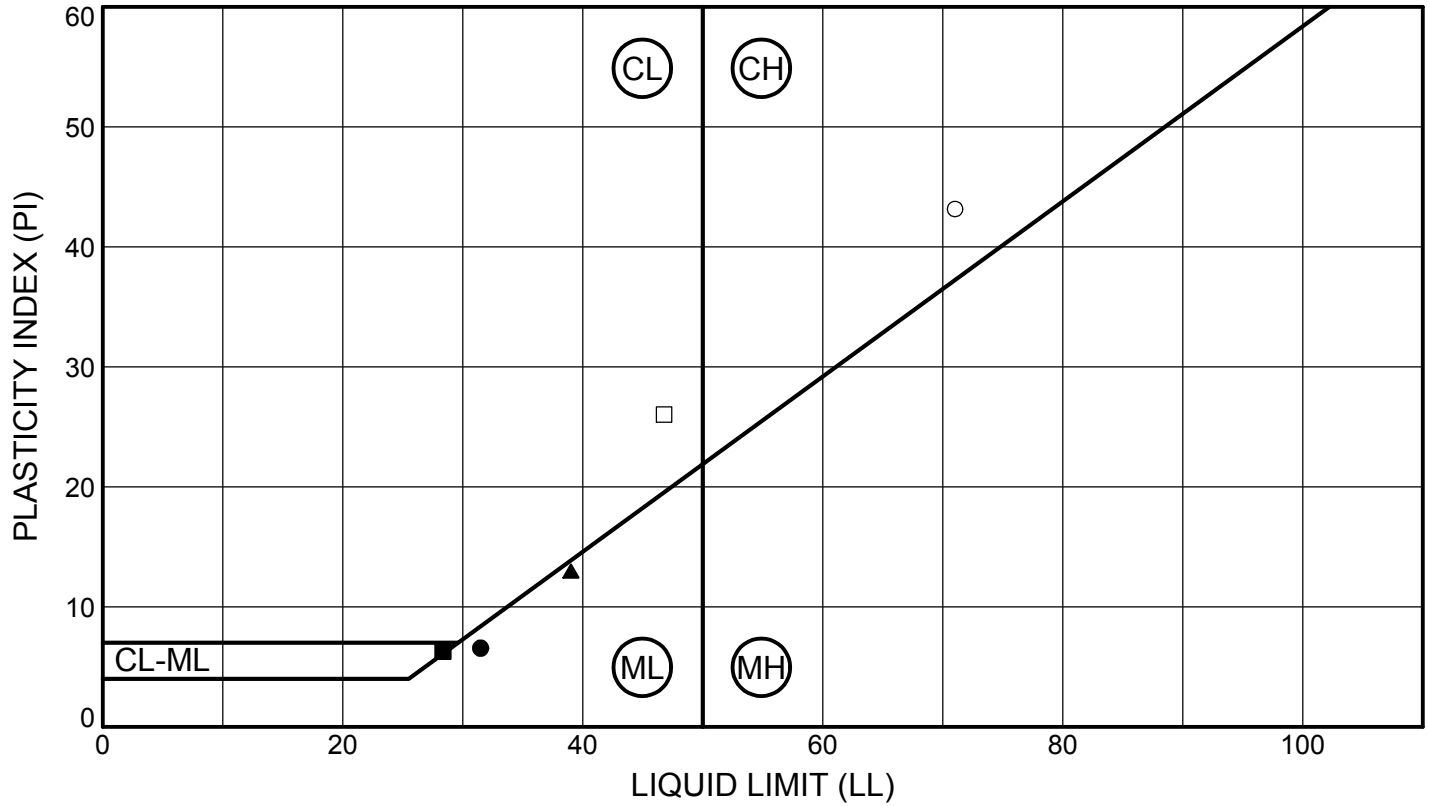
HIDDEN LAKE DAM REMOVAL
AND STREAM RESTORATION PROJECT
SHORELINE, WASHINGTON

BORING:
BH-4

PROJECT NO.: 2017-096-21 FIGURE: A-5

APPENDIX B

LABORATORY DATA



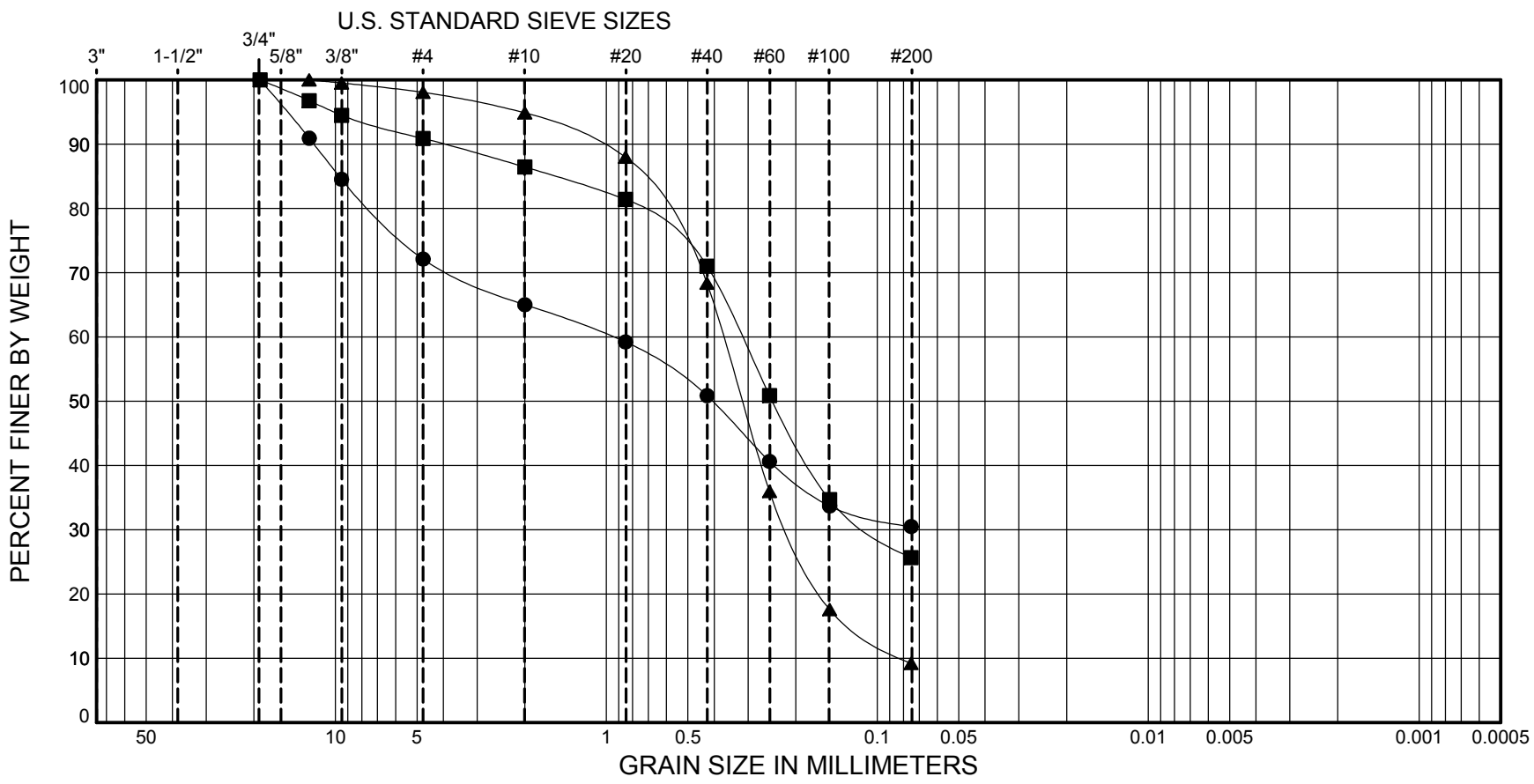
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	BH-1	S-2b	5.7 - 6.5	(ML) Dark gray, SILT	27	31	25	6	
■	BH-2	S-3	5.0 - 5.7	(CL-ML) Dark olive-gray, silty CLAY	29	28	22	6	
▲	BH-2	S-5	10.0 - 11.5	(ML) Dark gray, SILT	27	39	26	13	
○	BH-3	S-11	32.5 - 34.0	(CH) Dark gray, fat CLAY	32	71	28	43	
□	BH-4	S-11	27.5 - 27.7	(CL) Dark gray, lean CLAY	28	47	21	26	

HWA GEOSCIENCES INC.

Hidden Lake Dam Removal
Shoreline, WA

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS METHOD ASTM D4318

PROJECT NO.: 2017-096-21 FIGURE: B-1



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-2	S-2	2.5 - 3.2	(SM) Grayish-brown, silty SAND with gravel	24				27.9	41.6	30.5
■	BH-3	S-2	5.0 - 6.0	(SM) Olive brown, silty SAND	12				9.1	65.2	25.7
▲	BH-3	S-5	12.5 - 13.2	(SP-SM) Grayish brown, poorly graded SAND with silt	22				2.0	88.8	9.2

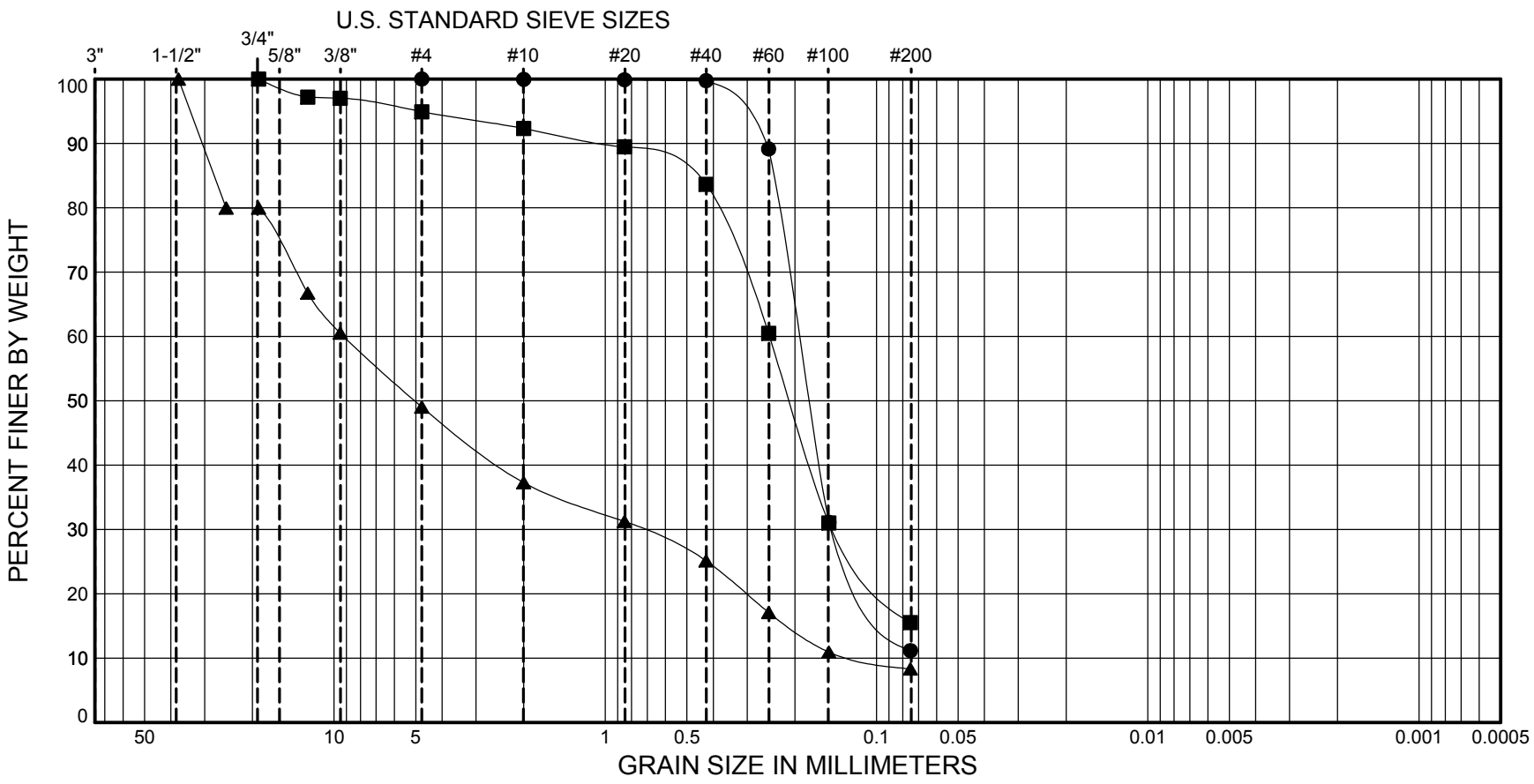
HWA GeoSciences Inc.

Hidden Lake Dam Removal
Shoreline, WA

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2017-096-21 FIGURE: B-2

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-3	S-14a	47.5 - 47.7	(SP-SM) Grayish brown, poorly graded SAND with silt	27					88.8	11.2
■	BH-4	S-4	10.0 - 10.8	(SM) Grayish brown, silty SAND	19				5.1	79.4	15.5
▲	BH-4	S-10	25.0 - 25.3	(GP-GM) Grayish brown, poorly graded GRAVEL with silt and sand	13				51.0	40.7	8.3

HWA GEOSCIENCES INC.

Hidden Lake Dam Removal
Shoreline, WA

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2017-096-21 FIGURE: B-3

APPENDIX C

Preliminary Cost Estimates

Engineering Cost Estimate for Preliminary Design - Preferred Alternative "Lake Reach" OPTION A

(Phase division at STA 2+40, downstream of existing dam)

Project: **Hidden Lake Dam Removal**
Herrera **15-05984-000**
Client: **City of Shoreline**

Date Modified: 1/9/2018
Spreadsheet by: V. Wu
Checked by: I. Mostrenko
Latest Date Checked: 1/22/2018

Bid Item #	Spec Section	Item Description	Quantity	Unit	Unit Cost	Price	Total Price	Comments
		Mobilization	**1**	**LS**	**$ 55,900.00**		**$ 55,900.00**	8% of construction subtotal (Div 2 - Div 8 work items)
		Temporary Erosion and Sediment Control	**1**	**LS**	**$ 13,100.00**		**$ 13,100.00**	Assumes 2% of all other items except water management
		Water Management (Incl. Streamflow Bypass)	**1**	**LS**	**$ 30,000.00**		**$ 30,000.00**	based partly on bid cost for Coal Creek culvert replacement in Bellevue; cvers draining the lake and bulk bag bypass at the downstream end of the constructed stream channel
		Traffic Control	**1**	**LS**	**$ 10,000.00**		**$ 10,000.00**	rough estimate, needs City input; no road closure needed
		Stabilized Construction Entrance	**1**	**EA**	**$ 3,000.00**		**$ 3,000.00**	Price derived from WSDOT UBA. Entrance from Innis Arden Way toward the lake
		Site Clearing - Clearing and Grubbing and Stripping and Stockpiling of Topsoil	**0.64**	**AC**	**$ 14,300.00**		**$ 9,200.00**	Price from WSDOT UBA. Clearing for upstream channel construction, assume access is maintained from dam area if dam removed in previous year
		Bark or Wood Chip Mulch	**1.57**	**AC**	**$ 13,000.00**		**$ 20,500.00**	Trailside restoration areas (4" depth, 5' wide each side of trail); Includes temporary access routes (18ft x 3200ft x 0.25ft) and incidental amount for staging area preparation as well as removal as needed
		Removal of Dam Conveyance and Trash Rack	**1**	**LS**	**$ 2,000.00**		**$ 2,000.00**	Reuse onsite excavated material. Quantity from CAD. Embankment compaction for upstream channel bank where the channel is not naturally deep enough
		Remove and Dispose of Gabion Matresses on Dam Face	**1**	**LS**	**$ 2,000.00**		**$ 2,000.00**	
		Demolition of Lake Outlet Conveyance	**1**	**LS**	**$ 3,500.00**		**$ 3,500.00**	Manhole ~$1.5k, pull pipes $2k
		Channel Excavation	**4250**	**CY**	**$ 35.00**		**$ 148,800.00**	Quantity from "excavation quantites" tab Includes control of water, removal and stockpiling Assumes $33+$2 per cy for water management.
		Embankment Compaction	**60**	**CY**	**$ 6.00**		**$ 400.00**	Reuse onsite excavated material. Quantity from CAD. Embankment compaction for upstream channel bank where the channel is not naturally deep enough
		Stream Channel	**1**	**LS**	**$ 113,200.00**		**$ 113,200.00**	channel length=650+112 FT; width= 25 FT; 2%@ 500ft long and 3%@ 150ft long; includes cost for stream channel for both the 2% and 3% sections
		Import Boulders	214	CY	$ 100.00	$ 21,366.94		see Streambed Material tab; price from Manashtash project
		Import Streambed Cobble/ Gravel	1293	CY	$ 70.00	$ 90,495.15		see Streambed Material tab; price from Manashtash project
		Placement of Boulders	214	CY	$ 6.00	$ 1,282.02		Price from Manashtash, 1 exc. 15 minute delivery r/t, place w/ 2 exc.s needed, 0.2 hour to place (2 Exc+op, laborer 0.2hr @ $150/hr)
		Habitat Structure Type 1	**3**	**EA**	**$ 3,800.00**		**$ 11,400.00**	
		Import Log: 18" DBH, 20' long no rootwad	1	EA	$ 750.00	$ 750.00		Structure and price from Hansen R5
		Import Log: 18" DBH, 30' long no rootwad	1	EA	$ 750.00	$ 750.00		Structure and price from Hansen R5
		Import Log: 18" DBH, 25' long with rootwad	2	EA	$ 750.00	$ 1,500.00		Structure and price from Hansen R5
		Labor, Installation, and Survey	0.5	DAY	$ 1,600.00	$ 800.00		Structure and price from Hansen R5
		Habitat Structure Type 2	**5**	**EA**	**$ 3,100.00**		**$ 15,500.00**	
		Import Log: 18" DBH, 30' long no rootwad	1	EA	$ 750.00	$ 750.00		Price from Hansen R5
		Import Log: 18" DBH, 25' long with rootwad	2	EA	$ 750.00	$ 1,500.00		Price from Hansen R5
		Labor, Installation, and Survey	0.5	DAY	$ 1,600.00	$ 800.00		Price from Hansen R5
		Wood Revetment Structure	**11**	**EA**	**$ 5,300.00**		**$ 58,300.00**	20 ft long sections
		Import Log: 18" DBH, 10' long no rootwad	1	EA	$ 750.00	$ 750.00		Price from Hansen R5
		Import Log: 18" DBH, 15' long no rootwad	2	EA	$ 750.00	$ 1,500.00		Price from Hansen R5
		Import Log: 18" DBH, 20' long no rootwad	1	EA	$ 750.00	$ 750.00		Structure and price from Hansen R5
		Import Log: 18" DBH, 10' long with rootwad	2	EA	$ 750.00	$ 1,500.00		Structure and price from Hansen R5
		Labor, Installation, and Survey	0.5	DAY	$ 1,600.00	$ 800.00		Price from Hansen R5
		Rock/Coir Wrap Embankment	**1**	**EA**	**$ 7,600.00**		**$ 7,600.00**	slope stabilization at the upstream end of the project to prevent slope faliure due to creek encroachment
		Streambed Boulders	20	CY	$ 77.00	$ 1,536.79		Revetment length= 112 FT; Price from Goheen
		Labor, Installation, and Survey	1.5	DAY	$ 1,600.00	$ 2,400.00		Price from Hansen R5
		Coir Lifts	240	LF	$ 15.00	$ 3,600.00		Price from Goheen, 1ft tall lifts; 120ft long and 2 lifts thick
		Soldier Pile Wall for Toe of Slope Upstream of Culvert	**983**	**SF**	**$ 80.00**		**$ 78,700.00**	west side 110ft length by 6ft tall, east side 41ft length by 3 ft tall, downstream of culvert 50ft long and 4 ft tall; Price from HWA
		Trash Rack	**1**	**LS**	**$ 2,000.00**		**$ 2,000.00**	
		Riparian Plantings	**1**	**LS**	**$ 56,988.68**		**$ 57,000.00**	See "Planting Backup" tab, planting area covers 1.13 acres of lake bottom and steam bank planting; includes restoration area for the culvert reach. Temporary seeding will be used between phases.
		Spoils Grading in Lake bed	**4190**	**CY**	**$ 4.00**		**$ 16,800.00**	Disposal of excavation spoils onsite in the abandoned lake bed. Price from Pressentin
		Educational Viewing Platform at South End of New Trail	**1**	**LS**	**$ 20,000.00**		**$ 20,000.00**	assume basic wood or faux wood decking a few feet above ground level, incl. signage
		New Trail Construction	**300**	**LF**	**$ 250.00**		**$ 75,000.00**	Based roughly on City of Bellingham rule of thumb trail cost for 6 ft width and crushed surfacing, knowing width at Hidden Lake trail could be less and probably don't need crushed surfacing but access and site clearing tricky

Construction Subtotal	**$ 753,900**	
Tax (10.0%)	**$ 75,400**	
Construction Total (roundup to 1000's)	**$ 830,000**	
Contingency (30%)	**$ 249,000**	*note: reduced contingency compared to culvert reach*
Construction Total with Contingency	**$ 1,079,000**	
Permitting	**$ 75,000**	cost will be less if permitted in combo with culvert reach
Design	**$ 100,000**	
Construction Management & Administration (15% of Construction Cost)	**$ 161,850**	
Post-construction Vegetation Monitoring and Supplemental Planting	**$ 50,000**	
GRAND TOTAL	**$ 1,470,000**	

Engineering Cost Estimate for Conceptual Design - Preferred Alternative "Culvert Reach" OPTION A

(Phase division at STA 2+40, downstream of existing dam)

Project: Hidden Lake Dam Removal
Herrera 15-05984-000
Client: City of Shoreline

Date Modified: 2/2/2018
Spreadsheet by: V. Wu
Checked by: I. Mostrenko
Latest Date Checked: 1/22/2018

Preferred Alternative "Culvert Reach- Option A" (Phase division at STA 2+40, upstream of existing dam)

Bid Item #	Spec Section	Item Description	Quantity	Unit	Unit Cost	Price	Total Price	Comments
		Mobilization	**1**	**LS**	**$ 92,700.00**		**$ 92,700.00**	8% of construction subtotal (Div 2 - Div 8 work items)
		Temporary Erosion and Sediment Control	**1**	**LS**	**$ 21,800.00**		**$ 21,800.00**	Assumes 2% of all other items except water management
		Water Management (Incl. Streamflow Bypass)	**1**	**LS**	**$ 50,000.00**		**$ 50,000.00**	based on bid cost for Coal Creek culvert replacement in Bellevue
		Traffic Control	**1**	**LS**	**$ 25,000.00**		**$ 25,000.00**	rough estimate; assumes ~12 weeks of road closure
		Utilty Protection	**1**	**LS**	**$ 10,000.00**		**$ 10,000.00**	Engineer's estimation for water, gas, and cable utility protection during culvert excavation and backfilling
		Temporary Access Road (also used for lake reach access)	**1**	**LS**	**$ 10,000.00**		**$ 10,000.00**	
		Stabilized Construction Entrance	**1**	**EA**	**$ 3,000.00**		**$ 3,000.00**	extending from Innis Arden Way shoulder toward the downstream end of the culvert
		Site Clearing - Clearing and Grubbing and Stripping and Stockpiling of Topsoil	**0.25**	**AC**	**$ 14,300.00**		**$ 3,600.00**	Price from UBA. Clearing for Dam removal, culvert replacement, and roughened channel to tie the project into the existing grade.
		Removal of Structure and Obstructions	**1**	**LS**	**$ 1,500.00**		**$ 1,500.00**	Estimated splash pad dimensions: 9'x10'
		Replace 8" Diameter Sanitary Sewer	**60**	**LF**	**$ 60.00**		**$ 3,600.00**	replace a section of the sanitary sewer beneath Innis Arden Way before excavating for culvert removal to simplify bridging of the sewer between shoring walls, connect into existing MH to west
		48" Diameter Sewer Manhole	**1**	**LS**	**$ 6,000.00**		**$ 6,000.00**	For sewer replacement; manhole is immediately west of culvert replacement and will be encountered during excavation activities.
		Remove and Dispose of Asphalt Concrete Pavement	**170**	**SY**	**$ 8.00**		**$ 1,400.00**	assume 50' length of street
		Remove Guardrail	**1**	**LS**	**$ 500.00**		**$ 500.00**	
		Channel Excavation	**444**	**CY**	**$ 35.00**		**$ 15,600.00**	Quantity from CAD. Includes control of water, removal and stockpiling Assumes $33+$2 per cy for water management.
		Structure Excavation Class A (shallow <20ft deep)	**3077**	**CY**	**$ 45.00**		**$ 138,500.00**	Quantity from CAD; assumes 2/3 of excavation for the culvert is shallower than 20ft plus over excavation for placement of shoring wall and streambed materia land 20ft wide of grading from top of culvert to existing shoulder. Includes control of water, removal and stockpiling; price from HWA
		Channel Excavation (deep >20ft deep)	**517**	**CY**	**$ 67.50**		**$ 35,000.00**	Quantity from CAD; assumes 1/3 of excavation for the culvert is shallower than 20ft plus over excavation for placement of shoring wall and streambed material. Includes control of water, removal and stockpiling; Engineer's estimate
		Stream Channel	**1**	**LS**	**$ 31,400.00**		**$ 31,400.00**	channel length=232 FT; width= 25 FT; 2%@ 165.5ft long and
		Import Boulders	95	CY	$ 77.00	$ 7,293.96		see Streambed Material tab; price from Manashtash project
		Import Streambed Cobble/ Gravel	391	CY	$ 60.00	$ 23,483.68		see Streambed Material tab; price from Manashtash project
		Placement of Boulders	95	CY	$ 6.00	$ 568.36		Price from Manashtash, 1 exc. 15 minute delivery r/t, place w/ 2 exc.s needed, 0.2 hour to place (2 Exc+op, laborer 0.2hr @ $150/hr)
		Soldier Pile Wall Cutoff Drain	**1**	**LS**	**$ 15,000.00**		**$ 15,000.00**	east side
		Soldier Pile Walls for Culvert Removal	**1**	**LS**	**$ 756,800.00**		**$ 756,800.00**	
		Soldier Pile for Shoring (above eventual	3370	SF	$ 80.00	$269,600.00		Cost from HWA; piling required to meet the existing ground
		Soldier Pile with Permanent Concrete	2660	SF	$ 115.00	$305,900.00		Cost from HWA;piling required for the culvert and open channel at
		Concrete Culvert Top Slab (assume cast-in-place)	1	LS	$ 175,000	$175,000.00		Average bid from Coal Creek Parkway $445,200 for a custom 38' x 90' culvert lid, surface area scaled for cost adjustment (39%) to Boeing Creek site (18'x90')
		Embankment Backfill and Compaction	1040	CY	$ 6.00	$ 6,240.00		Price from WSDOT UBA; backfill (above soldier pile culvert)
		Crushed Surfacing Base Course	**57**	**TN**	**$ 90.00**		**$ 5,200.00**	50ft long x 30ft wide (2 x 12ft wide lanes and 2 x 3ft wide
		HMA CL. 1/2 IN. PG	**23**	**TN**	**$ 40.00**		**$ 1,000.00**	50ft long x 30ft wide (2 x 12ft wide lanes and 2 x 3ft wide
		Steel Beam Guardrail (connect to	**40**	**LF**	**$ 75.00**		**$ 3,000.00**	
		Spoils Grading in Lake Bed	**1330**	**CY**	**$ 4.00**		**$ 5,400.00**	Disposal of excavation spoils onsite in the abandoned lake bed; includes excavation for stream channel and material removedfor culvert placement, remaining material is backfilled over the culvert for roadway reconstruction. Price from Pressentin
		Riparian Plantings	**1**	**LS**	**$ 14,514.19**		**$ 14,600.00**	See "Planting Backup" tab, planting area covers 1.13 acres of lake bottom and steam bank planting; includes restoration area for the culvert reach. Temporary seeding will be used between phases.

Construction Subtotal	**$**	**1,250,600**
Tax (10.0%)	**$**	**18,500**
Construction Total (roundup to 1000's)	**$**	**1,270,000**
Contingency (50%)	**$**	**635,000**
Construction Total with Contingency	**$**	**1,905,000**
Permitting	**$**	**50,000**
Design	**$**	**200,000**
Construction Management & Administration (15% of Construction Cost)	**$**	**285,750**
Post-construction Vegetation Monitoring and Supplemental Planting	**$**	**20,000**
GRAND TOTAL	**$**	**2,460,000**

Engineering Cost Estimate for Preliminary Design - Preferred Alternative "Lake Reach" OPTION B

(Phase division at STA 2+40, downstream of existing dam)

Project: Hidden Lake Dam Removal
Herrera 15-05984-000
Client: City of Shoreline

Date Modified: 1/9/2018
Spreadsheet by: V. Wu
Checked by: I. Mostrenko
Latest Date Checked: 1/22/2018

Bid Item #	Spec Section	Item Description	Quantity	Unit	Unit Cost	Price	Total Price	Comments
		Mobilization	**1**	**LS**	**$ 54,800.00**		**$ 54,800.00**	8% of construction subtotal (Div 2 - Div 8 work items)
		Temporary Erosion and Sediment Control	**1**	**LS**	**$ 12,900.00**		**$ 12,900.00**	Assumes 2% of all other items except water management
		Water Management (Incl. Streamflow Bypass)	**1**	**LS**	**$ 30,000.00**		**$ 30,000.00**	based partly on bid cost for Coal Creek culvert replacement in Bellevue; cvers draining the lake and bulk bag bypass at the downstream end of the constructed stream channel
		Traffic Control	**1**	**LS**	**$ 10,000.00**		**$ 10,000.00**	rough estimate, needs City input; no road closure needed
		Stabilized Construction Entrance	**1**	**EA**	**$ 3,000.00**		**$ 3,000.00**	Price derived from WSDOT UBA. Entrance from Innis Arden Way toward the lake
		Site Clearing - Clearing and Grubbing and Stripping and Stockpiling of Topsoil	**0.64**	**AC**	**$ 14,300.00**		**$ 9,200.00**	Price from WSDOT UBA. Clearing for upstream channel construction, assume access is maintained from dam area if dam removed in previous year
		Bark or Wood Chip Mulch	**1.57**	**AC**	**$ 13,000.00**		**$ 20,500.00**	Trailside restoration areas (4" depth, 5' wide each side of trail); Includes temporary access routes (18ft x 3200ft x 0.25ft) and incidental amount for staging area preparation as well as removal as needed
		Removal of Dam Conveyance and Trash Rack	**1**	**LS**	**$ 2,000.00**		**$ 2,000.00**	Reuse onsite excavated material. Quantity from CAD. Embankment compaction for upstream channel bank where the channel is not naturally deep enough
		Remove and Dispose of Gabion Matresses on Dam Face	**1**	**LS**	**$ 2,000.00**		**$ 2,000.00**	
		Demolition of Lake Outlet Conveyance	**1**	**LS**	**$ 3,500.00**		**$ 3,500.00**	Manhole ~$1.5k, pull pipes $2k
		Channel Excavation	**4250**	**CY**	**$ 35.00**		**$ 148,800.00**	Quantity from CAD plus over excavation for stream channel bed material; 650ft of stream channel through the lake reach. Includes control of water, removal and stockpiling Assumes $33+$2 per cy for water management.
		Embankment Compaction	**60**	**CY**	**$ 6.00**		**$ 400.00**	Reuse onsite excavated material. Quantity from CAD. Embankment compaction for upstream channel bank where the channel is not naturally deep enough
		Stream Channel	**1**	**LS**	**$ 113,200.00**		**$ 113,200.00**	channel length=650+112 FT; width= 25 FT; 2%@ 500ft long and 3%@ 150ft long; includes cost for stream channel for both the 2% and 3% sections
		Import Boulders	214	CY	$ 100.00	$ 21,366.94		see Streambed Material tab; price from Manashtash project
		Import Streambed Cobble/ Gravel	1293	CY	$ 70.00	$ 90,495.15		see Streambed Material tab; price from Manashtash project
		Placement of Boulders	214	CY	$ 6.00	$ 1,282.02		Price from Manashtash, 1 exc. 15 minute delivery r/t, place w/ 2 exc.s needed, 0.2 hour to place (2 Exc+op, laborer 0.2hr @ $150/hr)
		Habitat Structure Type 1	**3**	**EA**	**$ 3,800.00**		**$ 11,400.00**	
		Import Log: 18" DBH, 20' long no rootwad	1	EA	$ 750.00	$ 750.00		Structure and price from Hansen R5
		Import Log: 18" DBH, 30' long no rootwad	1	EA	$ 750.00	$ 750.00		Structure and price from Hansen R5
		Import Log: 18" DBH, 25' long with rootwad	2	EA	$ 750.00	$ 1,500.00		Structure and price from Hansen R5
		Labor, Installation, and Survey	0.5	DAY	$ 1,600.00	$ 800.00		Structure and price from Hansen R5
		Habitat Structure Type 2	**5**	**EA**	**$ 3,100.00**		**$ 15,500.00**	
		Import Log: 18" DBH, 30' long no rootwad	1	EA	$ 750.00	$ 750.00		Price from Hansen R5
		Import Log: 18" DBH, 25' long with rootwad	2	EA	$ 750.00	$ 1,500.00		Price from Hansen R5
		Labor, Installation, and Survey	0.5	DAY	$ 1,600.00	$ 800.00		Price from Hansen R5
		Wood Revetment Structure	**11**	**EA**	**$ 5,300.00**		**$ 58,300.00**	20 ft long sections
		Import Log: 18" DBH, 10' long no rootwad	1	EA	$ 750.00	$ 750.00		Price from Hansen R5
		Import Log: 18" DBH, 15' long no rootwad	2	EA	$ 750.00	$ 1,500.00		Price from Hansen R5
		Import Log: 18" DBH, 20' long no rootwad	1	EA	$ 750.00	$ 750.00		Structure and price from Hansen R5
		Import Log: 18" DBH, 10' long with rootwad	2	EA	$ 750.00	$ 1,500.00		Structure and price from Hansen R5
		Labor, Installation, and Survey	0.5	DAY	$ 1,600.00	$ 800.00		Price from Hansen R5
		Rock/Coir Wrap Embankment	**1**	**EA**	**$ 7,600.00**		**$ 7,600.00**	slope stabilization at the upstream end of the project to prevent slope faliure due to creek encroachment
		Streambed Boulders	20	CY	$ 77.00	$ 1,536.79		Revetment length= 112 FT; Price from Goheen
		Labor, Installation, and Survey	1.5	DAY	$ 1,600.00	$ 2,400.00		Price from Hansen R5
		Coir Lifts	240	LF	$ 15.00	$ 3,600.00		Price from Goheen, 1ft tall lifts; 120ft long and 2 lifts thick
		Soldier Pile Wall for Toe of Slope Upstream of Culvert	**783**	**SF**	**$ 80.00**		**$ 62,700.00**	west side 110ft length by 6ft tall, east side 41ft length by 3 ft tall; Price from HWA
		Trash Rack	**1**	**LS**	**$ 2,000.00**		**$ 2,000.00**	
		Riparian Plantings	**1**	**LS**	**$ 56,988.68**		**$ 57,000.00**	See "Planting Backup" tab, planting area covers 1.13 acres of lake bottom and steam bank planting; includes restoration area for the culvert reach. Temporary seeding will be used between phases.
		Spoils Grading in Lake bed	**4742**	**CY**	**$ 4.00**		**$ 19,000.00**	Disposal of excavation spoils onsite in the abandoned lake bed. Price from Pressentin
		Educational Viewing Platform at South End of New Trail	**1**	**LS**	**$ 20,000.00**		**$ 20,000.00**	assume basic wood or faux wood decking a few feet above ground level, incl. signage
		New Trail Construction	**300**	**LF**	**$ 250.00**		**$ 75,000.00**	Based roughly on City of Bellingham rule of thumb trail cost for 6 ft width and crushed surfacing, knowing width at Hidden Lake trail could be less and probably don't need crushed surfacing but access and site clearing tricky

Construction Subtotal	**$ 738,800**	
Tax (10.0%)	**$ 73,900**	
Construction Total (roundup to 1000's)	**$ 813,000**	
Contingency (30%)	**$ 244,000**	*note: reduced contingency compared to culvert reach*
Construction Total with Contingency	**$ 1,057,000**	
Permitting	**$ 75,000**	cost will be less if permitted in combo with culvert reach
Design	**$ 100,000**	
Construction Management & Administration (15% of Construction Cost)	**$ 158,550**	
Post-construction Vegetation Monitoring and Supplemental Planting	**$ 50,000**	
GRAND TOTAL	**$ 1,440,000**	

Engineering Cost Estimate for Conceptual Design – Preferred Alternative "Culvert Reach" OPTION B

(Phase division at STA 2+40, downstream of existing dam)

Project: **Hidden Lake Dam Removal**
Herrera **15-05984-000**
Client: **City of Shoreline**

Date Modified: 1/9/2018
Spreadsheet by: V. Wu
Checked by: I. Mostrenko
Latest Date Checked: 1/22/2018

Bid Item #	Spec Section	Item Description	Quantity	Unit	Unit Cost	Price	Total Price	Comments
		Mobilization	**1**	**LS**	**$ 77,200.00**		**$ 77,200.00**	8% of construction subtotal (Div 2 - Div 8 work items)
		Temporary Erosion and Sediment Control	**1**	**LS**	**$ 18,000.00**		**$ 18,000.00**	Assumes 2% of all other items except water management
		Water Management (Incl. Streamflow Bypass)	**1**	**LS**	**$ 50,000.00**		**$ 50,000.00**	utility protection
		Traffic Control	**1**	**LS**	**$ 25,000.00**		**$ 25,000.00**	rough estimate; assumes ~12 weeks of road closure
		Utilty Protection	**1**	**LS**	**$ 50,000.00**		**$ 50,000.00**	Engineer's estimation for water, gas, and cable utility protection during culvert excavation and backfilling
		Temporary Access Road (also used for lake reach access)	**1**	**LS**	**$ 10,000.00**		**$ 10,000.00**	
		Stabilized Construction Entrance	**1**	**EA**	**$ 3,000.00**		**$ 3,000.00**	extending from Innis Arden Way shoulder toward the downstream end of the culvert
		Site Clearing - Clearing and Grubbing and Stripping and Stockpiling of Topsoil	**0.25**	**AC**	**$ 14,300.00**		**$ 3,600.00**	Price from UBA. Clearing for Dam removal, culvert replacement, and roughened channel to tie the project into the existing grade.
		Removal of Structure and Obstructions	**2**	**LS**	**$ 1,500.00**		**$ 3,000.00**	Estimated splash pad dimensions: 9'x10'
		Replace 8" Diameter Sanitary Sewer	**200**	**LF**	**$ 60.00**		**$ 12,000.00**	replace a section of the sanitary sewer beneath Innis Arden Way before excavating for culvert removal to simplify bridging of the sewer between shoring walls, connect into existing MH to west
		48" Diameter Sewer Manhole	**2**	**LS**	**$ 6,000.00**		**$ 12,000.00**	For sewer replacement; manhole is immediately west of culvert replacement and will be encountered during excavation activities.
		Remove and Dispose of Asphalt Concrete Pavement	**670**	**SY**	**$ 8.00**		**$ 5,400.00**	assume 200' length of street
		Remove Guardrail	**1**	**LS**	**$ 500.00**		**$ 500.00**	
		Channel Excavation	**444**	**CY**	**$ 35.00**		**$ 15,600.00**	Quantity from CAD. Includes control of water, removal and stockpiling Assumes $33+$2 per cy for water management.
		Structure Excavation Class A	**6476**	**CY**	**$ 35.00**		**$ 226,700.00**	End Area calculation from CAD; 60ft of Section B excavation and 85ft of Section A excation and 20ft wide of grading from top of culvert to existing shoulder; Includes control of water, removal and stockpiling; price from HWA
		Stream Channel	**1**	**LS**	**$ 31,400.00**		**$ 31,400.00**	channel length=232 FT; width= 25 FT; 2%@ 165.5ft long and 10%@ 66.5ft long; includes cost for stream channel for both the 2% and 10% sections; bedmaterial needs to be re-laid in this section to meet design grade (concrete slab remained in place between phases)
		Import Boulders	95	CY	$ 77.00	$ 7,293.96		see Streambed Material tab; price from Manashtash project
		Import Streambed Cobble/ Gravel	391	CY	$ 60.00	$ 23,483.68		see Streambed Material tab; price from Manashtash project
		Placement of Boulders	95	CY	$ 6.00	$ 568.36		Price from Manashtash, 1 exc. 15 minute delivery r/t, place w/ 2 exc.s needed, 0.2 hour to place (2 Exc+op, laborer 0.2hr @ $150/hr)
		Precast Concrete Box Culvert	**1**	**LS**	**$300,000**		**$ 300,000.00**	120ft long culvert; price from Contech; includes cost of footing; does not include windwalls or head walls.
		Shoring	**1**	**LS**	**$ 116,000.00**		**$ 116,000.00**	
		Soldier Pile for Temporary Shoring	**1450**	SF	$ 80.00	$116,000.00		Cost from HWA; piling required for precast culvert placement and access road stability; 110ft on the west bank and 35ft on the east
		Embankment Backfill and Compaction	**6050**	**CY**	**$ 6.00**		**$ 36,300.00**	Reuse onsite excavated material, backfilling material over the culvert for roadway replacement and to fill in the access road (section c)
		Crushed Surfacing Base Course	**228**	**TN**	**$ 90.00**		**$ 20,500.00**	200ft long x 30ft wide (2 x 12ft wide lanes and 2 x 3ft wide shoulders) x 5in thick; see road calcs tab
		HMA CL. 1/2 IN. PG	**91**	**TN**	**$ 40.00**		**$ 3,700.00**	200ft long x 30ft wide (2 x 12ft wide lanes and 2 x 3ft wide shoulders) x 2in thick; see road calcs tab
		Steel Beam Guardrail (connect to existing)	**40**	**LF**	**$ 75.00**		**$ 3,000.00**	
		Spoils Grading in Lake Bed	**900**	**CY**	**$ 4.00**		**$ 3,600.00**	Disposal of excavation spoils onsite in the abandoned lake bed; includes excavation for stream channel and material removedfor culvert placement and grading from top of culvert to existing shoulder, remaining material is backfilled over the culvert for roadway reconstruction. Price from Pressentin
		Riparian Plantings	**1**	**LS**	**$ 14,514.19**		**$ 14,600.00**	See "Planting Backup" tab, planting area covers 1.13 acres of lake bottom and steam bank planting; includes restoration area for the culvert reach. Temporary seeding will be used between phases.

Construction Subtotal	**$ 1,041,100**
Tax (10.0%)	**$ 11,400**
Construction Total (roundup to 1000's)	**$ 1,053,000**
Contingency (50%)	**$ 527,000**
Construction Total with Contingency	**$ 1,580,000**
Permitting	**$ 50,000**
Design	**$ 200,000**
Construction Management & Administration (15% of Construction Cost)	**$ 237,000**
Post-construction Vegetation Monitoring and Supplemental Planting	**$ 20,000**
GRAND TOTAL	**$ 2,090,000**

Contract No. _____
Brief Description: _____

CITY OF SHORELINE
AGREEMENT FOR SERVICES – DESIGN PROFESSIONALS

This Agreement is entered into by and between the City of Shoreline, Washington, a municipal corporation hereinafter referred to as the "CITY," and _____, hereinafter referred to as the "CONSULTANT."

WHEREAS, the City desires to retain the services of a consultant to _____ and

WHEREAS, the City has selected _____ to perform the above-mentioned services;

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, it is mutually agreed as follows:

1. **Scope of Services to be Performed by the Consultant.**
   The Consultant shall perform the services outlined in Exhibit A. In performing these services, the Consultant shall at all times comply with all federal, state and local statutes, rules and ordinances applicable to the performance of such services. In addition, these services and all duties incidental or necessary therefore, shall be performed diligently and completely and in accordance with professional standards of conduct and performance. All services performed under this Agreement will be conducted solely for the benefit of the City and will not be used for any other purpose without written consent of the City.

2. **Compensation.**
   A. Services will be paid at the rate set forth in Exhibit A, not to exceed a maximum of $_____, including all fees and those reimbursable expenses listed in Exhibit A.
   B. The City shall pay the Consultant for services rendered after receipt of a billing voucher in the form set forth on Exhibit B. NO PAYMENT WILL BE ISSUED WITHOUT A BILLING VOUCHER. Payments will be processed within 30 (thirty) days from receipt of billing voucher. The Consultant shall be paid for services rendered but, in no case shall the total amount to be paid exceed the amount(s) noted in the Exhibit(s) and approved by the City. The consultant shall complete and return a W-9 to the City prior to contract execution by the City. No payment will be issued without a Taxpayer Identification Number on file. Mail all billing vouchers to: the attention of the contract manager identified in Section 16, 17500 Midvale Avenue North, Shoreline, Washington 98133-4905.

3. **Term.**
   A. The term of this Agreement shall commence _____and end at midnight on the _____ day of _____, 20____.

4. **Termination.**
   A. The City reserves the right to terminate this Agreement at any time, with or without cause by giving fourteen (14) days notice to Consultant in writing. In the event of such termination or suspension, all finished or unfinished documents, data, studies, worksheets, models and reports, or other material prepared by the Consultant pursuant to this Agreement shall be submitted to the City.
   B. In the event this Agreement is terminated by the City, the Consultant shall be entitled to payment for all hours worked and reimbursable expenses incurred to the effective date of termination, less all payments previously made. This provision shall not prevent the City from seeking any legal remedies it may have for the violation or nonperformance of any of the provisions of this Agreement and any such charges due the City shall be deducted from the final payment due the Consultant. No

payment shall be made by the City for any expenses incurred or work done following the effective date of termination unless authorized in advance in writing by the City.

C. The Consultant reserves the right to terminate this Agreement with not less than sixty (60) days written notice, or in the event outstanding invoices are not paid within 30 days.

D. If the Consultant is unavailable to perform the scope of services, the City may, at its option, cancel this Agreement immediately.

5. Ownership of Documents.

A. All documents, data, drawings, specifications, software applications and other products or materials produced by the Consultant in connection with the services rendered under this Agreement shall be the property of the City whether the project for which they are made is executed or not. All such documents, products and materials shall be forwarded to the City at its request and may be used by the City as it sees fit. The City agrees that if the documents, products and materials prepared by the Consultant are used for purposes other than those intended by the Agreement, the City does so at its sole risk and agrees to hold the Consultant harmless for such use.

B. The Consultant acknowledges that the City is a public agency subject to Washington's Public Records Act, chapter 42.56 RCW, and that all documents produced by the Consultant in connection with the services rendered under this Agreement may be deemed a public record as defined in the Public Records Act and that if the City receives a public records request, unless a statute exempts disclosure, the City must disclose the record to the requestor. All or portions of materials, products and documents produced under this Agreement may be used by the Consultant if the City confirms that they are subject to disclosure under the Public Disclosure Act.

C. The Consultant shall preserve the confidentiality of all City documents and data accessed for use in Consultant's work product. Any requests for City documents and data held by Consultant shall be forwarded to the City which shall be solely responsible for responding to the request.

6. Independent Contractor Relationship.

A. The consultant is retained by the City only for the purposes and to the extent set forth in this Agreement. The nature of the relationship between the Consultant and the City during the period of the services shall be that of an independent contractor, not employee. The Consultant, not the City, shall have the power to control and direct the details, manner or means of services. Specifically, but not by means of limitation, the Consultant shall have no obligation to work any particular hours or particular schedule, unless otherwise indicated in the Scope of Work where scheduling of attendance or performance is critical to completion, and shall retain the right to designate the means of performing the services covered by this Agreement, and the Consultant shall be entitled to employ other workers at such compensation and on such other conditions as it may deem proper, provided, however, that any contract so made by the Consultant is to be paid by it alone, and that employing such workers, it is acting individually and not as an agent for the City.

B. The City shall not be responsible for withholding or otherwise deducting federal income tax or Social Security or contributing to the State Industrial Insurance Program, or otherwise assuming the duties of an employer with respect to Consultant or any employee of the Consultant.

7. Hold Harmless.

The Consultant shall defend, indemnify, and hold the City, its officers, officials, employees and volunteers harmless from any and all claims, injuries, damages, losses or suits including attorney fees resulting from the sole negligence and/or willful misconduct of the Consultant, its agents or employees in arising out of or in connection with the performance of this Agreement.

In the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Consultant and the City, its officers, officials, employees, and volunteers, the Consultant's liability hereunder shall be only to the extent of the Consultant's negligence. It is further specifically and expressly understood that the Consultant hereby waives the immunity under Industrial Insurance, Title 51 RCW, solely for the purpose of this indemnification. This waiver has been mutually negotiated by the parties. The provisions of this section shall survive the expiration or termination of this Agreement.

8. Gifts.
The City's Code of Ethics and Washington State law prohibit City employees from soliciting, accepting, or receiving any gift, gratuity or favor from any person, firm or corporation involved in a contract or transaction. To ensure compliance with the City's Code of Ethics and state law, the Consultant shall not give a gift of any kind to City employees or officials.

9. City of Shoreline Business License.
As mandated by SMC 5.05.030, the Consultant shall obtain a City of Shoreline Business License prior to performing any services and maintain the business license in good standing throughout the term of its agreement with the City.

10. Insurance.
Consultant shall obtain insurance of the types described below during the term of this agreement and extensions or renewals. These policies are to contain, or be endorsed to contain, provisions that 1) Consultant's insurance coverage shall be primary insurance with insurance or insurance pool coverage maintained by the City as excess of the Consultant's insurance (except for professional liability insurance); and 2) Consultant's insurance coverage shall not be cancelled, except after thirty (30) days prior written notice to the City.

A. Professional Liability, Errors or Omissions insurance with limits of liability not less than $1,000,000 per claim and $1,000,000 policy aggregate limit shall be provided if services delivered pursuant to their Contract involve or require professional services provided by a licensed professional including but not limited to engineers, architects, accountants, surveyors, and attorneys.

B. Commercial General Liability insurance covering premises, operations, independent contractors' liability and damages for personal injury and property damage with a limit of no less than $1,000,000 each occurrence and $2,000,000 general aggregate. The City shall be named as an additional insured on this policy. The Consultant shall submit to the City a copy of the insurance certificate and relevant endorsement(s) as evidence of insurance coverage acceptable to the City.

C. Automobile Liability insurance with combined single limits of liability not less than $1,000,000 for bodily injury, including personal injury or death and property damage shall be required if delivery of service directly involves Consultant use of motor vehicles.

11. Delays.
Consultant is not responsible for delays caused by factors beyond the Consultant's reasonable control. When such delays beyond the Consultant's reasonable control occur, the City agrees the Consultant is not responsible for damages, nor shall the Consultant be deemed to be in default of the Agreement.

12. Successors and Assigns.
Neither the City nor the Consultant shall assign, transfer or encumber any rights, duties or interests accruing from this Agreement without the written consent of the other.

13. Nondiscrimination.
In hiring or employment made possible or resulting from this Agreement, there shall be no unlawful discrimination against any employee or applicant for employment because of sex, age, race, color, creed, national origin, marital status or the presence of any sensory, mental, or physical handicap, unless based upon a bona fide occupational qualification. This requirement shall apply to but not be limited to the following: employment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. No person shall be denied or subjected to discrimination in receipt or the benefit of any services or activities made possible by or resulting from this Agreement on the grounds of sex, race, color, creed, national origin, age except minimum age and retirement provisions, marital status, or in the presence of any sensory, mental or physical handicap.

14. Notices.

Any notice required under this Agreement will be in writing, addressed to the appropriate party at the address which appears below (as modified in writing from time to time by such party), and given personally, by registered or certified mail, return receipt requested, by facsimile or by a nationally recognized overnight courier service. All notices shall be effective upon the date of receipt.

City Manager	Consultant Name: _____
City of Shoreline	Name of Firm: _____
17500 Midvale Avenue N	Address: _____
Shoreline, WA 98133-4905	Address: _____
(206) 801-2700	Phone Number: _____

15. Governing Law and Venue.

This Agreement shall be construed and enforced in accordance with the laws of the State of Washington. Venue of any suit between the parties arising out of this Agreement shall be King County Superior Court.

16. General Administration and Management.

The City's contract manager shall be (name and title): _____.

17. Severability.

Any provision or part of the Agreement held to be void or unenforceable under any law or regulation shall be deemed stricken and all remaining provisions shall continue to be valid and binding upon the City and the Consultant, who agree that the Agreement shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

18. Entire Agreement.

This agreement contains the entire Agreement between the parties hereto and no other agreements, oral or otherwise, regarding the subject matter of this agreement, shall be deemed to exist or bind any of the parties hereto. Either party may request changes in the agreement. Proposed changes which are mutually agreed upon shall be incorporated by written amendment to this agreement.

This agreement is executed by

CITY OF SHORELINE	**CONSULTANT**
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

Approved as to form:

By: _____

Margaret J. King, City Attorney
Julie Ainsworth-Taylor, Assistant City Attorney

Attachments: Exhibit A (Scope and compensation), B (Billing Voucher)

APPENDIX B

Wetland Delineation Methods

WETLAND DELINEATION METHODS

The wetland delineation for the Hidden Lake Dam Removal Project was performed in accordance with the *Regional Supplement to the US Army Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region* (Environmental Laboratory 2010), which is consistent with the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). These methods use a three-parameter approach for identifying and delineating wetlands: the presence of field indicators for hydrophytic vegetation, hydric soils, and hydrology. This wetland delineation was performed according to procedures specified for the routine wetland determination method (Environmental Laboratory 1987).

HYDROPHYTIC VEGETATION

Hydrophytic vegetation is characterized by the ability to grow, effectively compete, reproduce, and persist in anaerobic soil conditions resulting from periodic or long-term saturation (Environmental Laboratory 1987). Vegetation must meet at least one of the four indicators (described below) that are used to determine the presence of hydrophytic vegetation in wetlands. Problematic and atypical situations for hydrophytic vegetation are also described in the US Army Corps of Engineers (USACE) delineation manual and supplement (Environmental Laboratory 1987, 2010).

Plant Species Identification

Plant species were identified using *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1987) and *A Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon* (Cooke 1997). The indicator status of each plant species is based on the *National Wetland Plant List* (Lichvar 2016) for the Western Mountains, Valleys, and Coast Region.

Dominant Species Determination

Dominant species are those that contribute more than other species to the character of a plant community. To determine dominance, a vegetation sampling area is determined by the field biologist to accurately characterize the plant community that occurs in the area to be evaluated. These are commonly circular sampling areas, centered on the location of the test plot (where soil and hydrologic data is also collected). The radius of the circle is determined in the field, based on site conditions. In large wetlands, a typical sampling radius would be 2 to 5 meters for tree and sapling/shrub species, and 1 meter for herbaceous species. In a small or narrow wetland (or upland), the radius might be reduced to accurately sample wetland (upland) areas,

thereby avoiding an overlap into an adjacent community having different vegetation, soils, or hydrologic conditions (Environmental Laboratory 2010).

Within the vegetation sampling area, a complete list of plant species that occur in the sampling area is compiled and the species divided into four strata: tree, shrub (including saplings, see criteria below), herb, and woody vines. A plant is included in the tree stratum if it is a woody plant 3 inches in diameter at breast height (dbh) or greater; in the shrub stratum if it is a woody plant less than 3 inches dbh (including tree saplings under 3 inches dbh); in the herb stratum if it is an herbaceous (non-woody) plant; and in the woody vine stratum if it is a woody vine of any height (Environmental Laboratory 2010). To be included in the sampling, 50 percent or more of the plant base must be within the radius of the sampling area. For trees specifically, more than 50 percent of the trunk (diameter) must be within the sampling radius to be included.

A rapid test, dominance test (e.g., the 50/20 rule), or prevalence index are commonly used to determine which species are considered dominant and to assess whether the criteria for hydrophytic vegetation are met at each test plot (Environmental Laboratory 2010). Additional hydrophytic vegetation indicators are discussed in the following section.

To conduct a rapid test (Indicator 1 on the wetland determination data form), the dominant species are evaluated visually and if all are FACW or OBL, the vegetation data passes the rapid test. To conduct a dominance test (Indicator 2 on the wetland determination data form), the absolute areal coverage of the plant species within a stratum are totaled, starting with the most abundant species and including other species in descending order of coverage, until the cumulative coverage exceeds 50 percent of the total coverage for the stratum. The plant species that constitute this first 50 percent of areal coverage are considered the dominant species in the stratum. In addition, any other any single plant species that constitutes at least 20 percent of the total percent cover in the stratum is also considered a dominant species (Environmental Laboratory 2010). The indicator status category for each plant (shown in Table B-1) is also listed on the wetland determination form. If more than 50 percent of the dominant species across all strata are rated OBL, FACW, or FAC, the hydrophytic vegetation dominance test (Indicator 2) is met.

The prevalence index (Indicator 3 on the wetland determination data form) is a weighted-average wetland indicator status of all plant species in the sampling plot, where weighting is by abundance (Environmental Laboratory 2010). This method is used where indicators of hydric soil and wetland hydrology are present, but the vegetation initially fails the rapid and dominance tests (Indicators 1 and 2). To determine the prevalence index, the absolute cover of each species in each stratum is determined. All species (across all strata) are organized into wetland indicator status groups (i.e., OBL, FACW, FAC, FACU, or UPL) and their cover values are summed within the groups. The formula for the prevalence index is applied. If the prevalence index (which ranges from 1.0 to 5.0) equals 3.0 or less, this hydrophytic vegetation indicator is met.

Table B-1. Plant Indicator Status Categories.		
Indicator Status	**Indicator Symbol**	**Definition**
Obligate wetland plants	OBL	Plants that occur almost always (estimated probability >99%) in wetlands under natural conditions but also occur rarely (estimated probability <1 percent) in upland areas
Facultative wetland plants	FACW	Plants that usually occur (estimated probability >67 percent) in wetlands under natural conditions but also occur (estimated probability 1 percent to 33 percent) in upland areas
Facultative plants	FAC	Plants with a similar likelihood (estimated probability 33 percent to 67 percent) of occurring in both wetlands and upland areas
Facultative upland plants	FACU	Plants that sometimes occur (estimated probability 1 percent to 33 percent) in wetlands but occur more often (estimated probability >67 percent to 99 percent) in upland areas
Obligate upland plants	UPL	Plants that rarely occur (estimated probability <1 percent) in wetlands under natural conditions
$WET \longleftarrow OBL - FACW - FAC - FACU - UPL \longrightarrow DRY$		

Source: Environmental Laboratory (1987).

Additional Hydrophytic Vegetation Indicators

The presence of morphological adaptations to wetland conditions in plants that lack a published hydrophytic vegetation indicator status or with an indicator status of FACU or drier is also a hydrophytic vegetation indicator (Indicator 4). Evidence of physiological, morphological, or reproductive adaptations indicating growth in hydrophytic conditions can include, but are not limited to, buttressed roots, adventitious roots, multi-stemmed trunks, or tussocks. To determine whether Indicator 4 is met, the morphological features must be observed on more than 50 percent of the individuals of a FACU species (or species without a published indicator status) living in an area where hydric soil and wetland hydrology are present. On the wetland determination data form, the indicator status of the species with morphological adaptations would be changed to FAC (with supporting notes), and the dominance test (Indicator 2) and/or prevalence index (Indicator 3) would then be recalculated.

Wetland non-vascular plants, referred to as bryophytes and consisting of mosses, liverworts, and hornworts, may also meet the hydric vegetation criteria, under Indicator 5 (Environmental Laboratory 2010). These plants must be present in areas containing hydric soils and wetland hydrology. The percent cover of wetland specialist bryophytes is determined in 10-inch-by-10-inch square plots placed at the base of hummocks, if present. The summed cover of wetland specialist bryophytes must be more than 50 percent of the total bryophyte cover in the vegetation sampling area.

The problematic hydrophytic vegetation indicator section in the USACE regional supplement further explains how to interpret situations in which hydric soils and wetland hydrology are present but hydrophytic vegetation Indicators 1 through 5 are lacking (Environmental

Laboratory 2010). Procedures for looking at settings such as areas with active vegetation management (e.g., farms), areas dominated by aggressive invasive species, active floodplains, and low terraces are described, as well as explanations for specific situations, such as seasonal shifts in plant communities, extended drought conditions, and riparian areas.

HYDRIC SOILS

A hydric soil is a soil that is saturated, flooded, or inundated long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation (Environmental Laboratory 1987, 2010). The evaluation of existing soil maps (developed by the US Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] and other sources) is used to understand hydric soil distribution and to identify the likely locations of hydric soils (by verifying their inclusion on the hydric soils list). Comparison of these mapped soils to conditions found on site help verify the presence of hydric soils.

For onsite soils characterization, hydric soils data were obtained generally by digging test pits at least 20 inches deep and 4 inches wide. Hydric soil conditions were evaluated using indicators outlined in *Field Indicators of Hydric Soils in the United States* (NRCS 2017) and adopted by the *Regional Supplement to the US Army Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region* (Environmental Laboratory 2010).

Hydric soil indicators applicable to the Western Mountains, Valleys, and Coast region include, but are not limited to, the presence of organic soils (i.e., histosols or histic epipedons); sulfidic material (i.e., hydrogen sulfide); depleted, gleyed, or reduced soil matrices; and/or the presence of iron or manganese concretions (Environmental Laboratory 2010). Soil color characterization (i.e., hue, value, and chroma) is a critical tool in determining depleted, gleyed, and reduced soil conditions. Soil color was evaluated by comparing soil colors at test plots to standardized color samples in *Munsell Soil Color Charts* (Munsell Color 2000).

WETLAND HYDROLOGY

Wetland hydrology is indicated by site conditions that demonstrate the periodic inundation or saturation to the soil surface for a sufficient duration during the total growing season. A *sufficient duration* during the growing season is defined as 14 or more consecutive days of flooding, ponding, or presence of a water table at 12 inches or less from the soil surface (Environmental Laboratory 2010). The growing season is the period of consecutive frost-free days, or the longest period during which the soil temperature stays above biological zero (41°F), when measured at 12 inches below the soil surface.

Two indicators of biological activity can be used to determine whether the growing season has begun and is ongoing (Environmental Laboratory 2010):

- Occurrence of aboveground growth and development of at least two non-evergreen vascular plant species growing within the wetland. Examples of this growth include the emergence or elongation of leaves on woody plants and the emergence or opening of flowers.

- Soil temperature, which can be measured once during a single site visit, should be at least 41°F or higher at a depth of 12 inches.

For this assessment, onsite hydrologic indicators were examined at the test plots. Hydrologic indicators include the presence of surface water, standing water in the test pit at a depth of 12 inches or less, saturation in the root zone, watermarks, drift lines, sediment deposits, drainage patterns within wetlands, oxidized rhizospheres surrounding living roots, and water-stained leaves.

Antecedent Precipitation Analysis

Analyzing climatic conditions and local weather patterns are important in the assessment of vegetation, soil conditions, and hydrology for wetland delineations (Environmental Laboratory 1987, 2010), and information on precipitation that precedes a site visit is valuable in helping determine whether conditions observed as a site are reflective of normal rainfall. The NRCS (1997) provides methodology for the analysis of normal environmental conditions using antecedent rainfall measurements. For this method, "normal precipitation" is defined as ranges of normal precipitation or values falling within defined thresholds, in this case, the 30th and 70th percentile thresholds (Sprecher and Warne 2000). These ranges for a particular site are provided by WETS tables, which can be accessed through the NRCS National Water and Climate Center (NRCS 2018) and are calculated using long-term data (30 years) recorded at National Weather Service meteorological stations. USDA WETS tables display monthly average rainfall data (50th percentile) in addition to the upper and lower limits at which there is a 30 percent chance that rainfall will be more or less than the average (30th and 70th percentiles) (NRCS 2017). USDA WETS tables use climatological probabilities and are calculated on the basis of the most recent three decades of data, as factors such as climate change and different recording technologies may alter probabilities (Sprecher and Warne 2000). Currently, the 30-year range from 1981 to 2010 is used. This method makes the assumptions that rainfall is evenly distributed within a month, that antecedent precipitation can be properly evaluated for a 3-month period (i.e., assumes that evapotranspiration is the same in each season), that antecedent precipitation affects different systems similarly, and that snowmelt has the same contribution to hydrology as rainfall (Sprecher and Warne 2000).

To determine whether recent precipitation is reflective of normal precipitation, a representative weather station near the site is selected; as other conditions may affect precipitation (e.g., elevation, aspect, and proximity to mountains), the nearest station may not be the most representative of the site (Environmental Laboratory 2010). The procedure for determining normal precipitation uses measured rainfall data from the 3 months prior to the month of the site visit. For example, if the site visit occurs in September, precipitation data from June, July, and

August would be analyzed. The recorded rainfall of each month is first compared to the long-term range of normal precipitation (30th and 70th percentiles) and is determined to have a "normal" condition if it falls within this range; if the recorded data is higher or lower than the range, then it is determined to have a "wet" or "dry" condition, respectively. The condition is then given a value, "1" for "dry," "2" for "normal," and "3" for "wet"; and this value is multiplied by the weighted monthly value, where the most recent month (one month prior) is weighted heavier (3) than 3 months prior (1). The sum of this product is then used to determine whether the entire 3-month period is "drier than normal" (6–9), "normal" (10–14) or "wetter than normal" (15–18). While this method is useful for comparing a short-term time period to normal, this method is limited in that it is discounts analysis of daily precipitation patterns within a given month (Sprecher and Warne 2000, Sumner et al. 2009).

REFERENCES

Cooke, S. 1997. A Field Guide to the Common Wetland Plants of Western Washington and Northwest Oregon. Seattle Audubon Society and Washington Native Plant Society, Seattle, Washington. June.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. January.

Environmental Laboratory. 2010. Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys, and Coast Region. Technical Report TR-08-13. US Army Corps of Engineers, Engineer Research and Development Center, Wetlands Regulatory Assistance Program, Vicksburg, Mississippi.

Hitchcock, C.L., and A. Cronquist. 1987. Flora of the Pacific Northwest. University of Washington Press, Seattle, Washington.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2018 wetland ratings. Phytoneuron 2016-30:1-17. US Army Corps of Engineers. Accessed November 30, 2018. <http://rsgisias.crrel.usace.army.mil/NWPL/>.

Munsell Color. 2000. Munsell Soil Color Charts. New Windsor, New York.

NRCS. 1997. Hydrology Tools for Wetland Determination. Chapter 19, Engineering field handbook. Edited by D.E. Woodward. USDA-NRCS, Fort Worth, Texas.

NRCS. 2017. Field Indicators of Hydric Soil in the United States, Version 8.1. L.M. Vasilas, G.W. Hurt, and J.F. Berkowitz, eds. US Department of Agriculture, Natural Resources Conservation Service, in cooperation with the National Technical Committee for Hydric Soils.

NRCS. 2018. Agricultural Applied Climate Information System. US Department of Agriculture, Natural Resources Conservation Service. Accessed January 25, 2018. <https://efotg.sc.egov.usda.gov/efotg_locator.aspx>.

Sprecher, S., and A. Warne. 2000. Accessing and Using Meteorological Data to Evaluate Wetland Hydrology. Technical Report TR-WRAP-00-01. US Army Corps of Engineers, Engineer Research and Development Center, Operations Division Regulatory Branch, Vicksburg, Mississippi. April.

Sumner, J.P., M.J. Vepraskas, and R.K. Kolka. 2009. Methods to Evaluate Normal Rainfall for Short-term Wetland Hydrology Assessment. Wetlands 29(3):1049–1062.

APPENDIX C

Wetland Delineation Data Forms

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Hidden Lake Dam Removal Project **City/County:** Shoreline/King **Sampling Date:** 04-Oct-18

Applicant/Owner: City of Shoreline **State:** WA **Sampling Point:** TP-A-UPL

Investigator(s): S. Petro, C. Merten **Section, Township, Range:** S 12 T 28N R 3E

Landform (hillslope, terrace, etc.): toe of slope **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR): LRR A **Lat.:** 47.7525 **Long.:** -122.3695 **Datum:** NAD 1983

Soil Map Unit Name: n/a **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present? Yes ○ No ◉	
Wetland Hydrology Present? Yes ○ No ◉	

Remarks:
Only one of the three wetland parameters present.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 3m^2)			
1. Fraxinus latifolia	25	☑ 26.3%	FACW
2. Acer macrophyllum	70	☑ 73.7%	FACU
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
	95	= Total Cover	
Sapling/Shrub Stratum (Plot size: 2m^2)			
1. Rubus spectabilis	50	☑ 100.0%	FAC
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
	50	= Total Cover	
Herb Stratum (Plot size: 1m^2)			
1. Geranium robertianum	10	☑ 45.5%	FACU
2. Ranunculus repens	10	☑ 45.5%	FAC
3. Rubus laciniatus	2	☐ 9.1%	FACU
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
	22	= Total Cover	
Woody Vine Stratum (Plot size: 1m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
	0	= Total Cover	

% Bare Ground in Herb Stratum: 0

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	**x 1 =**	0
FACW species	25	**x 2 =**	50
FAC species	60	**x 3 =**	180
FACU species	82	**x 4 =**	328
UPL species	0	**x 5 =**	0
Column Totals:	167	**(A)**	558 **(B)**

Prevalence Index = B/A = 3.341

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks:
Vegetation meets dominance test.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: TP-A-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR	2/1	100						Sandy Loam	
2-15	10YR	4/3	100						Sand	

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

No hydric soil indicators present.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches): _____

Water Table Present? Yes ○ No ◉ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches): _____

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators present.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Hidden Lake Dam Removal Project **City/County:** Shoreline/King **Sampling Date:** 04-Oct-18

Applicant/Owner: City of Shoreline **State:** WA **Sampling Point:** TP-A-WET

Investigator(s): S. Petro, C. Merten **Section, Township, Range:** S 12 T 28N R 3E

Landform (hillslope, terrace, etc.): depression **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR): LRR A **Lat.:** 47.7525 **Long.:** -122.3694 **Datum:** NAD 1983

Soil Map Unit Name: n/a **NWI classification:** PSSCh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present? Yes ◉ No ○	
Wetland Hydrology Present? Yes ◉ No ○	

Remarks:
All three wetland parameters are met.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 3m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 2m^2)			
1. Rubus spectabilis	2	☑ 100.0%	FAC
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
	2	= Total Cover	
Herb Stratum (Plot size: 1m^2)			
1. Ranunculus repens	75	☑ 83.3%	FAC
2. Geum macrophyllum	10	☐ 11.1%	FAC
3. Lysichiton americanum	5	☐ 5.6%	OBL
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
	90	= Total Cover	
Woody Vine Stratum (Plot size: 1 m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
	0	= Total Cover	

% Bare Ground in Herb Stratum: 10

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	**x 1 =**	5
FACW species	0	**x 2 =**	0
FAC species	87	**x 3 =**	261
FACU species	0	**x 4 =**	0
UPL species	0	**x 5 =**	0
Column Totals:	92	**(A)**	266 **(B)**

Prevalence Index = B/A = 2.891

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks:
Vegetation meets dominance test and prevalance index.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: TP-A-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR	2/2	100						Loamy Sand	
2-10	10YR	5/2	97	10YR	5/8	3	C	M	sand	
10-20	GL 2	4/10BG	46.5						Loamy Sand	
10-20	10YR	3/2	46.5	10YR	3/4	5	C	M	Loamy Sand	

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☑ Sandy Gleyed Matrix (S4)
- ☑ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

Soil meets hydric soil indicators S4 and S5.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ◉ No ○	Depth (inches):	12
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	10

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Hydrology indicators A2 and A3 are met.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Hidden Lake Dam Removal Project **City/County:** Shoreline/King **Sampling Date:** 04-Oct-18

Applicant/Owner: City of Shoreline **State:** WA **Sampling Point:** TP-B-UPL

Investigator(s): S. Petro, C. Merten **Section, Township, Range:** S 12 T 28N R 3E

Landform (hillslope, terrace, etc.): edge of lake **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR): LRR A **Lat.:** 47.7523 **Long.:** -122.3703 **Datum:** NAD 1983

Soil Map Unit Name: n/a **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉	No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○	No ◉	
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks:
Only one of the three wetland parameters present.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 3m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 2m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
	0	= Total Cover	
Herb Stratum (Plot size: 1m^2)			
1. Agrostis stolonifera	30	☑ 54.5%	FAC
2. Holcus lanatus	10	☐ 18.2%	FAC
3. Equisetum arvense	10	☐ 18.2%	FAC
4. Trifolium pratense	5	☐ 9.1%	FACU
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
	55	= Total Cover	
Woody Vine Stratum (Plot size: 1m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
	0	= Total Cover	

% Bare Ground in Herb Stratum: 0

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	**x 1 =**	0
FACW species	0	**x 2 =**	0
FAC species	50	**x 3 =**	150
FACU species	5	**x 4 =**	20
UPL species	0	**x 5 =**	0
Column Totals:	55	**(A)**	170 **(B)**

Prevalence Index = B/A = 3.091

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks:
vegetation meets dominance test.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: TP-B-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR	5/3	100						sand	
2-13	10YR	4/3	100						sand	

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

No hydric soil indicators met.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches): _____

Water Table Present? Yes ○ No ◉ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches): _____

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Hidden Lake Dam Removal Project **City/County:** Shoreline/King **Sampling Date:** 04-Oct-18

Applicant/Owner: City of Shoreline **State:** WA **Sampling Point:** TP-B-WET

Investigator(s): S. Petro, C. Merten **Section, Township, Range:** S 12 T 28N R 3E

Landform (hillslope, terrace, etc.): edge of lake **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR): LRR A **Lat.:** 47.7523 **Long.:** -122.3703 **Datum:** NAD 1983 H

Soil Map Unit Name: n/a **NWI classification:** PSSCh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present? Yes ◉ No ○	
Wetland Hydrology Present? Yes ◉ No ○	

Remarks:
All three wetland parameters are met.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 3m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 2m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
	0	= Total Cover	
Herb Stratum (Plot size: 1m^2)			
1. Typha latifolia	5	☐ 5.4%	OBL
2. Phalaris arundinacea	40	☑ 43.0%	FACW
3. Scirpus microcarpus	45	☑ 48.4%	OBL
4. Lemna minor	3	☐ 3.2%	OBL
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
	93	= Total Cover	
Woody Vine Stratum (Plot size: 1m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
	0	= Total Cover	

% Bare Ground in Herb Stratum: 7

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	53	**x 1 =**	53
FACW species	40	**x 2 =**	80
FAC species	0	**x 3 =**	0
FACU species	0	**x 4 =**	0
UPL species	0	**x 5 =**	0
Column Totals:	93	**(A)**	133 **(B)**

Prevalence Index = B/A = 1.430

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks:
Vegetation meets rapid test for hydrophytic vegetation, dominance test, and prevalence index.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: TP-B-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-2	G2	4/5BG	95	10YR	6/6	5	C	M	Sand	
2-20	G2	4/5BG	99	10YR	6/6	1	C	M	Sand	

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☑ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Soil meets hydric soil indicator S4.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ◉	No ○	Depth (inches):	9
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Hydrology indicators A2 and A3 are met.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Hidden Lake Dam Removal Project **City/County:** Shoreline/King **Sampling Date:** 04-Oct-18

Applicant/Owner: City of Shoreline **State:** WA **Sampling Point:** TP-C-UPL

Investigator(s): S. Petro, C. Merten **Section, Township, Range:** S 12 T 28N R 3E

Landform (hillslope, terrace, etc.): stream bank **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR): LRR A **Lat.:** 47.7528 **Long.:** -122.3695 **Datum:** NAD 1983

Soil Map Unit Name: n/a **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present? Yes ○ No ◉	
Wetland Hydrology Present? Yes ○ No ◉	

Remarks:
No wetland indicators present.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 3m^2)			
1. Acer macrophyllum	50	☑ 100.0%	FACU
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
	50	= Total Cover	
Sapling/Shrub Stratum (Plot size: 2m^2)			
1. Rubus spectabilis	0	☐ 0.0%	FAC
2. Rubus ursinus	10	☑ 100.0%	FACU
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
	10	= Total Cover	
Herb Stratum (Plot size: 1m^2)			
1. Equisetum arvense	10	☑ 100.0%	FAC
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
	10	= Total Cover	
Woody Vine Stratum (Plot size: 1m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
	0	= Total Cover	

% Bare Ground in Herb Stratum: 90

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	**x 1 =**	0
FACW species	0	**x 2 =**	0
FAC species	10	**x 3 =**	30
FACU species	60	**x 4 =**	240
UPL species	0	**x 5 =**	0
Column Totals:	70	**(A)**	270 **(B)**

Prevalence Index = B/A = 3.857

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **4 - Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **5 - Wetland Non-Vascular Plants** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks:
No hydrophytic vegetation indicators present.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: TP-C-UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR	3/2	100						sand	
3-14	10YR	5/2	100						sand	

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

No hydric soil indicators met.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches): _____

Water Table Present? Yes ○ No ◉ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches): _____

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

No hydrology indicators are present.

WETLAND DETERMINATION DATA FORM - Western Mountains, Valleys, and Coast Region

Project/Site: Hidden Lake Dam Removal Project **City/County:** Shoreline/King **Sampling Date:** 04-Oct-18

Applicant/Owner: City of Shoreline **State:** WA **Sampling Point:** TP-C-WET

Investigator(s): S. Petro, C. Merten **Section, Township, Range:** S 12 T 28N R 3E

Landform (hillslope, terrace, etc.): stream bank **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR): LRR A **Lat.:** 47.7527 **Long.:** -122.3697 **Datum:** NAD 1983

Soil Map Unit Name: n/a **NWI classification:** Riverine

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present? Yes ◉ No ○	
Wetland Hydrology Present? Yes ◉ No ○	

Remarks:
All three wetland parameters are met.

VEGETATION - Use scientific names of plants.

	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 3m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 2m^2)			
1. Rubus spectabilis	3	☑ 100.0%	FAC
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
	3	= Total Cover	
Herb Stratum (Plot size: 1m^2)			
1. Ranunculus repens	40	☑ 44.9%	FAC
2. Scirpus microcarpus	3	☐ 3.4%	OBL
3. Holcus lanatus	5	☐ 5.6%	FAC
4. Equisetum arvense	1	☐ 1.1%	FAC
5. Poa pratensis	40	☑ 44.9%	FAC
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
	89	= Total Cover	
Woody Vine Stratum (Plot size: 1m^2)			
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
	0	= Total Cover	

% Bare Ground in Herb Stratum: 11

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	3	x 1 =	3
FACW species	0	x 2 =	0
FAC species	89	x 3 =	267
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	92 (A)		270 (B)

Prevalence Index = B/A = 2.935

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☑ 3 - Prevalence Index is ≤3.0 [1]
- ☐ 4 - Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - Wetland Non-Vascular Plants [1]
- ☐ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks:
Vegetation meets dominance test and prevalence index.

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: TP-C-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR	3/2	97	10YR	3/6	3	C	M	Loamy Sand	
2-6	10YR	3/1	90	7.5YR	3/3	5	C	M	sand	
2-6				10YR	5/8	5	C	PL	sand	
6-8	10YR	4/2	80	10YR	4/6	20	C	M	sand	
8-13+	G2	5/10B	95	7.5YR	4/6	5	C	M	sand	

[1]Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☑ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except in MLRA 1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

Hydric soil indicator S5 is met.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (except MLRA 1, 2, 4A, and 4B)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (LRR A)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Water-Stained Leaves (B9) (MLRA 1, 2, 4A, and 4B)
- ☐ Drainage Patterns (B10)
- ☐ Dry Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (LRR A)
- ☐ Frost Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ◉	No ○	Depth (inches):	8
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitor well, aerial photos, previous inspections), if available:

Remarks:

Hydrology indicators A2 and A3 are present.

APPENDIX D

Wetland Rating Forms

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland A1 Date of site visit: 4-Oct-18

Rated by S. Petro, E. Spear Trained by Ecology? ☑ Yes ☐ No Date of training Oct-18

HGM Class used for rating Depressional & Flats Wetland has multiple HGM classes? ☐ Yes ☐ No

NOTE: Form is not complete with out the figures requested (*figures can be combined*).
Source of base aerial photo/map King County Aerial 2017

OVERALL WETLAND CATEGORY IV (based on functions ☑ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____ **Category I** - Total score = 23 - 27
_____ **Category II** - Total score = 20 - 22
X **Category III** - Total score = 16 - 19
_____ **Category IV** - Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		List appropriate rating (H, M, L)		
Site Potential	M	L	M	
Landscape Potential	M	M	M	
Value	L	L	H	**Total**
Score Based on Ratings	5	4	7	**16**

Score for each function based on three ratings (*order of ratings is not important*)

9 = H, H, H
8 = H, H, M
7 = H, H, L
7 = H, M, M
6 = H, M, L
6 = M, M, M
5 = H, L, L
5 = M, M, L
4 = M, L, L
3 = L, L, L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	Category
Estuarine	
Wetland of High Conservation Value	
Bog	
Mature Forest	
Old Growth Forest	
Coastal Lagoon	
Interdunal	
None of the above	**x**

Maps and Figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	D-1
Hydroperiods	D 1.4, H 1.2	D-2
Location of outlet (*can be added to map of hydroperiods*)	D 1.1, D 4.1	D-2
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	D 2.2, D 5.2	D-2
Map of the contributing basin	D 4.3, D 5.3	D-3
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	D-4
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	D-5
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	D-6

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream (*can be added to another figure*)	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to another figure*)	S 4.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

HGM Classification of Wetland in Western Washington

For questions 1 -7, the criteria described must apply to the entire unit being rated.
If hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1 - 7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☑ NO - go to 2 ☐ **YES** - the wetland class is **Tidal Fringe** - go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO - Saltwater Tidal Fringe (Estuarine)** ☐ **YES - Freshwater Tidal Fringe**
*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☑ NO - go to 3 ☐ **YES** - The wetland class is **Flats**
*If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☑ NO - go to 4 ☐ **YES** - The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
☐ The wetland is on a slope (*slope can be very gradual*),
☐ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
☐ The water leaves the wetland **without being impounded.**

☑ NO - go to 5 ☐ **YES** - The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
☐ The overbank flooding occurs at least once every 2 years.

☑ NO - go to 6 ☐ **YES** - The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding.

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

☑ NO - go to 7 ☑ **YES** - The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☑ NO - go to 8 ☐ **YES** - The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have ***more than 2 HGM classes*** *within a wetland boundary, classify the wetland as Depressional for the rating.*

NOTES and FIELD OBSERVATIONS:

Wetland name or number Wetland A1

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?		
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. ☐ Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing ☐ Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch.	points = 3 points = 2 points = 1 points = 1	2
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic (*use NRCS definitions*).	Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area Wetland has persistent, ungrazed, plants > ½ of area Wetland has persistent, ungrazed plants > $^1/_{10}$ of area Wetland has persistent, ungrazed plants < $^1/_{10}$ of area	points = 5 points = 3 points = 1 points = 0	5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland Area seasonally ponded is > ¼ total area of wetland Area seasonally ponded is < ¼ total area of wetland	points = 4 points = 2 points = 0	0
Total for D 1	Add the points in the boxes above	**7**

Rating of Site Potential If score is: ☐ **12 - 16 = H** ☑ **6 - 11 = M** ☐ **0 - 5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?		
D 2.1. Does the wetland unit receive stormwater discharges?	Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland?	Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1 - D 2.3? Source pet use from park access	Yes = 1 No = 0	1
Total for D 2	Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?		
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list?	Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list?	Yes = 1 No = 0	0
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)?	Yes = 2 No = 0	0
Total for D 3	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	2
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 ☐ Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 ☐ The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	0
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* ☐ The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 ☐ Entire wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	**2**

Rating of Site Potential If score is: ☐ **12 - 16 = H** ☐ **6 - 11 = M** ☑ **0 - 5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic function of the site?	
D 5.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): ● Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 ☐ ● Surface flooding problems are in a sub-basin farther down-gradient. points = 1 ☐ Flooding from groundwater is an issue in the sub-basin. points = 1 ☐ The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. Explain why points = 0 ☐ There are no problems with flooding downstream of the wetland. points = 0	0
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

☐ Aquatic bed
☑ Emergent
☑ Scrub-shrub (areas where shrubs have > 30% cover)
☐ Forested (areas where trees have > 30% cover)

4 structures or more: points = 4
3 structures: points = 2
2 structures: points - 1
1 structure: points = 0

If the unit has a Forested class, check if:
☐ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

1

H 1.2. Hydroperiods
Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

☐ Permanently flooded or inundated
☑ Seasonally flooded or inundated
☑ Occasionally flooded or inundated
☑ Saturated only

4 or more types present: points = 3
3 types present: points = 2
2 types present: points = 1
1 types present: points = 0

☑ Permanently flowing stream or river in, or adjacent to, the wetland
☐ Seasonally flowing stream in, or adjacent to, the wetland
☐ **Lake Fringe wetland** **2 points**
☐ **Freshwater tidal wetland** **2 points**

3

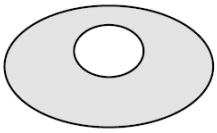
H 1.3. Richness of plant species
Count the number of plant species in the wetland that cover at least 10 ft^2.
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted:
> 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

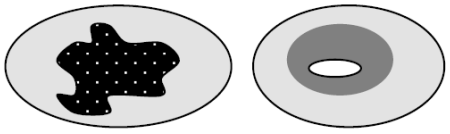
1

H 1.4. Interspersion of habitats
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*

None = 0 points

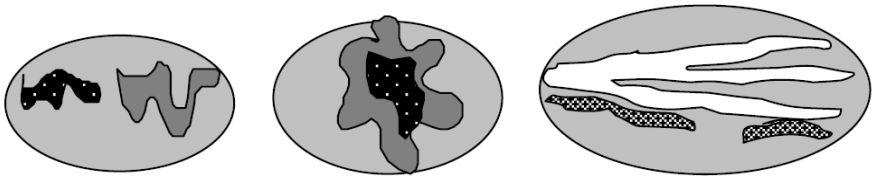


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3 points



2

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ☐ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long) ☐ Standing snags (dbh > 4 in) within the wetland ☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ☐ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present (*cut shrubs or trees that have not yet weathered where wood is exposed*) ☑ At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (*structures for egg-laying by amphibians*) ☑ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	2
Total for H 1 Add the points in the boxes above	**9**

Rating of Site Potential If Score is: ☐ **15 - 18 = H** ☑ **7 - 14 = M** ☐ **0 - 6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat function of the site?	
H 2.1 Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* 0 % undisturbed habitat + (11.68 % moderate & low intensity land uses / 2) = 5.84% If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20 - 33% of 1 km Polygon points = 2 10 - 19% of 1 km Polygon points = 1 < 10 % of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* 18.14 % undisturbed habitat + (26.77 % moderate & low intensity land uses / 2) = 31.525% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches points = 2 Undisturbed habitat 10 - 50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	2
H 2.3 Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (-2) ≤ 50% of 1km Polygon is high intensity points = 0	0
Total for H 2 Add the points in the boxes above	**2**

Rating of Landscape Potential If Score is: ☐ **4 - 6 = H** ☑ **1 - 3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated*. Site meets ANY of the following criteria: points = 2 ☑ It has 3 or more priority habitats within 100 m (see next page) ☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) ☐ It is mapped as a location for an individual WDFW priority species ☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources ☐ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) with in 100m points = 1 Site does not meet any of the criteria above points = 0	2

Rating of Value If Score is: ☑ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp.
http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here:
http://wdfw.wa.gov/conservation/phs/list/

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE****: This question is independent of the land use between the wetland unit and the priority habitat.*

- ☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 1 ac (0.4 ha).
- ☑ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).
- ☐ **Herbaceous Balds**: Variable size patches of grass and forbs on shallow soils over bedrock.
- ☐ **Old-growth/Mature forests**: Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.
- ☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).
- ☑ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.
- ☐ **Westside Prairies**: Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).
- ☑ **Instream**: The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.
- ☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page*).
- ☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.
- ☐ **Cliffs**: Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.
- ☐ **Talus**: Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.
- ☐ **Snags and Logs**: Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. List the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine Wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes - Go to **SC 1.1** ☑ No = **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☑ No - Go to **SC 1.2**	
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina* , see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☑ No = **Category II**	
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐ Yes - Go to **SC 2.2** ☑ No - Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ☐ Yes = **Category I** ☑ No = **Not WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ☐ Yes - **Contact WNHP/WDNR and to SC 2.4** ☐ No = **Not WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐ Yes = **Category I** ☐ No = **Not WHCV**	
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions*** *.* SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ☐ Yes - Go to **SC 3.3** ☑ No - Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes - Go to **SC 3.3** ☑ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Is a Category I bog** ☐ No - Go to **SC 3.4** **NOTE**: If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Is a Category I bog** ☐ No = **Is not a bog**	

SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

☐ **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.

☐ **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80-200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

☐ Yes = **Category I** ☑ No = **Not a forested wetland for this section**

SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

☐ The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon (*needs to be measured near the bottom*)

☐ Yes - Go to **SC 5.1** ☑ No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).

☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

☐ The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

☐ Yes = **Category I** ☐ No = **Category II**

SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

☐ Long Beach Peninsula: Lands west of SR 103

☐ Grayland-Westport: Lands west of SR 105

☐ Ocean Shores-Copalis: Lands west of SR 115 and SR 109

☐ Yes - Go to **SC 6.1** ☑ No = **Not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)?

☐ Yes = **Category I** ☐ No - Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

☐ Yes = **Category II** ☐ No - Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

☐ Yes = **Category III** ☐ No = **Category IV**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetlands A2, B2, B3, and B4 Date of site visit: 4-Oct-18

Rated by S. Petro, E. Spear Trained by Ecology? ☑ Yes ☐ No Date of training Oct-18

HGM Class used for rating Depressional & Flats Wetland has multiple HGM classes? ☑ Yes ☐ No

NOTE: Form is not complete with out the figures requested (*figures can be combined*).
Source of base aerial photo/map King County Aerial 2017

OVERALL WETLAND CATEGORY IV (based on functions ☑ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____ **Category I** - Total score = 23 - 27
_____ **Category II** - Total score = 20 - 22
_____ **Category III** - Total score = 16 - 19
X **Category IV** - Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		List appropriate rating (H, M, L)		
Site Potential	M	L	L	
Landscape Potential	M	M	M	
Value	L	L	H	**Total**
Score Based on Ratings	5	4	6	**15**

Score for each function based on three ratings (*order of ratings is not important*)

9 = H, H, H
8 = H, H, M
7 = H, H, L
7 = H, M, M
6 = H, M, L
6 = M, M, M
5 = H, L, L
5 = M, M, L
4 = M, L, L
3 = L, L, L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	Category
Estuarine	
Wetland of High Conservation Value	
Bog	
Mature Forest	
Old Growth Forest	
Coastal Lagoon	
Interdunal	
None of the above	**X**

Maps and Figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	D-7
Hydroperiods	D 1.4, H 1.2	D-8
Location of outlet (*can be added to map of hydroperiods*)	D 1.1, D 4.1	D-8
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	D 2.2, D 5.2	D-8
Map of the contributing basin	D 4.3, D 5.3	D-3
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	D-9
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	D-5
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	D-6

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream (*can be added to another figure*)	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to another figure*)	S 4.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

HGM Classification of Wetland in Western Washington

For questions 1 -7, the criteria described must apply to the entire unit being rated.
If hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1 - 7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☑ NO - go to 2 ☐ **YES** - the wetland class is **Tidal Fringe** - go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO - Saltwater Tidal Fringe (Estuarine)** ☐ **YES - Freshwater Tidal Fringe**
*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☑ NO - go to 3 ☐ **YES** - The wetland class is **Flats**
*If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☑ NO - go to 4 ☐ **YES** - The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
☐ The wetland is on a slope (*slope can be very gradual*),
☐ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
☐ The water leaves the wetland **without being impounded.**

☑ NO - go to 5 ☐ **YES** - The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
☐ The overbank flooding occurs at least once every 2 years.

☑ NO - go to 6 ☐ **YES** - The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding.

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

☐ NO - go to 7 ☑ **YES** - The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☑ NO - go to 8 ☐ **YES** - The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have ***more than 2 HGM classes*** *within a wetland boundary, classify the wetland as Depressional for the rating.*

NOTES and FIELD OBSERVATIONS:

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?		
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 ☑ Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 ☐ Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1		1
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic (*use NRCS definitions*).	Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^1/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^1/_{10}$ of area points = 0		5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0		0
Total for D 1	Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **12 - 16 = H** ☑ **6 - 11 = M** ☐ **0 - 5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?		
D 2.1. Does the wetland unit receive stormwater discharges?	Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland?	Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1 - D 2.3? Source stream carrying pollutants from developed upstream basin a	Yes = 1 No = 0	1
Total for D 2	Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?		
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list?	Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list?	Yes = 1 No = 0	0
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)?	Yes = 2 No = 0	0
Total for D 3	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	0
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 ☐ Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 ☐ The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	0
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* ☐ The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 ☐ Entire wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	**0**

Rating of Site Potential If score is: ☐**12 - 16 = H** ☐**6 - 11 = M** ☑**0 - 5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic function of the site?	
D 5.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐**3 = H** ☑**1 or 2 = M** ☐**0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): ● Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 ☐ ● Surface flooding problems are in a sub-basin farther down-gradient. points = 1 ☐ Flooding from groundwater is an issue in the sub-basin. points = 1 ☐ The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. Explain why points = 0 ☐ There are no problems with flooding downstream of the wetland. points = 0	0
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐**1 = M** ☑ **0 = L** *Record the rating on the first page*

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

☐ Aquatic bed
☑ Emergent
☐ Scrub-shrub (areas where shrubs have > 30% cover)
☐ Forested (areas where trees have > 30% cover)

4 structures or more: points = 4
3 structures: points = 2
2 structures: points - 1
1 structure: points = 0

If the unit has a Forested class, check if:
☐ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

0

H 1.2. Hydroperiods
Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

☐ Permanently flooded or inundated
☐ Seasonally flooded or inundated
☐ Occasionally flooded or inundated
☑ Saturated only

4 or more types present: points = 3
3 types present: points = 2
2 types present: points = 1
1 types present: points = 0

☑ Permanently flowing stream or river in, or adjacent to, the wetland
☐ Seasonally flowing stream in, or adjacent to, the wetland
☐ **Lake Fringe wetland** **2 points**
☐ **Freshwater tidal wetland** **2 points**

1

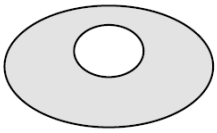
H 1.3. Richness of plant species
Count the number of plant species in the wetland that cover at least 10 ft^2.
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted:
> 19 species points = 2
5 - 19 species points = 1
< 5 species points = 0

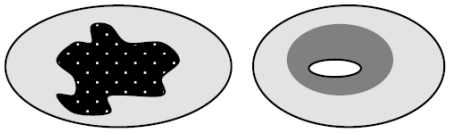
1

H 1.4. Interspersion of habitats
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*

None = 0 points

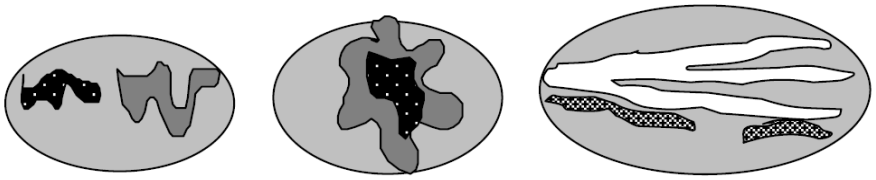


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3 points



1

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ☐ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long) ☐ Standing snags (dbh > 4 in) within the wetland ☑ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ☑ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present (*cut shrubs or trees that have not yet weathered where wood is exposed*) ☑ At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (*structures for egg-laying by amphibians*) ☐ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	3
Total for H 1 Add the points in the boxes above	**6**

Rating of Site Potential If Score is: ☐ **15 - 18 = H** ☐ **7 - 14 = M** ☑ **0 - 6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat function of the site?	
H 2.1 Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* 0 % undisturbed habitat + (11.26 % moderate & low intensity land uses / 2) = 5.63% If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20 - 33% of 1 km Polygon points = 2 10 - 19% of 1 km Polygon points = 1 < 10 % of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* 18.39 % undisturbed habitat + (28.18 % moderate & low intensity land uses / 2) = 32.48% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches points = 2 Undisturbed habitat 10 - 50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	2
H 2.3 Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (-2) ≤ 50% of 1km Polygon is high intensity points = 0	0
Total for H 2 Add the points in the boxes above	**2**

Rating of Landscape Potential If Score is: ☐ **4 - 6 = H** ☑ **1 - 3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated*. Site meets ANY of the following criteria: points = 2 ☑ It has 3 or more priority habitats within 100 m (see next page) ☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) ☐ It is mapped as a location for an individual WDFW priority species ☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources ☐ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) with in 100m points = 1 Site does not meet any of the criteria above points = 0	2

Rating of Value If Score is: ☑ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp.
http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here:
http://wdfw.wa.gov/conservation/phs/list/

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE**: This question is independent of the land use between the wetland unit and the priority habitat.*

- ☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 1 ac (0.4 ha).
- ☑ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).
- ☐ **Herbaceous Balds**: Variable size patches of grass and forbs on shallow soils over bedrock.
- ☐ **Old-growth/Mature forests**: Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.
- ☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).
- ☑ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.
- ☐ **Westside Prairies**: Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).
- ☑ **Instream**: The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.
- ☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page*).
- ☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.
- ☐ **Cliffs**: Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.
- ☐ **Talus**: Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.
- ☐ **Snags and Logs**: Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. List the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine Wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes - Go to **SC 1.1** ☑ No = **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☐ No - Go to **SC 1.2**	
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina* , see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☐ No = **Category II**	
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐ Yes - Go to **SC 2.2** ☑ No - Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ☐ Yes = **Category I** ☑ No = **Not WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ☐ Yes - **Contact WNHP/WDNR and to SC 2.4** ☐ No = **Not WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐ Yes = **Category I** ☐ No = **Not WHCV**	
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions*** *.* SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ☐ Yes - Go to **SC 3.3** ☑ No - Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes - Go to **SC 3.3** ☑ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Is a Category I bog** ☐ No - Go to **SC 3.4** **NOTE**: If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Is a Category I bog** ☐ No = **Is not a bog**	

SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

☐ **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.

☐ **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80-200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

☐ Yes = **Category I** ☑ No = **Not a forested wetland for this section**

SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

☐ The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon (*needs to be measured near the bottom*)

☐ Yes - Go to **SC 5.1** ☑ No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).

☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

☐ The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

☐ Yes = **Category I** ☐ No = **Category II**

SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

☐ Long Beach Peninsula: Lands west of SR 103

☐ Grayland-Westport: Lands west of SR 105

☐ Ocean Shores-Copalis: Lands west of SR 115 and SR 109

☐ Yes - Go to **SC 6.1** ☑ No = **Not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)?

☐ Yes = **Category I** ☐ No - Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

☐ Yes = **Category II** ☐ No - Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

☐ Yes = **Category III** ☐ No = **Category IV**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form

Wetland name or number B1, B5

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetlands B1 and B5 Date of site visit: 4-Oct-18

Rated by S. Petro, E. Spear Trained by Ecology? ☑ Yes ☐ No Date of training Oct-18

HGM Class used for rating Depressional & Flats Wetland has multiple HGM classes? ☑ Yes ☐ No

NOTE: Form is not complete with out the figures requested (*figures can be combined*).
Source of base aerial photo/map King County Aerial, 2017

OVERALL WETLAND CATEGORY IV (based on functions ☑ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____ **Category I** - Total score = 23 - 27
_____ **Category II** - Total score = 20 - 22
X **Category III** - Total score = 16 - 19
_____ **Category IV** - Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		List appropriate rating (H, M, L)		
Site Potential	M	L	M	
Landscape Potential	M	M	M	
Value	L	L	H	**Total**
Score Based on Ratings	5	4	7	**16**

Score for each function based on three ratings (*order of ratings is not important*)

9 = H, H, H
8 = H, H, M
7 = H, H, L
7 = H, M, M
6 = H, M, L
6 = M, M, M
5 = H, L, L
5 = M, M, L
4 = M, L, L
3 = L, L, L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	Category
Estuarine	
Wetland of High Conservation Value	
Bog	
Mature Forest	
Old Growth Forest	
Coastal Lagoon	
Interdunal	
None of the above	**X**

Maps and Figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	D-10
Hydroperiods	D 1.4, H 1.2	D-11
Location of outlet (*can be added to map of hydroperiods*)	D 1.1, D 4.1	D-11
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	D 2.2, D 5.2	D-11
Map of the contributing basin	D 4.3, D 5.3	D-3
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	D-12
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	D-5
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	D-6

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream (*can be added to another figure*)	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to another figure*)	S 4.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

HGM Classification of Wetland in Western Washington

For questions 1 -7, the criteria described must apply to the entire unit being rated.
If hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1 - 7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☑ NO - go to 2 ☐ **YES** - the wetland class is **Tidal Fringe** - go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO - Saltwater Tidal Fringe (Estuarine)** ☐ **YES - Freshwater Tidal Fringe**
*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☑ NO - go to 3 ☐ **YES** - The wetland class is **Flats**
*If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☑ NO - go to 4 ☐ **YES** - The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
☐ The wetland is on a slope (*slope can be very gradual*),
☐ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
☐ The water leaves the wetland **without being impounded.**

☑ NO - go to 5 ☐ **YES** - The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
☐ The overbank flooding occurs at least once every 2 years.

☑ NO - go to 6 ☐ **YES** - The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding.

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

☐ NO - go to 7 ☑ **YES** - The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☑ NO - go to 8 ☐ **YES** - The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have ***more than 2 HGM classes*** *within a wetland boundary, classify the wetland as Depressional for the rating.*

NOTES and FIELD OBSERVATIONS:

Wetland name or number B1, B5

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?		
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 ☑ Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 ☐ Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1		1
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic (*use NRCS definitions*).	Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^1/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^1/_{10}$ of area points = 0		5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0		0
Total for D 1	Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **12 - 16 = H** ☑ **6 - 11 = M** ☐ **0 - 5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?		
D 2.1. Does the wetland unit receive stormwater discharges?	Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland?	Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1 - D 2.3? Source stream carrying pollutants from developed basin and pets	Yes = 1 No = 0	1
Total for D 2	Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?		
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list?	Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list?	Yes = 1 No = 0	0
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)?	Yes = 2 No = 0	0
Total for D 3	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?		
D 4.1. Characteristics of surface water outflows from the wetland:		
Wetland is a depression or flat depression with no surface water leaving it (no outlet)	points = 4	
Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet	points = 2	0
Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch	points = 1	
Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing	points = 0	
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.*		
Marks of ponding are 3 ft or more above the surface or bottom of outlet	points = 7	
Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet	points = 5	0
☐ Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet	points = 3	
☐ The wetland is a "headwater" wetland	points = 3	
Wetland is flat but has small depressions on the surface that trap water	points = 1	
Marks of ponding less than 0.5 ft (6 in)	points = 0	
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.*		
☐ The area of the basin is less than 10 times the area of the unit	points = 5	0
The area of the basin is 10 to 100 times the area of the unit	points = 3	
The area of the basin is more than 100 times the area of the unit	points = 0	
☐ Entire wetland is in the Flats class	points = 5	
Total for D 4	Add the points in the boxes above	**0**

Rating of Site Potential If score is: ☐**12 - 16 = H** ☐**6 - 11 = M** ☑**0 - 5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic function of the site?		
D 5.1. Does the wetland unit receive stormwater discharges?	Yes = 1 No = 0	0
D 5.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate excess runoff?	Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)?	Yes = 1 No = 0	1
Total for D 5	Add the points in the boxes above	**1**

Rating of Landscape Potential If score is: ☐**3 = H** ☑**1 or 2 = M** ☐**0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?		
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.*		
The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds):		
● Flooding occurs in a sub-basin that is immediately down-gradient of unit.	points = 2	
☐ ● Surface flooding problems are in a sub-basin farther down-gradient.	points = 1	0
☐ Flooding from groundwater is an issue in the sub-basin.	points = 1	
☐ The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. Explain why	points = 0	
☐ There are no problems with flooding downstream of the wetland.	points = 0	
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?	Yes = 2 No = 0	0
Total for D 6	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐**1 = M** ☑ **0 = L** *Record the rating on the first page*

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

☐ Aquatic bed
☑ Emergent
☐ Scrub-shrub (areas where shrubs have > 30% cover)
☐ Forested (areas where trees have > 30% cover)

4 structures or more: points = 4
3 structures: points = 2
2 structures: points - 1
1 structure: points = 0

If the unit has a Forested class, check if:
☐ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

0

H 1.2. Hydroperiods
Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

☐ Permanently flooded or inundated
☑ Seasonally flooded or inundated
☐ Occasionally flooded or inundated
☑ Saturated only

4 or more types present: points = 3
3 types present: points = 2
2 types present: points = 1
1 types present: points = 0

☑ Permanently flowing stream or river in, or adjacent to, the wetland
☐ Seasonally flowing stream in, or adjacent to, the wetland
☐ **Lake Fringe wetland** **2 points**
☐ **Freshwater tidal wetland** **2 points**

2

H 1.3. Richness of plant species
Count the number of plant species in the wetland that cover at least 10 ft^2.
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

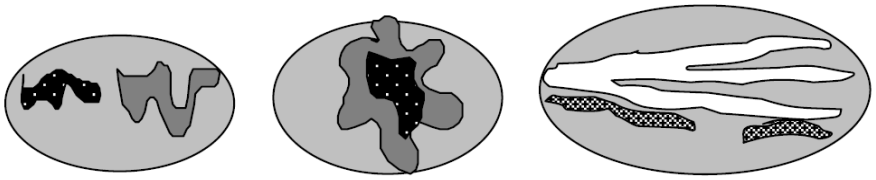
If you counted:
> 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

1

H 1.4. Interspersion of habitats
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*

None = 0 points **Low** = 1 point **Moderate** = 2 points

All three diagrams in this row are **HIGH** = 3 points



1

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ☑ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long) ☐ Standing snags (dbh > 4 in) within the wetland ☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ☑ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present (*cut shrubs or trees that have not yet weathered where wood is exposed*) ☑ At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (*structures for egg-laying by amphibians*) ☐ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	3
Total for H 1 Add the points in the boxes above	**7**

Rating of Site Potential If Score is: ☐ **15 - 18 = H** ☑ **7 - 14 = M** ☐ **0 - 6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat function of the site?	
H 2.1 Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* 0 % undisturbed habitat + (10.63 % moderate & low intensity land uses / 2) = 5.315% If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20 - 33% of 1 km Polygon points = 2 10 - 19% of 1 km Polygon points = 1 < 10 % of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* 17.46 % undisturbed habitat + (27.37 % moderate & low intensity land uses / 2) = 31.145% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches points = 2 Undisturbed habitat 10 - 50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	2
H 2.3 Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (-2) ≤ 50% of 1km Polygon is high intensity points = 0	0
Total for H 2 Add the points in the boxes above	**2**

Rating of Landscape Potential If Score is: ☐ **4 - 6 = H** ☑ **1 - 3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated*. Site meets ANY of the following criteria: points = 2 ☑ It has 3 or more priority habitats within 100 m (see next page) ☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) ☐ It is mapped as a location for an individual WDFW priority species ☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources ☐ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) with in 100m points = 1 Site does not meet any of the criteria above points = 0	2

Rating of Value If Score is: ☑ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp.
http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here:
http://wdfw.wa.gov/conservation/phs/list/

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE**: This question is independent of the land use between the wetland unit and the priority habitat.*

- ☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 1 ac (0.4 ha).
- ☑ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).
- ☐ **Herbaceous Balds**: Variable size patches of grass and forbs on shallow soils over bedrock.
- ☐ **Old-growth/Mature forests**: Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.
- ☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).
- ☑ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.
- ☐ **Westside Prairies**: Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).
- ☑ **Instream**: The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.
- ☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page*).
- ☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.
- ☐ **Cliffs**: Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.
- ☐ **Talus**: Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.
- ☐ **Snags and Logs**: Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. List the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine Wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes - Go to **SC 1.1** ☑ No = **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☐ No - Go to **SC 1.2**	
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina* , see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☐ No = **Category II**	
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐ Yes - Go to **SC 2.2** ☑ No - Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ☐ Yes = **Category I** ☐ No = **Not WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ☐ Yes - **Contact WNHP/WDNR and to SC 2.4** ☑ No = **Not WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐ Yes = **Category I** ☐ No = **Not WHCV**	
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions*** *.* SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ☐ Yes - Go to **SC 3.3** ☑ No - Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes - Go to **SC 3.3** ☑ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Is a Category I bog** ☐ No - Go to **SC 3.4** **NOTE**: If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Is a Category I bog** ☐ No = **Is not a bog**	

SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

☐ **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.

☐ **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80-200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

☐ Yes = **Category I** ☑ No = **Not a forested wetland for this section**

SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

☐ The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon (*needs to be measured near the bottom*)

☐ Yes - Go to **SC 5.1** ☑ No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).

☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

☐ The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

☐ Yes = **Category I** ☐ No = **Category II**

SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

☐ Long Beach Peninsula: Lands west of SR 103

☐ Grayland-Westport: Lands west of SR 105

☐ Ocean Shores-Copalis: Lands west of SR 115 and SR 109

☐ Yes - Go to **SC 6.1** ☑ No = **Not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)?

☐ Yes = **Category I** ☐ No - Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

☐ Yes = **Category II** ☐ No - Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

☐ Yes = **Category III** ☐ No = **Category IV**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetlands C1 and C2 Date of site visit: 10/4/2018

Rated by S. Petro, E. Spear Trained by Ecology? ☑ Yes ☐ No Date of training Oct-18

HGM Class used for rating Riverine & Fresh Water Tidal Wetland has multiple HGM classes? ☐ Yes ☑ No

NOTE: Form is not complete with out the figures requested (*figures can be combined*).
Source of base aerial photo/map King County Aerial, 2017

OVERALL WETLAND CATEGORY III (based on functions ☑ or special characteristics ☐)

1. Category of wetland based on FUNCTIONS

_____ **Category I** - Total score = 23 - 27
_____ **Category II** - Total score = 20 - 22
X **Category III** - Total score = 16 - 19
_____ **Category IV** - Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		List appropriate rating (H, M, L)		
Site Potential	M	M	L	
Landscape Potential	H	M	M	
Value	L	L	H	**Total**
Score Based on Ratings	6	5	6	**17**

Score for each function based on three ratings (*order of ratings is not important*)

9 = H, H, H
8 = H, H, M
7 = H, H, L
7 = H, M, M
6 = H, M, L
6 = M, M, M
5 = H, L, L
5 = M, M, L
4 = M, L, L
3 = L, L, L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	Category
Estuarine	
Wetland of High Conservation Value	
Bog	
Mature Forest	
Old Growth Forest	
Coastal Lagoon	
Interdunal	
None of the above	**X**

Maps and Figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods*)	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	C-13
Hydroperiods	H 1.2	C-14
Ponded depressions	R 1.1	C-14
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	R 2.4	C-14
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	C-14
Width of unit vs. width of stream (*can be added to another figure*)	R 4.1	C-14
Map of the contributing basin	R 2.2, R 2.3, R 5.2	C-3
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	C-15
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	C-5
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	C-6

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to another figure*)	S 4.1	
Boundary of area within 150 ft of the wetland (*can be added to another figure*)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

HGM Classification of Wetland in Western Washington

For questions 1 -7, the criteria described must apply to the entire unit being rated.
If hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1 - 7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☑ NO - go to 2 ☐ **YES** - the wetland class is **Tidal Fringe** - go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO - Saltwater Tidal Fringe (Estuarine)** ☐ **YES - Freshwater Tidal Fringe**
*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☑ NO - go to 3 ☐ **YES** - The wetland class is **Flats**
*If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☑ NO - go to 4 ☐ **YES** - The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
☐ The wetland is on a slope (*slope can be very gradual*),
☐ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
☐ The water leaves the wetland **without being impounded.**

☑ NO - go to 5 ☐ **YES** - The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
☑ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
☑ The overbank flooding occurs at least once every 2 years.

☐ NO - go to 6 ☑ **YES** - The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding.

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

☑ NO - go to 7 ☐ **YES** - The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☑ NO - go to 8 ☐ **YES** - The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have ***more than 2 HGM classes*** *within a wetland boundary, classify the wetland as Depressional for the rating.*

NOTES and FIELD OBSERVATIONS:

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

R 1.0. Does the site have the potential to improve water quality?		
R 1.1. Area of surface depressions within the Riverine wetland that can trap sediments during a flooding event:		
Depressions cover > $^3/_4$ area of wetland	points = 8	0
Depressions cover > ½ area of wetland	points = 4	
Depressions present but cover < ½ area of wetland	points = 2	
No depressions present	points = 0	
R 1.2. Structure of plants in the wetland (areas with >90% cover at person height, **not** Cowardin classes)		
Trees or shrubs > $^2/_3$ area of the wetland	points = 8	6
☐ Trees or shrubs > $^1/_3$ area of the wetland	points = 6	
☑ Herbaceous plants (> 6 in high) > $^2/_3$ area of the wetland	points = 6	
Herbaceous plants (> 6 in high) > $^1/_3$ area of the wetland	points = 3	
Trees, shrubs, and ungrazed herbaceous < $^1/_3$ area of the wetland	points = 0	
Total for R 1	Add the points in the boxes above	**6**

Rating of Site Potential If score is: ☐ **12 - 16 = H** ☑ **6 - 11 = M** ☐ **0 - 5 = L** *Record the rating on the first page*

R 2.0. Does the landscape have the potential to support the water quality function of the site?		
R 2.1. Is the wetland within an incorporated city or within its UGA?	Yes = 2 No = 0	2
R 2.2. Does the contributing basin to the wetland include a UGA or incorporated area?	Yes = 1 No = 0	1
R 2.3. Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years?	Yes = 1 No = 0	0
R 2.4. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
R 2.5. Are there other sources of pollutants coming into the wetland that are not listed in questions R 2.1 - R 2.4?		0
Other Sources	Yes = 1 No = 0	
Total for R 2	Add the points in the boxes above	**3**

Rating of Landscape Potential If score is: ☑ **3 - 6 = H** ☐ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 3.0. Is the water quality improvement provided by the site valuable to society?		
R 3.1. Is the wetland along a stream or river that is on the 303(d) list or on a tributary that drains to one within 1 mi?	Yes = 1 No = 0	0
R 3.2. Is the wetland along a stream or river that has TMDL limits for nutrients, toxics, or pathogens?	Yes = 1 No = 0	0
R 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? (*answer YES if there is a TMDL for the drainage in which the unit is found*)	Yes = 2 No = 0	0
Total for R 3	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Hydrologic Functions - Indicators that site functions to reduce flooding and stream erosion

R 4.0. Does the site have the potential to reduce flooding and erosion?		
R 4.1. Characteristics of the overbank storage the wetland provides: *Estimate the average width of the wetland perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of wetland)/(average width of stream between banks).*		1
If the ratio is more than 20	points = 9	
If the ratio is 10 - 20	points = 6	
If the ratio is 5 - < 10	points = 4	
If the ratio is 1 - < 5	points = 2	
If the ratio is < 1	points = 1	
R 4.2. Characteristics of plants that slow down water velocities during floods: *Treat large woody debris as forest or shrub. Choose the points appropriate for the best description (polygons need to have >90% cover at person height. These are NOT Cowardin classes*).		7
Forest or shrub for > $^1/_3$ area OR emergent plants > $^2/_3$ area	points = 7	
Forest or shrub for > $^1/_{10}$ area OR emergent plants > $^1/_3$ area	points = 4	
Plants do not meet above criteria	points = 0	
Total for R 4	Add the points in the boxes above	**8**

Rating of Site Potential If score is: ☐ **12 - 16 = H** ☑ **6 - 11 = M** ☐ **0 - 5 = L** *Record the rating on the first page*

R 5.0. Does the landscape have the potential to support the hydrologic functions of the site?			
R 5.1. Is the stream or river adjacent to the wetland downcut?	Yes = 0	No = 1	1
R 5.2. Does the up-gradient watershed include a UGA or incorporated area?	Yes = 1	No = 0	1
R 5.3 Is the up-gradient stream or river controlled by dams?	Yes = 0	No = 1	0
Total for R 5	Add the points in the boxes above		**2**

Rating of Landscape Potential If score is: ☐ **3 = H** ☑ **1 or 2 = M** ☐ **0 = L** *Record the rating on the first page*

R 6.0. Are the hydrologic functions provided by the site valuable to society?		
R 6.1. Distance to the nearest areas downstream that have flooding problems? *Choose the description that best fits the site.*		0
The sub-basin immediately down-gradient of the wetland has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds)	points = 2	
Surface flooding problems are in a sub-basin farther down-gradient	points = 1	
No flooding problems anywhere downstream	points = 0	
R 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?	Yes = 2 No = 0	0
Total for R 6	Add the points in the boxes above	**0**

Rating of Value If score is: ☐ **2 - 4 = H** ☐ **1 = M** ☑ **0 = L** *Record the rating on the first page*

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

☐ Aquatic bed
☑ Emergent
☑ Scrub-shrub (areas where shrubs have > 30% cover)
☐ Forested (areas where trees have > 30% cover)

4 structures or more: points = 4
3 structures: points = 2
2 structures: points - 1
1 structure: points = 0

If the unit has a Forested class, check if:
☐ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

1

H 1.2. Hydroperiods
Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

☐ Permanently flooded or inundated
☑ Seasonally flooded or inundated
☐ Occasionally flooded or inundated
☐ Saturated only

4 or more types present: points = 3
3 types present: points = 2
2 types present: points = 1
1 types present: points = 0

☑ Permanently flowing stream or river in, or adjacent to, the wetland
☐ Seasonally flowing stream in, or adjacent to, the wetland
☐ **Lake Fringe wetland** **2 points**
☐ **Freshwater tidal wetland** **2 points**

1

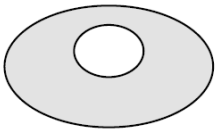
H 1.3. Richness of plant species
Count the number of plant species in the wetland that cover at least 10 ft^2.
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted:
> 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

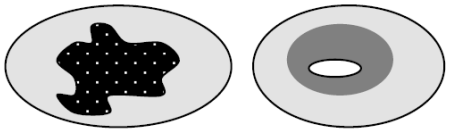
1

H 1.4. Interspersion of habitats
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*

None = 0 points

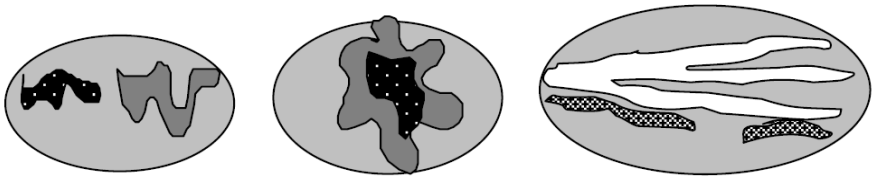


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3 points



1

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ☐ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long) ☐ Standing snags (dbh > 4 in) within the wetland ☐ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ☑ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present (*cut shrubs or trees that have not yet weathered where wood is exposed*) ☐ At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (*structures for egg-laying by amphibians*) ☐ Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 Add the points in the boxes above	**5**

Rating of Site Potential If Score is: ☐ **15 - 18 = H** ☐ **7 - 14 = M** ☑ **0 - 6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat function of the site?	
H 2.1 Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* 0 % undisturbed habitat + (11.75 % moderate & low intensity land uses / 2) = 5.875% If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20 - 33% of 1 km Polygon points = 2 10 - 19% of 1 km Polygon points = 1 < 10 % of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* 17.44 % undisturbed habitat + (26.12 % moderate & low intensity land uses / 2) = 30.5% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches points = 2 Undisturbed habitat 10 - 50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	2
H 2.3 Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (-2) ≤ 50% of 1km Polygon is high intensity points = 0	0
Total for H 2 Add the points in the boxes above	**2**

Rating of Landscape Potential If Score is: ☐ **4 - 6 = H** ☑ **1 - 3 = M** ☐ **< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated*. Site meets ANY of the following criteria: points = 2 ☑ It has 3 or more priority habitats within 100 m (see next page) ☐ It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) ☐ It is mapped as a location for an individual WDFW priority species ☐ It is a Wetland of High Conservation Value as determined by the Department of Natural Resources ☐ It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) with in 100m points = 1 Site does not meet any of the criteria above points = 0	2

Rating of Value If Score is: ☑ **2 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp.
http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here:
http://wdfw.wa.gov/conservation/phs/list/

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE**: This question is independent of the land use between the wetland unit and the priority habitat.*

- ☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 1 ac (0.4 ha).
- ☑ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).
- ☐ **Herbaceous Balds**: Variable size patches of grass and forbs on shallow soils over bedrock.
- ☐ **Old-growth/Mature forests**: Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.
- ☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).
- ☑ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.
- ☐ **Westside Prairies**: Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).
- ☑ **Instream**: The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.
- ☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page*).
- ☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.
- ☐ **Cliffs**: Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.
- ☐ **Talus**: Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.
- ☐ **Snags and Logs**: Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. List the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine Wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes - Go to **SC 1.1** ☑ No = **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☐ No - Go to **SC 1.2**	
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina* , see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☐ No = **Category II**	
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐ Yes - Go to **SC 2.2** ☑ No - Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ☐ Yes = **Category I** ☐ No = **Not WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ☐ Yes - **Contact WNHP/WDNR and to SC 2.4** ☑ No = **Not WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐ Yes = **Category I** ☐ No = **Not WHCV**	
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions*** *.* SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ☐ Yes - Go to **SC 3.3** ☐ No - Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes - Go to **SC 3.3** ☑ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Is a Category I bog** ☐ No - Go to **SC 3.4** **NOTE**: If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Is a Category I bog** ☐ No = **Is not a bog**	

SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

☐ **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.

☐ **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80-200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

☐ Yes = **Category I** ☑ No = **Not a forested wetland for this section**

SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

☐ The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon (*needs to be measured near the bottom*)

☐ Yes - Go to **SC 5.1** ☑ No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).

☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

☐ The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

☐ Yes = **Category I** ☐ No = **Category II**

SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

☐ Long Beach Peninsula: Lands west of SR 103

☐ Grayland-Westport: Lands west of SR 105

☐ Ocean Shores-Copalis: Lands west of SR 115 and SR 109

☐ Yes - Go to **SC 6.1** ☑ No = **Not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)?

☐ Yes = **Category I** ☐ No - Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

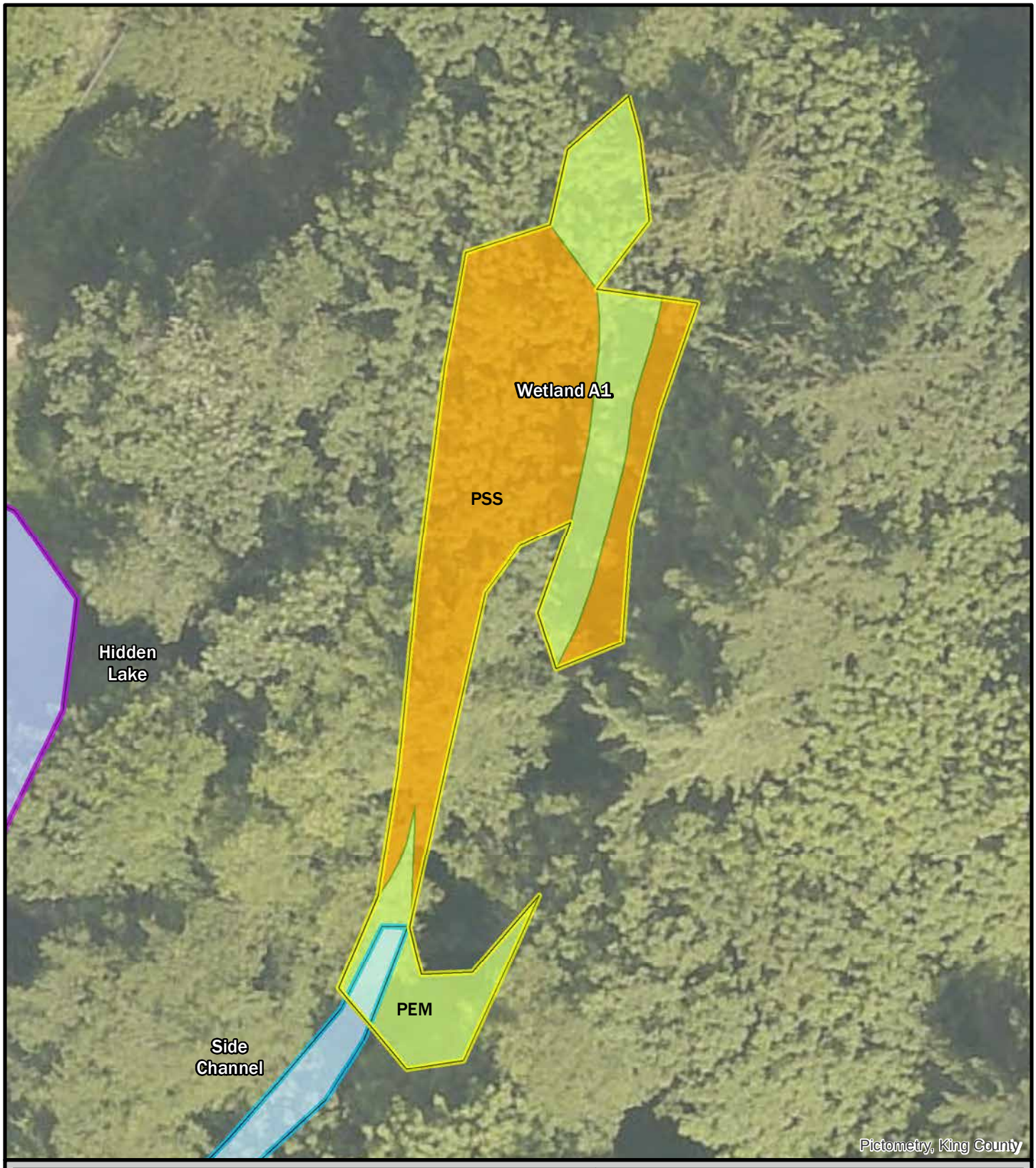
☐ Yes = **Category II** ☐ No - Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

☐ Yes = **Category III** ☐ No = **Category IV**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form



Legend

- Wetland
- Stream
- Lake

Cowardin class

- PEM
- PSS

Figure D-1.
Cowardin Class for Wetland A1.

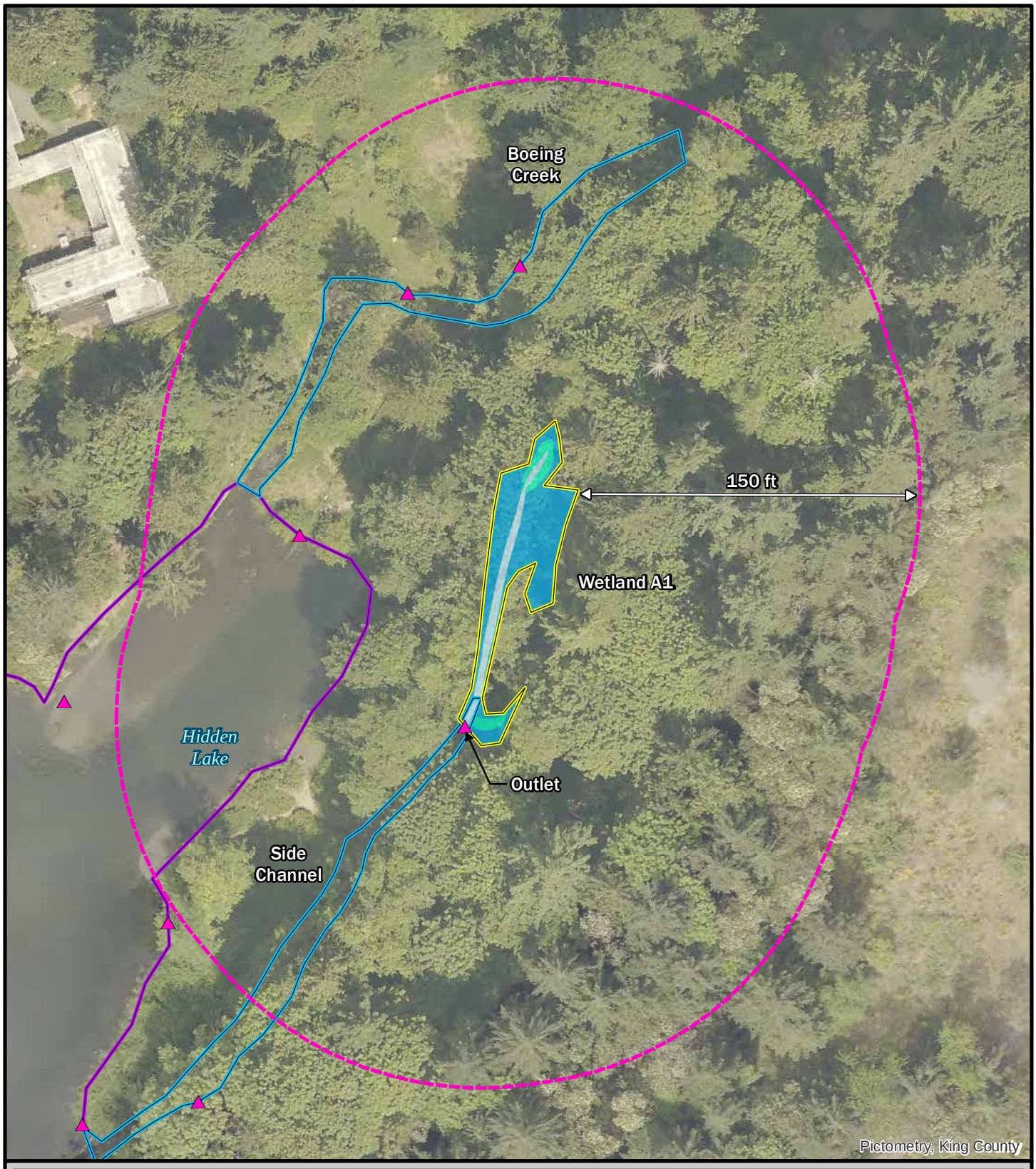
N

0 10 20 40 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD1_CowardinA1_letter.mxd



Legend

- Stream
- Wetland
- Lake

Hydroperiod

- Occasionally flooded
- Saturated only
- Seasonally flooded
- 150-ft boundary
- Outlet

Figure D-2.
Hydroperiods, 150-Foot Boundary, and Location of Outlet for Wetland A1.

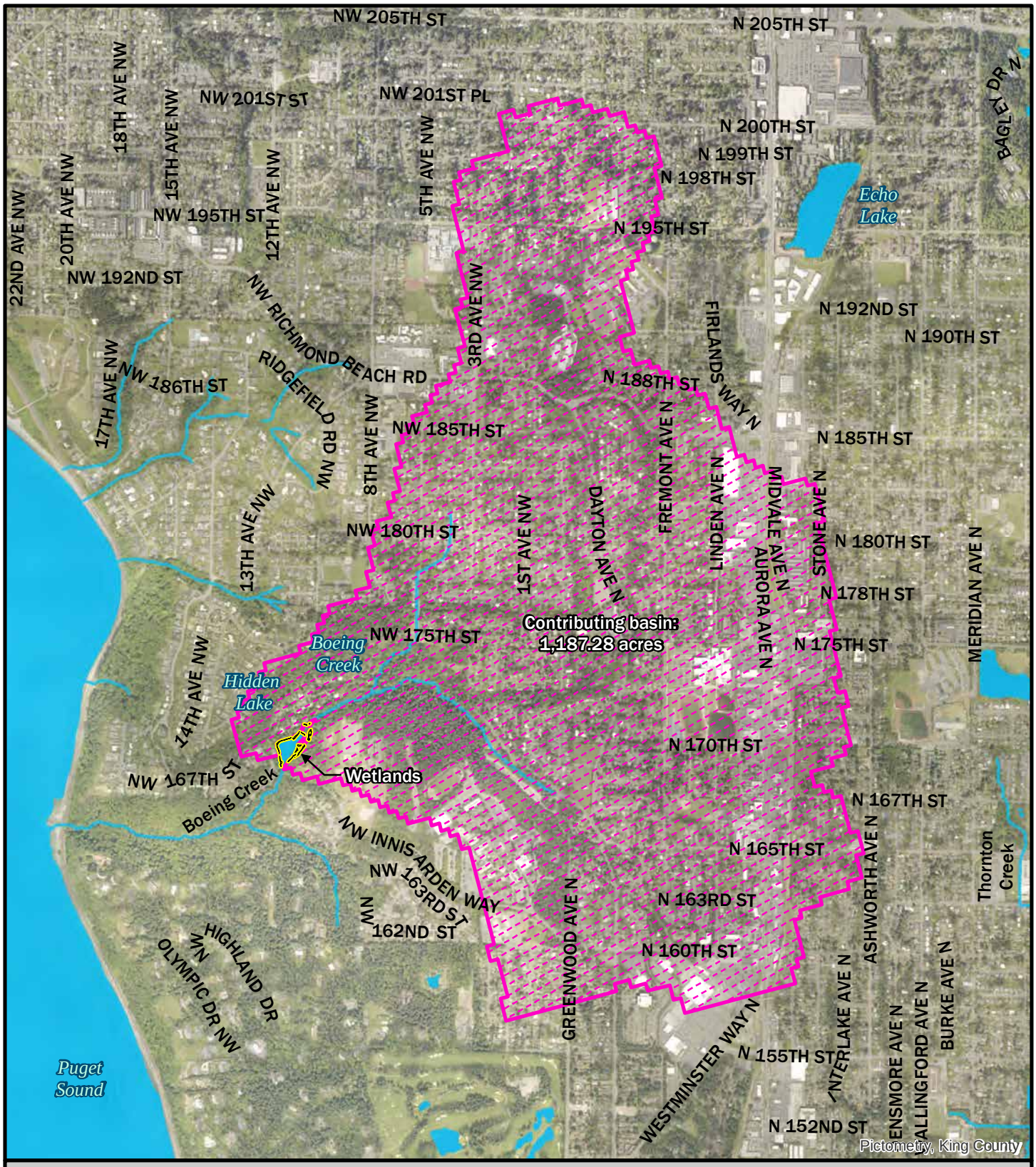
N

0 30 60 120 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD2_HydroperiodA1_letter.mxd



Legend

- Contributing basin
- Wetland boundary
- Stream (King County)
- Waterbody (King County)

Figure D-3.
Contributing Basin for Wetlands A1, A2, B1, B2, B3, B4, B5, C1, and C2.

N

0 1,000 2,000 4,000 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD3_ContributingBasin_letter.mxd

Legend

- Wetlands
- 1-kilometer boundary
- Stream (King County)
- Waterbody (King County)

Habitat types

- Low/Moderate Intensity
- Low/Moderate Intensity and Accessible
- Undisturbed

Figure D-4.
Habitat Within a 1-km Boundary of Wetland A1.

N

0 500 1,000 2,000 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD4_HabitatsA1_letter.mxd

Legend

- Wetland
- Stream (King County)
- Waterbody (King County)
- Street
- County boundary
- City limit
- 303(d) listed waters (Dept. of Ecology)

Figure D-5.
303(d) Waters in the Vicinity of Wetlands A1, A2, B1, B2, B3, B4, B5, C1, and C2.

N

0 1,500 3,000 6,000 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD5_303dWaters_letter.mxd

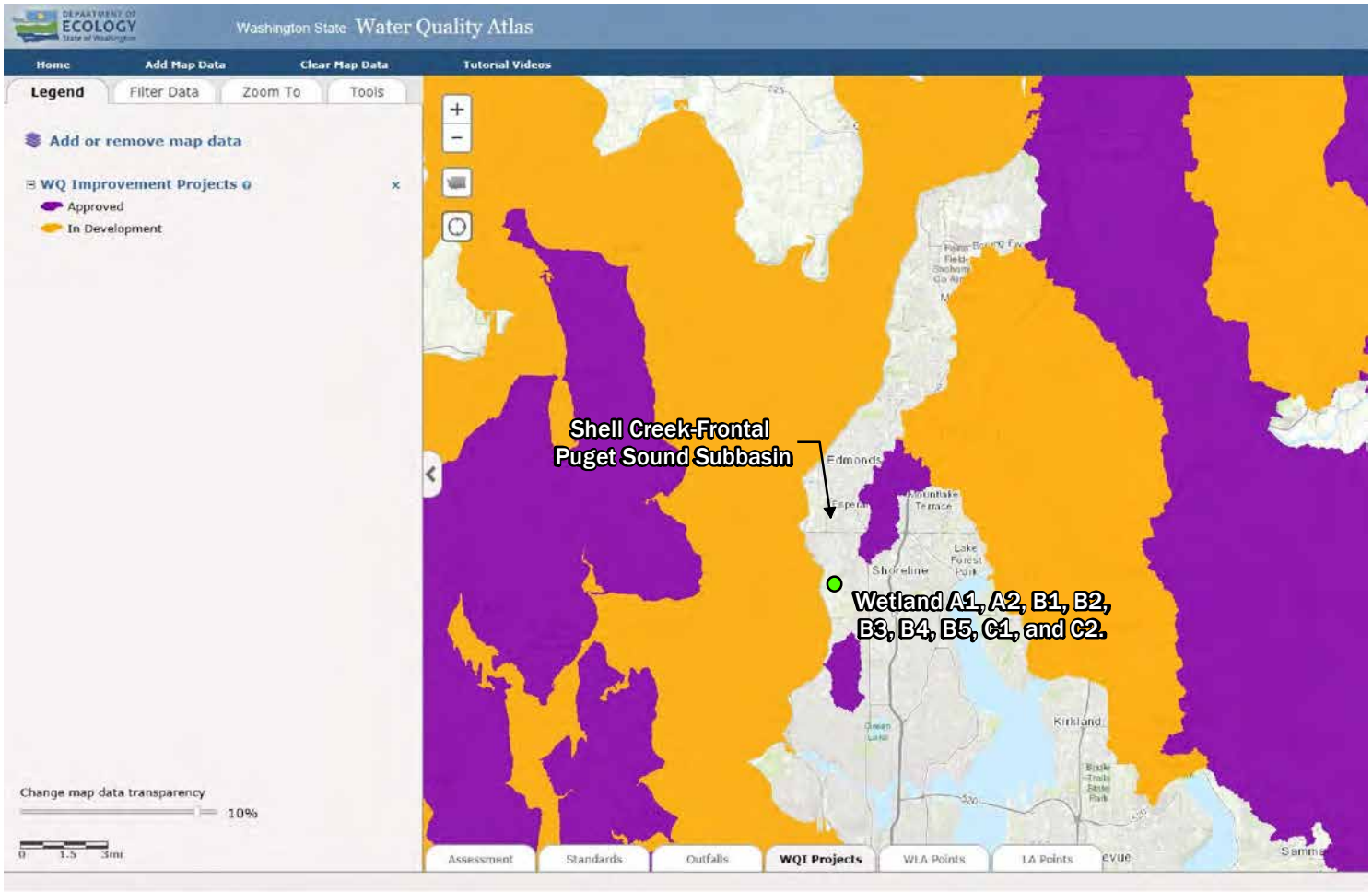


Figure D-6.
TMDLs for the Shell Creek-Frontal Puget Sound Subbasin.

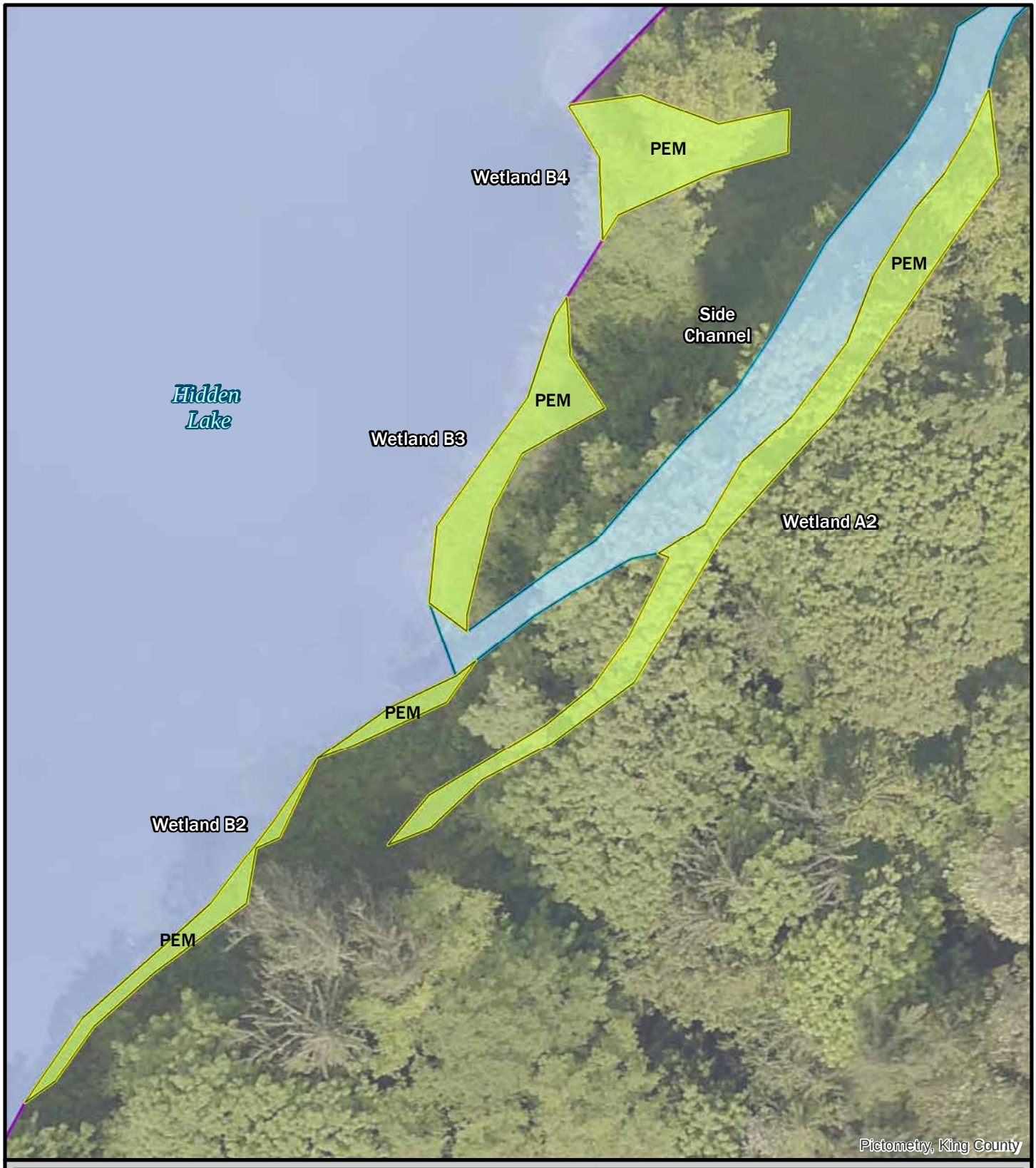
Legend

- Wetlands

Note:
There are no TMDLs for the Shell Creek-Frontal Puget Sound Subbasin.

HERRERA

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD6_TMDL_letter.mxd



Legend

- Wetland
- Stream
- Lake

Cowardin class

- PEM

Figure D-7.
Cowardin Class for Wetlands A2, B2, B3, and B4.

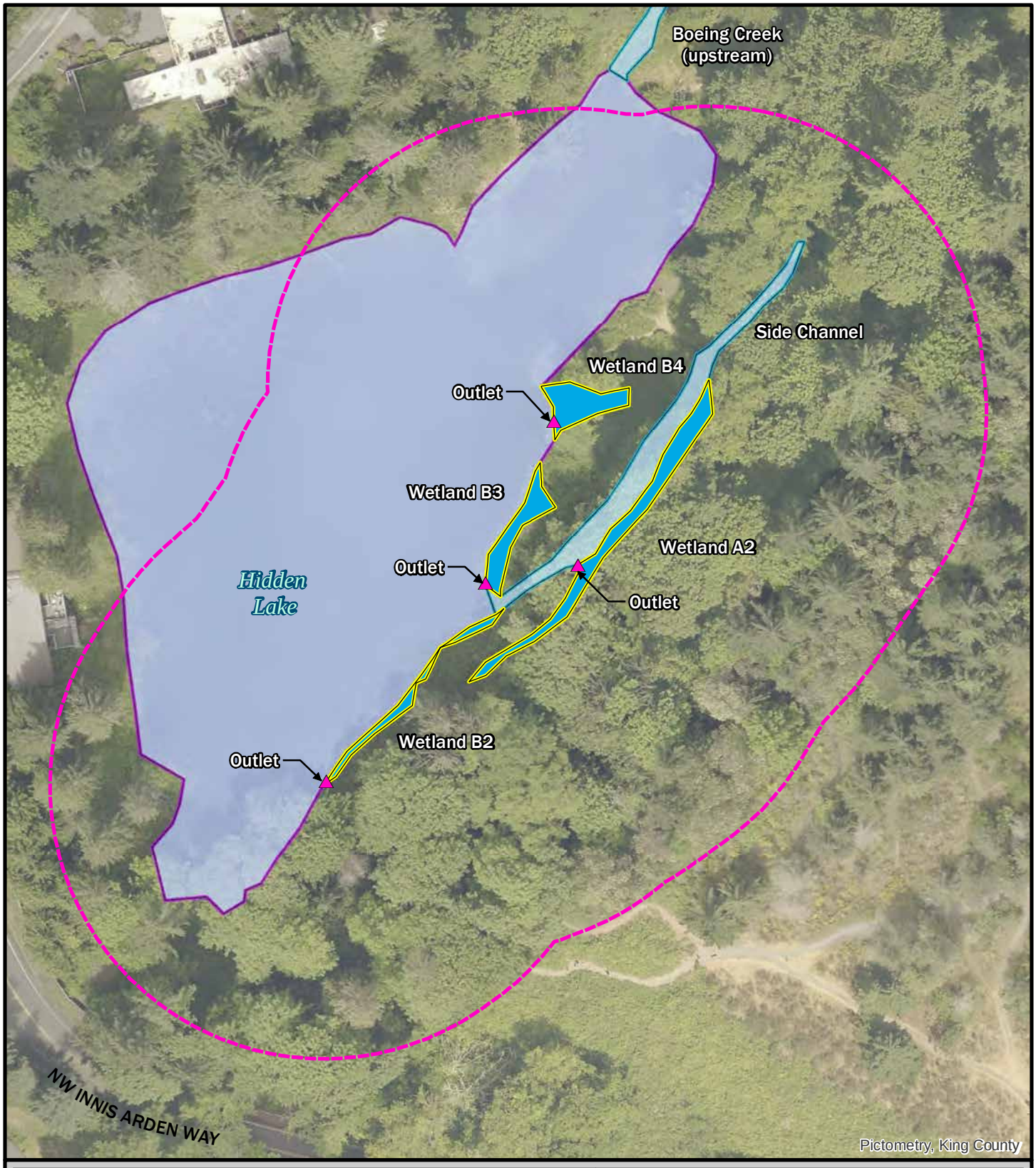
N

0 15 30 60 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD7_CowardinA2_B2-3-4_letter.mxd



Legend

- Wetland
- Stream
- Lake
- 150-ft boundary
- Outlet

Hydroperiod

- Saturated only

Figure D-8.
Hydroperiods, 150-Foot Boundary, and Location of Outlet for Wetlands A2, B2, B3, and B4.

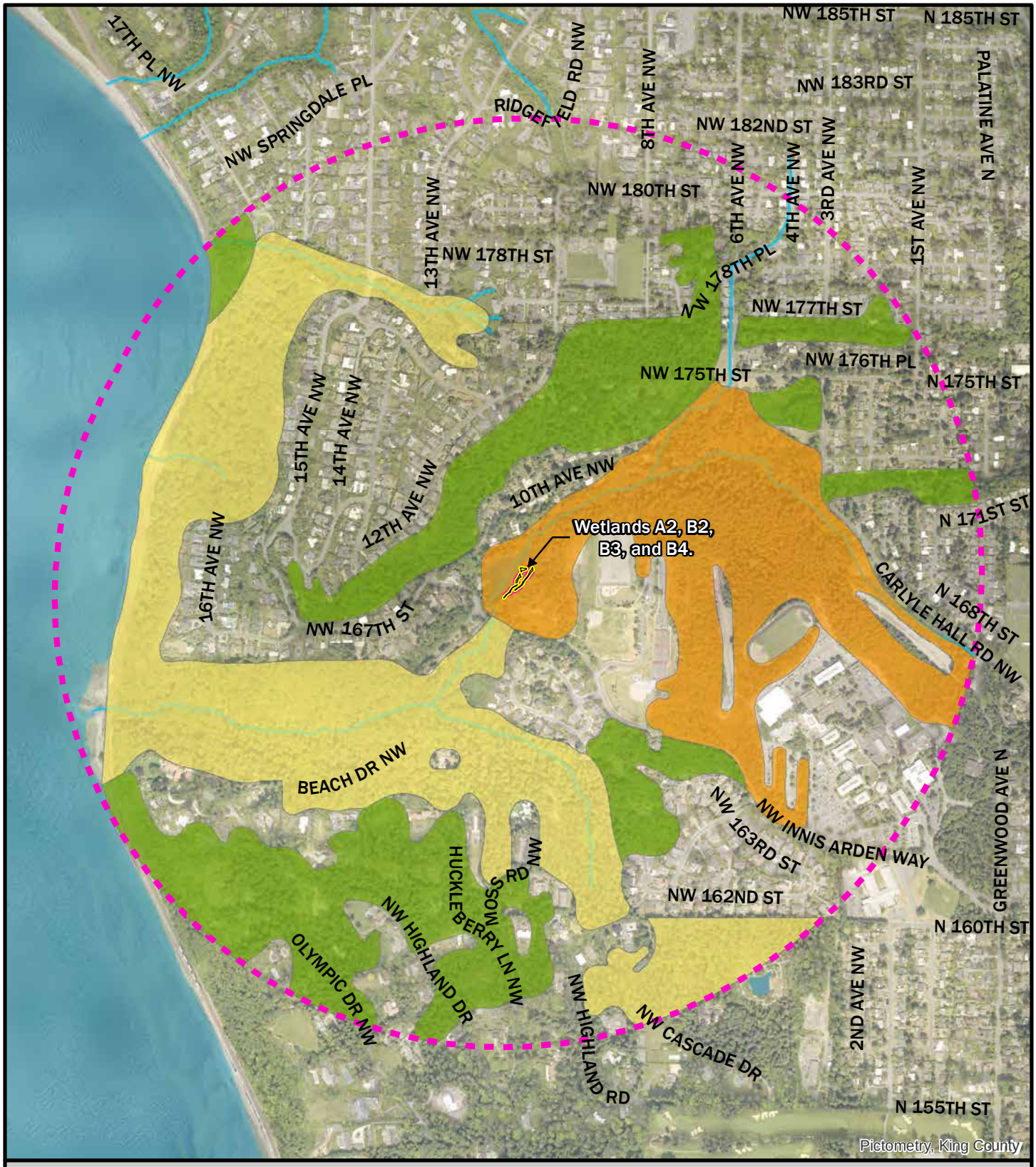
N

0 30 60 120 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD8_HydroperiodA2_B2-3-4_letter.mxd



Legend

- 1-kilometer boundary
- Wetlands
- Stream (King County)
- Waterbody (King County)

Habitat types

- Low/Moderate Intensity
- Low/Moderate Intensity and Accessible
- Undisturbed

Figure D-9.
Habitat Within a 1-km Boundary of Wetlands A2, B2, B3, and B4.

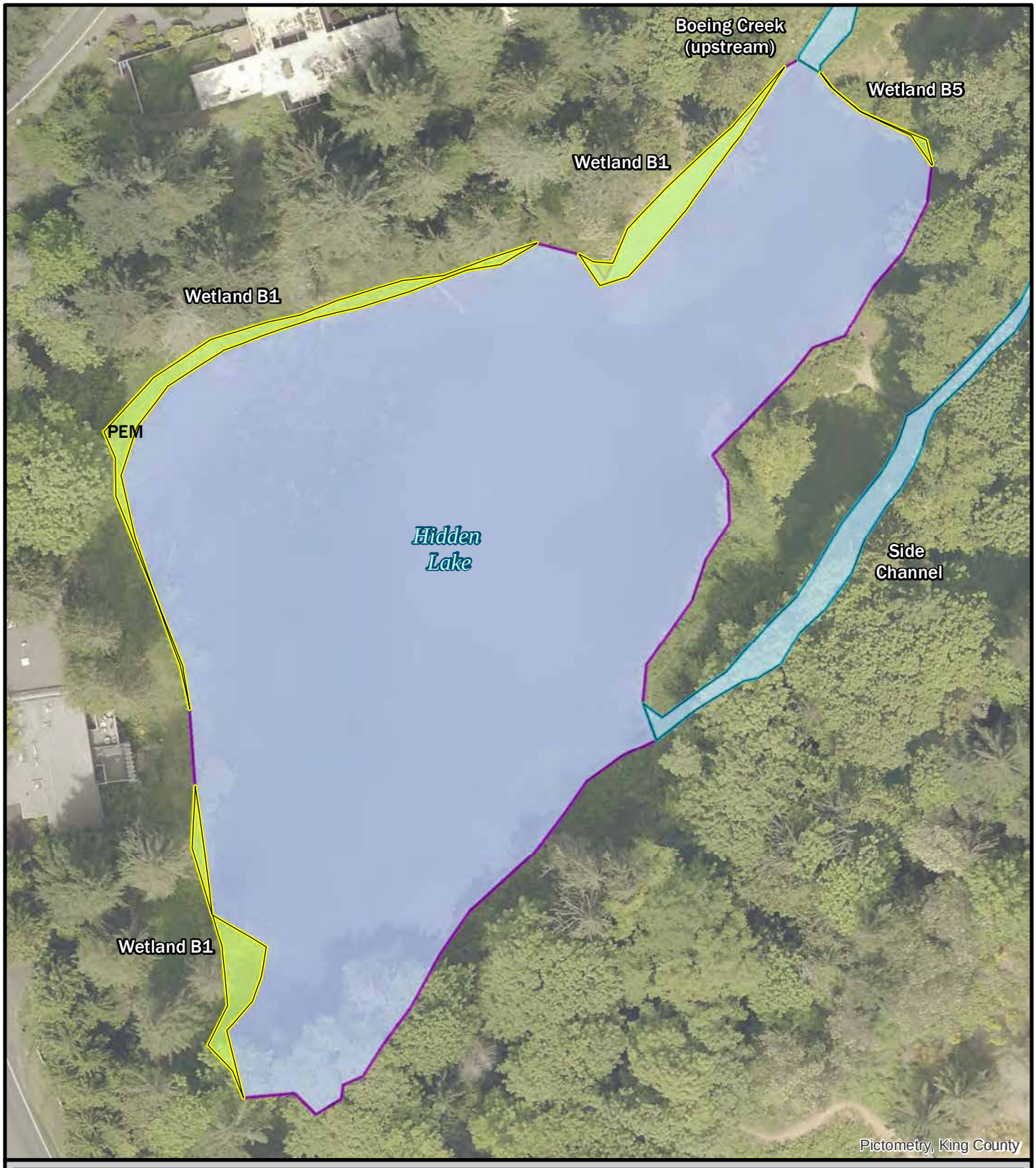
N

0 450 900 1,800 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD9_HabitatsA2_B2-3-4_letter.mxd



Legend

- Wetland
- Stream
- Lake

Cowardin class

- PEM

Figure D-10.
Cowardin Class for Wetlands B1 and B5.

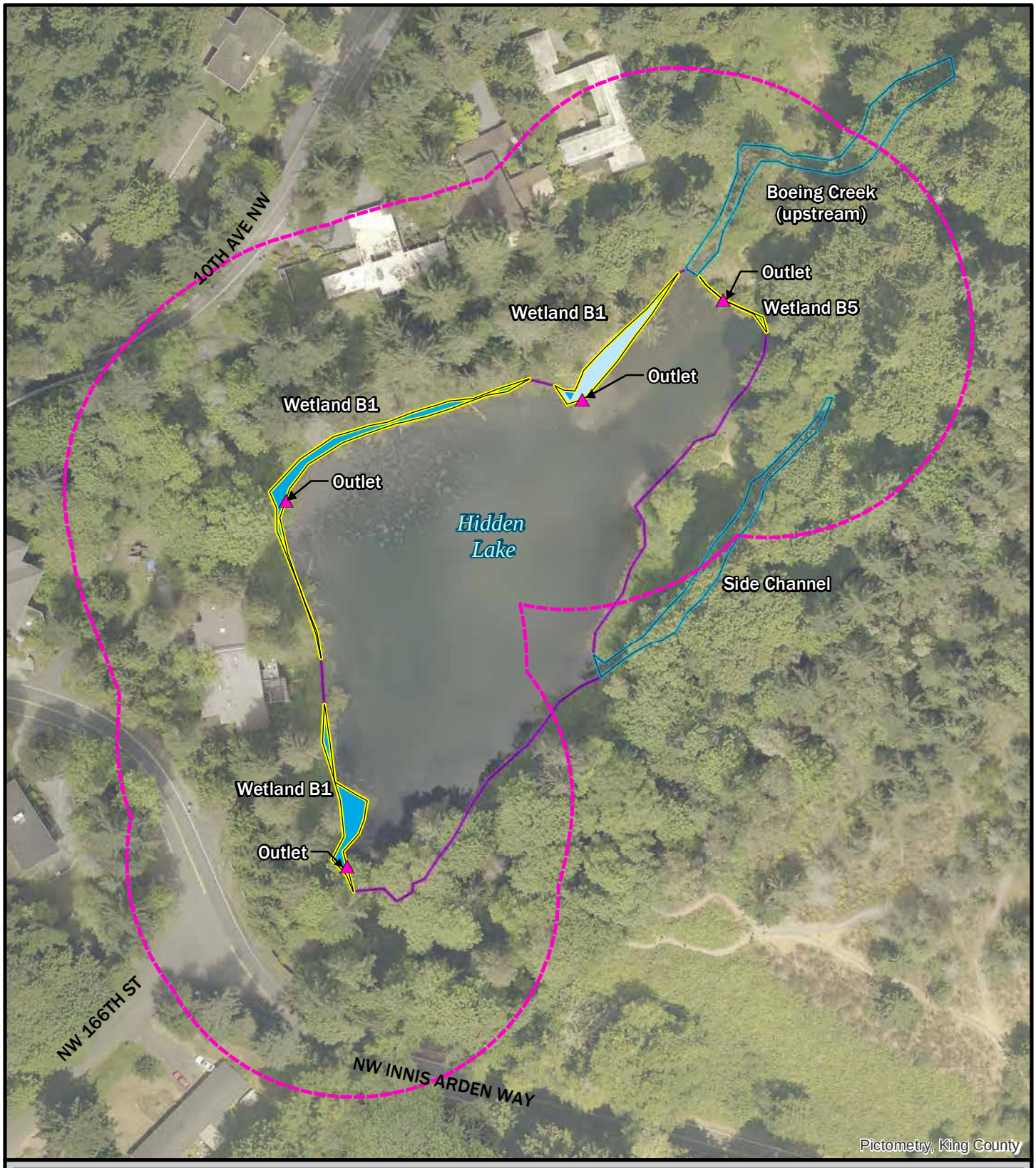
N

0 30 60 120
Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD10_CowardinB1-5_letter.mxd



Legend

- Wetland
- Stream
- Lake
- 150-ft boundary
- Outlet

Hydroperiod

- Saturated only
- Seasonally flooded

Figure D-11.
Hydroperiods, 150-Foot Boundary, and Location of Outlet for Wetlands B1 and B5.

N

0 50 100 200 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD11_HydroperiodB1-5_letter.mxd

Legend

- Wetlands
- 1-kilometer boundary
- Stream (King County)
- Waterbody (King County)

Habitat types

- Low/Moderate Intensity
- Low/Moderate Intensity and Accessible
- Undisturbed

Figure D-12.
Habitat Within a 1-km Boundary of Wetlands B1 and B5.

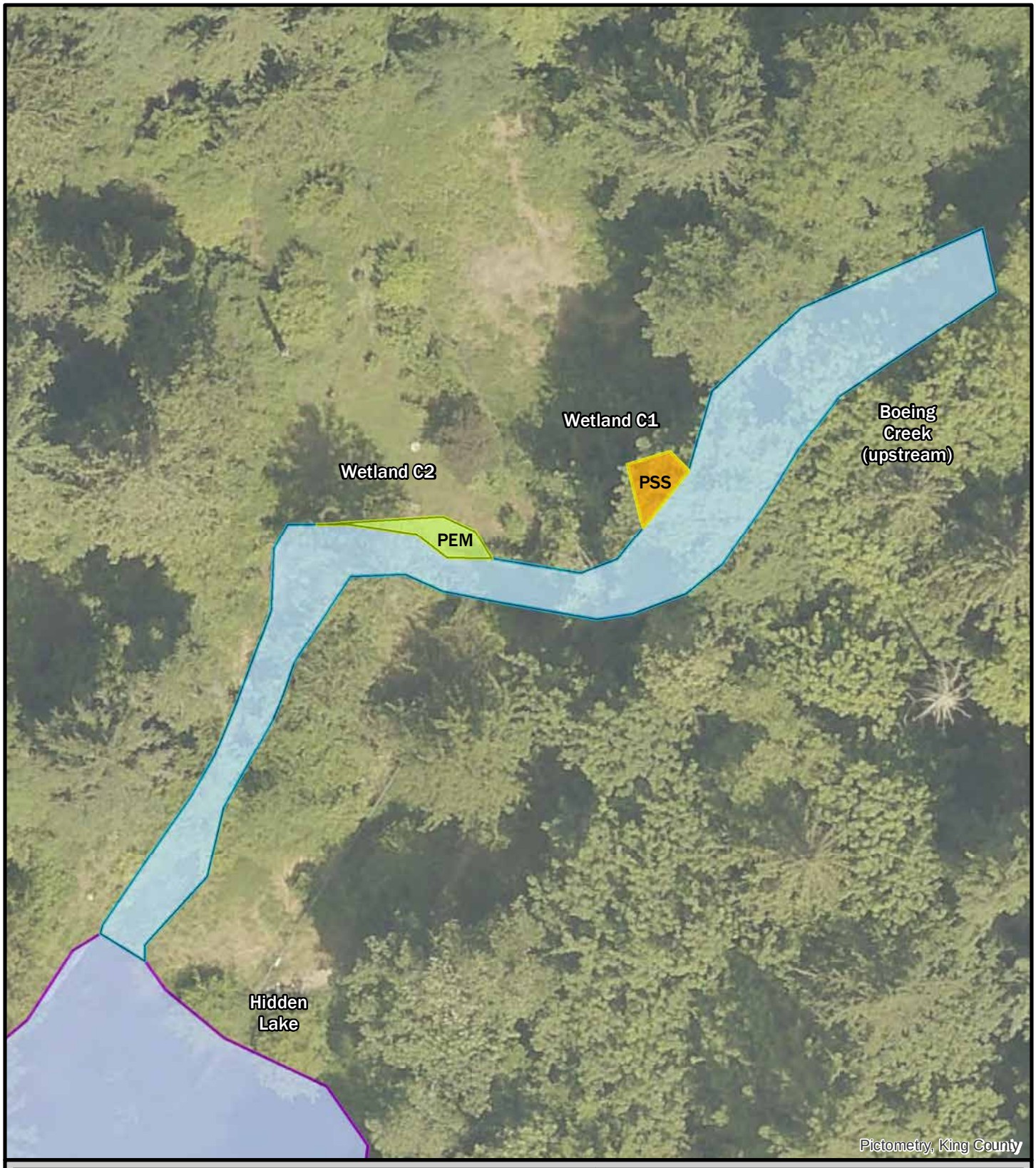
N

0 450 900 1,800 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD12_HabitatsB1-5_letter.mxd



Legend

- Wetland
- Lake
- Stream

Cowardin class

- PEM
- PSS

Figure D-13.
Cowardin Class for Wetlands C1 and C2.

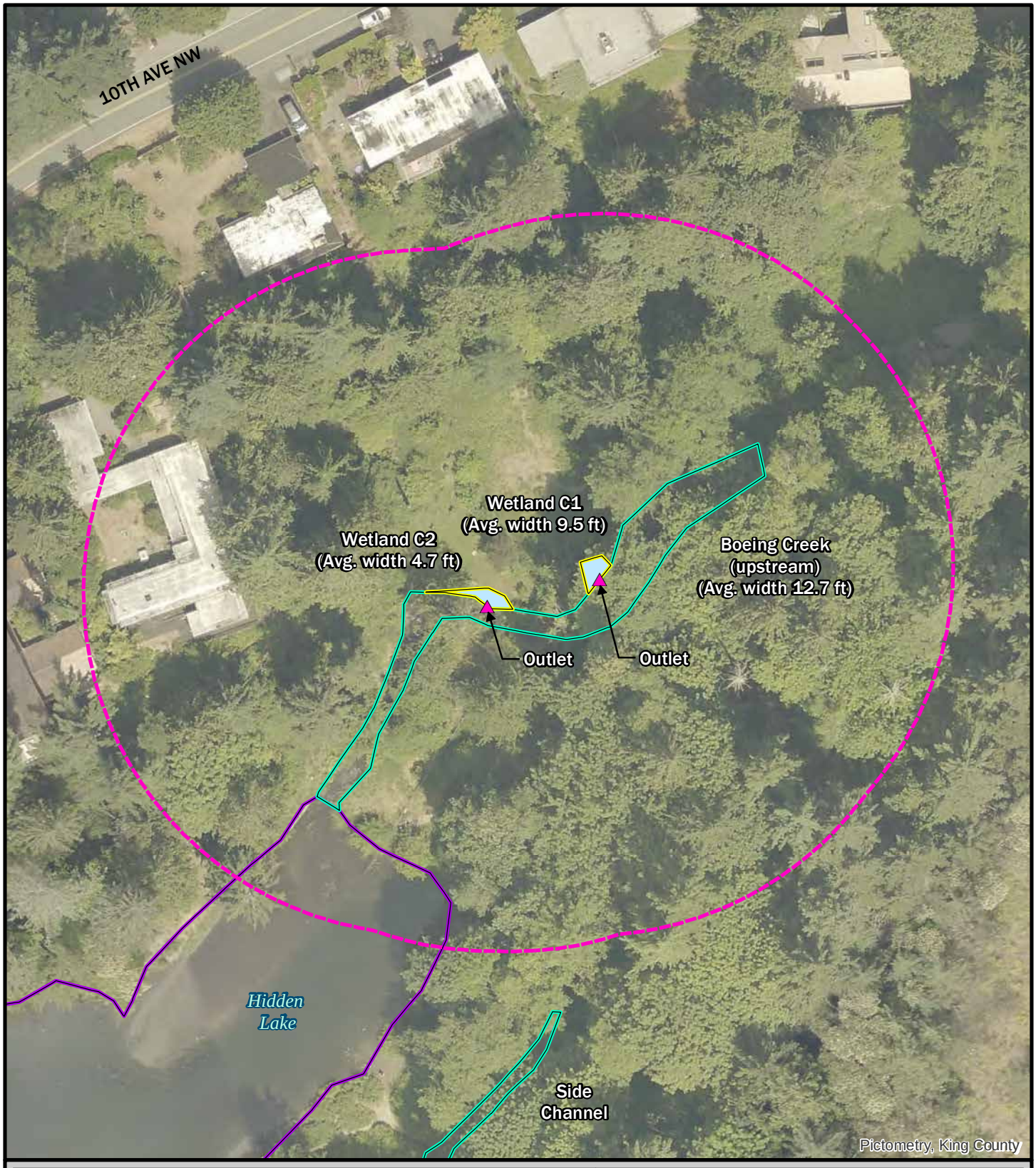
N

0 15 30 60 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD13_CowardinC1-2_letter.mxd



Legend

- Lake
- Stream
- Wetland
- 150-ft boundary
- Outlet
- Hydroperiod
  - Seasonally flooded

Note: There are no ponded depressions.

Figure D-14.
Hydroperiods, 150ft Boundary, and Width of Unit vs. Width of Stream for Wetlands C1 and C2.

N

0 30 60 120 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD14_HydroperiodC1-2_letter.mxd

Legend

- Wetlands
- 1-kilometer boundary
- Stream (King County)
- Waterbody (King County)

Habitat types

- Low/Moderate Intensity
- Low/Moderate Intensity and Accessible
- Undisturbed

Figure D-15.
Habitat Within a 1-km Boundary of Wetlands C1 and C2.

N

0 450 900 1,800 Feet

HERRERA

King County, Aerial (2017)

K:\Projects\Y2018\18-06771-000\Project\Rating\FigD15_HabitatsC1-2_letter.mxd