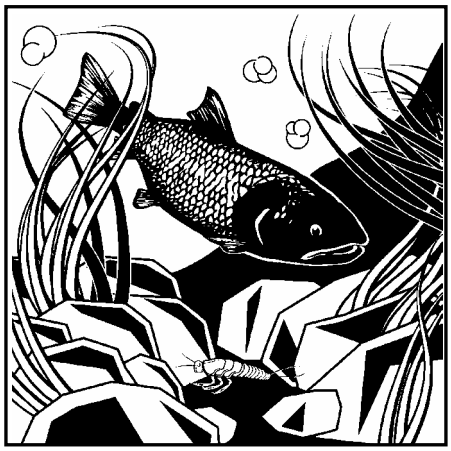
WETLAND CHARACTERIZATION:
CHUCKANUT VILLAGE MARSH

JUNE 2008

Prepared For:
WHATCOM COUNTY PUBLIC WORKS
2011 Young Street, Suite 201
Bellingham, WA 98225

Prepared By:
NORTHWEST ECOLOGICAL SERVICES, LLC
1229 Cornwall Avenue, Suite 313
Bellingham, WA 98225
360.734.9484



WETLAND CHARACTERIZATION:
CHUCKANUT VILLAGE MARSH

JUNE 2008

Prepared For:
WHATCOM COUNTY PUBLIC WORKS
2011 Young Street, Suite 201
Bellingham, WA 98225

Prepared By:
NORTHWEST ECOLOGICAL SERVICES, LLC
1229 Cornwall Avenue, Suite 313
Bellingham, WA 98225
360.734.9484

Executive Summary

Northwest Ecological Services, LLC (NES), Coastal Geological Services, Inc (CGS) and Fairbanks Environmental Services, Inc. (FES) were retained by Whatcom County Public Works to prepare a Wetland Characterization and Analysis of the Chuckanut Village Marsh.

The scope of this project is to provide a wetland characterization of Chuckanut Village Marsh to assist in the decision matrix for a proposed culvert removal project. The characterization includes a wetland rating, a general functional review, a survey of the marsh and immediate vicinity topography, and habitat mapping. It also includes an analysis of existing conditions, proposed action alternatives and recommendations based on the collected data.

Six primary vegetation communities were identified in or near the review area as defined by the Cowardin system (Cowardin, L. 1979). The communities are: Upland Forest (UPFO); Palustrine Forest (PFO); Upland Shrub (UPSH); Palustrine Scrub-Shrub (PSS); Palustrine Emergent (PEM); and Estuarine Emergent (EEM). Elevations ranged from 8′ to 11′ within the review area of the site. Mean High Water (MHW) occurs at 7.7′ elevation above Mean Lower Low Water (MLLW) and is limited to the ditch near the culvert extending to where the ditch divides (Figure 5). Mean Higher High Water (MHHW) occurs at 8.4′ above MLLW. Salinity within the marsh ranged from <1ppt, at elevations above 9′, and 2 ppt to 15 ppt within the lower elevations.

Guidance within the Washington Department of Ecology's Wetland Rating System places all estuarine wetlands in either a Category I or II depending on it condition. The wetland received 69 total points and a habitat score of 29 points using the Wetland Rating forms for Depressional wetlands. The wetland provides moderate to high functions within the reviewed suite of wetland functions.

Field observation and topographical data indicate that the culvert does not appear to limit flow significantly into or out of the marsh, except possibly during extreme events of high water and storm surge.

Four alternatives have been presented for review. Alternative Two is the preferred alternative and would result in removing the existing culvert, while still maintaining public access to the marine system using a pedestrian bridge. Alternative One would result in removing formal public access and may result in unintended harm to natural systems from informal access. The third would replace the culvert to maintain road access to the beach but improve the design to provide improved fish passage and flow into the marsh. The fourth is a no action alternative.

In summary, removal of the culvert under the western end of Fairhaven Avenue would provide minor benefits by providing additional salmonid and other fish access to the marsh for foraging under certain tidal cycles. The culvert removal would also facilitate improved flushing functions that facilitate nutrient and transfer of other allocantheous material from the terrestrial and marsh systems to the marine system.

TABLE OF CONTENTS

1.0 Background

1.1 Background

Northwest Ecological Services, LLC (NES), Coastal Geological Services, Inc (CGS) and Fairbanks Environmental Services, Inc. (FES) were retained by Whatcom County Public Works to prepare a Wetland Characterization and Analysis of the Chuckanut Village Marsh. The project site is located at the western terminus of Fairhaven Avenue in Bellingham, Washington (NW ¼ of Section 13, Township 37 N, Range 2E, W.M.) (Figure 1).

1.2 Scope of Work

The scope of this project is to provide a wetland characterization of Chuckanut Village Marsh to assist in the decision matrix for a proposed culvert removal project. The characterization includes a wetland rating, a general functional review, a topographic survey of the marsh and immediate vicinity, and habitat mapping. It also includes an analysis of existing conditions, proposed action alternatives and recommendations based on the collected data. This report is intended to provide background and guidance in designing, permitting and implementing restoration activities in this area.

Client:
Whatcom County Public Works
2011 Young Street, Suite 201
Bellingham, WA 98225
Phone: 360.715.7450
Contact: Atina Casas

2.0 Introduction

Chuckanut Village Marsh is a wetland complex adjacent to a pocket estuary at the north end of Chuckanut Bay. The review site is located at the northeastern end of the bay, north of the mouth of Chuckanut Creek (Figure 1).

The project review area is detailed in Figure 2. The marsh is on the north side of Fairhaven Avenue and extends from the marine mean high water (MHW) line eastward to the edge of the developed area and north to the toe of the slope. It also included the stream channel south and west of Fairhaven Avenue into the marine system.

3.0 Wetland Characterization

The wetland characterization included identification of existing vegetation, soils, supporting hydrology, and site topography. The methodologies employed for this study are detailed below.

3.1 Methods

Vikki Jackson and Clover Muters of NES visited the site on April 14, 15, 22 and May 22 of 2008. Biologists conducted the wetland assessment in accordance with the Washington State Wetlands Identification and Delineation Manual (Ecology, 1997) and the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987). Methods for each of these parameters are as follows:

- **Vegetation:** The plant community at each sample site is considered to be hydrophytic (wetland) vegetation if more than 50 percent of the dominant species from all strata have obligate wetland, facultative wetland, and/or facultative indicator status. Indicator status is taken from U.S. Fish and Wildlife Service (Reed, 1988 and 1993). Vegetation was identified in the field and from voucher specimens and identified in the office using Flora of the Pacific Northwest (Hitchcock and Cronquist 1974)
- **Soils:** Soil test pits are hand dug to approximately 20 inches and soils are examined for hydric soil indicators, per the Natural Resource Conservation Service *Field Indicators of Hydric Soils in the United States* (2006). These formal soil test pits are labeled with a data point number and located on the delineation map. Colors of the soil matrix, and mottling or gleying, if present, are measured immediately below the upper dark horizon using a Munsell color chart (Gregtagmacbeth, 2000).
- **Hydrology:** Site specific hydrology is assessed by an inspection of each site. Depth to shallow groundwater and/or saturation in each test pit is recorded, as are observations of other indicators of hydrology including water marks, drift lines, sediment deposits, and drainage patterns. These data provide information on timing and duration of ponding and/or saturation in the study area.

Data sheets are located in Appendix C of this report.

The wetland was rated using the Washington State Department of Ecology's Wetland Rating System for Western Washington, revised 2004 (Rating System) (Hruby, 2004). Wetland functions were also evaluated using the Rating System. This methodology identifies and quantifies the potential of various functions operating within a wetland. The determination is based on the physical characteristics of water quality, hydrologic, and habitat functions in the wetland and buffers. Using this system, wetlands are given a score based on the functions provided by the wetland, and classified as Category I through Category IV.

The site was surveyed by CGS to produce a new 1-foot contour interval topographic map. Marsh and adjacent beach topographic data were collected using a Leica TCR-1105 total station with direct rod measurements. The vertical datum was based on elevation COB monument 5213 established for the City by Wilson Survey and Engineering located at the west end of Fairhaven Avenue, and verified using tidal elevation observations corrected to interpolated NOAA tide station records. The monument had a stated

vertical accuracy of 0.164 ft. Data were reduced and map products produced using AutoCAD Civil 3D 2008 to National Map accuracy standards for 1-foot contour intervals. Calculations of available estuarine area for enhancement were produced from these data.

Mapping of project habitat types was performed by identification of the dominant vegetation species based on percent cover across and within the marsh. These were identified as communities and units and mapped on an aerial photograph and integrated into the CADD drawings. Species lists are included in Appendix F of this report.

3.2 Coastal Processes and Historic Change

A number of factors have been altered by development which affects coastal processes at the Chuckanut Village Marsh site. The most dramatic change was the installation of the road and culvert. Another major alteration was the construction of the Great Northern railroad (currently the Burlington Northern Santa Fe) bridge/causeway across the north-central portion of Chuckanut Bay.

Disturbance in the vicinity of the current access road and parking area appears to date back at least to the 1930's (Wahl, personal communication). A 1930's photograph depicts a small building, log boom and pier in the general location of the existing parking area (Appendix H). It is not clear if an access road was in the present location in this photograph, but there is no indication of a stream outlet in this area in the photograph. During the 1960's a gravel road extended from the current parking area north along the top of the berm to the toe of the slope of the north hill (Wahl personal communication). This road has since revegetated with native shrubs. Existing conditions today include an unpaved access road from Fairhaven Avenue to a gravel access area (approx. 100'X 35') that is used for informal parking.

The railroad causeway was originally a wood structure on pilings (as shown in a 1920s photo from the Whatcom Museum; Appendix H). Later, the causeway was filled in with rock (as shown by a 1930s photo from the Whatcom Museum; Appendix H). This solid-fill causeway greatly limits both water circulation and wave energy reaching the north end of Chuckanut/Mud Bay. The causeway currently only has one narrow bridged opening that is approximately 170 ft long.

The wind regime in Whatcom County is dominated by southerly winds which are both predominant (strongest winds) and prevailing (most frequently occurring). Under pre-causeway conditions, the wave fetch (the open water distance over which wind-generated waves can form) from the south-southwest was approximately 8 miles. After causeway construction, this fetch was reduced to 0.4 miles, which has greatly reduced wave energy at the beach at Chuckanut Village Marsh. This reduction in wave energy

has directly reduced the littoral sediment transport rate, thereby, reducing the likelihood that the tide channel will be closed by transport of beach sediment.

The beach in this portion of Chuckanut Bay generally behaves like a pocket beach in that it is contained by rock outcrops at both ends and has limited sediment exchange in or out. The longshore sediment transport has been limited and the beach is slightly crescentic in shape (Figure 2). Under current BNSF causeway conditions, the tide channel appears very stable and has not shown any obvious signs of infilling.

The absence of a mapped tide channel in this location in the 1887 T-sheet (number T-1796), the apparent lack of a tide channel in the 1930s air photo, and the presence of a generally linear, very steep-sided "ditch" type tide channel feature also indicates that the tide channel appears to have been excavated in the mid-20th century. Another indicator of the likely origin of the excavated tide channel is the significant difference between the relatively flat marsh plain surface and the ditch and tide channel network. This network is several feet lower in elevation than the marsh plain and the main tide channel has undercut banks.

Regardless of the origin of the tide channel, this feature seems to create an increase in the diversity of habitat types in the area and availability of forage habitat for use by juvenile salmon.

Without the tide channel, saltwater exchange would be far less than under the present configuration. Input of water from the bay would be limited to infrequent overwash during southerly windstorms that occurred at high tide. This would change the vegetation communities in the lower elevation portion of the marsh. Vegetation changes would likely result in the expansion of species less tolerant of salt and a decrease of species with low salt tolerance. There would also be direct loss of habitats in the tide channel.

3.3 Plant Communities

Six primary vegetation communities were identified in or near the review area, as defined by the Cowardin system (Cowardin, L. 1979) (Figure 3). The communities are: Upland Forest (UPFO); Palustrine Forest (PFO); Upland Shrub (UPSH); Palustrine Scrub-Shrub (PSS); Palustrine Emergent (PEM); and Estuarine Emergent (EEM). These general community types include sub-categories that we have defined as units within the overall communities. A complete list of plant species identified is included in Appendix F of this report. The following section describes the observed communities and vegetation units observed within the review area:

Upland Forest
This plant community is located along the north and eastern edges of the review area. The majority of this community occurs outside the actual review area for the project, but has been included as reference from field notes. No specific elevation has been attributed to this community, but it occurs above the 10 foot elevation on mineral soils. The dominant species in this community are predominately rated as facultative upland or drier and are mostly considered sensitive to very sensitive to salt (Reed 1993 and Hutchinson 1991). This community is not shown in Figure 3.

The community is characterized by a mixed canopy of Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), big-leaved maple (*Acer macrophyllum*) and red alder (*Alnus rubra*). The understory includes both shrub and herbaceous plant species including salal (*Gaultheria shallon*), Indian plum (*Oemleria cerasiformis*), salmonberry (*Rubus spectabilis*), low Oregon grape (*Mahonia nervosa*), tall Oregon grape (*M. aquifolium*), trailing blackberry (*Rubus ursinus*), and sword fern (*Polystichum munitum).*

Palustrine Forested Wetland
This vegetation community is situated between the UPFO and PSS habitats within the wetland. Most of this community lay outside the actual review area, but it appears the PFO on this site occurs on mostly organic soils that are at an elevation of 9′ or greater. Much of this community is located on slopes with permanently or seasonally saturated soils. Plant species occurring in this community have wetland indicator status of Facultative to Obligate Wetland and most are either not rated for salt sensitivity or are listed as Very Sensitive or Sensitive (Reed 1993 and Hutchinson 1991). This community is not shown in Figure 3.

Representative species in this community include: red alder, black cottonwood (*Populus balsamifera*), scattered western red cedar (*Thuja plicata*) and Sitka spruce (*Picea sitchensis*); black twinberry (*Lonicera involucrata*), salmonberry, salal, skunk cabbage (*Lysichitum americanum*), and slough sedge *(Carex obnupta*).

Upland Shrub
This plant community is located on the nearshore berm west of the marsh and east of the marine system and on remnant fringing marine berm approximately 30 east of the forberm in the southeast corner of the marsh. The community is located at the 10′+ elevation and occurs on gravelly mineral soil apparently of marine origin. Dominate plant species within this community are rated as predominately Facultative Species and most are rated as Sensitive to salt (Reed 1993 and Hutchinson 1991). This community is identified as Pink 2 on Figure 3.

The dominant plant species on the most western berm are Nootka rose (*Rosa nutkana*), cow parsnip (*Heracleum lanatum*), and American dunegrass (*Elymus mollis*). Other associated species include Scot's broom (*Cytisus scoparius*), Maritime peavine (*Lathyrus*

japonicus), tall Oregon grape, red elderberry (*Sambucus racemosa*) and yarrow (*Achilla millefolium*).

The inland berm is dominated by quaking aspen (*Populus tremuloides*), western crabapple (*Malus fusca*), and Douglas hawthorn (*Crataegus douglasii*). Scattered young western red cedar and Sitka spruce are also present. The understory includes a range of species including serviceberry (*Amelanchier alnifolia*), tall Oregon grape, sword fern, and false lily-of-the-valley (*Maianthemum dilatatum*).

Palustrine Scrub-Shrub Wetland

This plant community is dominated by shrub species interspersed with low tree species. Two units were identified within this community: Deciduous Shrub and Salix.

Deciduous Shrub Unit

This unit appears to be an extension of the upland shrub on the landward berms. It is characterized by low trees and tall shrubs over a well developed herbaceous layer. The canopy is fairly consistent across the moisture gradient, but the herbaceous layer is more reflective of the hydrologic regime. The unit occurs on organic soils that are seasonally flooded to permanently saturated. It occurs at elevations between 9′ and 10′ within the marsh. Dominant plants are rated as Facultative to Obligate Wetland within the unit and range from sensitive to moderately tolerant to salt exposure (Reed 1993 and Hutchinson 1991). Salinity within these units were <1 ppt. This community is identified as Pink 1 on Figure 3.

Representative plant species include: quaking aspen, western crabapple, black twinberry, slough sedge, Lyngby's sedge (*C. lyngbyi*), water parsley (*Oenanthe sarmentosa*), and soft rush (*Juncus effusus*).

Salix Unit

This unit is characterized by its dominance by native willow species. It appears to occur on organic soils within the wetland above 8.5′elevations and situated between the PFO habitat and the PEM area. The unit appears outside of the designated MHHW limit and does not appear to be affected by saline surface water. The unit is located in areas of permanently saturated soils with channelized surface water. Dominant species have a Facultative rating or wetter with a range of salt tolerances from Very Tolerant to Very Sensitive (Reed 1993 and Hutchinson 1991). This community is identified as Green on Figure 3.

Dominant species occurring in this unit include: red alder, Hooker's willow (*Salix hookeriana*), Sitka willow (*S. sitchensis*), Scouler's willow (*S. scouleriana*), hardhack(*Spiraea douglasii*), skunk cabbage (*Lysichitum americanum*), curly dock (*Rumex crispus*), and non-native yellow-flag iris (*Iris pseudacorus*).

Palustrine Emergent Wetland

The PEM wetland as a whole is composed of two vegetation units: Typha unit; and Phalaris unit. The PEM areas on the site are dominated by herbaceous emergent vegetation and occupy the southern half of the wetland. Shrub species are present along the fringes of these areas, but comprise less than 10 percent cover per unit. The Typha Unit is located on organic soil; whereas the Phalaris unit occurs on both mineral and organic soils. The PEM areas occupy a range of elevations within the wetland which appear to be important to the occurrence of specific units within the wetland. Salinity within these communities were <1 ppt.

Typha Unit

This unit occurs on organic soils that are saturated to the surface or flooded with up to 3 feet of water in depressions within muck soil. The unit occupies elevations between 8.0′ and 9.0′ and is situated between the PSS and other emergent units. The Typha Unit is dominated by common cattail (*Typha latifolia*) with an average cover of 90 percent where the unit occurs. Associated species in the unit include curly dock, pacific silverweed (*Potentilla pacifica*), saltgrass (*Distichlis spicata*), cow parsnip, hardhack, Hooker's willow, Sitka willow, slough sedge, Lyngby's sedge, and red alder. Common cattail is listed as an Obligate Wetland species and indicated to be Sensitive to salt exposure (Reed 1993 and Hutchinson 1991). This community is identified as White on Figure 3.

Phalaris Unit

Reed canarygrass (*Phalaris arundinacea*) dominates an area along the southeastern edge of the marsh. Reed canarygrass cover is 100 percent across the unit, with a trace of Nootka rose and Himalayan blackberry (*Rubus armeniacus*). The unit occurs above the 8′ elevation and occurs on mineral soils, ending abruptly at the organic soils. Reed canary grass has a Facultative Wetland status and is indicated to be Moderately Tolerant of salt (Reed 1993 and Hutchinson 1991). This community is identified as Blue on Figure 3.

Estuarine Emergent Wetland

The EEM wetland is composed of two vegetation units: Juncus Balticus unit; and Distichylis unit. The EEM areas on the site are dominated by herbaceous emergent vegetation and occupy the southern half of the wetland. Shrub species are present along the fringes of these areas, but comprise less than 10 percent cover per unit. All units occur on organic soil. The EEM areas occupy elevations between 8 and 9′. Salinity within these communities range from 2 ppt to 10 ppt. The highest salinity readings occurred within the Distichylis Unit.

Juncus Unit

This unit also occurs on organic soils and in areas that are saturated to the surface interspersed with ponded areas. The unit occupies elevations between 8.0′ and 9.0′ within the marsh and above the MHW but within the MHHW. The

Baltic Rush Unit is dominated by Baltic rush (*Juncus balticus*) with an average cover ranging from 60 to 90 percent within the unit. Vegetation cover within the unit is variable. Salinity within this community ranges between 1 ppt and 8 ppt. The highest salinity data recorded in this community was located at Station 7 near the center of the marsh. The associated species change across the unit, and appear to be reflective of changes to hydrologic gradients paired with salinity. The unit is predominately composed of Facultative Wetland and Obligate Wetland species (Reed 1993). Salt tolerance of species in this unit range from Very Tolerant to Sensitive (Hutchinson 1991). Representative species occurring in this unit include Pacific silverweed, saltgrass, Douglas aster (*Aster subspicatus*), Lyngby's sedge, slough sedge, curly dock, and seacoast bulrush (*Scirpus maritimus*). This community is unlabeled on Figure 3.

Distichlis Unit

This unit occurs on organic soils and at the lowest elevations within the marsh. The unit is best expressed at the 8.0′ elevation and only occurs in the vicinity of the mapped MHHW areas. This unit appears to occur, in part, in areas that are experiencing the greatest saltwater influence on the southern end of the marsh. A small disjunct part of the unit is located along the western marsh edge in the vicinity of the small MHHW area. Salinity recordings within this Unit ranged from 2 ppt to 10 ppt, with an average salinity of 9.5 ppt. The highest salinity data collected in this community was at Station 4 at the south end of the marsh. Data from Stations 8 and 9 were located in the Distichlis Unit at the northwest edge of the marsh and displayed salinity levels of 2 to 5 ppt. Soils observed in the unit were saturated to the surface or ponded . The southern population (near the road) was observed flooded during high tide conditions (>9′ tides). The unit is characterized by the dominance of saltgrass intermixed with Pacific silverweed, seaside arrowgrass (*Triglochin maritimum*) and Douglas aster. The unit occurring near Fairhaven Avenue is the only location that pickleweed (*Salicornia virginica*) was observed in the marsh. The dominant species are rated as Facultative Wetland or wetter and have a Moderate to very Tolerant rating for salt exposure (Reed 1993 and Hutchinson 1991). This community is identified as Yellow on Figure 3.

3.4 Marsh Topography

Elevations ranged from 8.0′ to 11.0′ within the review. MHW occurs at 7.7′ elevation above Mean Lower Low Water (MLLW) and is limited to the ditch near the culvert extending to where the ditch divides (Figure 4). Mean Higher High Water (MHHW) occurs at 8.4′ above MLLW and extends into the PEM areas of the marsh within the Distichlis Unit and beyond into the south end of the Juncus Unit. A higher elevation area extends from the culvert to the northwest, generally parallel to the present beach. This feature extends to between 11.0′ and 12.0′ elevation, and appears to be a relict beach ridge formed by littoral drift prior to the installation of the BNSF railroad causeway. The

beach ridge was essentially a spit that likely extended across the old northeast portion of the bay prior to the more recent infilling of the marsh. The beach ridge is higher in elevation due to greater wave energy that would have formed it pre-causeway (as discussed in Section 3.2, above). The beach ridge separates the lower elevation portions of the marsh from Mud Bay.

A disjunct elevation occurring at the MHHW is located along the western portion of the marsh as indicated in Figure 4. The beach at Mud Bay slopes gradually waterward from approximately elevation +9, and the MHHW waterline is apparent along the marine shoreline aligned with the beach and wrack, very close to the waterward extent of terrestrial vegetation.

3.5 Hydrology

The subject parcel is located in the South Bay watershed, in Water Resource Inventory Area 1 (Figure 5). Hydrology supporting Chuckanut Village Marsh appears to be driven by a combination of overland flow and groundwater (freshwater), in combination with a marine contribution. The drainage basin for this site is approximately 70 acres in size. The collection basin is a mix of forested habitat and residential development. Based on vegetation, topography and recorded and observed MHW and MHHW data, it appears the primary source of hydrology is freshwater originating from surrounding surface runoff and associated groundwater release at the toe of the surrounding slopes during the wet season (November through May). The marine system, however, could have a greater affect during the dry season and should be investigated further. The scope of this project did not include quantifying specific contributions of each source to this wetland.

Within the review area of the marsh, soils were either saturated to the surface or ponded with 1″ to 3′ of water. The dominant hydrological condition was soils saturated to the surface. Deep pools were located within pits in the muck soils on the east side of the Upland Shrub berm. Channelized surface water was observed entering northeast of the review area and in the northwest. The northeast drainage entered the review area in an apparent naturalized channel that appears ditched after it enters the PEM portions of the site. The ditches are depicted in Figures 3 and 4. Historical notes and photographs indicate that the marsh may not have originally had a defined outlet. Historic photographs depict buildings and roads in the vicinity of the current tide channel location. Additional channelized surface water enters the marsh along the northwest side. This appears to be a stormwater release from the Briza Development. Given the projects location in the drainage basin, groundwater may have significant inputs into the system.

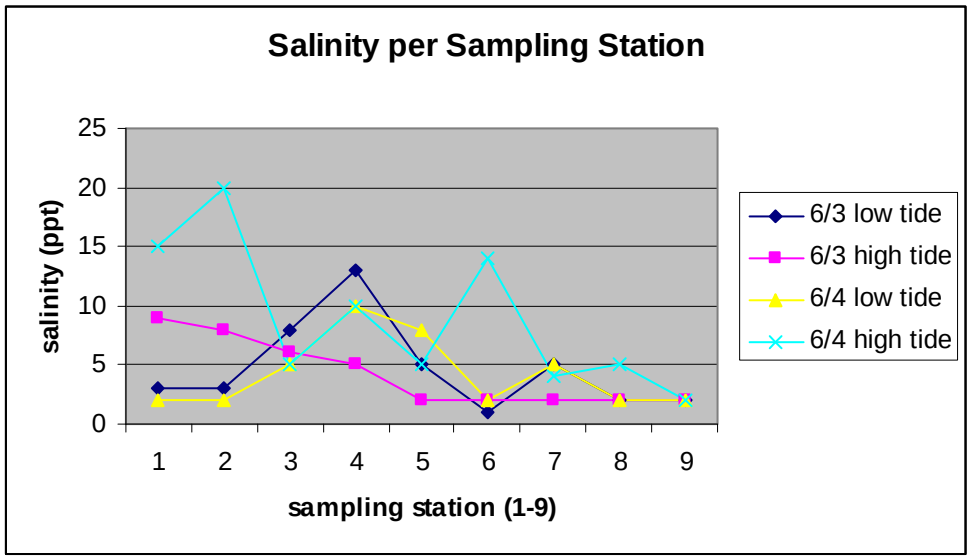
The Natural Resource Conservation Service (NRCS) indicates Fishtrap Muck soils as the dominant soil series at the site with an apparent water table that occurs 1.5 to 2.5 feet from the surface between October through May. Site observations from April and May 2008 indicate that the water table is higher than recorded for the series. Surface water

was observed at or above the soil surface throughout the marsh in the areas with underlying Fishtrap Muck soils.

3.6 Salinity

Salinity was measured with a hand-held salinity refractometer (model A366ATC, Vista). Data on salinity was recorded at 9 sample points within the marsh (Figure 3). The lowest detection for this equipment is 1 ppt. Salinity was sampled on two separate days on the low low and high high tide of each day. Samples were taken at 5 cm below the surface and 15 cm (or bottom of pool) to detect salinity stratification within samples.
Data was collected on June 3 and 4, 2008. Data sheets are located in Appendix C of this report. Figure 8 presents the results of the salinity recorded at individual sampling stations over two days. Recorded tides on the days of data collection were -3.4′ and -3.8′ respectively for the low low water and +9.0′ and +9.3′ for the high high water. June 4 was the lowest recorded tide of the year. Data collection also corresponded with heavy rainfall, particularly on the day of June 3. There was heavy flow within the primary site ditch during both collection times for that day.

Figure 8. Salinity per Sampling Station – Chuckanut Village Marsh



Surface water within the lower marsh (elevations 9′ and lower) is considered brackish. Brackish waters have salinity in the range of 0.5 ppt to 29 ppt. Salinity levels in the lower portions of the marsh exceeded the 0.5 ppt threshold in all locations sampled. Samples above the 9′ elevation fell below this limit. The data indicates a general salinity gradient ranging from most brackish at the southeast side of the marsh and decreasing in salinity moving north and west. The berm on the west side of the marsh appears to separate the salinity gradient on the east and west side of the marsh.

The data indicates that communities located below 9′ elevation in the marsh are best described as a mixhaline system as defined by the Cowardin System (Cowardin et. al

1979). Above 9′ elevations all samples were below 1 ppt. Table 1 presents salinity categories presented in the Cowardin System (Cowardin et. al 1979). This is essentially a brackish water condition. Areas within the marsh that included salinity sample areas 1-7 ranged from weakly brackish (Oligohaline) to moderately brackish (Mesohaline). These area displayed variability that appears correlated to tidal influence and precipitation rates. Sample area 1 was taken at the outlet on the marine side of the culvert. This sampling station was exposed to the greatest marine influence, but still received a heavy influence from the outflowing water from within the marsh. Salinity at this station ranged from <1 ppt to 15 ppt which is reflective of it more exposed location. During high tides a distinct stratification was detected with the marine water lying under the lower saline water flowing out of the marsh. This stratification lens was most distinct in sampling stations 1-7, but was detected in stations 8 and 9 during the last sampling. Salinity stratification was not detected during low tide events.

Table 1. Salinity Categories (Cowardin et. Al. 1979)

Classification Levels for Salinity	
Level	Salinity, ppt
Fresh	<0.5
Mixhaline	0.5-30.
Euhaline	30.0-40.0
Hyerhaline	>40.0

Sampling areas 2, 3 and 6 were taken within the ditches in the marsh and displayed the widest swings in salinity per tidal cycle. This is consistent with the sample locations in the ditches. These sampling stations would have the greatest direct connection. Sample stations 4, 5 and 7 also displayed fairly wide ranges in salinity between days sampled and between tidal cycles. The sampling differences between days may be do to the heavy rain on the first day and reduced precipitation on the second monitoring day. There may have also been an accumulated affect of multiple day high tides sufficient to flood the marsh. Salinity at Stations 8 and 9 showed little variability between sample days and with tidal influence.

3.7 Soils

The NRCS mapping indicates the wetland is dominated by Fishtrap Muck (#54) (Figure 6). This series is indicated to occur on 0 to 2 percent slopes and is listed as drained. This soil series is classified as a histosol and meets the criteria for a hydric soil. Everett-Urbanland complex is mapped along the southeastern and northern edge of the review area. This soil is a mineral soil that is not listed as a hydric soil on the NRCS hydric soils list. Whatcom Labounty silt loam complex is mapped east of the project area. Tidal Hydraquents are mapped in the extreme southwest corner in the vicinity of the parking area and immediately to the east.

Our site review confirms this mapping within the majority of the site, however mineral soil was only located at the extreme northern and far eastern portion of the site. Most of the review area was dominated with Fishtrap Muck with the exception of two cobbly gravel areas that form a berm between the marsh and the marine system and a parallel set of soils approximately 30 feet east of the primarily berm (the beach ridge). The second berm appears to be an old beach barrier berm and it is spilt near the center with approximately 50 feet of muck.

3.8 Wetland Function and Rating

A summary of the Chuckanut Village Marsh wetland category, Hydrogeomorphic classification, and Cowardin classification is included in Table 1 below (Brinson, 1993 and Cowardin et al 1973). The wetland includes both slope and depressional Hydrogeomorphic Classifications. The northern half meets the slope wetland classification with slopes ranging from 1 to over 5 percent. The southern portion of the wetland, dominating our review area, is a depressional outflow wetland meeting the criteria as an estuarine wetland. Within the overall wetland three Cowardin vegetation classes are present, excluding the marine habitat: PFO, PSS, PEM, and EEM (Cowardin et al 1973).

The wetland was rated using the Washington State Department of Ecology's (DOE) Wetland Rating System for Western Washington, revised 2004 (Rating System) (Hruby, 2004). Wetland functions were also evaluated using the Rating System. This methodology identifies and quantifies the potential of various functions operating within a wetland. The determination is based on the physical characteristics of water quality, hydrologic, and habitat functions in the wetland and wetland buffers. Using this system, wetlands are given a score based on the functions provided by the wetland, and classified as Category I through Category IV.

Guidance within the DOE Wetland Rating System places all estuarine wetlands in either a Category I or II depending on it condition (Hruby 2004). The Chuckanut Village Marsh meets the criteria as a Category I Wetland because is has the following features:

1) It larger than one acre in size;
2) It is relatively undisturbed. The wetland was ditched and grazed in the past, however these impacts occurred long enough ago that the wetland appears to have no long lasting negative affects and continues to function with native estuarine plant communities;
3) The marsh is dominated by native plants with less than 10% of the total area covered by non-native plants;
4) A naturalized buffer is present for more than 75% the distance of the wetland and exceeds 100 feet in width; and

5) The estuarine portion of the marsh is contiguous with a freshwater wetland and contains depressions with open water.

The rating system does not provide worksheets on functions for estuarine wetlands, as they assume they are providing high function. We have included rating sheets for Depressional Wetlands from this Rating System to provide more specifics on particular functions acting within the wetland.

Based on this rating system, the Chuckanut Village Marsh meets the criteria of a Category II wetland with 69 total points and a habitat score of 29 points. Table 2 summarizes the rating form results. It should be noted: the wetland received one point lower than a Category I designation.

Table 2. Wetland Classification and Categorization Summary

Hydrogeomorphic Class	Cowardin Classification	COB Wetland Category	DOE Wetland Category
Slope/Depressional	PFO/PSS/PEM/EEM	II (wildlife 29pts)	II

Wetland and Buffer Functions

Concepts in the Ecology Rating Form and best professional judgment were used to assess general wetland and buffer functions, such as water quality, hydrology, and fish and wildlife habitat. For each function, wetlands are rated high, moderate or low. A summary of wetland functions are listed in Table 3.

Water Quality

The Chuckanut Village Marsh and its buffers have high potential for providing water quality functions. Organic soils are present the wetland with the ability to remove a wide range of pollutants from surface water. It also has persistent, ungrazed vegetation over greater than 95% of the area which can physically filter and trap sediments and pollutants. More than a quarter of the marsh is seasonally ponded indicating that the wetland undergoes a cyclic change between oxic and anoxic conditions which allow for high levels of nutrient removal, specifically nitrogen. Finally, the wetland also has the opportunity to improve water quality because there are residential areas within 150-feet of the wetland which can contribute pollutants to the marsh.

Table 3. Wetland Functional Assessment

Functional Value or Score	Wetland A
Total DOE Score	69
Total Water Quality Score	26
Overall Water Quality Functions	High
Total Hydrology Score	14
Overall Hydrologic Functions	Moderate
Total Habitat Score	29
Overall Wildlife Habitat Potential	High
Overall Wildlife Habitat Opportunity	Moderate
Vegetation structure	High
Habitat features	High
Buffer quality	Moderate/High
Priority habitats	High
Habitat connectivity	Moderate

Hydrology

The marsh and its buffer have moderate potential for providing hydrologic function. It has an intermittently flowing outlet which allows some water to be retained; however, there are marks of ponding less than six inches above the bottom of the outlet, indicating little depth of storage during wet periods. The wetland also contributes significantly to storage in the watershed as the area of the contributing basin is less than ten times the area of the wetland itself. Finally, it has the opportunity to reduce flooding and erosion as the water from the wetland is released into Chuckanut Bay. It is located in an increasingly urbanized area, which along with its size and storage capacity, make it significant in protecting downstream resources.

Fish and Wildlife Habitat

Overall the Chuckanut Village Marsh appears to provide high wildlife function. It scores very high for the *potential* for providing this function, although has slightly lower *opportunity* mainly to breaks in the vegetated corridors surrounding it as a result of major roads such as Chuckanut Drive, and the surrounding residential development to the east and west. The marsh has high structural and species diversity with multiple hydroperiods present and a complex interspersion of habitat types. It also has multiple habitat features present including large downed woody debris, standing snags, amphibian habitat and low invasive plant species cover. There are multiple habitat types in and around the marsh that are listed as "priority habitats" by the Washington State

Department of Fish and Wildlife, including: riparian, urban natural open space, estuary/estuary-like, and marine/estuarine shorelines.

In addition to the above habitat features, the Bay provides fish habitat as well. The mouth of Chuckanut Creek is located approximately 850 feet southwest of the marsh and the railroad causeway across the mouth of the bay has created a pocket estuary defined as a small estuary nested inside of a larger estuary which is important rearing habitat for juvenile Chinook salmon (Beamer *et al.* 2003). Beamer and others (2003 and 2006) have concluded that juvenile Chinook salmon prefer non-natal pocket estuaries to other adjacent nearshore habitat areas and have documented juvenile salmon in several small pocket estuaries in the Whidbey Basin and north Skagit County.

Table 4. Chuckanut Creek spawner data collected by City of Bellingham technicians between October and May of 2001 through 2006.

Species		Year (October - May)					
		2001 - 2002	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	**Total**
Chum	Live	1,171	5,217	1,143	247	69	7,847
	Dead	1,086	3,764	400	63	183	5,496
	Redds	7	431	201	9	53	701
Coho	Live	72	115	90	69	4	350
	Dead	59	40	14	5	0	118
	Redds	3	21	17	5	0	46
Chinook	Live	0	0	0	1	1	2
	Dead	0	0	0	1	0	1
	Redds	0	0	0	0	0	0
Steelhead	Live	0	0	0	0	0	0
	Dead	1	0	0	0	0	1
	Redds	3	5	0	8	0	16
Cutthroat	Live	0	0	0	0	0	0
	Dead	0	0	0	0	0	0
	Redds	0	1	1	5	0	7
Unknown	Live	3	3	1	37	6	50
	Dead	64	0	1	13	4	82
	Redds	67	27	0	3	1	98

Chuckanut Creek supports runs of steelhead trout, chum and coho salmon (Stream Net 2008). The City of Bellingham has conducted surveys of spawning salmon in Chuckanut Creek for several years. The results of these spawner surveys for the years 2001 – 2006 are listed in Table 4. During this time, one Chinook salmon was identified in Chuckanut Creek but it appears to have been without a mate and no redds were observed. Sea-run cutthroat trout redds were also identified but no live or dead cutthroat trout were observed. Chum and coho salmon are the largest salmon runs in Chuckanut Creek. After emergence and rearing for a short time in the creek, the juvenile salmon migrate

downstream and rear in the Chuckanut Bay estuary as they undergo smoltification, the physiological transition from the freshwater to their marine lifestage.

The Lummi Nation Department of Natural Resources has conducted beach seining surveys at several beaches in Whatcom County including the beach in Chuckanut Bay at the end of Fairhaven Avenue where 21 sets were made in 2005 through 2007. Four unmarked juvenile Chinook salmon (55 – 60 mm), 95 juvenile chum salmon and 2 juvenile coho salmon were captured with 380 sculpin, 13 starry flounder and 4 stickleback (M. MacKay personal communication). Since Chinook salmon are not known to spawn in Chuckanut Creek, these unmarked fish captured by the Lummi Nation technicians likely entered Chuckanut Bay as they migrated along the nearshore from their native stream system. Estuarine wetlands are an important nursery habitat for juvenile salmon where prey items are abundant and refuge from predators is available. Shreffler, Simentstad and Thom (2000) found that juvenile chum and Chinook salmon were found temporarily residing in restored estuarine wetlands and selecting insect larvae that were available as prey items.

4.0 Wetland Characterization Analysis

4.1General Findings

Field observation and topographical data indicate the culvert does not appear to limit flow significantly into or out of the marsh, except possibly during extreme events of high water and storm surge. The marsh does not have enough low elevation area to have a large enough tidal prism that would otherwise make the culvert a limiting factor to tidal water flow. This conclusion is based on observations at an incoming and high +8.8 ft MLLW tide (field notes, Appendix C). So the culvert does not appear to significantly change estuarine conditions during most times, but the extreme high water events may be altered in the marsh as flow may be impeded. This could result in a minor shift in the plant communities if the culvert were removed/replaced, which could have a minor affect on functions for juvenile salmon. Removal of the culvert would also allow juvenile salmon access into the estuarine wetland and thereby increase the area of estuarine wetland habitat available for rearing at periods of high tidal elevations. Juvenile salmon may however become stranded in the wetland if they fail to move downstream as the tide is receding. This is a common condition of estuarine wetlands and saltmarshes and the Chuckanut Village Marsh has refuge and cover with undercut banks and some overhanging vegetation.

Most high tides have limited flow onto the marsh plain, but are instead mostly confined to the tide channel and the ditches, except at tides that are equal or greater than +9.0 ft MLLW. A computation using Tides and Currents software (Nautical Software Inc) reveals that 103 events were predicted to meet or exceed +9.0 ft MLLW in all of 2008. In fact, due to common low pressure systems, the actual high water events very likely would be more than 103 in the 2008 calendar year. Therefore tidal flow is an important

element controlling the vegetation communities and availability of habitats in the marsh. Conditions during these high tidal flow times would likely be slightly altered by removal of the existing limited flow culvert.

The vegetation communities do not consistently mirror the hydrological and salinity gradients observed within the marsh. The Distichlis Unit is dominated by species that are typically located in more saline conditions. These species do not require a saline environment, but generally do not dominate a community until saline conditions are present. This community is situated within the MHHW elevation in the marsh, but our observations do not indicate the salinity is at high enough levels to preclude other less tolerant species. We suspect this is due to an increased salinity later in the season when freshwater inputs are reduced. We recommend salinity be reviewed during July or August to confirm this.

Within the area delineated as occurring in the MHHW, the plant community at the northern edge of the zone is composed of a mix of species that range in salt tolerance. We would expect the species all to have a moderate to high tolerance, but this does not appear to be the case. This may be due to either of the following reasons: 1) the area has a high degree of microtopography that was not detected in the topographic data. This would allow for a wider range of species and salt tolerances; or 2) The hydraulic pressure from the incoming freshwater, combined with friction and soil features in the system may not allow the salt lens to extend as far as the topography indicates.

Chuckanut Creek and the Chuckanut Village Marsh are connected when the tidal elevation is greater than 6.6 feet above MLLW. This occurs approximately 40 percent of the time (Bates *et al*. 2003) and is predicted to occur 611 times during 2008 (Nautical Software Inc.) during these high water periods, the wetland habitat would be available as rearing habitat by the juvenile salmon. Although fish have been observed in the wetland channel, they have not been positively identified as salmon.

The existing culvert is 27 feet long with a 1.1% slope, which, in a freshwater system would be determined to be a fish passage barrier using the level-A SSHEAR protocol (WDFW 2000. The SSHEAR protocol is not applicable, however, because the tidal influence creates bidirectional flow with variable velocity. At times, the flow direction would assist salmon passing through the culvert and at other times the flow would exceed fish swimming speed and fish would not be able to pass through the culvert swimming against the water flow. Removal of the culvert and enhancing the channel would create rearing habitat for the juvenile salmon and allow greater access to the wetland channels.

The removal of the culvert or replacement with a larger, fish passable design may have the following benefits:

1. A slight increase in free flowing exchange of tidal water during high flow and greater flushing, likely leading to very minor water quality benefits;
2. Increased exchange of terrestrial nutrients and terrestrial allocantheous inputs to the nearshore;
3. Slightly increased sediment transport in and out of the tidal channel, resulting in a slightly more dynamic system
4. Increased fish passage to a limited area of estuarine habitat within the marsh; and
5. An increase of intertidal area with culvert and road removal.

4.2 Enhancement Alternatives

Four alternatives have been presented for review. The first two would result in removing the existing culvert. The third would replace the culvert but improve the design to provide improved fish passage and flow into the marsh. The fourth is a no action alternative.

Alternative 1. Remove culvert and road and restore beach and backshore in parking area;
Alternative 2. Remove culvert and road and replace with pedestrian access with bridge, with limited beach and backshore restoration;
Alternative 3. Replace culvert with fish friendly culvert and retain vehicle access to the beach parking area.
Alternative 4. No action. Retain road and culvert in existing condition.

Both Alternative 1 and 2 would involve removing the existing culvert and restoring an open naturalized channel connecting the marine system to the marsh. The channel would be designed to provide improved fish passage, but not significantly increase outflow from the marsh to avoid draining the system. The channel would have a natural substrate bed and have similar slopes to existing conditions with minor modifications. The side slopes would be planted with native shrub cover matching surrounding reference conditions. Both Alternative 1 and 2 would result in similar benefits to the marsh habitat. Both would involve removing the culvert and creating a fish passable natural channel to the marsh area. No changes would occur within the marsh.

Alternative 1 would remove all pedestrian and vehicle access to the current parking area. This would make the existing road and parking areas available for restoration with native estuarine, shrub and backshore habitats. However Alternative 1 is not an option for this project because the City of Bellingham has an agreement tied to the purchase of the property that requires continued public access to this area. Removing the culvert not providing public access would violate that agreement. Additionally, if public access is not provided unofficial "access" will likely be generated and could result in increased damage to natural systems within and adjacent to site sensitive areas.

Alternative 2 would include a narrow pedestrian bridge crossing to provide access to the beach area. This alternative would also allow some restoration work within the old parking area, but the area would be more limited to provide pedestrian access along the beach. Both of these alternatives would remove vehicle access from the beach area and very likely reduce pollutant input from vehicles to the marine and wetland environments.

Alternative 3 would replace the existing culvert with either a vehicle bridge or a fish passable culvert sized to maximize flow exchange within the marsh. The alternative would improve potential fish access and exchange of nutrients and associated materials within the marsh to the marine system. Retaining vehicle access to the beach would not provide restoration actions along the nearshore and would have a continued likelihood of vehicle-associated pollutants entering surface waters.

Alternative 4 is a no action alternative. No negative affects were identified in removing or replacing the culvert under Fairhaven Avenue. Alternatively the existing culvert does not appear to adversely affecting marsh functions significantly. The existing road surface near the culvert is narrow and severely rutted with deep puddles present. Standing water and vehicle movement through the puddles increases the risk of pollutants and silt entering surface waters. Vehicles allowed to park essentially at the MHHW mark are a high risk action that likely results in pollutants entering surface water or other direct damage to the natural habitats.

If Alternative 1-3 are employed for the project, similar affects are anticipated within the marsh. The removal of the culvert would likely slightly increase tidal exchange within the marsh, by allowing tidal water to move into the marsh more quickly during very high water events. This would also allow for a faster flushing during ebbing tides which could improve export of nutrients and other allocantheous inputs to the marine nearshore. No large changes to the channel network or plant communities are anticipated from the culvert removal. We would expect a slight expansion of the Distichlis Unit into a greater area delineated by the MHHW line (Figure 7). Within the Juncus Unit an increase in salt tolerant plant species would be expected to expand within areas delineated in the MHHW displacing species with reduced salt tolerance. If microtopography is important in this zone, there may not be significant changes in the community structure. No measurable changes to plant communities are anticipated in the areas outside the MHHW areas.

Of interest is historical notes that indicate there may not have been a natural surface water outlet (tide channel) from the marsh to the bay and the observed estuarine features in the marsh may not have been fully present before ditching, except where subsoil intrusions may have occurred. The *Distichlis spicata* observed near the western MHHW may be the result of saline water seeping through the porous beach soils. There

was no evidence of this occurring during the site visits in April and May 2008, but it could occur during the dry season when freshwater inputs are reduced.

In summary, removal of the culvert under the western end of Fairhaven Avenue would provide minor benefits by improving salmonid and other fish access to the marsh for foraging under certain tidal cycles. The culvert removal would also facilitate improved flushing functions that facilitate nutrient and transfer of other allocantheous material from the terrestrial and marsh systems to the marine system. Muck soils indicate the marsh has developed in poorly flushed hydrologic regimes. The minor amount of increased flushing resulting from the culvert removal is not expected to have an adverse affect on the marsh function, but this has not be quantified.

APPENDIX A: LITERATURE CITED

Literature Cited

Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm

Bates, K., B. Barnard, B. Heiner, J.P. Klavas, and P.D. Powers. 2003. Design of road culverts for fish passage. Washington State Dept of Fish and Wildlife. Olympia WA.

Beamer, E., A. McBride, R. Henderson, and K. Wolf. 2003. The importance of non-natal pocket estuaries in Skagit Bay to wild Chinook salmon: An emerging priority for restoration. Skagit System Cooperative Research Department. La Conner, WA. http://www.skagitcoop.org/documents/EB1579_Beamer_et_al_2003.pdf

Beamer, E., A. McBride, R. Henderson, J. Griffith, K. Fresh, T. Zackey, R. Barsh, T. Wyllie-Echeverria, and K. Wolf. 2006. Habitat and fish use of pocket estuaries in the Whidbey Basin and north Skagit County Bays, 2004 and 2005. Skagit System Cooperative Research Department. La Conner, WA. http://www.skagitcoop.org/documents/EB2207_Beamer_et_al_2006.pdf

Brinson, M. 1993. A Hydrogeomorphic Classification for Wetlands. U.S. Army Corps of Engineers, Washington D.C. Tech. Report WRP-DE-4.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. Army Waterways Experiment Station, Vicksburg, Miss.

Gretagmacbeth. 2000. Munsell soil color charts. New Windsor, NY.

Hitchcock, C.L. and A Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press. Seattle, WA.

Hutchinson, Ian. 1991. Salinity Tolerance of Plants of Estuarine Wetlands and Associated Uplands. Washington State Shorelands and Coastal Zone Management Project: Wetlands Section. Olympia, WA.

M. MacKay, Lummi Nation Department of Natural Resources, Fisheries Biologist. Telephone conversation, April 15, 2008.

Reed, R.B. Jr. 1988. National List of Plant Species that Occur in Wetlands: 1988 Northwest. Biological Report 88 (26.9), U.S. Fish and Wildlife Service, St. Petersburg, Florida.

Reed, R.B. Jr. 1993. 1993 Supplement to the List of Plant Species that Occur in Wetlands, Northwest (Region 9). Supplement to Biological Report 88 (26.9), U.S. Fish and Wildlife Service, St. Petersburg, Florida.

Shreffler, D.K., C.A. Simenstad, and R.M. Thom. 1992. Forging by juvenile salmon in a restored estuarine wetland. Estuaries; 15:2.

Shafer, Deborah J. 1998. National guidebook of application of hydrogeomorphic assessment to tidal fringe wetlands/ by Deborah J. Shafer, David J Yozzo; prepared for U.S. Army Corps of Engineers. 76p.

StreamNet. 2008. Data query accessed February 6, 2008. http://www.streamnet.org/

USDA, NRCS. 2001. Whatcom County Area Hydric Soil List. United States Department of Agriculture, Natural Resource Conservation Service. [www.wa.nrcs.usda.gov]

USDA, NRCS. 2004. Soil Survey of Whatcom County Area, Washington. United States Department of Agriculture, Natural Resource Conservation Service. [www.websoilsurvey.nrcs.usda.gov]

Wahl, Tim. City of Bellingham Greenway Program Coordinator. Telephone communication June 6, 2008.

Washington State Depart of Fish and Wildlife (WDFW) 2000. Fish passage barrier and surface water diversion screening assessment and prioritization manual. WDFW Habitat Program. Olympia, WA.

Washington State Department of Ecology. 2004. Washington State Wetlands Rating System: Western Washington. Washington Department of Ecology, Olympia WA. Publ. #04-06-025.

Washington State Department of Ecology. March 1997. Washington State Wetlands Identification and Delineation Manual. Washington Department of Ecology, Olympia WA. Publ. #96-94.

APPENDIX B: FIGURES

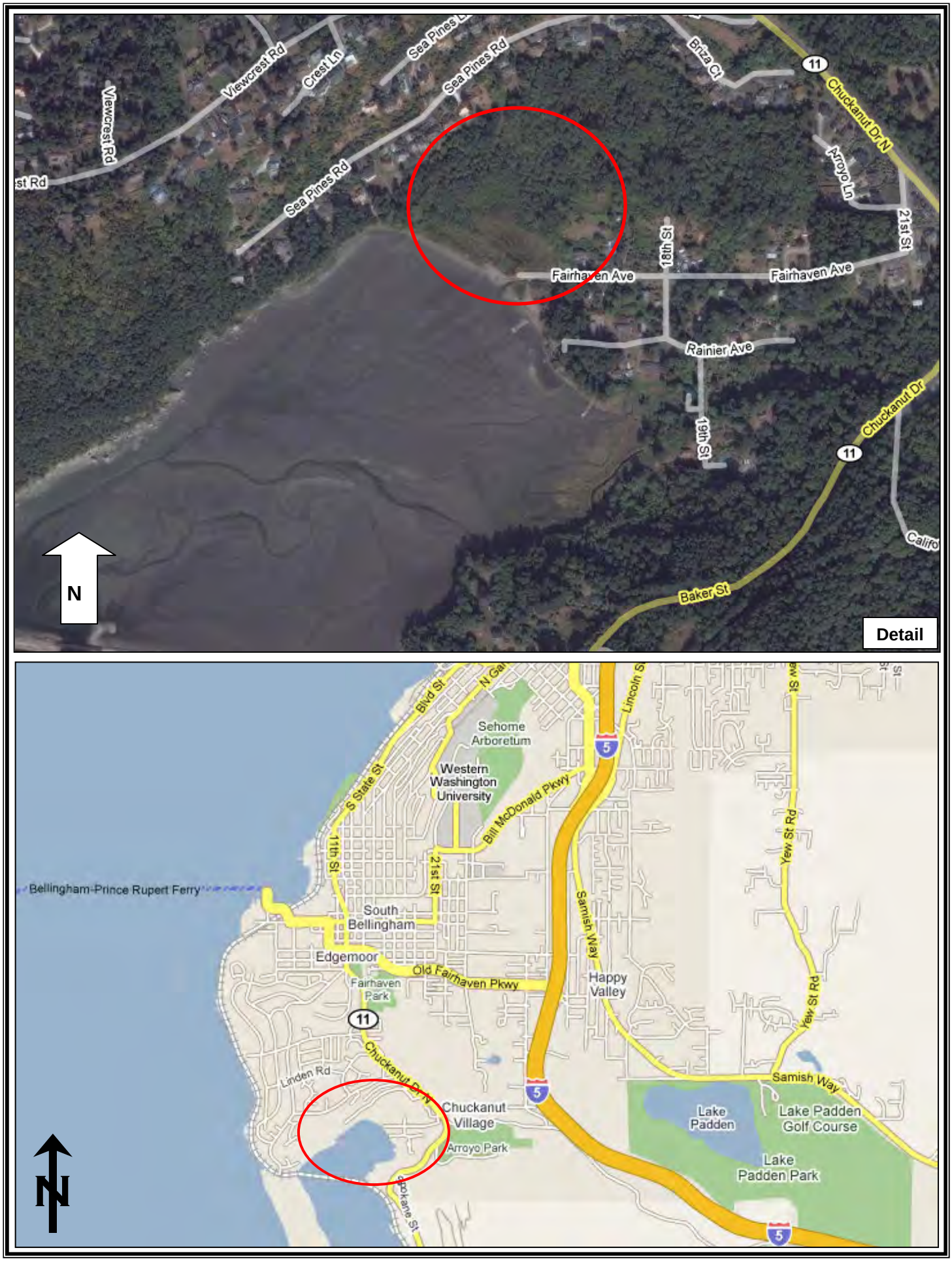
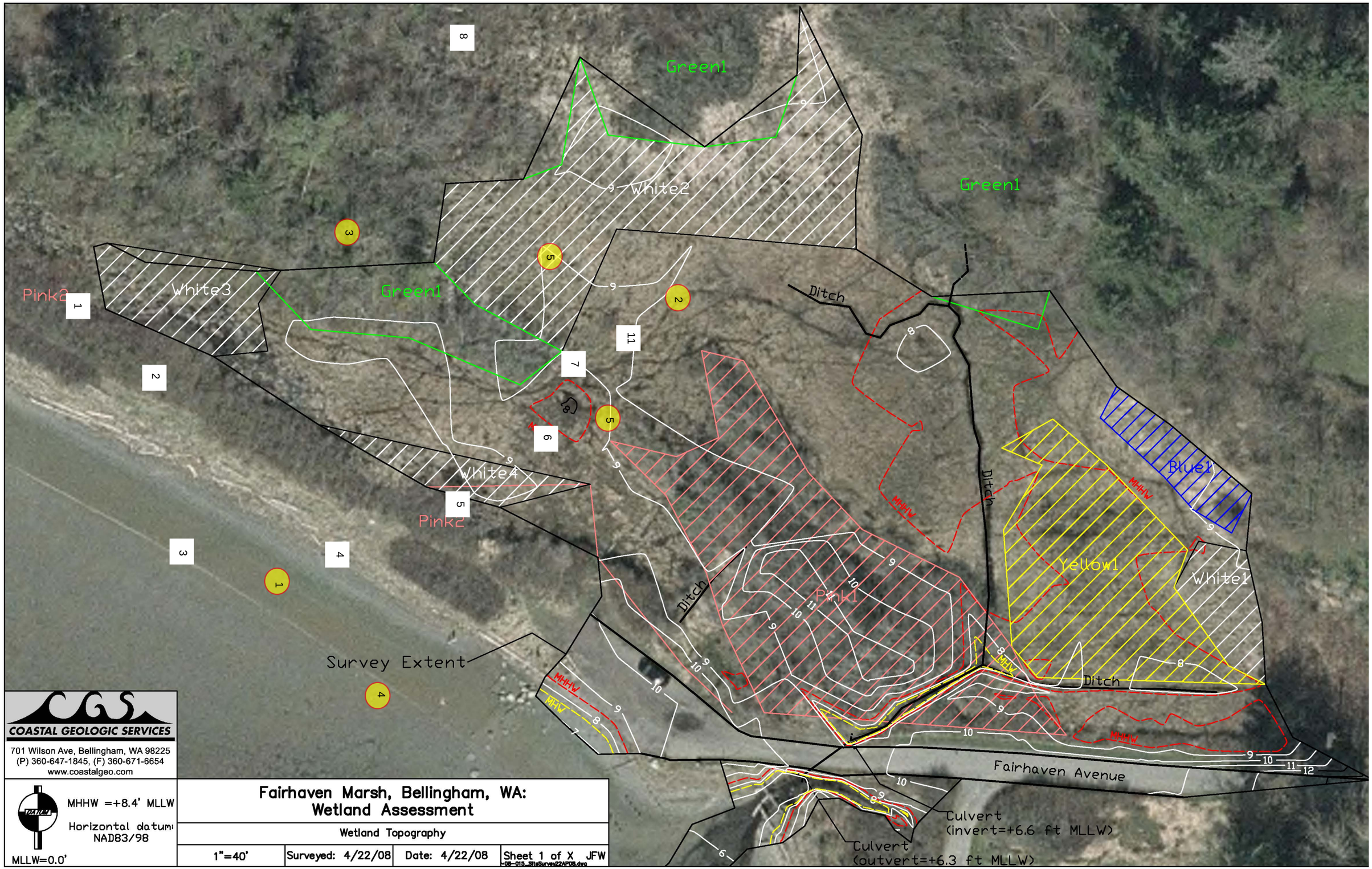


Figure 1. Vicinity Map
(Googlemaps, 2008)

Figure 2. Approximate Review Area Boundary



COASTAL GEOLOGIC SERVICES
701 Wilson Ave, Bellingham, WA 98225
(P) 360-647-1845, (F) 360-671-6654
www.coastalgeo.com

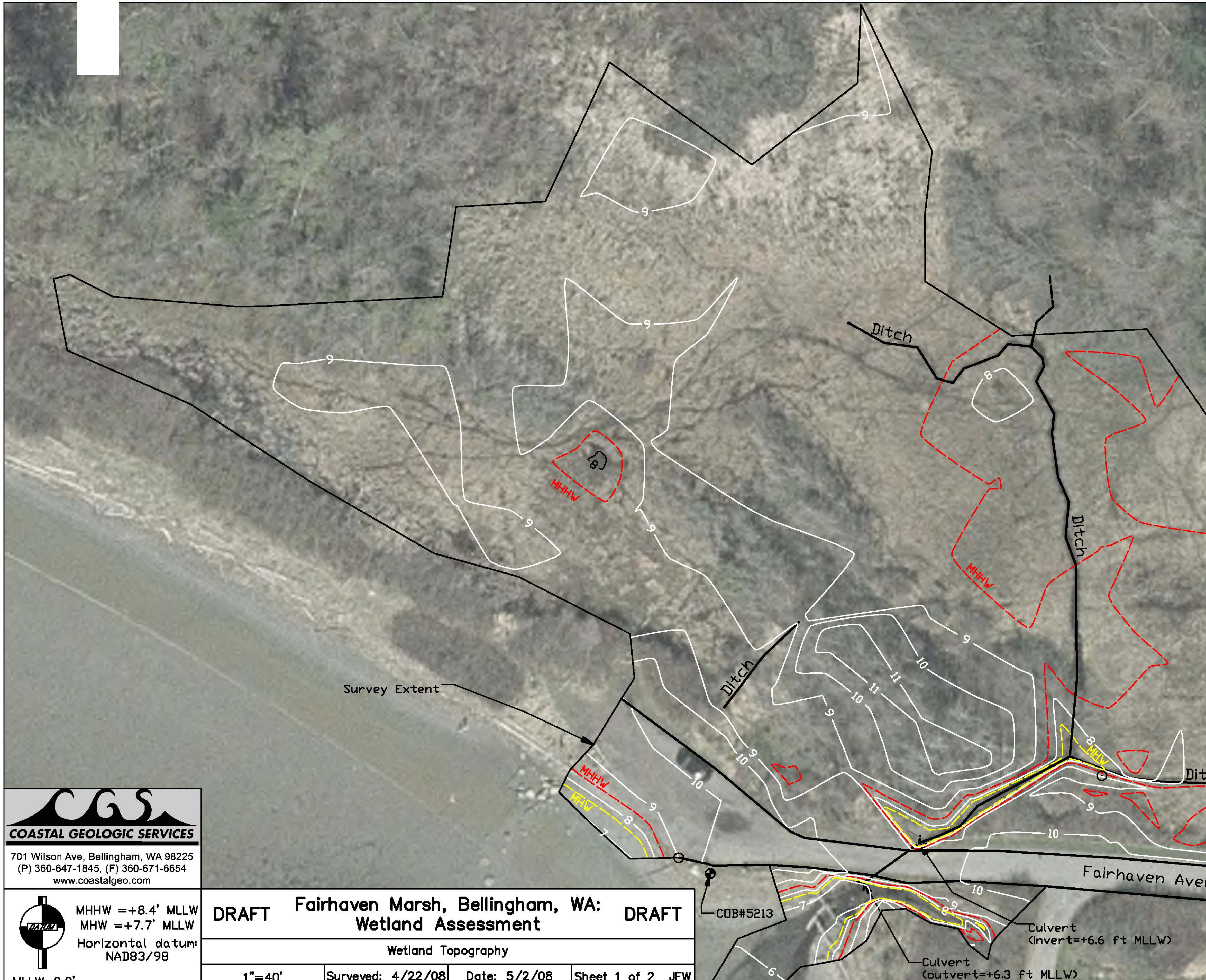
MHHW =+8.4' MLLW
Horizontal datum:
NAD83/98
MLLW=0.0'

Fairhaven Marsh, Bellingham, WA: Wetland Assessment

Wetland Topography

1"=40'	Surveyed: 4/22/08	Date: 4/22/08	Sheet 1 of X JFW

-08-015_SiteSurvey22AP08.dwg



SURVEY NOTES

Horizontal and vertical control established using COB monument 5213 located at western end of Fairhaven Avenue.

Stated monument accuracy (based on GPS fix)
horizontal: 0.0660 ft
vertical: 0.1640 ft

Survey completed using Leica TCR1105 with direct rod measurements

Image 2004 Aerial from City of Bellingham

○ Found 3/8" rebar with flagging

⊙ Found 3/8" rebar with cap "JEPSON 9361"

● Found brass disc in concrete, stamped "5213"

COASTAL GEOLOGIC SERVICES
701 Wilson Ave, Bellingham, WA 98225
(P) 360-647-1845, (F) 360-671-6654
www.coastalgeo.com

MHHW =+8.4' MLLW
MHW =+7.7' MLLW
Horizontal datum: NAD83/98
MLLW=0.0'

DRAFT **Fairhaven Marsh, Bellingham, WA: Wetland Assessment** DRAFT

Wetland Topography

1"=40'	Surveyed: 4/22/08	Date: 5/2/08	Sheet 1 of 2 JFW

Figure 5. South Bellingham Bay Watershed
(Source: COB GIS Watershed and Subbasin map)

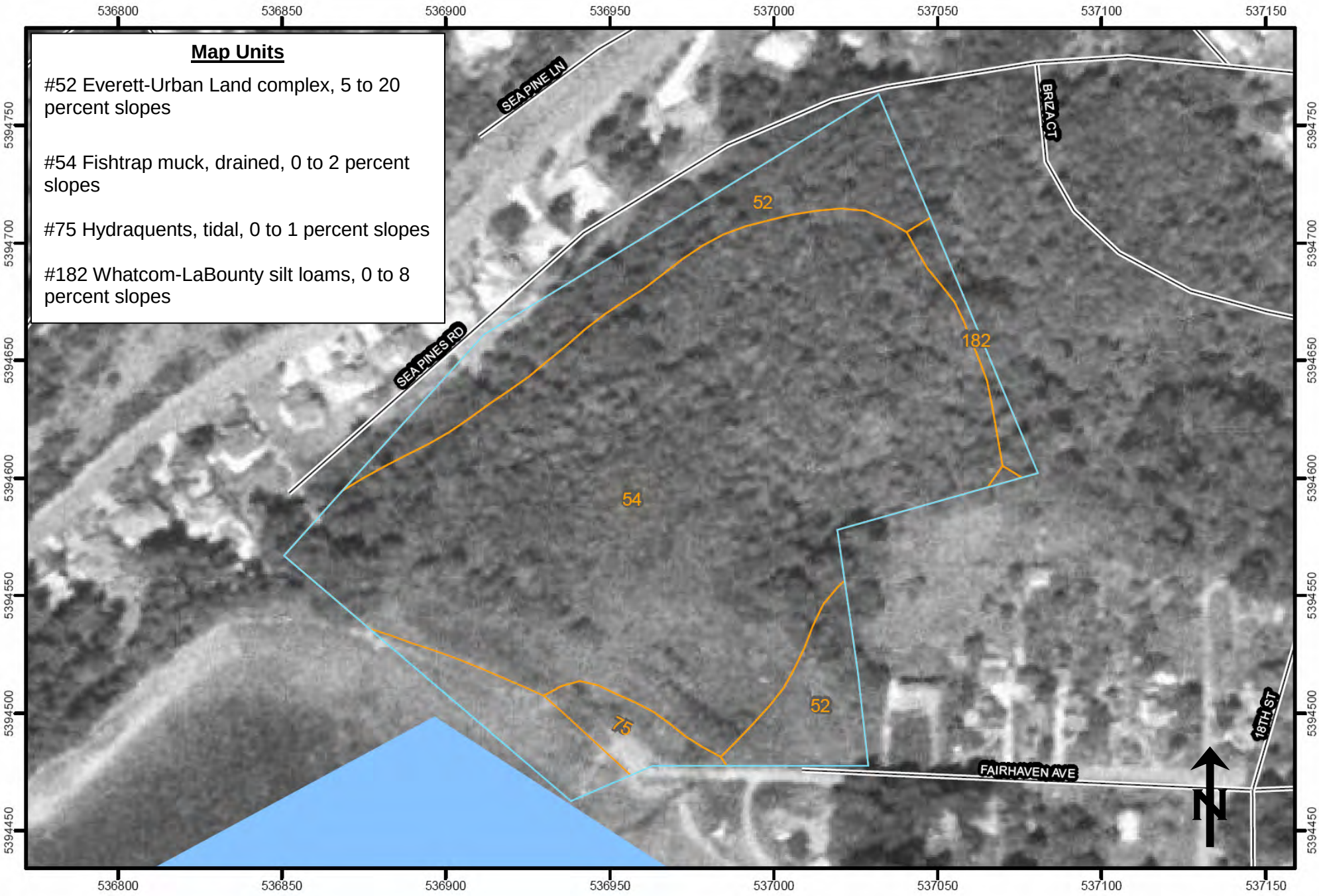


Figure 6. USDA Natural Resources Conservation Service Soil Survey

Green1
White2
Green1
Pink2
White3
Green1
Ditch
Blue1
White4
Pink2
Ditch
Pink1
Yellow1
White1
Survey Extent
Ditch
Fairhaven Avenue
Culvert
(invert=+6.6 ft MLLW)
Culvert
(outvert=+6.3 ft MLLW)

COASTAL GEOLOGIC SERVICES
701 Wilson Ave, Bellingham, WA 98225
(P) 360-647-1845, (F) 360-671-6654
www.coastalgeo.com

MHHW =+8.4' MLLW
Horizontal datum:
NAD83/98
MLLW=0.0'

Fairhaven Marsh, Bellingham, WA: Wetland Assessment

Wetland Topography

1"=40'	Surveyed: 4/22/08	Date: 4/22/08	Sheet 1 of X JFW

I:\08-015_SiteSurvey\22APR08.dwg

APPENDIX C: DATA SHEETS

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 6
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒ No ☐**
Remarks: Salix unit	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
Salix hookeriana	100	FACW-	☒
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Lysichitum americanum	40	OBL	☒
Rumex crispus	10	FAC+	☒
Carex obnupta	40	OBL	☒
		-	☐
		-	☐
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	3 (A)
Total number of dominant species across all strata:	3 (AB)
Percent of dominant species that or OBL, FACW, FAC:	100 (A/B)

Prevalence Index worksheet	
OBL species: 2	x 1=
FACW species: 1	x 2=
FAC species: 1	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: Salix unit

Hydrophytic Vegetation Present?

Yes ☒ No ☐

SOIL

Sample Point:6

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20					-	-	Muck	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☒ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland hydrology Indicators:
Primary Indicators (any one indicator is sufficient)

- ☒ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): **2**

Water Table Present? Yes ☒ No ☐ Depth (inches): **0**

Saturation Present? Yes ☒ No ☐ Depth (inches): **0** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: inundated with 2 to 6" of water.

Remarks: **surface water in channel**

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 5
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒ No ☐**
Remarks: Juncus unit	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
none		-	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Juncus balticus	90	FACW	☒
Pontentilla pacifica	40	OBL	☒
Distichlis spicata	30	FAC+	☒
Aster subspicatus	15	FACW+	☒
		-	☐
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	4 (A)
Total number of dominant species across all strata:	4 (AB)
Percent of dominant species that or OBL, FACW, FAC:	100 (A/B)

Prevalence Index worksheet	
OBL species: 1	x 1=
FACW species: 2	x 2=
FAC species: 1	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: Juncus unit	**Hydrophytic Vegetation Present?** **Yes ☒ No ☐**

SOIL **Sample Point:5**

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20				0	-	-	Muck	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☒ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

HYDROLOGY

Wetland hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): **0**

Water Table Present? Yes ☒ No ☐ Depth (inches): **0**

Saturation Present? Yes ☒ No ☐ Depth (inches): **0** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: soils saturated to the surface. Standing water present in depressions nearby sample plot.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 4
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒ No ☐**
Remarks: Phalaris Unit	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
Rosa nutkana	trace	FAC	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Pharalaris arundinancea	100	FACW	☒
		-	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	2 (A)
Total number of dominant species across all strata:	2 (AB)
Percent of dominant species that or OBL, FACW, FAC:	100 (A/B)

Prevalence Index worksheet	
OBL species: 0	x 1=
FACW species: 1	x 2=
FAC species: 1	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: Phalaris unit	**Hydrophytic Vegetation Present?** **Yes ☒ No ☐**

SOIL

Sample Point:4

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20	10yr 3/2		10yr 4/6	30	D	-	silt loam	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland hydrology Indicators:
Primary Indicators (any one indicator is sufficient)

- ☐ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): **0**

Water Table Present? Yes ☒ No ☐ Depth (inches): **0**

Saturation Present? Yes ☒ No ☐ Depth (inches): **0** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: saturated to the surface.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 3
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒ No ☐**
Remarks: decidous shrub unit	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
Malus fusca	30	FACW	☒
Populus tremuloides	40	FAC	☒
Rosa nutkana	15	FAC	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Oenanthe sarmentosa	40	OBL	☒
Carex obputa	25	OBL	☒
Juncus effusus	trace	FACW	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	4 (A)
Total number of dominant species across all strata:	4 (AB)
Percent of dominant species that or OBL, FACW, FAC:	100 (A/B)

Prevalence Index worksheet	
OBL species: 2	x 1=
FACW species: 1	x 2=
FAC species: 1	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: deciduous unit

Hydrophytic Vegetation Present?

Yes ☒ No ☐

SOIL

Sample Point:3

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20					-	-	Peaty Muck	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☒ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ No ☐

Remarks: Histosol

HYDROLOGY

Wetland hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): **0**

Water Table Present? Yes ☒ No ☐ Depth (inches): **0**

Saturation Present? Yes ☒ No ☐ Depth (inches): **0** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: Saturated to the surface. Surface ponding present in depressions around sample point.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 2
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒ No ☐**
Remarks: Typha Unit	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
Rubus armeniacus	5	FACU	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Typha latifolia	95	OBL	☒
Potentilla pacifica	15	OBL	☒
Distichlis spicata	trace	FAC+	☐
Heracleum lanatum	5	FAC+	☐
		-	☐
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	2 (A)
Total number of dominant species across all strata:	2 (AB)
Percent of dominant species that or OBL, FACW, FAC:	100 (A/B)

Prevalence Index worksheet	
OBL species: 2	x 1=
FACW species: 1	x 2=
FAC species: 1	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: Typha Unit

Hydrophytic Vegetation Present?

Yes ☒ No ☐

SOIL

Sample Point:2

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20					-	-	Peaty Muck	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☒ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ No ☐

Remarks: Histosol

HYDROLOGY

Wetland hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☐ No ☐ Depth (inches): **0**

Water Table Present? Yes ☒ No ☐ Depth (inches): **0**

Saturation Present? Yes ☒ No ☐ Depth (inches): **0** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: saturated to the surface. Surface water flowing in sheet flow nearby.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 1
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒ No ☐**
Remarks: Distichlis Unit	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
none		-	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Distichlis spicata	80	FAC+	☒
Triglochin maritimum	5	OBL	☐
Carex lyngbyei	20	OBL	☒
Juncus balticus	30	FACW	☒
Potentilla pacifica	10	OBL	☒
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	4 (A)
Total number of dominant species across all strata:	4 (AB)
Percent of dominant species that or OBL, FACW, FAC:	100 (A/B)

Prevalence Index worksheet	
OBL species: 2	x 1=
FACW species: 1	x 2=
FAC species: 1	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: Distichlis Unit	**Hydrophytic Vegetation Present?** **Yes ☒ No ☐**

SOIL

Sample Point:1

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20					-	-	Peaty Muck	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☒ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ No ☐

Remarks: Histosol

HYDROLOGY

Wetland hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☒ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): **0**

Water Table Present? Yes ☒ No ☐ Depth (inches): **0**

Saturation Present? Yes ☒ No ☐ Depth (inches): **0** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: soil saturatation to the surface. No inundation at sample point, but occurs within 20 feet with 1 inch inundation.

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: Chuckanut Village Marsh	City/County: B'ham/Whatcom	Sample Date: 4/22/08
Applicant/Owner: WC Public Works	State: WA	Sample Point: 7
Investigator: V. Jackson/C. Muters	Section/Township/Range:	
Landform (hillslope, terrace, etc): slope/depression	Local Relief (concave, convex, none) : concave	Slope(%): 5% and <
Subregion: LRR A Lat:	Long:	Datum:
Soil Map Unit Name: Fishtrap Muck #52		NWI Classification:

Are climatic/hydrologic conditions on the site typical of 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 ☐ Hydric Soil Present? Yes ☐ No ☒ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** **Yes ☐ No ☒**
Remarks: upland shrub	

VEGETATION

Tree Stratum	Absolute % Cover	Indicator Status	Dominant Species?
none		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum			
Rosa nutkana	95	FAC	☒
Sambucus racemosa	1	FACU	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Herb Stratum			
Heraculeum lanatum	25	FAC+	☒
Elymus mollis	40	NI	☒
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Woody Vine Stratum			
None		-	☐
		-	☐
		-	☐
Total Cover: % Bare Ground in Herb Stratum:			

Dominance Test worksheet Number of Dominant Species that are OBL, FACW, or FAC:	2 (A)
Total number of dominant species across all strata:	3 (AB)
Percent of dominant species that or OBL, FACW, FAC:	67 (A/B)

Prevalence Index worksheet	
OBL species: 0	x 1=
FACW species: 0	x 2=
FAC species: 2	x 3=
FACU species:	x 4=
UPL species:	x 5=
Total: (A)	(B)
Prevalence Index = B/A =	

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is > 50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1]

[1]Indicators of hydric soil and wetland hydrology must be present.

Remarks: upland shrub	**Hydrophytic Vegetation Present?** **Yes ☒ No ☐**

SOIL

Sample Point:7

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

Depth	Soil Color		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20	see remarks	100	0	0	-	-	see remarks	unconsolidated gravelly/sandy soil
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[1]Type: C=concentration D=depletion RM=reduced matrix [2]Location: PL=pore lining RC=root channel M=matrix

Hydric Soil Indicators: (applicable to all LRRs unless otherwise noted)

- ☐ Histosol (A1)
- ☐ Histic Epidedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (except 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.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes ☐ No ☒

Remarks: Substrate uncolsolodated gravelly sandy soils that did not color. No hydric soils inidicators observed. This is the beach foredune.

HYDROLOGY

Wetland hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ 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)
- ☐ Water-stained Leaves (B9) (**except NW coast)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along living roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stresses Plants (D1)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-stained (B9) (**NW coast)**
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ Raised Ant Mounds (D6)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): **0**

Water Table Present? Yes ☐ No ☒ Depth (inches): **>20"**

Saturation Present? Yes ☐ No ☒ Depth (inches): **>20"** (include capillary fringe)

Wetland Hydrology Present?

Yes ☐ **No** ☒

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

Remarks:

Wetland Rating Field Data Form- Western Washington

Background Information:

Name of Rater: V.Jackson, C.Muters Affiliation: NW Ecological Date of site visit: 4.16.08

Name of Wetland (if known): Fairhaven Marsh

Government Jurisdiction of Wetland: Whatcom Co., Army Corps of Engineers, Dept. of Ecology

Location (attach map with outline of wetland to rating form):

¼Section: Section:13 Township:37N Range: 02E

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland: I ☐ II ☒ III ☐ IV ☐

Category I = Score >70
Category II = Score 51-69
Category III = Score 30-50
Category IV = Score < 30

Score for Water Quality Functions	26
Score for Hydrologic Functions	14
Score for Habitat Functions	29
TOTAL score for Functions	69

Category based on SPECIAL CHARACTERISTICS of wetland

I ☐ II ☐ III ☐ **Does not apply** ☒

Final Category (choose the "highest" category from above) II

Check the appropriate type and class of wetland being rated.

WETLAND TYPE		WETLAND CLASS	
Estuarine	☐	Depressional	☒
Natural Heritage Wetland	☐	Riverine	☐
Bog	☐	Lake-fringe	☐
Mature Forest	☐	Slope	☐
Old Growth Forest	☐	Flats	☐
Coastal Lagoon	☐	Freshwater Tidal	☐
Interdunal	☐		
None of the Above	☒		

Does the wetland being rated meet any of the criteria below?

If the answer to any of the questions below is YES than the wetland will need to be protected according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands That Need Special Protection, and That Are Not Included in the Rating	YES	NO
SP1. *Has the wetland been documented as a habitat for any Federally listed Threatened or Endangered animal or plant species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.	☐	☒
SP2. *Has the wetland been documented as habitat for any State listed Threatened or Endangered animal species?* For the purpose of this rating system, "documented" means the wetland is on the appropriate state database.	☐	☒
SP3. *Does the wetland contain individuals of Priority species listed by the WDFW for the state?* **Pileated Woodpecker**	☒	☐
SP4. *Does the wetland have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.	☒	☐

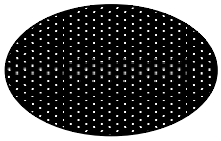
DEPRESSIONAL AND FLATS WETLANDS	Points
Water Quality Functions – Indicators that wetland functions to improve the water quality.	
D1 Does the wetland unit have the <u>potential</u> to improve water quality?	----------
D1.1 Characteristics of surface water which flows out of the wetland: ☐ Unit is a depression with no surface water leaving it (no outlet) 3 pts ☒ Unit has intermittently flowing, or highly constricted permanently flowing outlet 2 pts ☐ Unit has an un-constricted, or slightly constricted, surface outlet (permanently flowing) 1 pt ☐ Unit is a flat depression (Q.7), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch 1 pt *(If ditch is not permanently flowing, treat unit as intermittently flowing)*	2
D1.2 The soil two inches below the surface (or duff layer) is clay or organic (*use NRCS definitions*) ☒ YES 4 pts ☐ NO 0 pts	4
D1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class): ☒ Wetland has persistent, ungrazed, vegetation in >95% of the area 5 pts ☐ Wetland has persistent, ungrazed, vegetation in ≥ ½ of the area 3 pts ☐ Wetland has persistent, ungrazed, vegetation in ≥ 1/10 of the area 1 pt ☐ Wetland has persistent, ungrazed, vegetation in< 1/10 of the area 0 pts	5
D1.4 Characteristics of seasonal ponding or inundation. *This is the area of the wetland unit that is ponded for at least two months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition five out of 10 years.* ☐ Area seasonally ponded is > ½ total area of the wetland 4 pts ☒ Area seasonally ponded is > ¼ total area of the wetland 2 pts ☐ Area seasonally ponded is < ¼ total area of the wetland 0 pts	2
Total for D1 *Add the points in the boxes above*	13
D2 Does the wetland unit have the <u>opportunity</u> to improve water quality? Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce quality in streams, lakes, or groundwater down gradient from the wetland. *Note which of the following conditions provide the sources of pollutants, A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 feet ☐ Untreated stormwater discharges to the wetland ☐ Tilled fields or orchards within 150 feet of the wetland ☐ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ☒ Residential, urban areas, or golf courses are within 150 feet of wetland ☐ Wetland is fed by groundwater high in phosphorus or nitrogen ☐ Other YES = multiplier is 2 NO = multiplier is 1	Multiplier =2
<u>Total- Water Quality Functions</u> Multiply the score from D1 by D2 *Add the score to the table on page 1*	26

DEPRESSIONAL AND FLATS WETLANDS	Points
Hydrologic Functions Indicators that wetland functions to reduce flooding and stream degradation.	
D3 Does the wetland unit have the <u>potential</u> to reduce flooding and erosion?	----------
D3.1 Characteristics of surface water flows out of the wetland unit: ☐ Unit is a depression with no surface water leaving (no outlet) 4 pts ☒ Unit has an intermittently flowing, OR highly constricted permanently flowing outlet 2 pts ☐ Unit is flat depression (Q.7), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch 1 pt *(If ditch is not permanently flowing, treat unit as intermittently flowing)* ☐ Unit has an un-constricted, or slightly constricted, surface outlet (*permanently flowing*) 0 pts	2
D3.2 Depth of Storage during wet periods *Estimate the height of ponding above the bottom of the outlet. For units with no outlet, measure from the surface of permanent water or deepest part (if dry).* ☐ Marks of ponding are 3 ft or more above the surface or bottom of outlet 7 pts ☐ The wetland is a headwater wetland 5 pts ☐ Marks of ponding between 2 ft to < 3 ft from the surface or bottom of outlet 5 pts ☐ Marks are at least 0.5 ft to < 2 ft from the surface or bottom of outlet 3 pts ☐ Unit is flat (yes to Q.2 or Q.7) but has small depressions on the surface that trap water 1 pt ☒ Marks of ponding less than 0.5 ft 0 pts	0
D3.3 Contribution of wetland unit 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 5 pts ☐ The area of the basin is 10 to 100 times the area of the unit 3 pts ☐ The area of the basin is more than 100 times the area of the unit 0 pt ☐ Entire unit is in the FLATS class 5 pts	5
Total for D3 *Add the points in the boxes above*	7
D4 Does the wetland unit have the <u>opportunity</u> to reduce flooding and erosion? Answer YES if the wetland is in a location in the watershed where it provides flood storage, or reduction in water velocity; it helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as floodgate, tide gate, flap valve, reservoir, etc.; OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* ☐ Wetland is in a headwater of a river or stream that has flooding problems ☐ Wetland drains to a river or stream that has flooding problems ☐ Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems ☒ Other: Released into Chuckanut Bay YES = multiplier is 2 NO = multiplier is 1	Multiplier =2
<u>Total- Hydrologic Functions</u> Multiply the score from D3 by D4 *Add score to table on page 1*	14

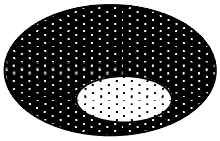
HABITAT FUNCTIONS Indicators that the wetland functions to provide important habitat			Points
H1 Does the wetland unit have the <u>potential</u> to provide habitat for many species?			----------
H1.1 Vegetation structure *Check the types of vegetation classes present (as defined in Cowardin) - Size threshold for each class is ¼ acre or more than 10% of the area if unit is smaller that 2.5 acres.* ☐ Aquatic bed ☒ Emergent plants ☒ Scrub/shrub- areas where shrubs have >30% cover ☒ Forested- areas where trees have >30% cover *If the unit has a forested class, check if:* ☒ Forested areas have three out of five strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon *Add the number of vegetation types that qualify. If you have:*	4 or more structures 3 structures 2 structures 1 structure	4 pts 2 pts 1 pt 0 pts	4
H1.2 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 acre to count.* ☐ Permanently flooded or inundated ☒ Seasonally flooded or inundated ☒ Occasionally flooded or inundated ☒ Saturated only ☐ Permanently flowing stream or river in, or adjacent to, the wetland ☒ Seasonally flowing stream in, or adjacent to, the wetland ☐ **Lake-fringe wetland** ☐ **Freshwater tidal wetland**	4 or more present 3 present 2 present 1 present	3 pts 2 pts 1 pt 0 pts **2 pts** **2 pts**	3
H1.3 Richness of Plant Species Count the number of plant species in the wetland that cover at least 10 square feet. *(Different patches of the same species can be combined to meet the size threshold)* *You do not have to name the species.* Do no include Eurasian Milfoil, reed canary grass, purple loosestrife, or Canadian thistle Number of Species Counted: ☒ >19 species ☐ 5-19 species ☐ <5 species List of species counted (not required):		2 pts 1 pt 0 pts	2

H1.4 Interspersion of Habitats

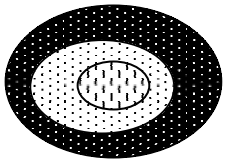
Decide from the diagrams below, whether interspersion between Cowardin vegetation classes (described in H1.1), or the classes and un-vegetated areas (can include open water or mudflats) is high, medium, low, or none.

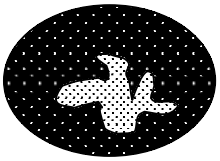


None = 0 points

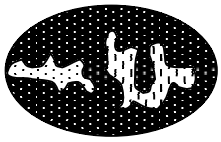


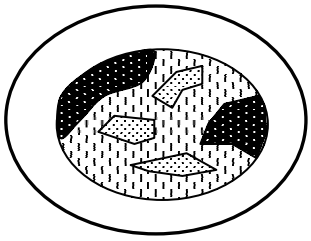
Low = 1 point





Moderate = 2 points





(Riparian braided channels)

High = 3 points

NOTE: If you have four or more classes or three vegetation classes and open water, the rating is always "high".

4

H1.5 Special Habitat Features

Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the points column.

- ☒ Large, downed, woody debris within the wetland (>4 inches diameter and 6ft long)
- ☒ Standing snags in the wetland (diameter at bottom >4 inches)
- ☐ Undercut banks are present for at least 6.6ft (2m) and/or overhanging vegetation which extends at least 3.3ft (1m) over a stream for at least 33 ft (10m)
- ☐ Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30degree slope) OR signs of recent beaver activity are present
- ☒ At least ¼ acre of thin-stemmed persistent vegetation or woody branches are present in area that are permanently or seasonally inundated (structures for egg-laying by amphibians)
- ☒ Invasive plants cover less than 25% of the wetland area in each stratum of plants

H1. Total Score – potential for providing habitat

Add the scores in all H1 columns above

16

Comments:

H2. Does the wetland unit have the <u>opportunity</u> to provide habitat for many species?	Points
H2.1 Buffers *Choose the description that best represents the condition of the buffer of the wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed."* ☐ 100m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. No structures are within undisturbed part of buffer. (Relatively undisturbed also means no-grazing, no landscaping, no daily human use.) **5 pts** ☒ 100m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >50% circumference. **4 pts** ☐ 50m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >95% circumference. **4 pts** ☐ 100m (330ft) of relatively undisturbed vegetated areas, rocky areas, or open water >25% circumference. **3 pts** ☐ 50m (170ft) of relatively undisturbed vegetated areas, rocky areas, or open water >50% circumference. **3 pts** **If the buffer does not meet ay of the above criteria** ☐ No paved areas (except paved trails) or buildings within 25m (80ft) of wetland >95% circumference. Light to moderate grazing, or lawns are OK. **2 pts** ☐ No paved areas or buildings within 50m of wetland for >50% circumference. Light to moderate grazing, or lawns are OK. **2 pts** ☐ Heavy grazing in the buffer. **1 pt** ☐ Vegetated buffers are <2m wide (6.6ft) for more than 95% of the circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland). **0 pts** ☐ Buffer does not meet any of the criteria above. **1 pt**	4
H2.2 Corridors and Connections **H2.2.1** Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150ft wide, has at least 30% cover of shrubs, forest, or native undisturbed prairie, that connects to estuaries, other wetlands, or undisturbed uplands that are at least 250 acres in size? Dams in riparian corridors, heavily used gravel roads, and paved roads are considered breaks in the corridor. YES = **4 points** (go to question H 2.3) NO = go to question H2.2.2 **H2.2.2** Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50ft wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands, or undisturbed uplands that are at least 25 acres in size? OR a Lake-fringe wetland, if it does not have an undisturbed corridor as in the question above. YES = **2 points** (go to question H2.3) NO = go to question H2.2.3. **H2.2.3** Is the wetland: ☒ within five miles (8km) of a brackish or salt water estuary OR ☐ within three miles of a large field or pasture (>40 acres) OR ☐ within one mile of a lake greater than 20 acres? YES = **1 point** NO = **0 points**	2

H2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)* Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*	**Points**
☒ **Riparian:** The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.	4
☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 0.8ha (2acres).	
☐ **Cliffs**: Greater than 7.6 m (25ft) high and occurring below 5000ft.	
☐ **Old-growth** 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 20 trees/ha (8 trees/acre) which are >81 cm (32 in) dbh or > 200 yrs of age.	
☐ **Mature forests**: Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less than 100% ; decay, decadence, numbers of snags, and quality of large downed material is generally less than that found in old-growth; 80-200 yr old west of the Cascade crest.	
☐ **Prairies**: Relatively undisturbed areas (as indicated y dominance of native plants) where grasses and/or forbs form the natural climax plant community.	
☐ **Talus**: Homogeneous areas of rock rubble ranging in average size from 0.15 to 2.0 m (0.5 to 6.5ft), composed as basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.	
☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages.	
☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%.	
☒ **Urban Natural Open Space**: A priority species resides within or is adjacent to the open space and uses it for breeding and/or regular feeding; and /or the open space functions as a corridor connecting other priority habitats, especially those that would otherwise be isolated; and/or the open space is an isolated remnant of natural habitat larger than 4ha (10 acres) and is surrounded by urban development.	
☒ **Estuary/Estuary-like**: Deepwater tidal habitats and adjacent tidal wetlands, usually semi-enclosed by land but with open, partly obstructed or sporadic access to the open ocean, and which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low- energy coastlines there is appreciable dilution of sea water. Estuarine habitat extends upstream and landward to where ocean-derived salts measure less than 0.5% during the period of average annual low flow. Includes both estuaries and lagoons.	
☒ **Marine/ Estuarine Shorelines**: Shorelines include the inter-tidal and sub-tidal zones of beaches, and may also include the backshore and adjacent components of the terrestrial landscape (e.g. cliffs, snags, mature trees, dunes, meadows) that are important to shoreline and associated fish and wildlife, and that contribute to shoreline function (e.g. sand/rock/log recruitment, nutrient contribution, erosion control).	
If the wetland has 3 or more **priority** habitats **4 pts** 2 priority habitats **3 pts** 1 priority habitat **1 pt** no priority habitats **0 pts**	

H2.4 Wetland Landscape (*see p.85)*	Points
Choose the one description of the landscape around the wetland that best fits. ☐ There are at least three other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, field, or other development). **5 pts** ☐ The wetland is Lake-fringe on a lake with little disturbance and there are three other lake-fringe wetlands within ½ mile. **5 pts** ☒ There are at least three other wetlands with in ½ mile, BUT the connection between them is disturbed. **3 pts** ☐ The wetland is Lake-fringe on a lake WITH disturbance and there are three other lake-fringe wetlands within ½ mile. **3 pts** ☐ There is at least one other wetland within ½ mile. **2 pts** ☐ There are no other wetlands within ½ mile. **0 pts**	3
H2. Total Score - opportunity to provide habitat *Add the scores in all of the H2 columns above*	13
Total for H1	16
Total Score for Habitat Functions- *Add the points from the total H1 and H2 boxes* *Add the score to table on page 1*	29

APPENDIX D: FIELD NOTES

Field Notes from Chuckanut Village Marsh

May 8, 2008, By Jim Johannessen, LEG

Culvert Observations at Landward end 18" Culvert

- At 9:36 pm PDT, apparent high water and flooding tide temporarily reverses to ebbing current
- At this time water surface at downstream end of culvert is equal to top edge of culvert opening + 0.03 ft (water 0.03 ft above top of opening)
- Prior to high slack, several current reversals observed near high slack
- Flood current consistently greatest exiting mid-level of north end culvert
- 10 minutes post high slack, current greatest at near surface exiting south end culvert
- May 8, 2008 at 9:40-9:47 pm, current flooding
- 9:49 pm current starts ebbing, velocity quickly increased to maximum seen so far
- 10:03 pm PDT, water still flooding in channel landward of culvert
- 10:08 pm PDT, water slowly ebbing at same location

Biological Observations in Tide Channel

- One small fish observed 2- 8 ft landward of north end culvert, approximately 1.2 inches long (unknown species, but thin), found in the upper half of water column (not sculpin)
- Several species of swimming invertebrates observed (3 +) immediately landward of landward end of 18" culvert

Tide Channel Depths at High Water

Water Depths at high slack upstream from 18" culvert

Distance	Depth
0.2 ft landward of culvert	1.3 ft
3.0 ft landward of culvert	1.15 ft
6 ft landward of culvert	1.0 ft
15 ft landward of culvert	1.0 ft
20 ft at bend landward of culvert	0.7 ft
15 ft N of bend in channel	0.5 ft
15 ft S of landward ditch T	0.45 ft
5.0 ft S of landward ditch T	0.65 ft

- Immediately downstream of waterward end 18" culvert; water depth 2.0 ft

Distance	Depth
0.2 ft downstream	1.9 ft
2.0 ft downstream	2.1 ft
5.0 ft downstream	2.25 ft

Tide Channel Profiles

- At 2.5 ft landward of culvert channel width is 5.0 ft
- At 5.0 ft landward of culvert channel width is 6.0 ft
- At 8.0 ft landward of culvert bank full width 6.5 ft
    - Evidence of erosion on both banks, west bank a vertical scarp 0.6 ft high, east bank vertical scarp 0.8 ft below water surface with total height of 2.0 ft
    - Channel depth 0.7 ft to 0.9 ft all the way across

- CGS: Eliminate contours on map showing deep area angling off side of channel immediately landward of culvert, in fact this is higher elevation with aspens growing
- 8 ft south of small bend in channel, approximately 15.0 ft landward of culvert, water depth is 1.0 ft (debris and wood apparently in SW channel)
- At 15 ft landward of culvert depth is 1.0 ft and wetted width is 4.0 ft
- 15 ft N of bend in channel depth 0.5 ft deep, bank full width is 7.7 ft, bank is undercut on both sides, west side water is 0.3 ft deep on a gently sloping lower bank with near vertical 0.7 ft above and overhang with excessive aspen tree roots (1.0 – 1.3 ft (bank overhang on west side). Bank overhang on N side bank overhang is 0.3 - 0.5 ft, (note: examine stratigraphy of banks in daylight)
- Tide channel is a straight artificially-cut channel in plan view
- Old beach deposits, sandy beach deposits with approximately 20% gravel
- 25 ft landward of bend, depth varies, is approximately 0.6 ft, cross-section maximum width is 8.6 ft west side bank undercut 0.3-0.8 ft, east side bank undercut 0.1-0.8 ft
- At 15 ft downstream of ditch T, depth is 0.45 ft, width is 8.4 ft, south side bank undercut 0.3-0.8 ft, east side bank undercut 0.1-0.8 ft, organic stained soil at slightly wavering depth of 0.8 - 1.3 ft above water surface at 10:05 pm PDT
- 5 ft waterward of ditch T, depth is 0.65 ft, apple trees (?) near ditch T on west side on high ground

Marsh Observations

- 40-70 ft northeast of ditch thalweg, standing water ponds in saltgrass area in north central portion of salt grass area, tasted and appeared fresh and tannin rich, water surface appears equal elevation to water in ditch. Generally 3+ ponds with saltgrass popping through at approximately 10-25 ft long. And on landward side of fence line paralleling alley(?) ROW.
- Entering rushes to NW at old fence post corner (bayward of closest relatively new house, at SW end fences where intersects ditch, possibly in alley behind Fairhaven.) Ditch channel width ranged from 2.5-3.4 ft, thalwag depths generally 1.1-1.2 ft deep. At 10:20 pm PDT, current ebbing in ditch at an accelerating rate
- On southwest side of longest ditch, numerous small intersecting ponds with considerably less overall size, but more widespread wet pockets
- At 10:30 pm PDT water surface 0.8 ft above top of culvert with ebbing tidal current
- Further southwest in marsh towards hill of mansions; several sinuous channels…with water depth = 0.7 ft, in area of partial coverage silver weed
- Further west, southwest adjacent to large landward cattail patch; more widespread ponds among rushes(?), very wet

Mud Bay Beach Observations

- At beach west of parking lot water was calm and moderate density floating detritus such as eelgrass and algae (dead) was apparent.
- Water surface 0-0.5 ft waterward of dune grass mats/water at vegetation line. Water surface elevation 0 – 0.4(?) ft below continuous dune grass

So tidal water was high, but has not overtopped the banks by too much inside the marsh.

Second, 12" Culvert

- At 12" culvert east of road, rubber "tidegate" partially inundated, slightly more than half inundated, water surface equal to approximately 1/3 of the way up the 12" culvert at 10:45 pm PDT.

APPENDIX E: PHOTOGRAPHS

Photo 1. Downstream end of Fairhaven Avenue culvert. Low tide.

Photo 2. Marsh ditch at intersection between two primary ditches. Low tide.

Photo 3. View east from Ditch intersection. Viewing southern ditch. Juncus Unit on right of ditch; PEM Distichlis Unit left of ditch; PEM Typhus unit ahead and left of ditch. Low tide.

Photo 3. View south from middle of north/south ditch. From from PEM Juncus unit into PEM Distichlis Unit. Low tide.

Photo 4. View south. Detail north/south ditch about 30 feet upstream of ditch intersection. Low tide.

Photo 5. View west from PEM Juncus Unit view PSS Deciduous Shrub Unit. Low tide.

Photo 6. View northwest into PEM Typha Unit. Low tide.

Photo 7. View south into PEM Juncus Unit. Low tide.

Photo 8. Detail in Palustrine Forested Community. Low tide.

Photo 9. Detail in Palustrine Scrub-Shrub community in the Salix Unit. Note surface water channel. Low tide.

Photo 10. View north into Palustrine Emergent community, Typha Unit. Low tide.

Photo 11. Detail of Palustrine Emergent community, Distichlis Unit. Photo taken after day of heavy rains. Pools had tannic water with mosquito larvae. Low tide.

Photo 12. Detail of existing parking area and Upland Shrub community. Low tide.

APPENDIX F: SPECIES LISTS

Chuckanut Village Marsh Plant List

Scientific Name	*Common Name*	*Salt Sensitivity*	*Wetland Indicator*
Upland Forest			
Abies grandis	Grand fir	NI	FACU-
Acer macrophyllum	Big-leaf maple	NI	FACU
Alnus rubra+	Red alder	S	FAC
Amelanchier alnifolia	Serviceberry	NI	UPL
Betula papyrifera	Paper birch	NI	FACU
Gaultheria shallon	Salal	NI	FACU
Ilex aquifolium	English holly	NI	NI
Mahonia aquifolium	Tall Oregon grape	VS	UP
Oemleria cerasiformis+	Indian plum	NI	FACU
Picea sitchensis	Sitka spruce	VS	FAC
Polystichum munitum+	Sword fern	S	FACU
Prunus avium*	Sweet cherry	NI	NI
Pseudotsuga menziesii+	Douglas fir	NI	FACU
Rubus spectabilis	Salmonberry	S	FAC+
Rubus ursinus	Wild blackberry	S	FACU
Sambucus racemosa	Red elderberry	NI	FACU
Thuja plicata	Western red cedar	NI	FAC
Tsuga heterophylla	Western hemlock	VS	FACU-
Palustrine Forested			
Alnus rubra+	Red alder	S	FAC
Carex obnupta+	Slough sedge	S	OBL
Gaultheria shallon	Salal	NI	FACU
Lonicera involucrata+	Black twinberry	S	FAC+
Lysichitum americanum	Skunk cabbage	VS	OBL
Malus fusca	Crabapple	S	FACW
Picea sitchensis	Sitka spruce	VS	FAC
Polystichum munitum	Sword fern	S	FACU
Rubus spectabilis	Salmonberry	S	FAC+
Rubus ursinus	Wild blackberry	S	FACU
Thuja plicata	Western red cedar	NI	FAC
Tsuga heterophylla	Western hemlock	VS	FACU
Upland Shrub			
Amelanchier alnifolia	Serviceberry	NI	UPL
Betula papyrifera	Paper birch	NI	FACU
Mahonia aquifolium	Tall Oregon grape	VS	UP
Maianthemum dilatatum+	False lily-of-the-valley	S	FAC
Malus fusca+	Crabapple	S	FACW
Polygonum cuspidatum	Japanese knotweed	NI	FACU
Polystichum munitum	Sword fern	S	FACU
Populus tremuloides	Quaking aspen	NI	FAC
Populus trichocarpa+	Black cottonwood	FAC	FAC
Rosa nutkana+	Nootka rose	S	FAC
Thuja plicata	Western red cedar	NI	FAC
Vicia gigantea	Giant vetch	MS	NI
Upland Beach Fringe			
Achillea millefolium	Yarrow	NI	UP

Artemisia campestris	Northern wormwood	NI	NI
Cytisus scoparius*	Scot's broom	NI	NI
Elymus mollis+	American dunegrass	MT	NI
Grindelia integrifolia	Coastal gumweed	VT	FACW
Heracleum lanatum+	Cow parsnip	VS	FAC+
Lathyrus japonicus	Maritime peavine	S	NI
Mahonia aquifolium	Tall Oregon grape	VS	UP
Rosa nutkana+	Nootka rose	S	FAC
Sambucus racemosa	Red elderberry	NI	FACU
Palustrine Scrub-Shrub			
Carex lyngbyei	Lyngby's sedge	T	OBL
Carex obnupta+	Slough sedge	S	OBL
Crataegus douglasii	Black hawthorn	NI	FAC
Epilobium watsonii	Watson's willow-herb	NI	FACW-
Gautheria shallon	Salal	NI	FAC
Heracleum lanatum	Cow parsnip	VS	FAC+
Holcus sp.	Velvet grass	NI	FAC
Hordeum brachyantherum	Meadow barley	MT	FAC-
Iris pseudacorus	Yellow-flag iris	VS	OBL
Juncus balticus	Baltic rush	VT	FACW
Juncus effusus	Soft rush	NI	FACW
Lonicera involucrate+	Black twinberry	S	FAC+
Lysichitum americanum+	Skunk cabbage	VS	OBL
Malus fusca+	Crabapple	S	FACW
Oenanthe sarmentosa+	Water parsley	MT	OBL
Phalaris arundinacea	Reed canarygrass	MT	FACW
Populus tremuloides+	Quaking aspen	NI	FAC
Rumex crispus	Curly dock	MS	FAC+
Salix hookeriana+	Hooker's willow	M	FACW-
Salix lasiandra	Pacific willow	NI	FACW+
Salix scouleriana	Scouler willow	NI	FAC
Salix sitchensis+	Sitka willow	NI	FACW
Thuja plicata	Western red cedar	NI	FAC
Palustrine Emergent			
Aster subspicatus+	Douglas' aster	MT	FACW
Carex lyngbyei+	Lyngby's sedge	T	OBL
Carex obnupta	Slough sedge	S	OBL
Distichlis spicata+	Seashore saltgrass	VT	FAC+
Epilobium watsonii	Watson's willow-herb	NI	FACW-
Festuca rubra	Red fescue	MT	FAC+
Heracleum lanatum	Cow parsnip	VS	FAC+
Holcus sp.	Velvet grass	NI	FAC
Juncus balticus+	Baltic rush	VT	FACW
Juncus effusus	Soft rush	NI	FACW
Oenanthe sarmentosa	Water parsley	MT	OBL
Phalaris arundinacea*+	Reed canarygrass	MT	FACW
Plantago maritima	Seaside plantain	VT	FACW
Potentilla pacifica+	Pacific silverweed	MT	OBL
Rubus discolor*	Himalayan blackberry	S	FACU
Rumex crispus	Curly dock	MS	FAC+

Salicornia virginica	Pickleweed	VT	OBL
Salix hookeriana	Hooker's willow	M	FACW-
Salix lasiandra	Pacific willow	NI	FACW+
Salix scouleriana	Scouler willow	NI	FAC
Salix sitchensis	Sitka willow	NI	FACW
Scirpus maritimus	Seacoast bulrush	T	OBL
Scirpus microcarpus	Small-fruited bulrush	S	FACW
Spiraea douglasii	Hardhack	NI	FACW
Triglochin maritimum	Seaside arrowgrass	VT	OBL
Typha latifolia+	Common cattail	S	OBL

* non-native + dominant species in unit or community

APPENDIX G: SALINTY INDICATOR LISTS

APPENDIX B

Salt sensitivity rating of the estuarine wetlands and associated uplands flora of the Pacific Northwest (*=estimated) from Hutchinson (1991).

Very Sensitive
Tsuga heterophylla
Angelica arguta
Berberis aquifolium
Caltha asarifolia
Carex rostrata
Equisetum fluviatile
Galium cymosum
Habenaria dilatata
Heracleum lanatum
Hypericum formosum
Iris pseudoacorus
Juncus nevadensis
Lysichitum americanum
Mentha arvensis
Mentha piperata
Myosotis laxa
Pichea sitchensis
Rumex acetosella

Sensitive
*Aira praecox
*Alnus rubra
*Angelica lucida
*Anthoxanthum odoratum
*Athyrium felix-femina
*Calamagrotis nutkaensis
*Carex obnupta
*Cornus stolonifera
*Equisetum arvense
*Glyceria grandis
*Holcus lanatus
*Hypochaeris radicata
*Lonicera involucrata
*Maianthemum dilatatum
*Physocarpus capitatus
*Polystichum munitum
*Potentilla palustris
*Pteridium aquilinum
*Ribes sanguineum
*Vaccinium spp.
Alisma plantago-aquatica
Bidens cernua
Bromus mollis
Juncus articulatis
Juncus oxymeris
Lathyrus japonicus
Menyanthes trifoliate
Pyrus fusca
Rosa gymnocarpa
Rosa nutkana
Rubus spp.
Rumex conglomeratus
Sagittara latifolia
Scirpus microcarpus
Sium suave
Typha latifolia

Moderately Sensitive
*Ammophila arenaria
*Lathyrus palustris
*Phargmites communis
*Rumex crispus
*Salix hookeriana
*Vicia gigantea
Achilea millefolium
Agropyron repens
Cicuta douglasii
Dactylis glomerata
Limosella aquatica
Lotus ulignosus
Lythrum salicaria
Plantago lanceolata
Poa pratensis
Scirpus acutus
Scirpus validus
Sonchus arvensis
Trifolium spp.

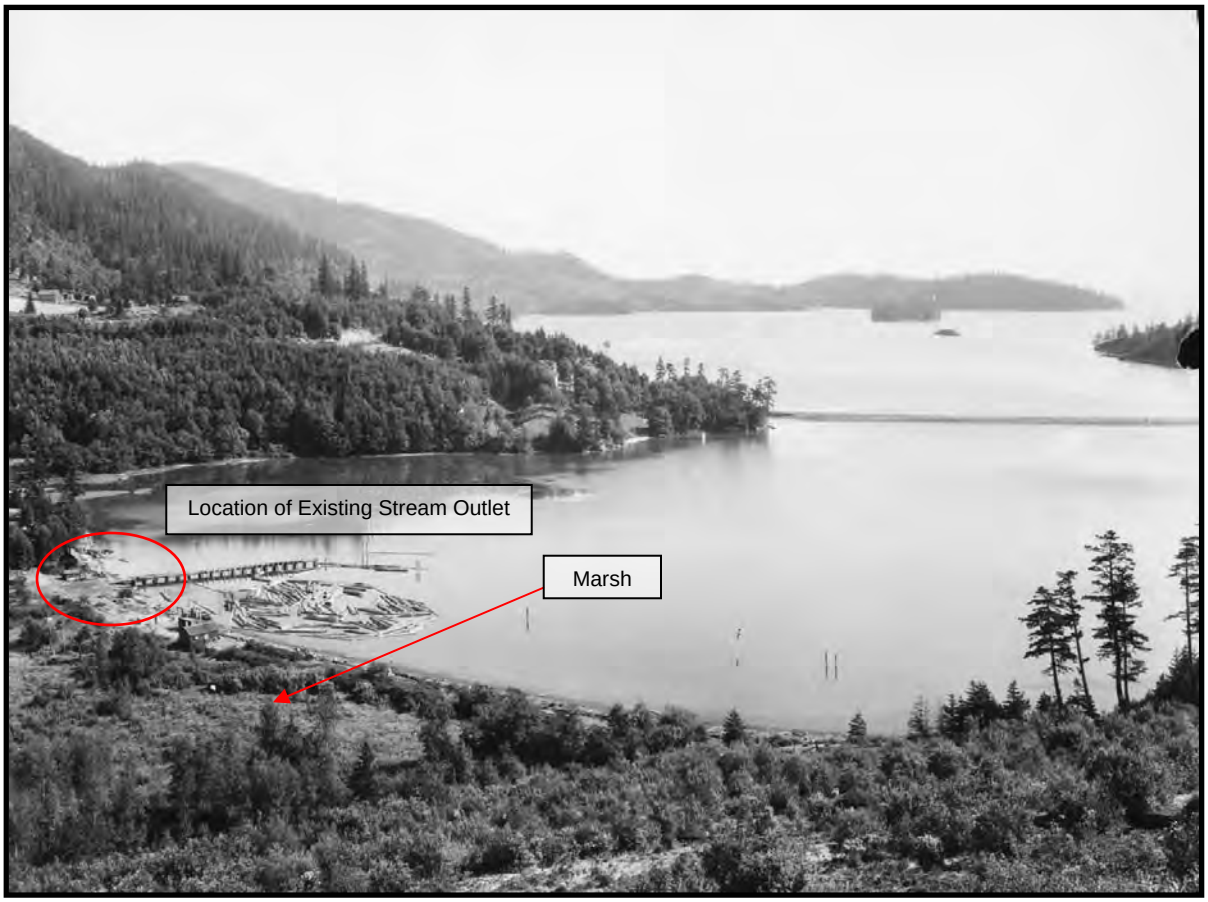
Moderately Tolerant
*Elymus mollis
*Hordeum brachyantherum
*Oenanthe sarmentosa
*Phalaris arunidacea
*Scripus cernuus
Agrostis alba
Aster subspicatus
Eleocharis acicularis
Eleocharis palustris
Eleocharis parvula
Festuca arundinacea
Festuca ruba
Lolium perenne
Lotus corniculatus
Potentilla pacifica
Ranunculus cymbalaria
Scripus americanus
Trifolium wormskjoldii

Tolerant
*Orthocarpus castillejoides
*Typha angustifolia
Carex lyngbyei
Deschampsia caespitosa
Glaux maritima
Hordeum jubatum
Juncus gerardii
Liliaeopsis occidentalis
Scripus maritimus
Stellaria humifusa

Very Tolerant
*Grindelia integrifolia
*Suaeda maritima
*Triglochin concinnum
*Triglochin maritimum
Atriplex patula
Cotula coronopifolia
Distichlis spicata
Jaumea carnosa
Juncus balticus
Plantago maritima
Salicornia europea
Salicornia viginica
Spergularia canadensis
Spergularia marina

VS	very sensitive	0 - 0.5 ppt
S	sensitive	0.5 - 5. ppt
MS	moderately sensitive	5-10 ppt
MT	moderately tolerant	10 - 15 ppt
T	tolerant	15 - 20 ppt
VT	very tolerant	>20 ppt

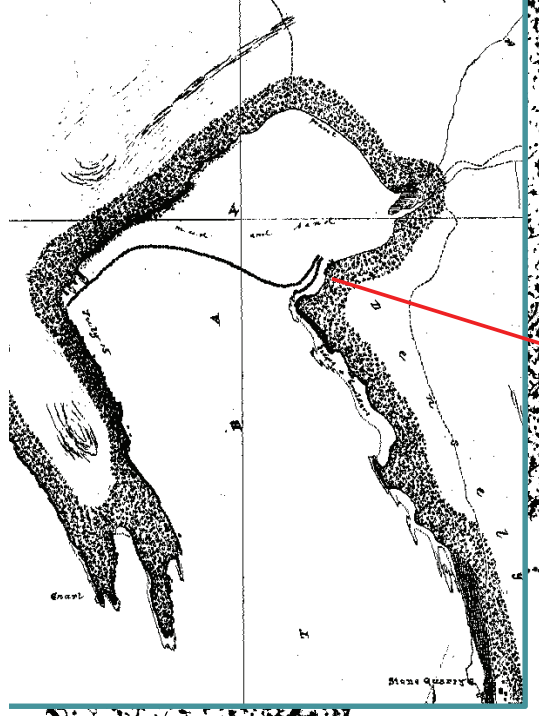
APPENDIX H: HISTORICAL PHOTOGRAPHS



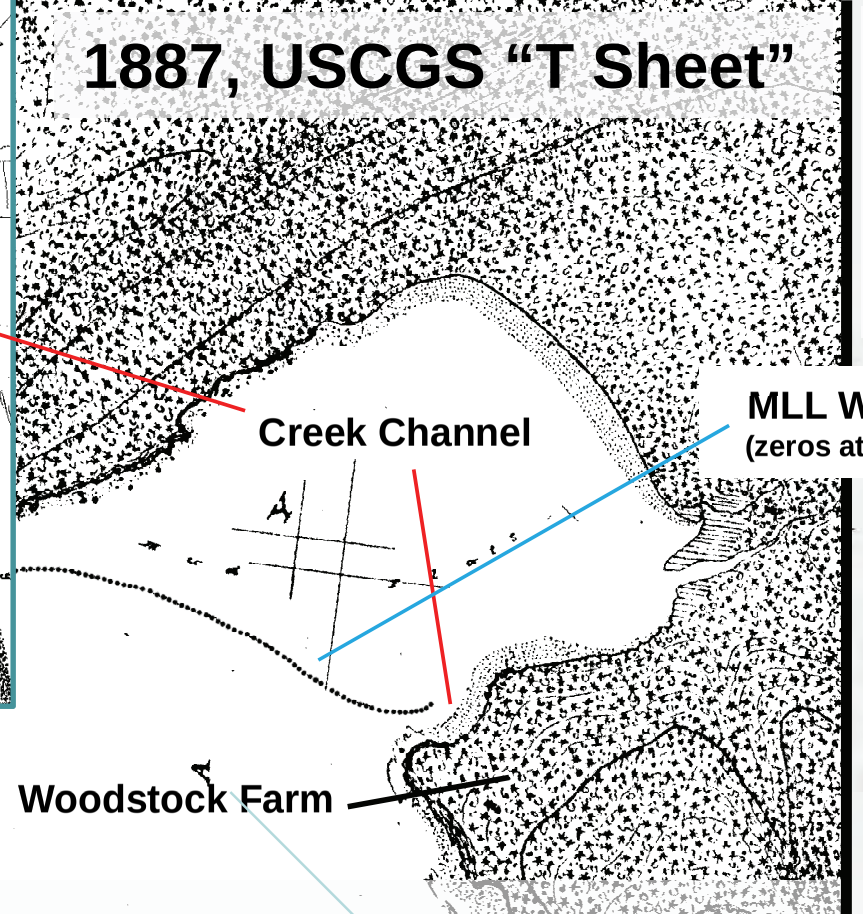
Chuckanut Bay 1930's

Chuckanut Bay 1920's

From Grit to Mud
in "Railroad Bay"
or
When Eddy Left on the Train



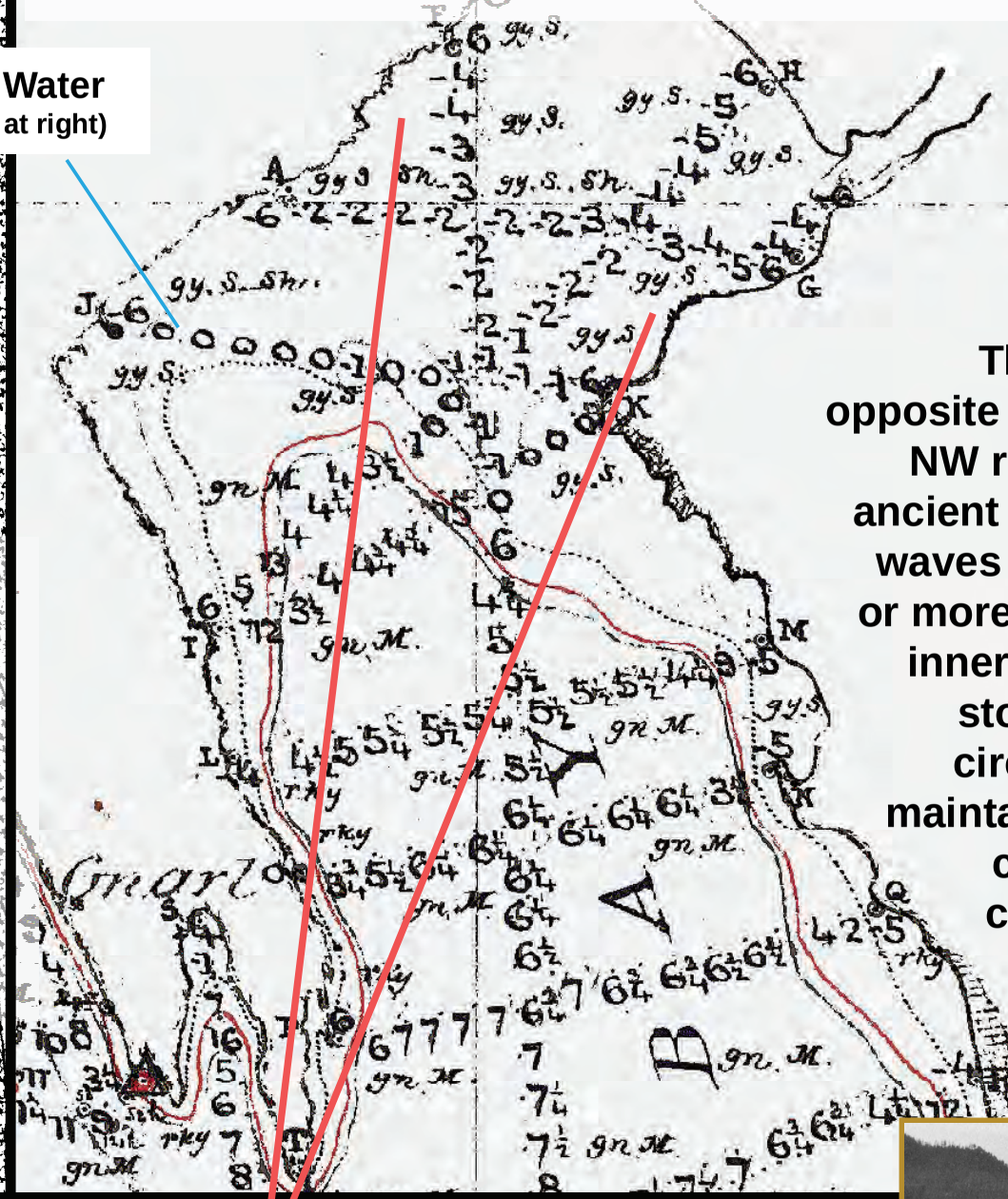
1887, USCGS "T Sheet"



There are 2 versions of the 1887 "T sheet". The lower one labels the inner bay "mud flats", the upper one "mud and sand", based on visual assessment by cartographers who were mapping emergent landforms. Note the location of the creek mouth at Woodstock's West Point. (The presenter has darkened the draftsman's MLL lines.)

1888, USCGS "H Sheet"

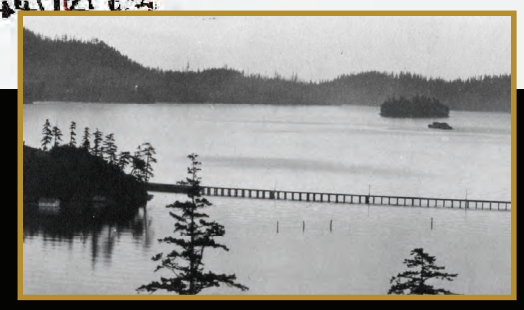
Based on actual bottom sampling, sand, gravel & shell substrates were mapped above Mean Lower Low Water (MLL). Another USCGS dataset (not shown) was created in 1891, capturing hydrography at & below MLL in greater detail.



The sculpted shore opposite Woodstock to the NW reveals the steady, ancient work of pounding waves from the SW. One or more eddies swept the inner bay, especially in storms & apparently circling clockwise to maintain the main creek channel & a gravel canoe beach along the Woodstock shore.

1859 US GLO

Deputy Surveyors of US Land Office traversed the US Meander Line & noted sand & gravel beaches in today's "Mud Bay".



The RR would soon change all this…

Compiled by Tim Wahl 1125 16th St. Bellingham, WA