City of Bellingham WASHINGTON

Chuckanut Village Marsh Restoration

Project Overview: EN-0031

Restoration of the Chuckanut Village Marsh will enhance the area's ability to provide pocket estuary functions, including improving water quality and providing rearing, foraging and osmo-regulation for juvenile salmonids migrating from nearby Chuckanut Creek. The project involves:

- Replacing an undersized culvert with a much larger box culvert to increase the tidal exchange between the marsh and the bay;
- Creating an ADA accessible path to the shoreline from the end of Fairhaven Ave.;
- Re-establishing a native salt marsh buffer along the publicly owned sections of the shoreline;
- Protecting native vegetation and habitat elements by restricting vehicle access to sections of the shoreline and intertidal zones;
- Relocating parking away from the shoreline;
- Educating the public about the importance of marine nearshore environments, with the end goal of producing behavioral change that promotes a healthy nearshore habitat.
- Chuckanut Village Marsh Restoration Project Final Plans (PDF)
- Chuckanut Village Marsh Restoration Project Final Plans (PDF)
- Chuckanut Village Marsh Plan Revision 11-09-09 (PDF)

Additional Background Information

Update - March 2011

Accomplishments: Construction substantially complete.

Next Milestones: Final paving, inspection and closeout

Affected Neighborhood

South

Project Manager

Ravyn Whitewolf, P.E.
Engineering Manager
Renee LaCroix, Environmental Coordinator

Phone: (360) 778-7900
Email Public Works

Project Details

- Status - Construction
- Contract Awarded - N/A
- Contract Amount - $51,628.42
- Contractor - Larry Brown Construction
- Completion Date:
- Final Contract Amount:

Additional Background Information

The goals of the project are to:

1. Improve water quality by protecting and preserving existing marine resources
2. Restore impaired areas while enhancing public access
3. Educate the public about the importance of marine water quality while changing the behaviors that contribute to water quality impairments

Chuckanut Village Marsh Restoration Steps

The City's consulting team, Coastal Geologic Services, developed a final design for Alternative #1 and incorporated as many citizen comments into the chosen alternative as possible.

Construction is anticipated to occur in 2011 after local, state and federal permits are obtained. Funding for design and permitting is from Whatcom County Marine Resources Committee via Whatcom County. Funding for construction is through a grant from Washington State Department of Ecology.

Chuckanut Bay Habitat

Chuckanut Bay is one of seven pocket estuaries found within Bellingham Bay. Pocket estuaries are shallow, low energy shoreline areas that range from the mouths of small streams and creeks (such as Chuckanut Creek) to nearly enclosed bays and lagoons (such as Padden lagoon).

They can be composed of habitats such as unvegetated mud flats, salt marsh, tidal channels and estuarine wetlands. Cumulatively, pocket estuaries are very important to several life history

stages of juvenile chum salmon and federally listed juvenile Chinook and steelhead salmon. Chuckanut Bay and adjacent lands also provide habitat for many species of wildlife, including Great Blue Heron.

Chuckanut Village Marsh restoration was proposed based on an understanding of the ecological importance of this type of habitat and its scarcity locally. Numerous technical assessments attest to the importance of this type of marine habitat.

Public Involvement in Restoration Plans

The City held a series of public meetings in Spring 2009 regarding the Chuckanut Village Marsh restoration project. Three conceptual alternatives were presented at the meetings along with several blank maps for citizens to design other alternatives. Forty-five people commented during the public comment period. Of those stating a preference for one design alternative, a significant majority preferred Design Alternative #1.

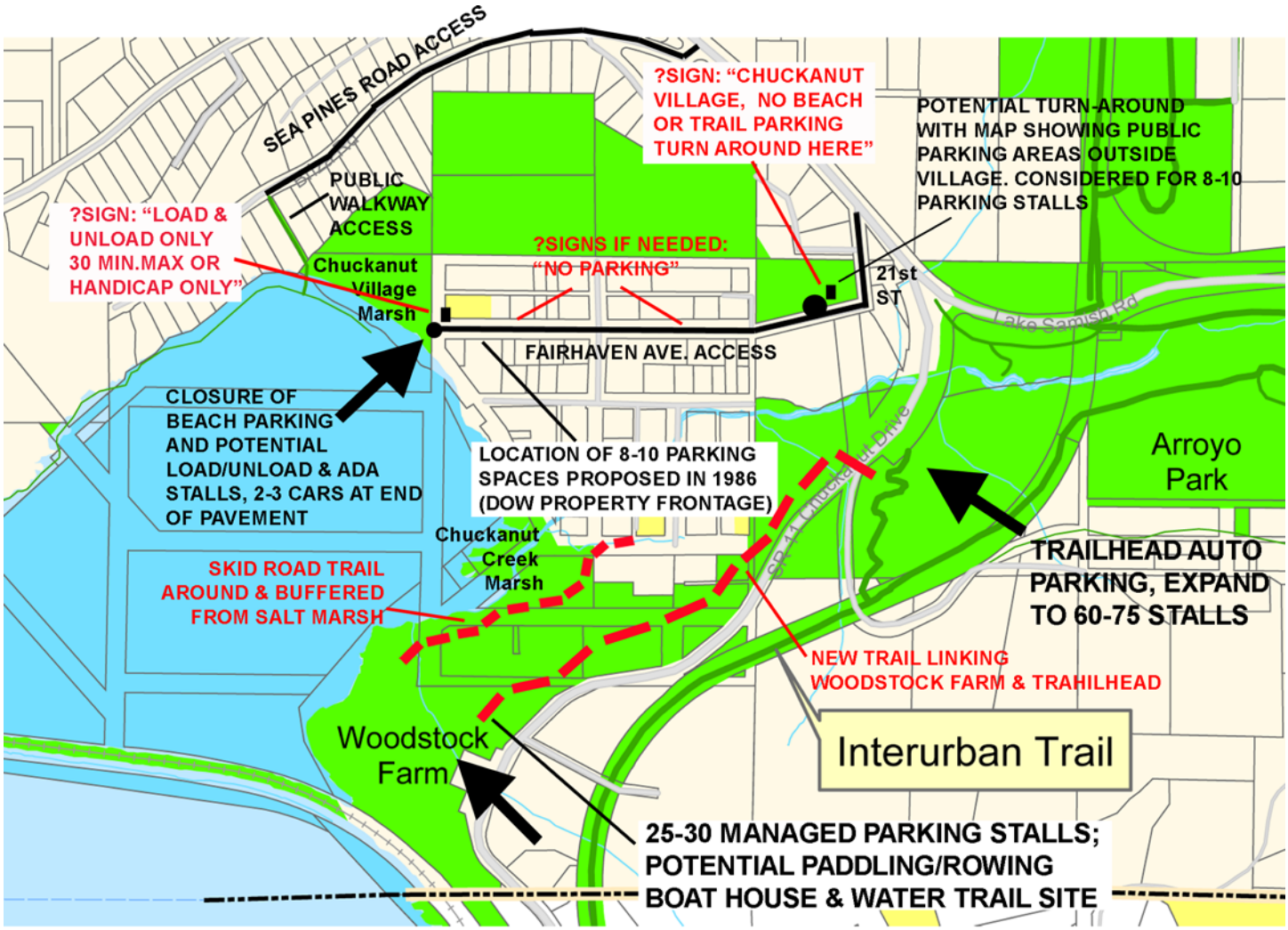
For public involvement steps, alternatives presented and other details, see documents listed below:

Project Documents

- Chuckanut Village Marsh Water Quality Report 2013 (PDF)
- Chuckanut Village Marsh Follow-up Community Survey 2013 (PDF)
- Chuckanut Village Marsh Baseline Community Survey, 2010 (PDF)
- Chuckanut Village Marsh Final Plans, October 2009 (PDF)
- Preferred Alternative - Beach Plan (PDF)
- Preferred Alternative - Brackish Region (PDF)
- Preferred Alternative - Parking (PDF)
- Project Overview (PDF)
- Project Alternatives (PDF)
- Public Process (PDF)
- Public Access Map (PDF)
- April 7, 2009 Meeting - Power Point (PDF)
- April 7, 2009 Meeting - Public Comments (PDF)

Studies

- Wetland Characterization Chuckanut Village Marsh - June 2008 (PDF)
- Nearshore Habitat Restoration Prioritization - Whatcom County, June 2007 (PDF)
- Management of City of Bellingham Pocket Estuaries - February 2006 (PDF)
- Importance of Pocket Estuaries - Beamer, May 2003 (PDF)
- Fairhaven Avenue Wetland Delineation Report 2009 (PDF)



EXISTING AND POTENTIAL PUBLIC ACCESS ELEMENTS IN AND AROUND CHUCKANUT VILLAGE

The 3 established public parking areas are shown with black arrows.

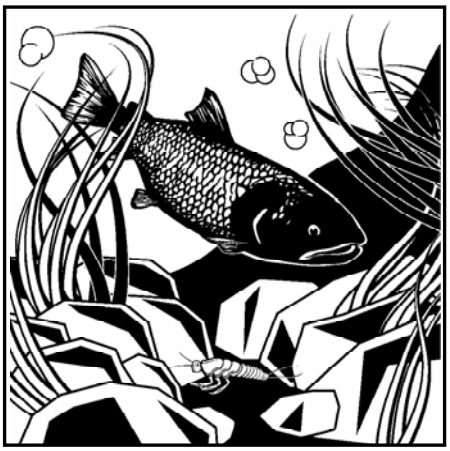
Public streets providing direct public access to the traditional public beach are Sea Pines Rd. and Fairhaven Ave. On-street parking is feasible only on Sea Pines.

Potential public parking areas along Fairhaven Ave. are indicated, along with closure of the informal parking west of the paved road. The location of the Dow property frontage parking considered in 1986 is shown.

Potential signing to manage parking is shown along Fairhaven Ave.

Map prepared for discussion purposes by Tim Wahl, Parks and Recreation Dept.

MANAGEMENT RECOMMENDATIONS FOR CITY OF BELLINGHAM POCKET ESTUARIES



FEBRUARY 2006
(REVISED SEPTEMBER 2006)

Prepared For:
CITY OF BELLINGHAM PLANNING AND DEVELOPMENT DEPARTMENT
210 Lottie Street
Bellingham, WA 98225

Prepared By:
NORTHWEST ECOLOGICAL SERVICES, LLC
1229 Cornwall Avenue, Suite 201
Bellingham, WA 98225
360.734.9484

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Management Recommendations for City of Bellingham Pocket Estuaries

Background

As part of the Shoreline Management Program update for the City of Bellingham, the City identified 'pocket estuaries' as a critical habitat. Once these features were identified it became necessary to formulate a management strategy for these habitats that would be incorporated into the revised Shoreline Management Program.

Report Objectives

In order for the City to address management decisions regarding pocket estuary habitats in the City of Bellingham and the Urban Growth Boundary, Northwest Ecological Services, LLC was engaged to complete the following tasks:

- Compile existing scientific documents that have been completed within the past year on pocket estuaries and adjacent shorelands.
- Identify essential functions of pocket estuaries.
- Identify essential functions within City pocket estuaries and provide management recommendations.
- Develop goals, policies, objectives and draft implementation actions for each pocket estuary to be managed.
- Draft a sub-designation section on pocket estuaries that can be blended into the existing draft shoreline designations.
- Identify areas and topics where additional regulations may be beneficial in managing pocket estuaries.

This report describes the methods used to perform the above referenced tasks. Information presented in this report includes: existing best available science on pocket estuaries; general pocket estuary functions; a brief summary of the general level of functions and estuary habitat features for each pocket estuary reviewed for this report; a description of each pocket estuary studied; general pocket estuary buffer functions; buffer width effectiveness; summary of key functions for each pocket estuary; and management recommendations for goals, objectives and buffer widths for each pocket estuary.

Methods

The literature review for this report resulted in locating very few studies specifically addressing pocket estuaries. The most current and local studies addressing pocket estuary function have been performed by Skagit System Cooperative Research Development whose work has focused on salmonid use of pocket estuaries (Beamer et al 2003). Other studies are limited to nearshore or general estuary review. Because the Best Available Science is limited for this specific habitat type the literature review for this analysis was extended into other similar habitats that have received more rigorous study, specifically marine nearshore and riparian habitats, and estuarine habitats. These habitats have large overlaps with each other and pocket estuaries, resulting in data that can be extended to pocket estuary analysis.

Existing Best Science on Pocket Estuary Habitat

Estuarine habitat is located in a transition zone between the land, freshwater and the sea. This zone is typically dynamic and influenced by a variety of physical, chemical and biological processes (Williams and Thom 2001). Within Bellingham City limits pocket estuaries are located at the mouths of drainages or within artificial impoundments created by the railroad. These habitats typically are, or have the potential to be, very productive. They often include habitat classes such as saltmarsh, mudflat or algae/eelgrass beds within them which are reported to be some of the most productive marine habitat types.

Pocket estuaries are small sub-estuaries within a larger estuary (Bellingham Bay) that form behind spits or barriers. Most pocket estuaries in this review are located behind human created barriers. Pocket estuaries are typically tidal lagoons with fringing unvegetated flats, saltmarsh and tidal channels. Pocket estuaries typically have: habitat types consistent with lower wave or long-shore current energy; and local freshwater inputs (surface or groundwater sources) where salinity is depressed during some part of the year (usually winter and spring) (Beamer et al 2003).

Six pocket estuaries were identified within the City of Bellingham and its Urban Growth Area (UGA) for this review: Chuckanut Creek estuary, Edgemore South pocket estuary, Edgemore North pocket estuary, Post Point Lagoon estuary, Padden Creek estuary, and Whatcom Creek estuary (Figures 1, 2 & 3). Squalicum Creek estuary was not included in this review because it lacks an impoundment separating it from the greater nearshore environment, although many of the discussions from this review could be extended to it. Whatcom Creek estuary has only a minimal separation, but appears to have sufficient elements matching the definition of a pocket estuary to be included in this review. The size of these estuaries ranges from 75 acres for Chuckanut Creek estuary to 0.7 acres for Edgemore South pocket estuary located at the base of the Edgemore bluffs. The average size of the reviewed pocket estuary was three acres. It could be argued that all of Bellingham Bay is a single estuary.

GENERAL POCKET ESTUARY FUNCTION

The literature indicates pocket estuaries provide similar functions to larger estuary systems and nearshore habitat, but become more valuable as overall estuary area is lost in a system. Changes to Bellingham Bay's waterfront over the past 150 years have resulted in a significant loss of estuary habitat. This loss has resulted in interruptions to migration pathways for salmonid, shorebird and other wildlife species occurring in Bellingham Bay on a seasonal and annual basis. Studies by the Waterfront Futures Group and Anchor Environmental have highlighted the disruption of aquatic habitat migratory pathways and its potential effects on salmonid populations. The remaining pocket estuaries functions appear to be significant in maintaining aquatic habitat for a variety of fish species, waterfowl, shorebird and terrestrial wildlife by providing links between fractured habitat corridors. The following section discusses specific potential functions of pocket estuaries.

- **Salmonid Habitat**

Research on the importance of estuary habitat to salmonids is well documented. However, specific research on pocket estuary functional is limited. The literature indicates that general estuary and nearshore habitat provides a range of important functions for all life phases of salmonids. Functions provided by estuaries and nearshore habitat include: migration of juvenile fish from freshwater to marine system; nursery habitat (particularly for chum and Chinook salmon juveniles); juvenile food production and feeding; adult food production; residence or refuge habitat for juveniles; and areas suitable for the physiological transition from freshwater to marine habitat (Williams and Thom 2001). Within Bellingham Bay pocket estuaries are important habitat links in a fractured aquatic habitat for out migrating juvenile salmon as refuge, forage areas, areas allowing for physiological adaptation to saltwater, food production for juvenile and adult fish. All salmonid species utilize estuary habitat at some point in their life cycle, but pocket estuary habitat appears to be particularly important to Chinook and chum salmon juveniles as they are the most estuarine dependent salmon species. These species feed and rear in these habitats for extended periods before moving to deeper water habitats (Williams and Thom 2001). Studies performed by the Skagit River Cooperative have demonstrated the significance of this habitat type to both Chinook and chum salmon populations (Beamer et al 2003).

Features that make pocket estuaries most functional for salmonids include the presence of eelgrass/algae beds, saltwater marsh, overhanging terrestrial vegetation, the presence of large woody debris, connectivity to other productive nearshore habitats, and a source of freshwater. These features provide the maximum potential for cover, food production, refuge, access and opportunity for physiological changes for juveniles adapting to the marine chemistry.

Estuaries reviewed that appear to provide these functions particularly well include: Chuckanut Creek and Edgemore North pocket estuaries. Post Point Lagoon, and Whatcom and Padden Creek estuaries have the potential to serve this function well, and currently provide it in a limited manner, but are limited by current land use practices. There is no fish access to the Edgemore South estuary.

- **Forage and Groundfish**

Estuary and nearshore habitat have been recorded to be important for refuge and rearing habitat for juvenile forage fish (e.g. surf smelt, herring, sand lance) and groundfish (e.g. flatfish, rockfish) (Williams and Thom 2001). These habitats provide for adult spawning, residence and migration of juvenile and adults, and juvenile rearing for Pacific herring, surf smelt, longfin smelt, and sand lance. Estuary habitat tends to be more significant for forage fish species than groundfish species, but there are some exceptions. Estuaries are most functional to juveniles in these taxa groups as the adults tend to be more pelagic. No specific information was located for Bellingham Bay with regards to these species and pocket estuaries, however surf smelt and sand lance both spawn within Bellingham Bay and several spawning areas occur near pocket estuaries. Based on supporting documentation illustrating the importance of estuary habitat to a wide variety of fish species Bellingham's pocket estuaries are most likely providing these functions as well. Features that make pocket estuaries most functional for forage fish and groundfish are similar those listed for salmonids.

All of the reviewed pocket estuaries have the potential to provide habitat for forage and groundfish, except the Edgemore South estuary which has no fish access. Habitat features and buffer conditions indicate that Chuckanut Creek and Edgemore North pocket estuaries have a high potential to serve this function. Post Point Lagoon, and Whatcom and Padden Creek estuaries have the potential to serve this function well, and currently provide it in a limited manner, but are limited by current land use practices and the disruption of aquatic migration pathways. Chuckanut Creek estuary also provides important shellfish habitat.

- **Wildlife**

Estuaries provide habitat for a variety of wildlife species. A study from King County lists 205 species are associated at sometime during their life with estuaries or the near shore habitat (King County 2001). No specific study was located that addressed wildlife usage of pocket estuaries, but it is expected to be similar as reported for general estuary and nearshore areas. Wildlife reported using pocket estuaries in the Bellingham Bay area include concentrations of wintering waterfowl (e.g. bufflehead, goldeneye, merganser, grebes, etc.), winter concentrations of dabbling duck and rocky shorebird species, important stopover foraging areas for migrating shorebirds, foraging for great blue herons, foraging habitat bald eagle and habitat for mustilid mammals (e.g. mink, river otter, weasel). The level of use of local pocket estuaries is dependent not only on in-water features within the estuary but also the condition and connectivity of the

surrounding upland buffer. Estuaries with the highest level of wildlife usage tend to be larger, have a variety of in-water features such as a variety of plant communities and large woody debris along the shoreline, and a connection to other upland habitats via a large forested upland buffer. In general, wildlife functions decrease as you move northward from Chuckanut Bay due to increasing levels of development that have left little to no vegetated buffers or connections to other habitat areas.

All of the reviewed pocket estuaries provide important wildlife habitat. Chuckanut Creek estuary has the greatest numbers of habitat features and supports the greatest diversity of wildlife species of all the reviewed sites. The two Edgemore pocket estuaries and Post Point Lagoon are all connected via shoreline habitat corridors to other significant habitats. Padden and Whatcom Creeks are located in more isolated positions from surrounding terrestrial habitat, but maintain some continuity via the associated steam corridors. Aquatic and shoreline habitat corridors for these two pocket estuaries are more fragmented.

Table 1. Summary of general level of function for pocket estuaries.

Pocket Estuary	General Level of Function							
	Salmonid	Forage/ground fish Habitat	Shellfish Habitat	Winter Water Fowl	Bald Eagle	Great Blue Heron	Mustilid Use	General Wildlife Use
Chuckanut Creek	H	M	H	H	H	H	H	H
Edgemore South	N/A	N/A	N/A	L	L	L	L	L
Edgemore North	M/H	M/H	M?	M	M	M	M	L/M
Post Point Lagoon	M	M	L	M	L	L	M	L/M
Padden Creek	M	L	L?	M	L	M	M	L/M
Whatcom Creek	M/H	L	L	L/M	L	L/M	M	L/M

H – High (Habitat is currently performing a given function well and appears to be sustainable over time.)
M – Medium (Habitat is currently performing a given function but the function is limited by a natural or human aspect. Sustainability of this function is at risk, but may be corrected through restoration actions.)
L – Low (Habitat is currently not performing a given function or the function is severely impaired. The sustainability of the function is at high risk of permanent failure.)
? – Level of function is difficult to assess. Listed function level is an approximation.
N/A – A given function is currently or historically not applicable to this habitat.

Table 2. Summary of estuary habitat features per pocket estuary.

Estuary	Buffer forested 100' or >	Mudflat	Cobble	Rock	Algae/eel-grass	Saltmarsh	Large woody material	Overhanging vegetation	Access for fish	Salmonid Stream present	Human Presence prominent	Forested corridor to other habitats
Chuckanut Creek	X	X	X	X	X	X	X	X Present on south side	X	X	O	X
Edgemore South	X	X	X	O	?	X Small fringe	O Limited	X	O	O	O	X
Edgemore North	O Partial	X	X	O	O	X Small fringe	X	X Present in areas	X	O	O	O Small area present
Post Point Lagoon	X just planted	X	O	O	X	O Small fringe	X Limited	O	X	O	X	X Broken forested corridor
Padden Creek	O	X	O	O	O, but near	X Present on west-south side, lacking on east side	X	O	X	X	X	X Present in areas but broken
Whatcom Creek	O	X	O	O	X	X	O Limited	X Present in areas	X	X	X	O Broken corridor

X – existing; O – non-existing; ? - unknown

X - Habitat is currently performing a given function and appears to be sustainable over time.
O - Habitat is currently not performing a given function or the function is impaired. The sustainability of the function is at high risk of permanent failure.
? - Level of function is difficult to assess.

POCKET ESTUARIES REVIEWED

The following section provides a review of the important features and functions of each of the pocket estuaries identified for this analysis. Tables 1 and 2 also provide a summary of functions and specific habitat features to be found in each of the estuaries.

Chuckanut Creek Pocket Estuary

The Chuckanut Creek estuary provides the highest level of functions of the pocket estuaries reviewed for this report (Table 1). The barrier separating this estuary from the marine nearshore is an artificial railbed berm located at the west end of the estuary. The berm has a restricted opening, but effectively reduces wave energy, separates the bay from longshore currents, and presumably reduces mixing with marine waters resulting in reduced salinity levels during the spring and winter. The primary freshwater source to this system is Chuckanut Creek. Secondary inputs include a small stream flowing through a saltmarsh and runoff from surrounding bluffs.

This estuary includes a variety of features that contribute to its high quality. It provides functions at a high level for all functions except forage fish and groundfish spawning, for which there is no data (Tables 1 and 2). Chuckanut Creek estuary includes extensive mudflats that are associated with softshell clam beds and that provide abundant winter waterfowl habitat, particularly for dabbling duck species (Table 2). Chuckanut Creek provides documented spawning habitat for chum, coho, sea-run cutthroat and steelhead. Saltmarsh habitat is present at the mouth of Chuckanut Creek and at the northwest terminus of Fairhaven Avenue, however regular fish access to this saltmarsh is unlikely due to a restricted culvert and reduced access during tidal cycles. The Chuckanut Creek estuary buffer is functioning at high level for all aspects and the buffer is well connected to other significant riparian and terrestrial habitats along Chuckanut Creek and Chuckanut Mountain.

The primary limitations and risks to the Chuckanut Creek estuary is water quality (fecal coliform) from failing septic systems in the Chuckanut Village area and upstream and from potential future development of private land that could reduce the quantity and quality of forested buffer and result in interruptions of wildlife travel corridors.

Edgemore South Pocket Estuary

A small pocket estuary is located immediately north of the railroad tunnel at Clark's Point. This feature may have been artificially formed by the railbed, which now completely encloses it. There is no visible opening to the marine system, but seepage through the berm ballast is likely. Incoming freshwater to this system originates from runoff from the surrounding uplands and possible groundwater inputs. The pocket is surrounded by steep sandstone bluffs, supporting a high quality Douglas fir forest intermixed with Pacific Madrone, which averages100 feet or

more in width. The uplands surrounding this pocket are currently being developed for single family residences.

The estuary appears to function more like a wetland due to the enclosed nature of the estuary. It is unclear if the system is affected by tidal cycles. Functions associated with fish habitat are non-existent due to a lack of access to the nearshore. There is little access to the public. The estuary maintains moderate functions for winter waterfowl, eagles and other wildlife species, but is somewhat limited by its small size. Additionally, future development around this estuary is likely to increase human related activities further reducing the wildlife function of this small system.

Edgemore North Pocket Estuary

A pocket estuary, enclosed by the railbed, is located immediately south of Post Point. Unlike the Edgemore South estuary, this system has an opening to the marine system, providing access to fish and tidal cycles. The freshwater input to this system is limited to the surface runoff from the surrounding uplands, mostly residential yards. The buffers are primarily deciduous trees and shrubs averaging about 75 feet wide. Some of the vegetation reaches over the banks, providing potential leaf litter and insects for fish. Some lawns extend to the edge of the estuary. No large trees are present, reducing its function for bald eagle foraging. The estuary includes cobble substrate and possible mudflat or algae beds (data was not present on these aspects). The estuary is small, but of sufficient size to provide habitat for fish and wildlife. Fish access is present and the estuary may provide important refuge, forage and rearing habitat for chum, Chinook and other forage fish and ground fish juveniles. It may serve as an important linkage and refuge area for all salmonid species when juveniles are moving from freshwater natal sites to more pelagic habitats. The estuary is regularly used by wintering waterfowl and is likely utilized by great blue heron, mustilid species and occasional bald eagles.

This pocket estuary is connected via a narrow vegetated strip to habitat to the north and south. Vegetation within the buffer is primarily lower deciduous shrubs and non-native shrub and herbaceous species. There is moderate connectivity along the nearshore, except for the railbed. This estuary has a number of features that provide it with moderate habitat diversity such as large woody material on the shore, more than one substrate type, connectivity with other habitats in both aquatic and nearshore habitats. The estuary receives light human use that is unlikely to disturb wildlife usage. There are possible water quality issues from diverted residential surface runoff that has been tight-lined to the toe of the bluff. Tight-lining negates the buffer's ability to provide water quality improvement.

Post Point Lagoon Pocket Estuary

Post Point Lagoon pocket estuary is located immediately west of the City of Bellingham sewer treatment plant. This estuary is also impounded by the railroad tracks and has a small opening

near the middle of the impoundment providing access to the marine nearshore. The main source of freshwater input to this estuary is a small seasonal stream that enters the lagoon near its southern end. Surface water runoff from the upland dog park is also directed into the estuary via culverts (this area is part of a City of Bellingham Park and is a designated off-leash area for dogs). Dog access to the buffer and estuary itself have resulted in significant damage to the vegetation and erosion of the shoreline. The buffer was dominated by grass until recently planted by the City of Bellingham with native trees and shrubs. Dog access has been restricted to a small area of the estuary and exposed soils have been mulched. The estuary is within 500 feet of a Great Blue Heron heronry located to the southeast.

Habitat features in the estuary include eelgrass (algae bed), a small saltmarsh habitat at the north end, and some limited mudflat. It has limited large woody debris (except what was recently brought in for enhancement) and no overhanging vegetation (expected when new plantings mature). The park is part of a disrupted, highly fragmented corridor that can be utilized by some wildlife species. The estuary receives high levels of human related disruption ranging from dog access, human presence, sewer treatment plant activities and trains. Despite the high level of disturbance, winter waterfowl regularly use the site and herons continue to nest nearby. The habitat may be significant to salmonids as well as other fish species. The estuary is located near a salmon spawning creek (Padden Creek) and eelgrass habitat, and may serve as an important migration linkage for juvenile salmonids during migration to more pelagic habitats.

Padden Creek Pocket Estuary

Padden Creek Estuary is located at the mouth of Padden Creek, south of the railroad tracks. This estuary has been impounded by the railed and has one outlet to the marine system near Padden Creek Boatyards. The primary freshwater input to this system is Padden Creek, a salmonid spawning stream. The estuary is located in a highly industrialized area. There is very little vegetated buffer around the estuary. The City of Bellingham enhanced the buffer on the west side of the estuary approximately 10 years ago. The enhanced area has a saltmarsh, upland system that averages about 50 feet. A narrow, grass dominated, buffer is present on south side along Harris Avenue. The remaining areas have impervious surface to the edge of the estuary. There is little to no overhanging vegetation over the shoreline and limited large woody material. This system does provide a relatively large mudflat habitat and is the largest area of this habitat type within the City limits north of the Chuckanut Creek estuary. Eelgrass beds are present outside the estuary.

Habitat associated with juvenile and adult salmonids is likely the most significant habitat in the Padden Creek estuary. The estuary generally drains completely at most low tides, resulting in minimal refuge and forage functions except during higher tides. The mudflats are utilized as foraging habitat for great blue herons, dabbling ducks, Canada geese and occasional shorebirds. Mustilid species may use it on occasion. Other wildlife utilization is limited by a lack of well

connected forested corridor to other systems. A corridor is present up Padden Creek, but it is fragmented and impacted by surrounding development.

Whatcom Creek Pocket Estuary

Whatcom Creek Estuary is located at the mouth of Whatcom Creek. This estuary is partially impounded by the Holly Street bridge crossing. The Whatcom Creek Estuary does not meet the definition of a pocket estuary in the strictest sense, but the restriction resulting from the Holly Street bridge appears to allow it to function in a similar manner and therefore it will be included in this discussion.

The primary freshwater source to this system is Whatcom Creek. The estuary is located in a highly developed portion of the downtown business district in Maritime Heritage Park. The Whatcom Waterway (a federally maintained waterway) dominates the nearshore environment west of the estuary. The Maritime Fish Hatchery is located on the northern bank of the estuary and Whatcom Falls forms the upstream end of the estuary. Whatcom Creek supports a number of salmonid fish species, most originating from the hatchery. The estuary recently underwent major restoration work during a remediation project to the historic landfill that covers the former tidelands. The restoration increased estuary area and included saltmarsh and riparian plantings that are doing well. The City of Bellingham Parks Department, in conjunction with the Nooksack Salmon Enhancement Association and other volunteers, planted a corridor, up to one hundred feet wide, of native trees, shrubs and associated plantings along the upland buffer. The area maintains moderate to heavy use by pedestrians and seasonal fishermen.

Habitat features include new saltmarsh plantings, riparian plantings, moderate large woody debris, and mudflats. Despite a forested corridor in the vicinity of the Maritime Heritage Park, this system is functionally isolated from any surrounding terrestrial or nearshore habitat due to constrictions and disconnections upstream. Despite its isolation, the area is utilized by a number of avian species and is likely important mustilid habitat. Aquatic linkages to other habitats are also limited, an issue that has been discussed in conjunction with the success of salmonid populations. There have been a number of proposals to provide aquatic connections to other habitat types.

POCKET ESTUARY BUFFER FUNCTIONS

Literature specifically addressing buffer protection for pocket estuaries was not located and research on buffers for estuarine and marine systems is limited. Much of the material for this review comes from a summary of the best available information on marine and estuarine riparian function (Brenner and Culverwell 2001). Brenner and Culverwell (2001) theorize that marine riparian zones function in a similar manner as freshwater riparian zones. The following

summary is the result of information from estuary and nearshore reviews addressing riparian function for estuary and nearshore habitats.

To provide maximum opportunities to protect critical areas it is important to include other regulatory tools besides buffers. Buffers are just one of a palette of tools available to help protect shorelines and aquatic habitat including: comprehensive plan designations; zoning and associated land use density requirements; performance standards for different activities (e.g. stormwater, erosion control, noise, glare); best management practices; and monitoring and enforcement of project conditions. Buffers are not always the most effective manner to protect function in a system. Landscape requirements may be more effective in restoring an area or stormwater features maybe more effective in developed and developing areas. Two stormwater outfalls are planned to be rerouted in this area.

Buffer Effectiveness

Buffers surrounding the reviewed pocket estuaries range from relatively undisturbed to highly impacted buffers that are nearly non-existent. It is important to keep in mind that buffers are only one mechanism used to protect sensitive areas.

The following sections provide a brief discussion of the functions buffers can provide in protecting estuarine and nearshore processes and habitat.

- **Water Quality/Sediment Removal**

Filtering and removing sediments that may enter a stream, lake, or marine water system is one of the most commonly identified functions of a vegetated buffer. The main functions are removing pollutants and providing soil stability. In marine systems with limited circulation, sediment can increase turbidity and adversely affect marine habitat and aquatic life. The removal of fine sediments is of particular importance because of the negative effect of suspended sediments on aquatic organisms and the degradation fine sediments have on substrate habitat (gravels). A buffer that is characterized by dense and woody vegetation reduces the velocity of runoff flow, stabilizes soils, takes up nutrients and other contaminants, and reduces siltation – all of which protect water from contamination (Desbonnet et al 1994; Brennan and Culverwell 2004). The effectiveness of a vegetated buffer depends upon its width, slope, soil type and vegetation species (Brennan and Culverwell 2004).

- **Nutrient Removal**

Vegetated buffers can be effective at removing and filtering nutrients, thus controlling inputs to surface water (Desbonnet et al 1994; Pentec 2001). Nitrogen is a limiting nutrient within marine systems that results in excessive outbreaks of algae and diatoms that can have adverse affects to the marine environments. Nutrient inputs may be of particular concern in systems such as pocket estuaries because they have limited circulation and tend to accumulate nutrients.

Nutrient inputs, particularly nitrogen, are often associated with runoff from residential yards where fertilizers are commonly used. Pocket estuaries located near residential uses such as Chuckanut Creek Estuary, and the north and south Edgemore pocket estuaries appear to be at the greatest risk from nutrient enrichment. Padden and Whatcom Creek estuaries could also be at risk from nitrogen sources carried from upstream sources. Buffers designed to reduce nutrient levels in surface runoff can be utilized to help protect systems, but the buffers need to be applied within the entire watershed and not just adjacent to the pocket estuaries. Other aspects of infrastructure may be equally beneficial, such as requiring stormwater treatment in new developments and retrofitting old developments lacking such systems.

- **Bacterial Removal**

Vegetated buffers can be effective in controlling fecal coliform levels (Pentec 2001). The reduction of fecal coliform is dependent upon precipitation, temperature, infiltration, soil characteristics, bacterial die-off, run-off and the characteristic or condition of the buffer (*Id.)*. Fecal coliform often adheres to and is transported on sediment particles. Buffers and Best Management Practices that are effective for sediment control can be effective for controlling fecal coliform transport. Bacterial contamination sources can originate from range of sources: failing septic systems, agricultural activities with livestock, pets, and wildlife. Failing septic systems have been an issue in the Chuckanut Creek estuary. The off-leash dog park at the Post Point Lagoon could be another potential source. Engineered water quality treatment systems may be useful in addressing issues at the Post Point Lagoon. Again more comprehensive engineered stormwater treatment on a drainage wide basis could be effective in reducing bacterial contamination in these and other marine and freshwater systems.

The literature shows that buffer effectiveness to improve and protect water quality is dependent on number of factors, chief among them are slope and the physical character of the vegetation (Desbonnet et al 994). Gentle slopes are more effective at slowing runoff velocities allowing sediments to be trapped and nutrients and other pollutants to be taken up by vegetation. Grass and herbaceous dominated buffers are superior at improving water quality for a number of parameters, but woody material provides separate and equally important features. A buffer with a low slope, that includes both herbaceous and woody plants, is most effective for a range of buffer functions.
Existing buffers around the Padden Creek and Whatcom Creek estuaries are located in areas of heavy development. Surface water in these areas may not have the opportunity to flow through vegetated buffers even if provided. Existing stormwater may be redirected into the City stormwater system or into individual stormwater systems as redevelopment occurs. Proposed buffer requirements should include these factors when determining the final width.

Table 3. Summary of sediment and pollutant removal effectiveness and wildlife habitat value based on buffer width (Desbonnet et al 1993, 1994)

Buffer Width	Pollutant Removal Effectiveness	Wildlife Habitat Value
16ft (5m)	Approximately 50% or greater sediment and pollutant removal	Poor habitat value, useful for temporary activity of wildlife.
32ft (10m)	Approximately 60% or greater sediment and pollutant removal	Minimally protects stream habitat, poor wetland habitat, useful for temporary activity of wildlife.
49ft (15m)	Greater then 60% sediment and pollutant removal	Minimum general wildlife and avian habitat value.
66ft (20m)	Greater then 70% sediment and pollutant removal	May have use as a wildlife travel corridor for some species as well as minimal to fair wildlife habitat.
98ft (30m)	Approximately 70% or greater sediment and pollutant removal	May have use as a wildlife travel corridor for some species as well as minimal to fair wildlife habitat.
164ft (50m)	Approximately 75% or greater sediment and pollutant removal	Minimum to fair general wildlife habitat value.
264ft (75m)	Approximately 80% or greater sediment and pollutant removal	Fair to good general wildlife and avian habitat value.
328ft (100m)	Approximately 80% or greater sediment and pollutant removal	Good general wildlife and avian habitat value; may protect significant wildlife habitat value.
656ft (200m)	Approximately 90% or greater sediment and pollutant removal	Excellent general wildlife and avian habitat value; likely to support diverse community.
1,968ft (600m)	Approximately 99% or greater sediment and pollutant removal	Excellent general wildlife and avian habitat value; likely to support diverse community; protection of significant species.

The literature indicates a vegetated buffer of 50 feet provides up to 60% removal of sediments; whereas a 98 foot buffer removes approximately 70% of the sediment. Increasing the buffer to 300 feet would provide an increase removal by a mere 10% (Desbonnet et al 1993, 1994). Table 3 provides a summary of buffer widths and their associated effectiveness in controlling sediment and pollution in surface water.

- **Shoreline Stabilization**

In the marine system, vegetation is only minimally effective at stabilizing slopes against tides and storm surges (Pentec 2001). However, vegetation can be effective at controlling toe of slope erosion. Vegetation provides effective erosion control and increases slope stability by reinforcing soils with root systems and by reducing soil moisture through evapotranspiration, reducing velocity of surface runoff, reducing erosion by spreading runoff water over a wide area, and promoting absorption and infiltration through the leaf layer and underlying soils (Brennan and Culverwell 2004). Soils, slope height and angle, drainage, and other factors are also important in determining risk of erosion. Native vegetation is particularly important in areas where bluffs are steep and eroding (Pentec 2001). Excessive erosion can increase sedimentation in the nearshore aquatic zone, resulting in decreased water quality. However, sediment input from eroding shores is also an important source of material for beach nourishment, formation and maintenance, particularly since most of the shoreline in the City of Bellingham has been separated from the nearshore by the railroad. This function would not be a limiting factor in pocket estuary protection.

- **Shade/Temperature Moderation**

Solar radiation exposure, which causes higher temperatures and desiccation, is a limiting factor for upper intertidal organisms (Brennan and Culverwell 2004). The degree of solar exposure has an affect in determining distribution, abundance, and species composition. How shade affects the nearshore in Puget Sound is not well understood. However, until more data can be gathered, it is important recognize that shade provided by shoreline vegetation can be a limiting factor and its importance should not be totally discounted. In particular, studies have shown that surf smelt (*Hypomesus pretiosus)* egg mortality is significantly higher on unshaded beaches.

- **Microclimate**

Temperature and moisture regulation, tidal inundation, wind exposure, and salt spray all contribute to microclimates in the nearshore marine, aquatic and terrestrial, and plant and animal communities (Brennan and Culverwell 2004; Pentec 2001). In turn, the marine environment is affected by upstream riparian conditions. The biggest effect at the marine/upland interface is temperature moderation; along the marine shoreline, uplands are cooler in the summer and warmer in the winter. Terrestrial temperature and moisture is also regulated by the density of vegetation. All these factors contribute to microclimates that support

a variety of fish, invertebrate, and wildlife species. Removing vegetation increases solar exposure and decreases organic matter, resulting in increased run-off rates, increased water temperature entering marine systems, desiccation of soils, and increased stress for animals dependent upon cool, moist conditions.

Studies are varied, but a study conducted by Brosofske et al (1997) indicated that buffer distances of 102 to 155 feet are required to maintain natural microclimate conditions in forested systems. These buffer widths may be difficult to achieve in urban settings such as Padden and Whatcom Creeks.

- **Large Woody Debris Contribution**

Large woody debris (LWD) provides many functions in aquatic ecosystem, including, habitat structure and bank stabilization (Brennan and Culverwell 2004). Coarse wood debris is an important segment of estuarine and ocean habitats. Many of the functions documented for LWD in the freshwater systems are analogous to similar functions in the marine system. Structurally, LWD provides roosting, nesting, refuge, and foraging opportunities for wildlife; foraging, refuge, and spawning substrate for fish; and foraging, refuge, spawning, and attachment substrate for aquatic invertebrates and algae in the marine/estuarine environment. It is also important in the development and maintenance of some saltmarsh communities. A lack of this material has a direct affect on the level of function provided to the system.

The literature recommendations vary for buffer width requirements to maintain a natural contribution of large woody debris to systems. No specific reference was directed to estuary large woody debris requirements. Most of the reviews are for streams. The literatures indicates forested buffers ranging between 50 and 100 feet may provide sufficient recruitment to meet system large woody debris requirements (Pentec 2001).

- **Wildlife Habitat**

Riparian and wetland habitats are some of the most diverse for animals if a system is undisturbed. The 'edge effect' between different plant assemblages, water regimes and physical structures provides more diverse and quantifiable habitat niches – thus providing a broader spectrum of habitats that support a wider variety of aquatic organisms, mammals and bird species (Pentec 2001). Vegetated buffers provide refuge from predation and weather, and habitat for nesting and feeding. Many species rely upon buffers for their entire life cycle, while others are dependent upon terrestrial areas for specific life stages such as seasonal migrations (Brennan and Culverwell 2004). Generally, vegetated buffer widths that support full wildlife habitat are greater than for other functions. Larger buffer widths are typically needed for species that are more sensitive to disturbance (Desbonnet et al 1994). In addition, connectivity of the buffer to adequate corridors and large forested areas determines the extent of functional wildlife habitat, particularly when evaluated for specific species. The effectiveness of vegetated

buffer for wildlife habitat is dependent upon buffer width, vegetation type (native vs. non-native) and vegetation diversity (more diverse vegetation promotes biodiversity) (*Id.)*.

Forested 100 foot buffers provide adequate buffer functions to maintain common songbird, small mammal and amphibian populations. Larger buffers specific for identified species are required to protect more sensitive species needs. See Table 3 for recommendations for wildlife habitat buffer widths.

- **Screening Noise, Light, Disturbance**

Buffers can protect wildlife by reducing or limiting the amount of noise, light and physical disturbance from human activities (Pentec 2001). All wildlife respond to human disturbances, however, the degree to which wildlife are affected by disturbance is dependent upon many factors including, intensity of the disturbance, duration, species, and the life-cycle stage of the species (*Id.)*. Losses in reproduction and overall population sizes can result from disturbance during nesting, breeding, feeding and resting. Screening functions are very limited at Post Point Lagoon, Padden Creek and Whatcom Creeks. Screening within portions of the Maritime Heritage Park provide this function at a higher level, although the north side of the park is still limited for these functions. A 50 foot buffer can be effective for this function.

- **Nesting, Feeding, Breeding**

Greater structural and vegetation diversity provides more habitat niches for nesting, feeding and breeding. Vertical complexity and diverse vegetation provides many strata for foraging wildlife. Surface water associated with vegetated buffers provides hydration and feeding opportunities for waterfowl, birds of prey, fish, mammals, and amphibians and reptiles (Pentec 2001). Post Point Lagoon, Padden Creek and Whatcom Creek currently do not have sufficient buffer widths to support these functions.

- **Travel Corridors**

Many species use riparian areas, wetlands, and undeveloped open spaces for travel, dispersion and migration (Pentec 20010). These habitat corridors become increasingly important as urbanization occurs. Padden Creek and Whatcom Creek have poor connections to travel corridors.

- **Leaf Litter/Insect Fall**

Leaf litter and insect fall is both an indirect and direct energy source for streams and rivers. Leaf litter adds organic matter to the system. Insect fall provides a food source for juvenile salmonids. The greatest recruitment of insects to the water surface is immediately adjacent to the waters edge or from over-hanging vegetation. Many insects consumed by fish in estuaries are produced in marsh vegetation that is below ordinary high water; and it is likely that shoreline shrub and forested areas are also important for insect production (Pentec 2001). Moist

microclimates that are created by riparian vegetation can be favorable to the production of prey resource insects for juvenile salmon (Brennan and Culverwell 2004).

Buffers of 50 to 75 feet provide appear to meet full litter and insect fall function (Pentec 2001). Post Point Lagoon, Padden Creek and Whatcom Creek currently fall below this threshold, but native plantings at Post Point Lagoon and areas of the Whatcom Creek estuary are expected to improve these functions over time.

BUFFER WIDTH RECOMMENDATIONS

Chuckanut Creek Pocket Estuary

***Summary of Key Functions*:**
This system provides high quality estuarine habitat with multiple habitat features that support significant wildlife and shellfish populations. Existing buffers are providing high water quality, shoreline protection, and all wildlife habitat functions. Water quality issues from Fecal coliform have been documented for this system.

Goals

- Preserve and protect existing shoreline natural resources including the estuary, beaches, shorelines, fragile ecological areas, fish and wildlife habitats, native vegetation, associated critical areas and buffers. Due to the quality of the habitat in this estuary, the Chuckanut railroad pocket estuary should have the highest priority for preservation.
- Preserve and protect the connectivity between the Chuckanut estuary and Chuckanut Creek by protecting habitat corridors.
- Improve water quality with emphasis on control of bacterial contamination.

Objectives

- Protect critical areas and shoreline ecological processes and functions through regulatory and non-regulatory means, which may include, acquisition of key properties, regulation of development, and incentives.
- Manage and treat stormwater and wastewater properly. This may include extending the City sewer to serve areas currently without service.
- Maintain wildlife function within buffers and estuary.

Buffer Recommendation

- Wildlife Function: Maximum width [200 feet where available, not less than 150 feet] – should be applied to sites where forested or naturally vegetated buffer is present.
- Water Quality Function: 50 feet on gently sloping sites and 100 on sites with moderate to steep slopes (should be applied to sites where the buffer has already been decreased to less than 100 feet). There should be no pesticides, herbicides or fertilizer application allowed in the buffer. Un-groomed native vegetation should be encouraged.

Edgemore South Pocket Estuary

***Summary of Key Functions*:**
This pocket estuary is more functionally a wetland than an estuary. The feature provides moderate to high quality wildlife habitat for avian and terrestrial wildlife species, but lacks fish access. Buffer functions are currently moderate to high for most functions, but the properties adjacent to this feature are currently under development for single family homes. Current development site preparation includes vegetation removal and significant areas of bare ground. No erosion control features other than a thin layer of mulch are present. Erosion of sediment into the estuary could occur under current conditions and during construction of houses.

Goals

- Preserve and protect estuary and buffer functions. The buffer of this wet pocket is very steep and vegetated with native trees and shrubs. The maximum buffer distance should be maintained.
- Preserve and protect the connectivity with the Chuckanut estuary and Clark's Point.
- Preserve existing water quality of the estuary.

Objectives

- Protect critical areas and shoreline ecological processes and functions through regulatory and non-regulatory means, including buffer setbacks, regulation of development, and incentives.
- Improve water quality by eliminating tight-line drainages from residential development.
- Regulate the use of pesticides, herbicide and fertilizers in residential yards.

Buffer Recommendation (due to steep bluff this should be measured from top of bank)

- Wildlife associated emphasis: 100 feet
- Water Quality: 50 feet (in areas where the native vegetation community is disturbed)

Edgemore NorthPocket Estuary

***Summary of Key Functions*:**
This pocket estuary provides moderate wildlife habitat for avian and terrestrial wildlife species and excellent fish resources. Buffers are currently functioning at moderate levels for most functions, but have been degraded by removal of shrubs and trees. Conifer trees are essentially absent from the buffer. The estuary appears to be well linked to other important fish habitat and is likely an important habitat for salmonid, forage fish and ground fish species.

Goals

- Preserve and protect existing shoreline natural resources including the estuary, beaches, shorelines, fragile ecological areas, fish and wildlife habitats, native vegetation, associated critical areas and buffers.
- Restore degraded buffer habitat.
- Improve and protect existing water quality in the estuary.

Objectives

- Protect critical areas and shoreline ecological processes and functions through regulatory and non-regulatory means, including buffer setbacks, regulation of development, and incentives.
- Regulate the use of pesticides, herbicide and fertilizers in residential yards.
- Protect and restore native buffer vegetation by removing of non-native vegetation and replacing with native trees and shrubs.
- Improve water quality by eliminating tight-line drainages from residential development.
- Limit disturbances to aquatic habitat – restrict the use of boats and docks in the estuary.

Buffer Recommendations

- Wildlife associated emphasis: If existing buffer is dominated by native vegetation, buffer should be 150 feet.
- Water Quality: 50 feet from top of bank.

Post Point Lagoon Pocket Estuary

***Summary of Key Functions*:**
This estuary currently has the potential to provide important fish and wildlife habitat functions, but has been limited by past uses. It is located near an active heronry and is used lightly by wintering waterfowl. The habitat is somewhat isolated from other terrestrial habitat, but there is a narrow habitat corridor for terrestrial species along the shoreline. The estuary appears to be well linked to other important aquatic habitats and is likely important to salmonid, forage fish and ground fish species.

The existing buffer is in poor condition, but is part of a recent City enhancement project that includes extensive planting of native plants and fencing. The Post Point Lagoon has experienced significant impacts associated with an off-leash dog park where dogs access the lagoon. Free access to the lagoon has resulted in a lack of ground cover and sediment being carried into the lagoon along with potential bacterial contamination from dog feces. The City has recently revegetated much of the buffer around the lagoon and restricted dog access to a limited portion of the lagoon shoreline. However, dog activity could still result in wildlife disturbance within the lagoon and associated buffer reducing its overall potential wildlife function. Impacts to aquatic life within the lagoon from dog access to the lagoon is unclear. Runoff from the adjacent off-leash areas continues to enter to lagoon and is a potential source of sediment and bacterial contamination.

Goals

- Preserve and protect existing shoreline natural resources including the estuary, beaches, shorelines, fragile ecological areas, fish and wildlife habitats, native vegetation, associated critical areas and buffers.
- Enhance and restore protect estuary and buffer functions.
- Improve water quality.

Objectives

- Maintain and improve estuary and buffer functions.
- Improve habitat and water quality by restricting use of estuary and adjacent buffer by domesticated animals.
- Maintain freshwater input to estuary.
- Improve water quality in fresh water tributary by implementing buffer and vegetation enhancement and preservation up-stream; improve stormwater treatment.
- Restore and enlarge salt marsh habitat.

Buffer Recommendations

- Wildlife associated emphasis: 200 feet
- Water Quality: 50 feet (including the following features: estuary ordinary high water mark, freshwater tributary, culvert(s) which drain the off-lease dog park)

Padden Creek Pocket Estuary

***Summary of Key Functions*:**
Padden Creek estuary currently has the potential to provide important fish and wildlife habitat functions, but is limited by surrounding development. The habitat is somewhat isolated from other terrestrial habitat, but has linkages to the Padden Creek riparian corridor. There is little to no connection by terrestrial habitat along the shoreline to other shoreline habitats. The estuary appears to be moderately well linked to other important aquatic habitats and is connected to a salmonid spawning stream. Fish residence within the estuary is likely limited, since the estuary drains regularly with the tides. Mudflat habitat is well represented and utilized by birds year round.

Padden and Whatcom Creeks offer the most estuary area for improvement and or restoration, with Padden having more area. Due to existing conditions, Padden currently offers better habitat opportunities. Padden should receive priority for habitat restoration and overall preservation.

Goals

- Restore and maintain the Padden Creek delta as a viable urban marsh/estuary that supports diverse wildlife habitat.
- Enhance and restore estuary and buffer functions.
- **Improve water quality by determining runoff sources and treat prior to entering lagoon.**

Objectives

- Improve water quality in Padden Creek by implementing buffer and vegetation enhancement and preservation up-stream; improve stormwater treatment throughout watershed.
- Maintain and improve estuary and buffer wildlife functions with a particularly emphasis on habitat connectivity, and screening functions.
- Encourage lower impact urban land uses and technologies adjacent to estuary and buffer.

- Provide development incentives for buffer area increases and habitat improvements.
- Protect and improve riparian vegetation up-stream**.**

Buffer Recommendations

- Wildlife and water quality – 50 feet minimum.

Whatcom Creek Pocket Estuary

***Summary of Key Functions*:**
Whatcom Creek Estuary has been studied more extensively than any other estuary system in the City. This estuary has undergone extensive enhancement within the buffer and aquatic habitats over the past 15 years. The estuary continues to function well for both fish and wildlife despite the estuary's location within a highly developed area. Fish habitat has been the issue of much study for this system and could benefit greatly by construction of aquatic habitat islands in the adjacent marine system to provide more continuity and connectivity for juvenile fish.

Goals

- Preserve and protect estuary and buffer functions.
- Improve habitat connectivity between estuary and other habitats in Bellingham Bay.

Objectives

- Maintain and improve estuary and buffer function through plantings and installation of habitat features (completed).
- Provide habitat refuge and connectivity within Bellingham Bay via habitat islands.
- Provide terrestrial habitat corridors along shorelines to other significant habitats.
- Continue to work on remediation of old landfill sites. Remediation work associated with the Holly Street landfill has been completed. Work associated with Roeder Street Landfill still remains to be performed.

Buffer Recommendations

- Wildlife and water quality – 50 feet minimum.

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Figure 1. Vicinity Map
Southside Pocket Estuaries

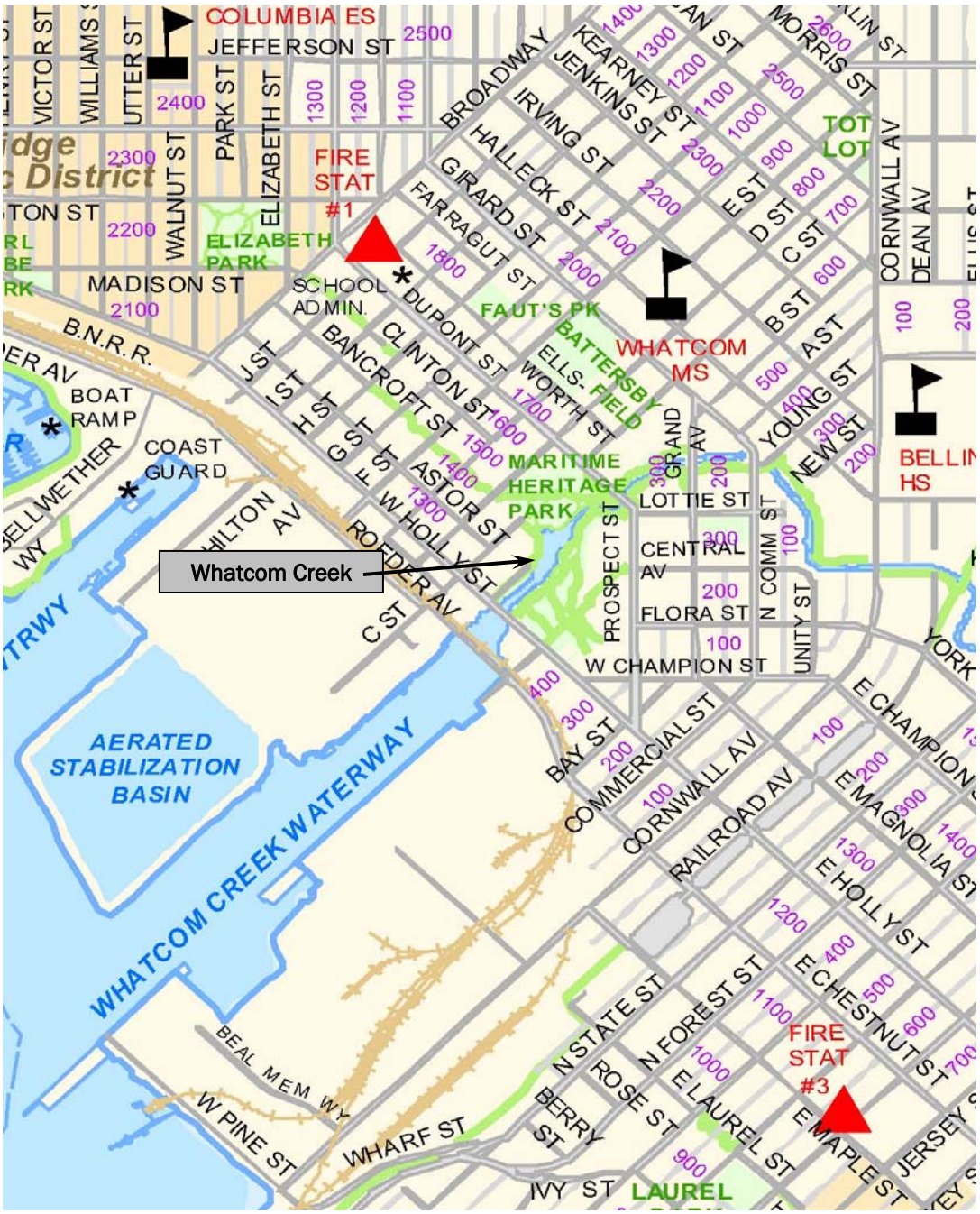

Figure 2. Vicinity Map
Central City Pocket Estuaries

Figure 3A. Chuckanut Creek Pocket Estuary

Figure 3B. Edgemore South Pocket Estuary

Figure 3C. Edgemore North Pocket Estuary

Figure 3D. Post Point Lagoon Pocket Estuary

Figure 3E. Padden Creek Pocket Estuary

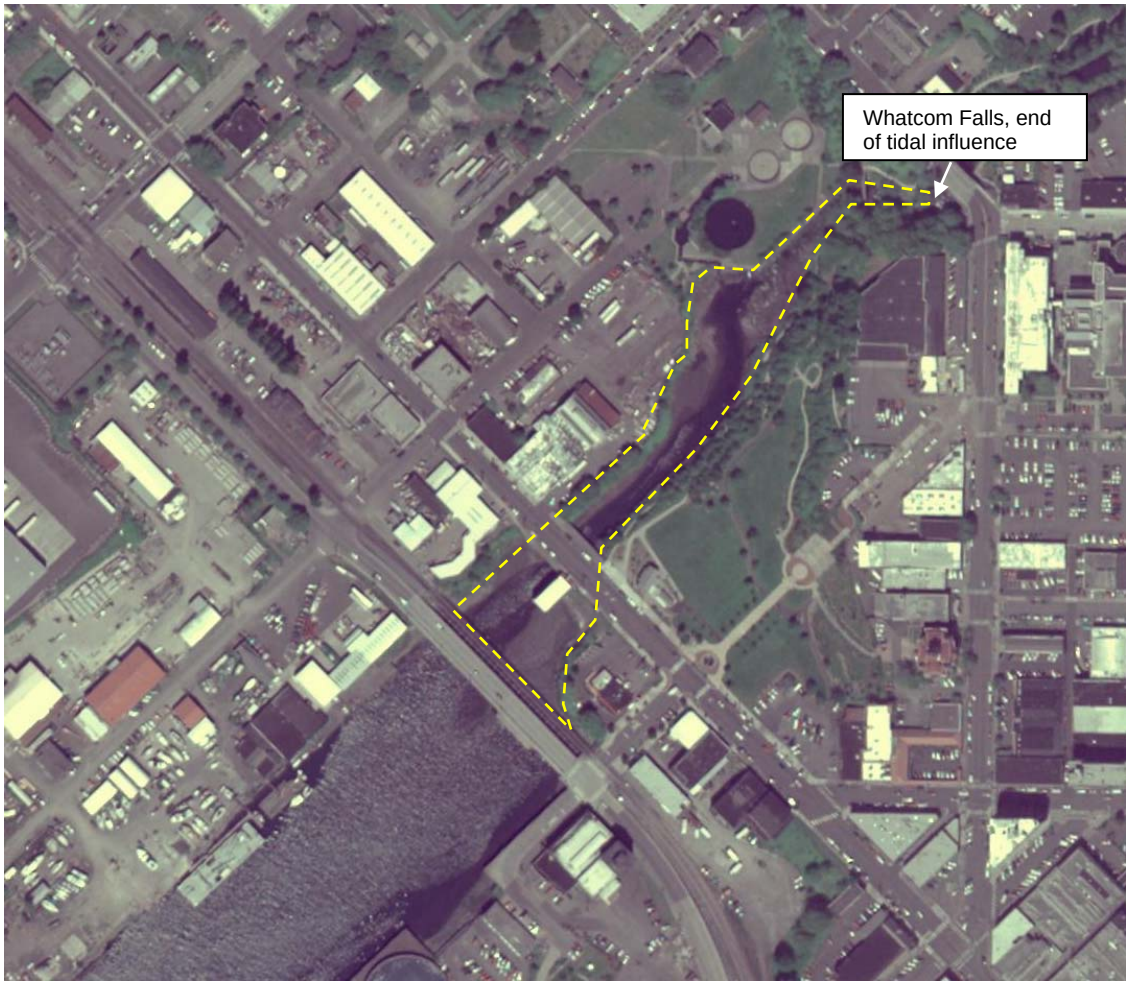

Figure 3F. Whatcom Creek Pocket Estuary

Skagit System Cooperative
Research Department
P.O. Box 368
11426 Moorage Way
La Conner, WA 98257-0368

THE IMPORTANCE OF NON-NATAL POCKET ESTUARIES IN SKAGIT BAY TO WILD CHINOOK SALMON: AN EMERGING PRIORITY FOR RESTORATION

Eric Beamer[1], Aundrea McBride, Rich Henderson, and Karen Wolf

May 2003

INTRODUCTION

The Skagit River basin, encompassing over 3,100 square miles (8,030 square kilometers), is one of the largest and last remaining strongholds of fish and wildlife habitat in the Puget Sound region. The geomorphic output from this watershed is an 80,728 acre (32,670 hectare) delta, connecting the river to Skagit Bay, part of the protected inland waters of the larger Puget Sound fjord estuary system. Together with Skagit Bay, the Skagit River watershed and delta estuary form the juvenile rearing habitats for endangered Skagit Chinook. For the last 10 years the Skagit System Cooperative (SSC) has been studying habitat use of juvenile chinook salmon in order to identify opportunities for habitat restoration. Past results have directed us to Skagit Bay nearshore habitats, where we have identified pocket estuaries (small sub-estuaries connected to Skagit Bay) as a priority for research and restoration.

PREVIOUS RESEARCH

SSC research has focused on patterns of juvenile wild chinook abundance, size, growth, survival, and population structure (i.e., juvenile life history types) within estuarine habitat available to Skagit-origin chinook. Due to conversion for agriculture and residential uses, pristine estuarine delta habitat has shrunk by approximately 80% (Collins *et al*., 2001). Enormous delta habitat loss has lead to research into whether present day estuarine habitat conditions may be adversely influencing wild Skagit Chinook populations, which have been shown to extensively use the delta for rearing (Beamer *et al*., 2000; Congleton *et al*., 1981).

Our results indicate that the relationship between freshwater wild juvenile chinook population size and wild juvenile chinook abundance in estuarine river delta habitat is density dependent (asymptotic) (Figure 1). This result supports the idea that present day Skagit delta habitat conditions are limiting the capacity of delta-rearing chinook. Conversely, the proportion of the total wild juvenile chinook population in Skagit Bay that bypasses rearing in delta habitats and migrates directly into Skagit Bay (we term this life history type: fry migrant) increases with wild

[1] ebeamer@skagitcoop.org

smolt outmigration levels above 2,500,000 (Figure 2). This finding indicates that at least some of the density dependence occurring in the delta results in the displacement of juvenile chinook out of the rearing habitats in the delta where they end up in Skagit Bay. Additionally, an independent study (Greene *et al*., 2003) using environmental data and adult returns of wild Skagit Chinook has shown that factors present during the nearshore life stage (i.e., when juvenile chinook are present in Skagit Bay and the Puget Sound fjord estuary) significantly influence adult spawning recruitment, further supporting the need to understand the nearshore ecosystem and its role in the recovery of Puget Sound Chinook. These findings have raised questions about where fry migrants go within Skagit Bay. Are there preferred habitats for fry migrant chinook? What functions do they serve? Could pocket estuaries be a significant habitat for wild Skagit Chinook displaced from the delta estuary?

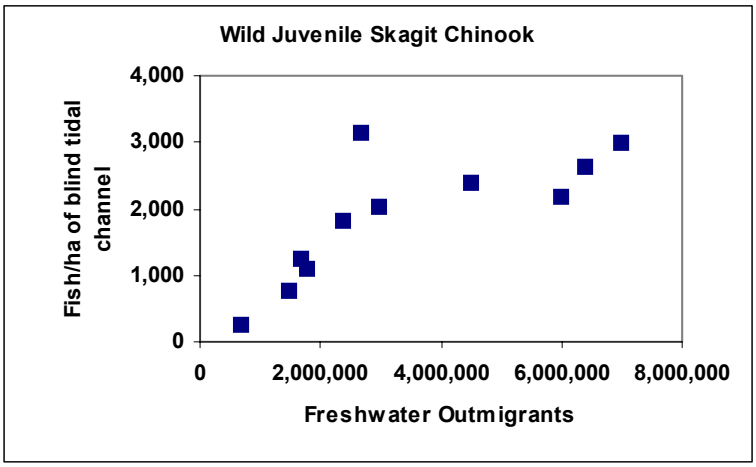

Figure 1. The relationship between freshwater wild chinook smolt population size and density of juvenile wild Skagit Chinook in Skagit River delta habitat, 1992-2002. The number of chinook per unit area within the delta levels-off as the total number of outmigrants increases, indicating density dependent use of the delta. Freshwater chinook smolt population estimates are from D. Seiler, WDFW, Olympia, WA. Juvenile chinook density estimates in delta habitat are seasonal averages derived from 8 index sites using fyke trapping methods.

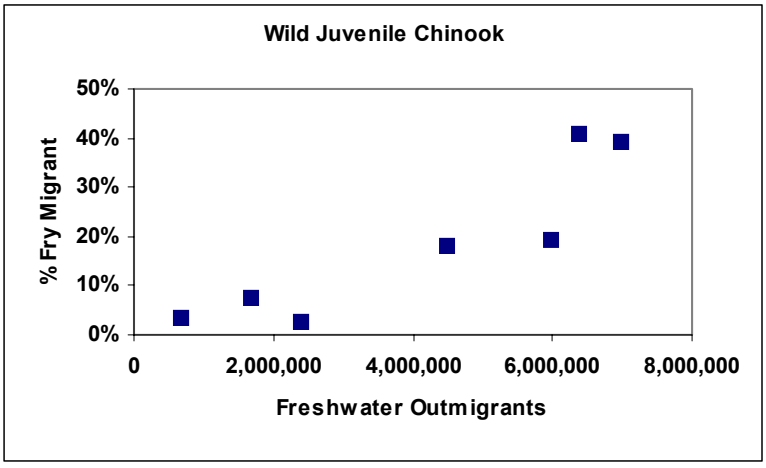

Figure 2. The relationship between freshwater wild chinook smolt population size and the proportion of wild juvenile chinook population with a fry migrant life history type, derived from Skagit Bay index beach seine sites, 1996-2002. The number of fry migrant chinook (those migrating directly to Skagit Bay without residing in the delta) increases as the outmigrating population increases, indicating that some fish are displaced from the delta and tend to become fry migrants. Freshwater chinook smolt population estimates are from D. Seiler, WDFW, Olympia, WA.

POCKET ESTUARY HABITAT

Pocket estuaries are small sub-estuaries within the larger Skagit Bay estuary, that form behind spit or barrier beach landforms at submerged, tectonically- or glacially-derived valleys or at small creek deltas (Figure 3). They are typically tidal lagoons with fringing unvegetated flats, saltmarsh and tidal channels. Compared to adjacent intertidal habitat in Skagit Bay, pocket

estuaries: (1) reflect habitat types consistent with lower wave or long-shore current energy, and (2) have local freshwater inputs (surface or groundwater sources) where salinity is depressed during some part of the year (usually winter and spring). Historic pocket estuaries in Skagit Bay range in size from approximately 4 to 400 acres (1.6 to 162 hectares).

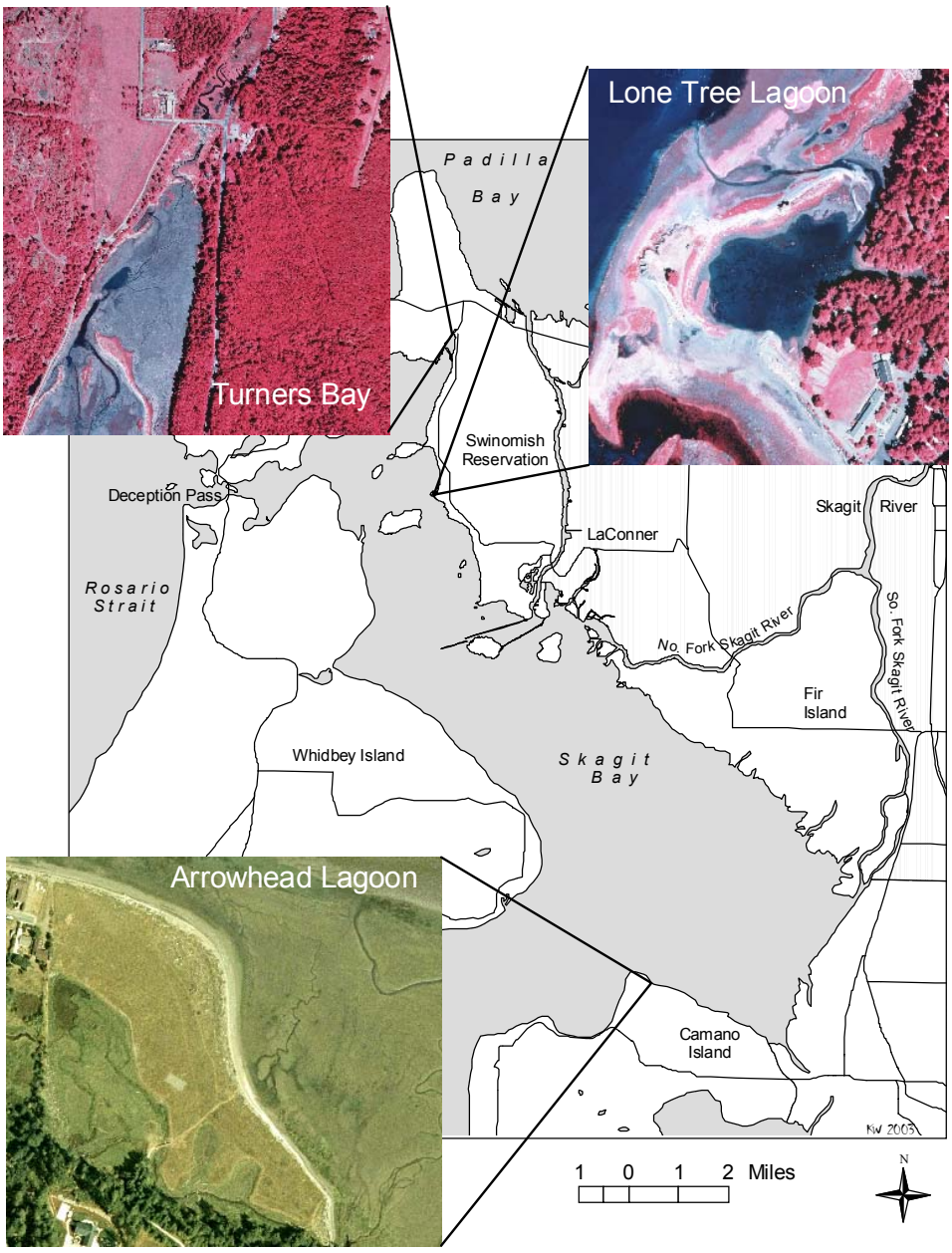

Figure 3. Examples of pocket estuaries in Skagit Bay that are currently accessible to non-natal salmon use.

POCKET ESTUARIES AS REARING HABITAT

Juvenile chinook salmon utilize pocket estuaries (Figure 4A). We term juvenile chinook use of pocket estuaries as "non-natal" because chinook do not originate from the watersheds draining into the pocket estuaries. All chinook utilizing pocket estuaries must find them via migration

pathways through Skagit Bay. Skagit River origin chinook can migrate from the larger Skagit River and delta into nearshore areas of Skagit Bay, and then into a pocket estuary adjacent to Skagit Bay.

Abundance of wild chinook fry migrants in pocket estuary habitat (Figure 4A) more closely mimics wild juvenile chinook use in the delta (Figure 4B) than in nearshore (Figure 4C) or offshore (Figure 4D) areas adjacent to pocket estuaries. Juvenile chinook are over 100 times and 10 times more abundant in pocket estuary habitat than in offshore or nearshore habitat, respectively.

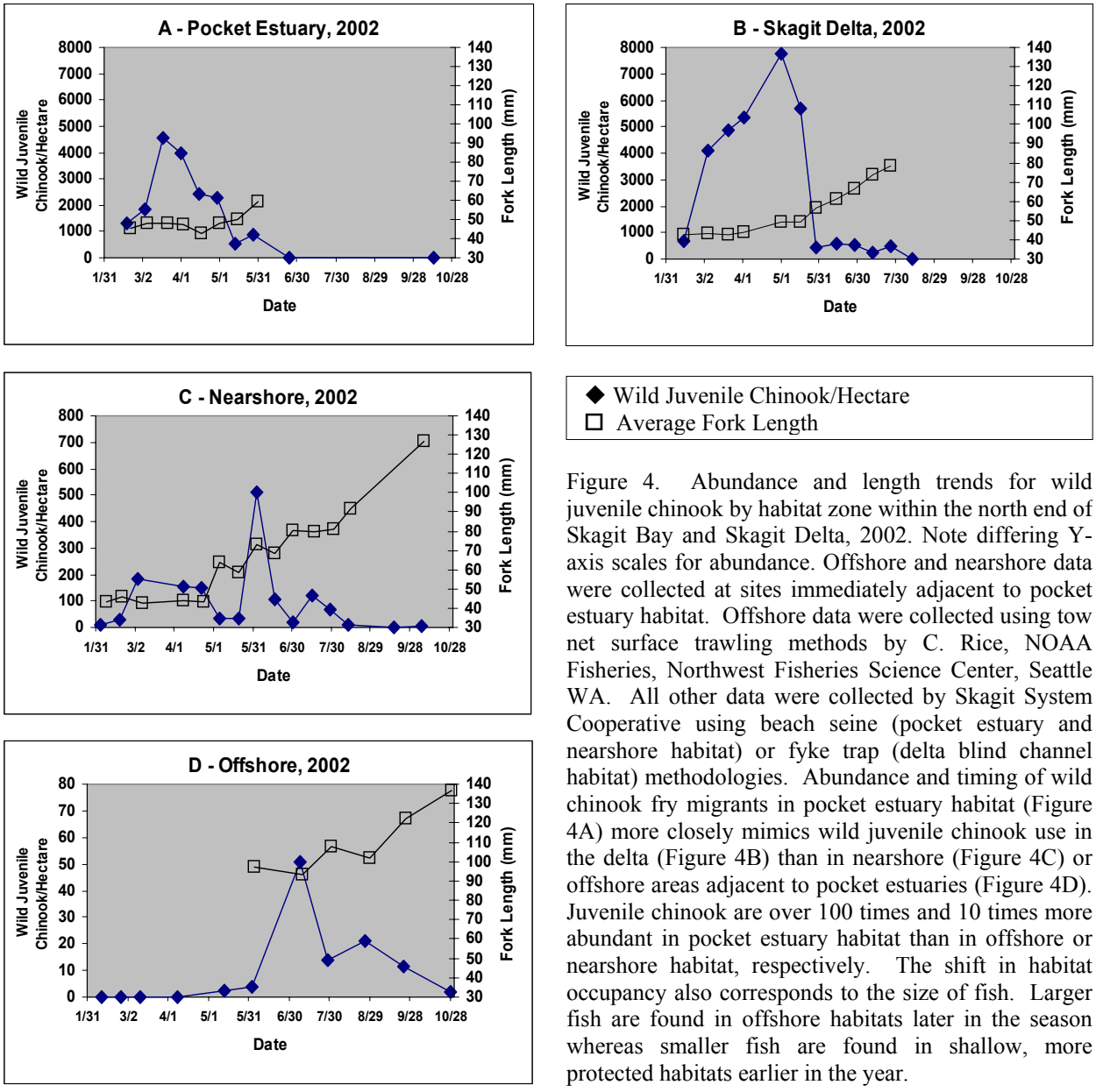

Figure 4. Abundance and length trends for wild juvenile chinook by habitat zone within the north end of Skagit Bay and Skagit Delta, 2002. Note differing Y-axis scales for abundance. Offshore and nearshore data were collected at sites immediately adjacent to pocket estuary habitat. Offshore data were collected using tow net surface trawling methods by C. Rice, NOAA Fisheries, Northwest Fisheries Science Center, Seattle WA. All other data were collected by Skagit System Cooperative using beach seine (pocket estuary and nearshore habitat) or fyke trap (delta blind channel habitat) methodologies. Abundance and timing of wild chinook fry migrants in pocket estuary habitat (Figure 4A) more closely mimics wild juvenile chinook use in the delta (Figure 4B) than in nearshore (Figure 4C) or offshore areas adjacent to pocket estuaries (Figure 4D). Juvenile chinook are over 100 times and 10 times more abundant in pocket estuary habitat than in offshore or nearshore habitat, respectively. The shift in habitat occupancy also corresponds to the size of fish. Larger fish are found in offshore habitats later in the season whereas smaller fish are found in shallow, more protected habitats earlier in the year.

There is a seasonal shift in habitat occupancy by juvenile chinook from shallow, more protected habitats, like pocket estuary and delta blind channel, to offshore areas later in the year. During the period from February through May large numbers of fry migrant chinook utilize and appear

to prefer pocket estuary habitat connected to Skagit Bay, compared to adjacent nearshore and offshore areas. Timing of wild chinook fry migrants in pocket estuary habitat (Figure 4A) more closely mimics wild juvenile chinook use in the delta (Figure 4B) than in nearshore (Figure 4C) or offshore (Figure 4D) areas adjacent to pocket estuaries.

The shift in habitat occupancy also corresponds to the size of fish. Larger fish are found in offshore habitats later in the season whereas smaller fish are found in shallow, more protected habitats earlier in the year. Juvenile chinook start out similar sized in February, but for the rearing period before May, juvenile chinook in the shallow pocket estuary habitat (0.5 m max. depth) averaged 4-6 mm longer than juvenile chinook sampled from the deeper (2.8 m max. depth) nearshore sites immediately adjacent to the pocket estuary (T-test, $p < 0.001$). This suggests that the fish within the pocket estuary may be a more isolated (and a rearing rather than migrating) population, or that pocket estuary habitat may be more productive than the more exposed nearshore environment. After May, fish in the nearshore environment were larger than the few remaining fish in the pocket estuary. The increase in average fork length coincided with fish leaving pocket estuary and delta habitats. These fish presumably migrated to Skagit Bay nearshore and offshore habitats.

POCKET ESTUARIES AS REFUGE FROM PREDATORY FISH

Pocket estuaries appear to be a refuge from larger predatory fish for fry migrant chinook, compared to the adjacent nearshore environment. This working hypothesis is based on: (1) preliminary data establishing a relationship between predator size and prey size, and (2) applying the relationship to size and abundance data of potential predator species and juvenile chinook found in both pocket estuary and adjacent nearshore habitat.

We assembled predator fish species into three groups: yearling salmonids (coho and chinook), larger salmonids (subadult cutthroat and steelhead, and subadult and adult native char), and scuplins (mostly Pacific Staghorn). This preliminary analysis did not include flatfish because of a too low sample size of flatfish diets. Each species included in the predator/prey dataset were observed to prey on fish, including juvenile chinook salmon. Our predator/prey relationship was derived from diet samples of 101 predators ranging in length from 42mm to 640mm collected in the Skagit estuary during the juvenile chinook outmigration season. Overall, 39.6% of the predator samples had fish in their diet. With our limited dataset, the frequency of fish in the diets of predators was related to predator size, not the groupings of species. Fish were not present in the diets of predators until they reached a length range of 75mm to 100mm. Fish were consistently present in the diets of predators greater than 60% of the time when the predators were larger than 125mm in length.

By applying these results to estimate the density of predators that are large enough to prey on juvenile chinook, we find that rearing in pocket estuaries exposes fry migrant chinook to a much lower risk of predation than nearshore habitat. Sculpins are very abundant in pocket estuary habitat (Figure 5A), but they are not large enough to prey on averaged-sized chinook salmon (Figure 5C). Conversely, though predator density is lower in nearshore habitat (Figure 5B), a high percentage of predators (100% in the case of larger salmonids) are large enough to prey on average-sized juvenile chinook (Figure 5D).

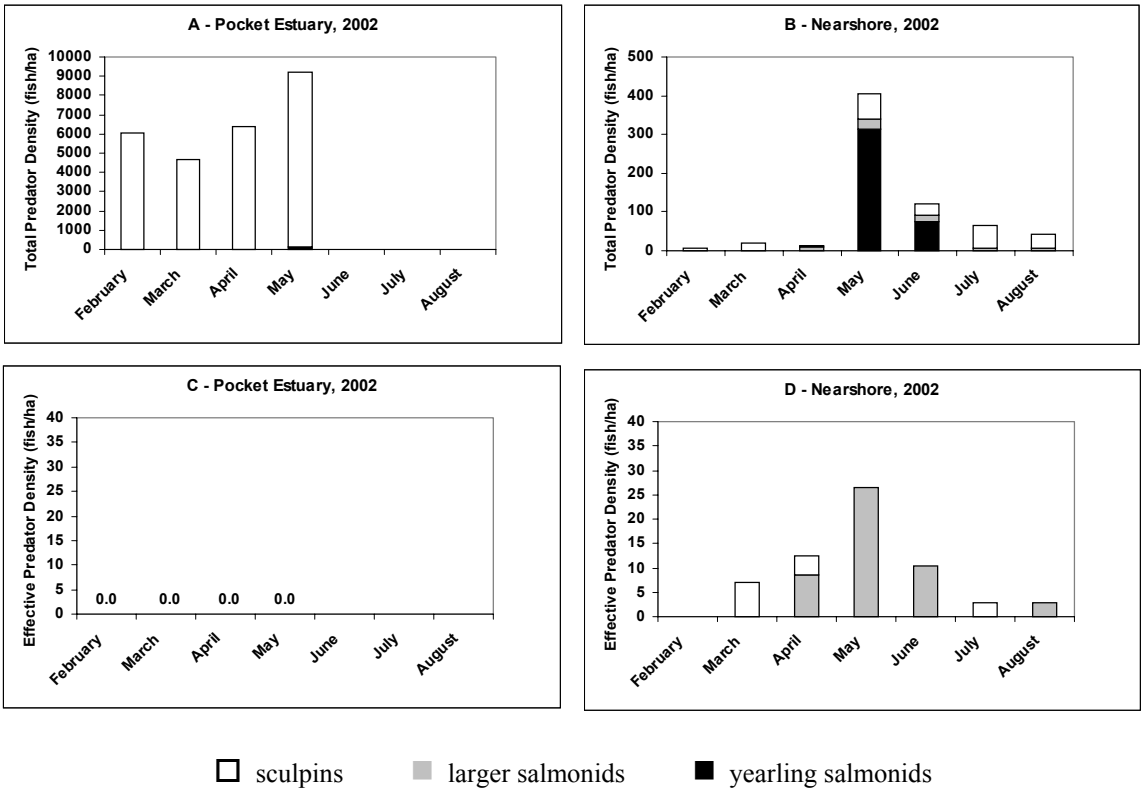

Figure 5. Density of all predators in pocket estuary compared to nearshore habitats (5A and 5B), and density of effective predators (i.e., predators large enough to eat sub-yearling chinook) in pocket estuary compared to nearshore habitats (5C and 5D). We derived a linear regression relationship ($r^2 = 0.69$, $p = 2.21 \times 10^{-11}$) between predator length and the maximum length of prey found in the 40 samples of predators with fish in their diet. The regression equation is: Maximum Prey Length in mm = 0.238 (Predator Length in mm) + 21.6. We applied the regression analysis to the length frequency of predators by month to calculate the proportion of the predator population that effectively posed a risk to averaged-size sub-yearling chinook. The proportion was used to calcuate the density of "effective" predators in pocket estuary (Figure 5C) and nearshore habitat (Figure 5D). We only graphed months when significant numbers of juvenile chinook are present in pocket estuaries or nearshore habitat.

POCKET ESTUARY LOSS AND PROPOSAL FOR RESTORATION

Loss and degradation of pocket estuary habitat reduces the ability of fry migrant chinook to rear in a shallow, more protected estuarine environment. All twelve historic pocket estuaries in our Skagit Bay study area, totaling nearly 656 acres (265 hectares), have been either degraded or completely removed from non-natal salmon rearing through land use, thereby significantly limiting the opportunity for fry migrant chinook to utilize these habitats (Figure 6). Eighty-nine percent (89%) of the total historic pocket estuary area is currently inaccessible to non-natal salmon use and the habitat-forming forces of tidal hydrology. The main causes of inaccessibility include: tide gates, roads, or other fills within tidal wetlands. An additional one percent (1%) of the historic pocket estuary area has been dredged to create a small boat basin. While estuarine restoration in the Skagit has recently focused on habitat in the delta (e.g., U.S. Army Corps of Engineers, 1998), an additional chinook recovery priority should include restoration and protection of the pocket estuaries within the Skagit Bay nearshore environment.

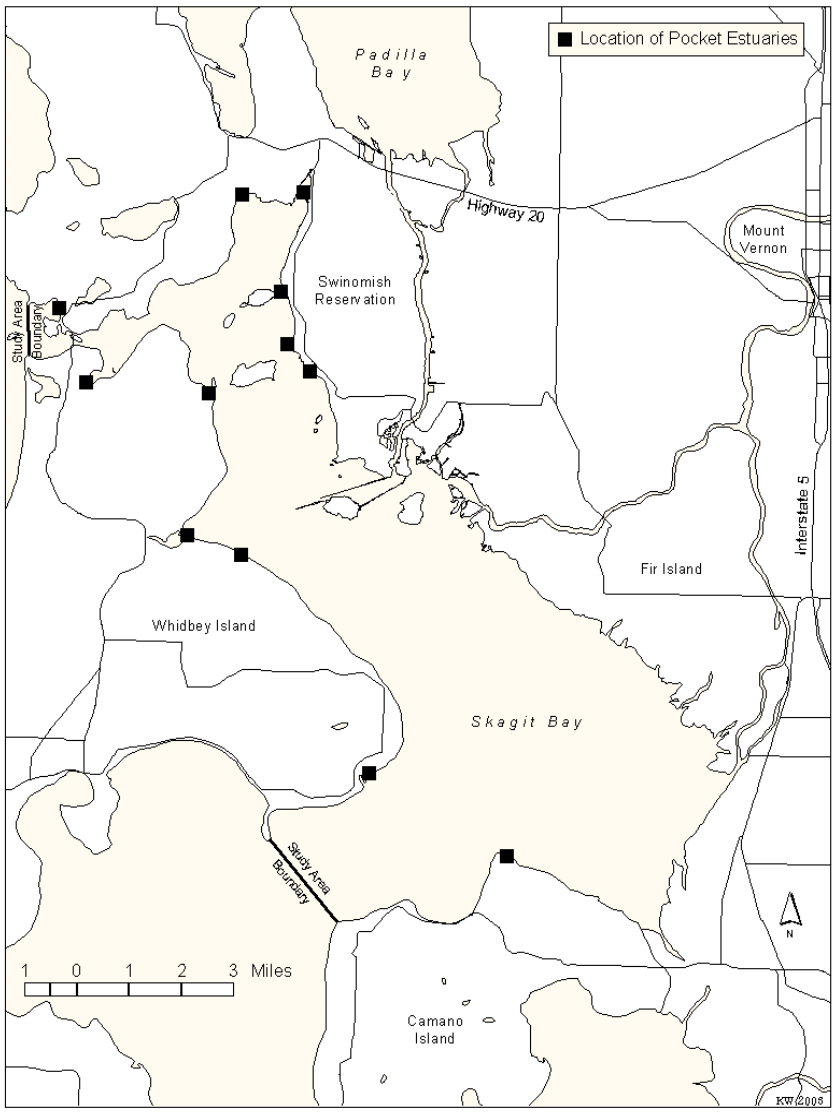

Figure 6. Location of present day or historic pocket estuaries in Skagit Bay.

CAN POCKET ESTUARY RESTORATION REPLACE DELTA RESTORATION?

We assert that both pocket estuary and delta estuary restoration are important to the recovery of Skagit Chinook. Because present day delta conditions appear to be contributing to a higher percentage of the total juvenile wild ocean type chinook population being fry migrants there may be the temptation by some habitat managers or interest groups to advocate pocket estuary restoration as a substitution for delta restoration. Pocket estuary restoration is not a substitute for delta restoration because of differences in restoration potential and habitat use by different life history types.

The limited extent of pocket estuary habitat cannot substitute for the vast extent of delta habitat. Pocket estuaries are limited in extend by geology, landform, and coastal processes (long shore sediment drift, wave energy/exposure). Under present day conditions, the contiguous habitat

area of the Skagit delta that is exposed to tidal and river hydrology totals about 7,883 acres (3,190 hectares). This is mostly the delta area in the vicinity of Fir Island, but it also includes a fringe of estuarine emergent marsh habitat extending from La Conner to the north end of Camano Island. Historically, the contiguous habitat area of the Skagit delta included the same area, but also included the Swinomish Channel corridor and extended to the southern end of Padilla Bay (Collins *et al*., 2001). The historic area equaled 28,370 acres (11,481 hectares). In contrast, our preliminary inventory of historic pocket estuary area estimates 656 acres (256 hectares) were available to juvenile salmon. Under present day pocket estuary conditions, only about 73 acres (30 hectares), including the pocket estuary dredged into a boat basin, can be utilized by juvenile salmon. Therefore, the potential for pocket estuary restoration is limited to 583 acres (236 hectares). Delta restoration potential is over 20,000 acres (8,093 hectares). While societal issues will reduce both amounts significantly, the dramatic difference in the potential area that could be restored between delta and pocket estuaries makes substituting pocket estuaries for delta habitat a physical impossibility. Even if 100% of historic pocket estuary is restored, less than 3% of the total lost estuary habitat in the Skagit is regained.

Pocket estuary and delta habitat are utilized by different juvenile chinook life history types and are therefore not necessarily equal on a per area basis. This is especially true if differences in survival to the adult life stage exist between juvenile life history types, and recovery of the overall chinook population is a management goal. Pocket estuary restoration should be pursued for the benefit the fry migrant life history type. The Skagit results show a consistent presence of fry migrant chinook in Skagit Bay over seven years of sampling (Figure 2). While we do not currently know Skagit Chinook survival differences between three possible juvenile life history types that vary in early estuarine rearing: (1) fry migrants that use pocket estuaries, (2) fry migrants that do not use pocket estuaries, and (3) delta-rearing individuals, collaborative research supported by Skagit System Cooperative, USGS Western Fisheries Research Center, Seattle City Light, Washington Department of Fish and Wildlife, and NOAA Fisheries is studying this question using otolith technology. Several studies, however, show that juvenile chinook with shorter (or no) estuary residence periods survive to the adult life stage at much lower rates than juvenile chinook with extended estuary residence periods (Reimers 1973, Levings et al., 1989). The definitions of estuarine rearing in these studies more closely resembled the estuarine use by juvenile chinook that occurs in delta habitat and not the more exposed habitats in Skagit Bay or the larger Puget Sound estuary system.

Pocket estuary use by chinook displaced from rearing in delta habitat can be viewed as their "Plan B" option to early estuary rearing ("Plan A" was rearing in the delta). Survivors from both the delta-rearing and fry migrant life history types must ultimately migrate to Skagit Bay. The fry migrants, however, do so at an earlier time of year and at a much smaller size. Even if survival potential after early estuary rearing is the same for delta-rearing and pocket estuary rearing chinook, fry migrants are exposed to the perils of finding pocket estuary habitat in Skagit Bay (a minimum distance of 7-11 miles) at a time of year (February and March) when they are very small in size (<45 mm fork length) compared to the size of delta-rearing fish (>60 mm fork length) at the end of delta residence in May or June. The presumed higher mortality associated with this earlier migration of smaller fish through Skagit Bay would be an additional source of mortality not mitigated by increases in pocket estuary habitat alone.

CONCLUSION

Pocket estuaries are clearly utilized by wild juvenile fry migrant chinook during late winter through spring. Early in the year, pocket estuaries may be a safer environment for fry migrant chinook than the more exposed nearshore and offshore areas of Skagit Bay. Similar to our understanding of delta habitat for delta-rearing chinook, pocket estuaries could provide extended rearing and growth opportunity for fry migrant chinook during late winter and spring months, and refuge from larger predatory fish. Juvenile chinook later in the year are much larger in size and presumably are more capable of handling the perils of deeper and more offshore habitats.

Considering the dramatic loss of pocket estuary habitat within our study area, habitat restoration makes sense. Ample opportunities for habitat restoration projects of various size and complexity exist within the Skagit Bay. Pocket estuary restoration should be pursued for the benefit of the fry migrant life history type known to be consistently present in Skagit Bay. Pocket estuary restoration may secondarily be a strategy to alleviate the effects of delta overcrowding, but delta restoration should remain the primary restoration strategy for delta-rearing chinook. Continued research regarding fry migrant use of pocket estuary habitats will help to further prioritize and support restoration efforts.

ACKNOWLEDGMENTS

This research has been conducted, in part, through funding provided by: U. S. Department of Interior Pacific Salmon Treaty Implementation, U. S. Department of Commerce Pacific Coastal Salmon Recovery, and Seattle City Light.

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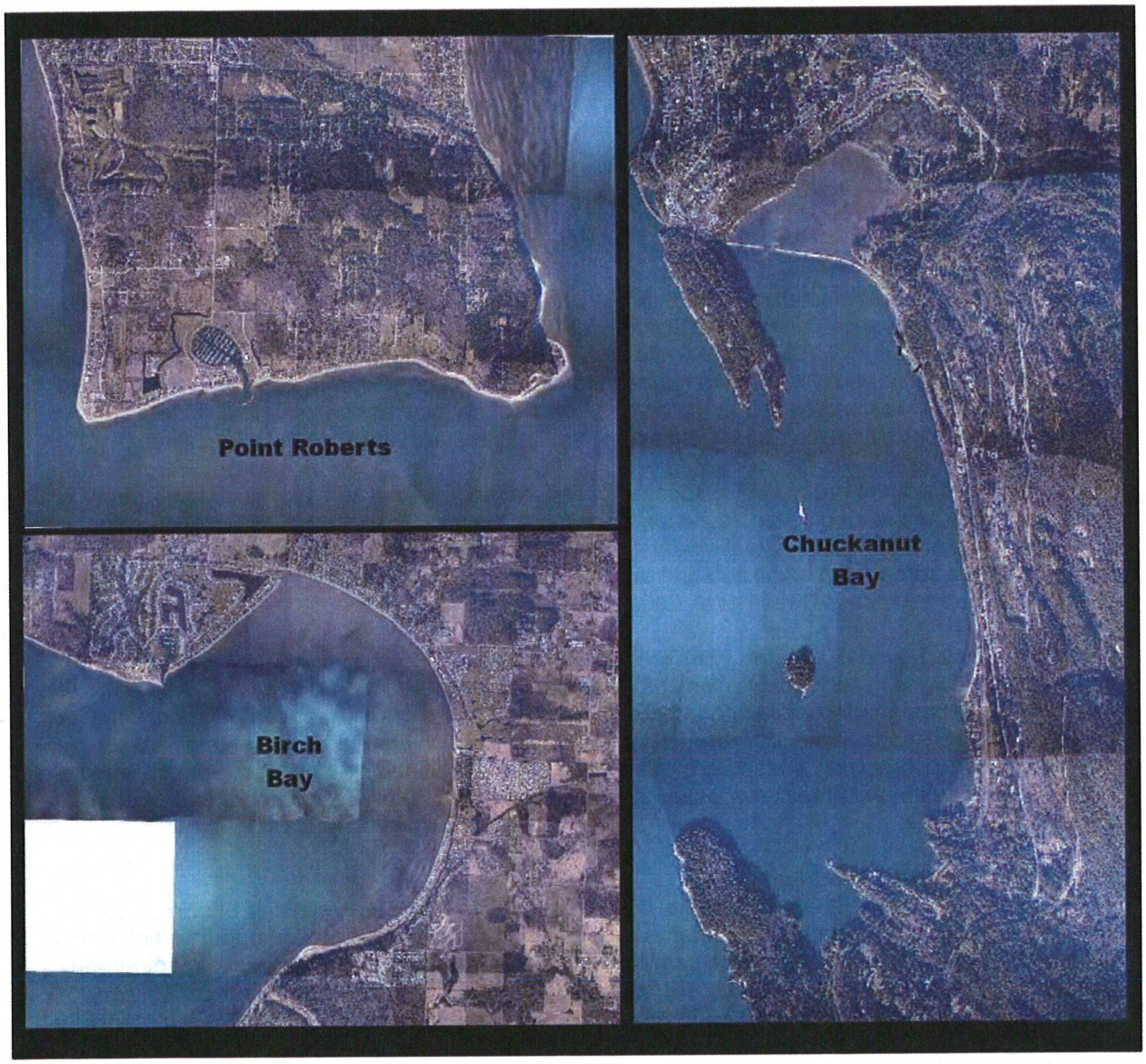
Whatcom County Nearshore Habitat Restoration Prioritization

Prepared for: Whatcom County Marine Resources Committee

Prepared by: Andrea MacLennan, MS and
Jim Johannessen, Licensed Engineering Geologist, MS

Coastal Geologic Services Inc.

June 27, 2007



www.coastalgeo.com
Bellingham, Washington

Introduction

Coastal Geologic Services, Inc. (CGS) was contracted by the Whatcom County Marine Resource Committee (MRC) to augment and prioritize a list of nearshore restoration opportunities within three target regions of Whatcom County: Point Roberts, Birch Bay, and Chuckanut Bay. This restoration prioritization was intended to build on previous work completed for the County/MRC (Enhanced Nearshore Assessment, ESA Adolfson, Parametrix and CGS), and to employ similar methods developed for prioritizing nearshore restoration projects in nearby counties (Skagit Bays Blueprint, People for Puget Sound; Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches, CGS) but applied at a finer scale.

This project provides the MRC with a tool to help achieve the MRC mandate to identify and solve problems reagrding local marine resources such as intertidal and estuarine habitat, shellfish beds, and bottomfish. The objective of this study was to develop and apply a straightforward, user-friendly prioritization approach that integrates sustainability, risk, practicality and feasibility with each site's ability to support the following three key biological resources: forage fish spawning, juvenile salmonid rearing/migration, and aquatic vegetation.

Methods

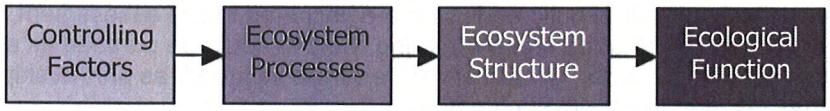
Restoration means the re-establishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics (Cairns 1998, Magnuson et al. 1980; and Lewis 1989 in National Research Council 1992). Restoration typically results in a net increase in the amount, size and/or functions of an ecosystem or components of an ecosystem (Thom et al. 2005). Inherent in current concepts in restoration is that restoration goals cannot typically be achieved without first addressing the controlling ecosystem processes, habitat structure and ecological functions.

In order to maximize the probability of successful restoration, one must develop a clear strategy. Fundamental to any strategic plan, is the identification of clear restoration goals and the development of a conceptual model. A conceptual model can help organize knowledge about how nearshore ecosystems are composed, organized and operate as well as how the system might respond to a particular restoration action (Fresh et al. 2004).

A basic conceptual model, adapted from Thom and Wellman (1996) and Diefenderfer et al. (2006), integrates conditions in the target regions of Whatcom County, MRC restoration objectives and a commonly accepted model used in nearshore restoration (Figure 1). This conceptual model can help guide restoration efforts to assure more sustainable, well functioning nearshore systems, rather than site-specific enhancement. Conceptual models have been developed by the Puget Sound Nearshore Partnership to guide and predict responses to restoration within Puget Sound nearshore systems (Figure 2).

Restoration List Augmentation

The first step in achieving the goals of this study was to refine the coarse-scale of the *Enhanced Nearshore Assessment* report, by supplementing the list of potential restoration opportunities within each of the targeted areas. The list was amended using the county's pictometry/aerial photography dataset (Pictometry International Corp 2004), combined with Washington State Department of Ecology's shoreline oblique air photos of Whatcom County (2001), and the Shorezone database shoreline (2001) in a GIS. Shores where anthropogenic alterations to the nearshore were degrading habitat processes, structure or function (stressors), were digitized and further assessed to determine if restoration was viable.



Controlling Factors	Ecosystem Processes	Ecosystem Structure	Ecological Function
Geology Climate Wave energy Tidal regime Geomorphic shoretype Drift cell context Water quality Anthropogenic stressors Sea level	Sediment input, transport Wave dissipation Hydrologic connectivity (tidal flushing) Nutrient exchange	Sediment composition Eelgrass beds LWD Landscape connectivity Shade Vegetation	Surf smelt spawning Sand lance spawning Herring spawning Eelgrass Shellfish production Juvenile salmonid rearing, migration

Figure 1. Basic conceptual model of nearshore systems in Whatcom County.

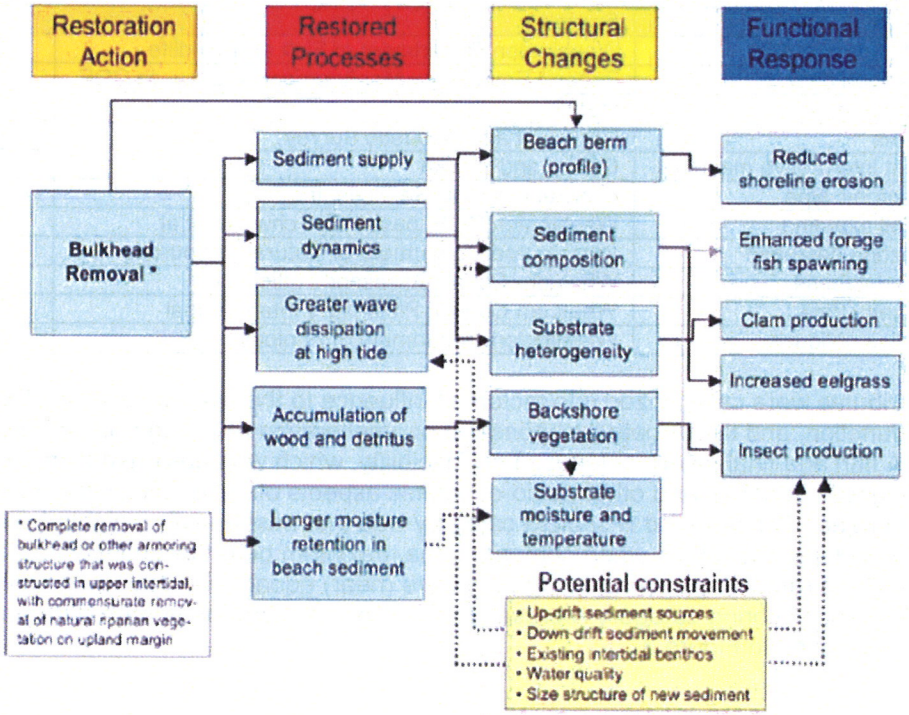


Figure 2. Demonstrates how conceptual models can be used to achieve restoration goals (Simenstad et al. 2006.)

In many locations it was challenging to determine the historic character of the shore and thus assess the degree of alteration from its original condition and the viability of restoration. For this purpose, the T-sheets (earliest accurate topographic maps, generally from the late 1800s) and interpretive T-sheet mapping by Collins and Sheikh (2005) were referenced. Historic air photos were also accessed via the WA DOE Digital Coastal Atlas to determine if structures were likely "grand-fathered" in prior to the Shoreline Management Act, and to observe how structures and shore alterations have changed coastal processes and habitat conditions. Where structures had been in place since the 1970s, and appeared still functioning, restoration was not recommended due to what seemed to be an obvious lack of willingness.

Public waterfront and community owned shores received full consideration in this assessment. Small, single family parcels with individual bulkheads were not included in this assessment, nor were the deconstruction of illegally constructed shore armoring, which should be pursued as a regulatory action. Restoration actions on larger, private properties were included, as partnership and/or mitigation opportunities may exist with such entities.

Once a potential project was appeared likely to be viable and restoration actions were identified, the new sites were digitized and the recommended restoration actions were recorded in the attribute table. Additional data was then compiled in preparation for scoring, which is discussed further below.

Prioritization Scoring

To achieve the objectives of this study and to fine-focus on restoration opportunities with the greatest feasibility, habitat value, and sustainability, CGS applied a three-tiered filter. This approach followed the same general model that was used by CGS in the San Juan County Soft Shore/Structure Removal Blueprint for San Juan County Forage Fish Beaches and entailed applying an initial filter using GIS data and proposed restoration actions, followed by field investigations and then the final ranking and mapping. Numerous data sets were used both in the ranking process and in determining restoration goals (Table 1).

Table 1. Data sources for restoration prioritization.

Name	Source	Year
Priority Species data	Washington Department of Fish and Wildlife	2006
FEMA flood data	Federal Emergency Management Agency via DOE	1998
LIDAR imagery	USGS	2007
T-sheets	US Coast and Geodetic Survey	1887-88
T-sheet interpretive mapping	Collins and Sheikh	2005
Geomorphic type	Coastal Geologic Services, Inc.	2005
Drift cell mapping	Washington DOE, based on Schwartz et al.	1991
Shorezone database	Washington Department of Natural Resources	2001
Parcel database	Whatcom County Assessor's office	2007
Pictometry data	Whatcom County, Pictometry International	2004
Shoreline obliques	Washington Department of Ecology	2001

Scoring attributes were categorized into factors of influence to the overall sustainability, risk, ecological function, and the targeted response(s) or amelioration resulting from the restoration action (Table 2). A fifth and final category focused on feasibility, which was designed to integrate property owner willingness, funding, and other socio-economic aspects of accomplishing a nearshore restoration project. The targeted response category was the most heavily weighted scoring category, followed by ecological function, when comparing the maximum potential scores in each category. Cumulatively, the remaining scoring categories were (near) equally weighted with ecological function. The ratio that each scoring category represents of the total restoration prioritization score is graphically displayed in Figure 3.

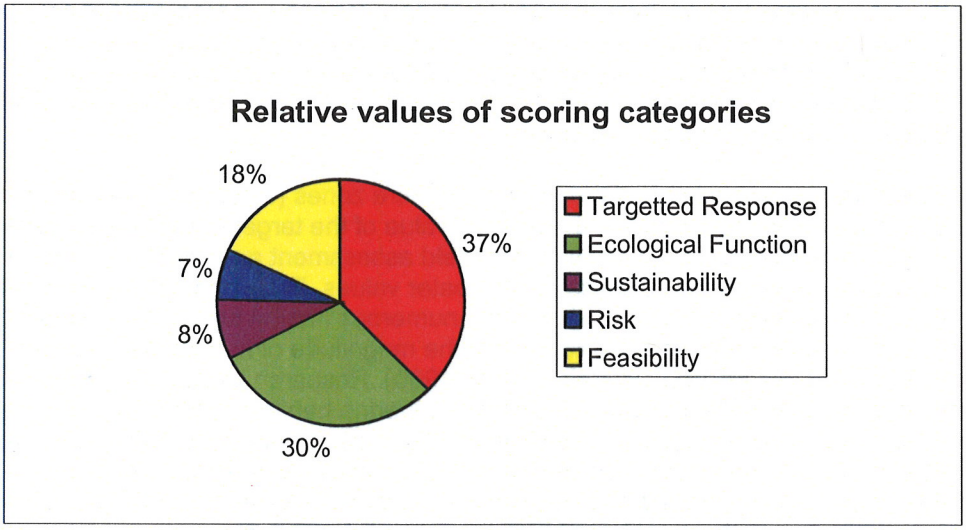


Figure 3. Relative value of each scoring category used in the prioritization model.

It must be noted that although a wide variety of regional assessments and research were reviewed to develop the prioritization scoring, this is far from an exact science and assumptions were made based on incomplete understanding of processes and function. Although certainly imperfect, this quantitative approach was chosen to allow for a systematic way to compare different potential restoration actions.

Targeted response score - Targeted response scores were comprised of 9 questions aimed at addressing the adverse impacts the restoration action is intended to ameliorate. The rationale for the scores assigned to each question was determined by reviewing best available science, including documents designed to guide restoration practitioners in the Puget Sound and Northern Straits.

Targeted response scores convey the relative influence the action will have on the nearshore system. The Puget Sound Nearshore Project has published several documents to aid in addressing Puget Sound restoration needs (pugetsoundnearshore.org). Their research emphasizes that the recovery of ecosystems can best be achieved by reestablishing or significantly improving ecosystem processes. Restoring processes is key to generating and maintaining ecosystem structures (habitats) and important functions (salmonid production, clean beaches and water) (Simenstad et al, 2006). These reasons comprise the general rationale for why restoration projects encompassing the restored ecosystem processes were awarded 5 points. Table 2 displays the rationale and related citation for each of the ranking criteria used in the targeted response category. Restoring ecosystem structure and function, would provide more site-specific benefits and were also included in the targeted response scoring protocol, however with fewer points awarded.

Applying a landscape perspective to restoration planning has received considerable emphasis in recent years. This new landscape view of salmon habitat proposes that the function of any unit of habitat depends upon both local attributes and the context of that habitat within the "bigger picture" of the surrounding habitat (Fresh et al 2004). Understanding transport, migratory pathways and associated barriers can enable restoration practitioners to clearly maintain connectivity across habitat types within nearshore systems. In this restoration prioritization connectivity is valued in three forms: alongshore-sediment, alongshore-salmon and cross-shore. Alongshore-sediment connectivity conveys the functionality of alongshore sediment transport pathways. An example of an impediment to alongshore transport would be a groin or jetty, up-drift of which sediment and driftwood often accumulate. Salmonid landscape connectivity is a measure of the transition and accessibility of habitat types at variable tidal elevations. For example contiguous shallow water habitat is known to reduce predation on juvenile salmonids (Simenstad et al. 1982). Groins and other infringing shore modifications decrease alongshore connectivity for juvenile salmonids migrating alongshore, as these shore modifications make for abrupt transitions from shallow to deeper water often increasing opportunities for predation. Another example of a feature that degrades salmonid landscape

connectivity is a tide gate that controls access to potential rearing and foraging habitat at higher tides. Cross-shore connectivity is similar and encompasses the exchange of sediments, nutrients and large woody debris from terrestrial to marine ecosystems. A loss of cross-shore connectivity is commonly exemplified by bluff sediment impounded behind a bulkhead. Cross-shore connectivity typically entails process restoration but does not in every case.

The restoration area(s) within each of the three nearshore zones (estuarine, intertidal and backshore) were calculated and weighted to reflect the relative value of the target habitats being restored (Table 2). Areas were delineated using GPS points from field assessment and digitized in GIS. Restoration projects recovering larger areas were assigned greater values. Estuarine habitat restoration was awarded the greatest number of points, due to the numerous habitat functions provided to ESA listed salmonids during critical life stages and relative to the magnitude of habitat loss incurred in Puget Sound estuaries (Simenstad 1982, Bortelson et al. 1980). Research by Beamer (2005), in the Skagit River Delta, has found that the carrying capacity of estuarine habitats is often at or exceeding capacity. As a result, juvenile Chinook have been utilizing other nearshore habitats including pocket estuaries (Beamer at al. 2005). As a result restoration or recovery of additional estuarine area was awarded the highest points. Intertidal restoration was awarded slightly fewer points, but was also viewed as a priority due to the number of MRC priority species that rely on intertidal ecosystem structure and function. Backshore habitat restoration received fewer points for restoration as the functions provided by marine riparian areas may not be as critical to target species and require several years to achieve maturity following restoration.

Water quality improvements were identified as a requirement to increase capacity of nearshore environments to support more abundant out-migrant juvenile salmonids and generally increase marine productivity (SHARED STRATEGY 2005); as a result actions that will directly or indirectly improve water quality were also awarded points.

Table 2. Targeted response scores and rationale

Targeted response	Rationale	Citation	Points
Restore ecosystem process	Enhance system health	Simenstad et al. 2006, Fresh et al. 2004	5
Restore structure and/or function	Enhance habitat and/or conditions, thus productivity	Simenstad et al. 2006, Fresh et al. 2004.	2
Improve juvenile salmonid connectivity	Enhance alongshore salmonid migration corridors (shorescape connectivity)	Simenstad et al. 2006, Fresh et al. 2004, Pentec Environmental 2003	2
Restore alongshore connectivity	Remove impediment to alongshore sediment transport/habitat forming processes	Shared Strategy, 2005	3
Restore cross-shore connectivity	Remove impediment to cross-shore sediment/nutrient/water transport	Shared Strategy 2005, Fresh et al. 2004, Simenstad et al. 2006.	5
Backshore area	Calculated backshore area for marine riparian enhancement area (ft^2). <100 ft^2=1 pt, 101-500 ft^2=2, 501-1000 ft^2=3, 1001-3000 ft^2=4, >3000 ft^2 =5	Shared Strategy, 2005 Brennan and Culverwell 2004	1-5
Intertidal area	Calculated recoverable intertidal habitat (ft^2). <100 ft^2=4 pt, 101-500 ft^2=5, 501-1000 ft^2=6, 1001-3000 ft^2=7, >3000 ft^2 =8	Shared Strategy 2005, Beamer et al 2005	4-8
Estuarine area	Calculated recoverable estuarine habitat (ft^2). <100 ft^2=6 pt, 101-500 ft^2=7, 501-1000 ft^2=8, 1001-3000 ft^2=9, >3000 ft^2 =10	Shared Strategy 2005, Beamer et al 2005	6-10
Water quality	Improved water quality direct/indirect	Shared Strategy 2005	3

Ecological function score - The presence of specific habitats and shore characteristics in close proximity to the restoration action were used as a measure of the ecological function of the shore unit.

Each of the scored attributes contributed to the functionality of the nearshore system and directly related to habitat needs of the MRC target species (Table 3).

Table 3. Ecological function scores and rationale.

Ecological Function	Rationale	Citation	Points
Herring spawning	Salmonid forage food, MRC mandate	Diefenderfer et al. (2006)	2
Surf smelt spawning	Salmonid forage food, MRC mandate	Simenstad et al. 2006	2
Sand lance spawning	Salmonid forage food, MRC mandate	Simenstad et al. 2006	2
Eelgrass beds	Salmonid forage food, refuge from predation, MRC mandate, Shared Strategy 2005	Shared Strategy 2005	3
Marsh vegetation	Refuge and foraging habitat salmonids	Shared Strategy 2005, Fresh et al. 2004, Simenstad et al. 2006.	5
Marine Riparian vegetation	Shade; source of food, microclimate function, LWD recruitment.	Rice 2006, Brennan and Culverwell 2004	
Salmonid-bearing steam	Shorescape connectivity	Fresh et al. 2004, Beamer et al. 2005	
Freshwater	Juvenile salmonid osmoregulatory function	Fresh et al. 2004, Clark and Hirano 1995	
LWD recruitment/storage	Habitat structure, backshore ecosystems, detritivore habitat, nutrients	Brennan and Culverwell, 2004. Shared Strategy, 2005	3

Sustainability score - The sustainability of each restoration project was measured using two nested criteria, which included the condition of up-drift sediment sources and projected maintenance. The condition of up-drift sediment sources simply conveys how intact the sediment supply is relative to historic conditions at the site. An ample sediment supply enables shoreforms to be more resilient to changing conditions and naturally self-sustaining from a sediment perspective (Crooks 2004). Up-drift sediment sources were qualified as intact (n), impaired (i) or eliminated (e) (Table 4).

Required projected maintenance was determined by estimating the likelihood of required maintenance events, and projecting the approximate number of events required over a 50-year period. These scores were assigned based on the professional experience of Licensed Engineering Geologist, Jim Johannessen.

Table 4. Sustainability scores and rationale.

Sustainability	Rationale	Citation	Points
Intact Sediment Sources Up-drift?	Sediment impoundment has reduced self-sustaining capacity of many shoreforms but decreasing sediment volumes in nearshore systems. Intact=4, Impaired=2, Eliminated=0	Jacobsen and Schwartz 1981, Crooks 2004	4, 2, 0
Required Maintenance	Required maintenance per 50 year period Low=1 or fewer, Mod=2-4, High=4+	Johannessen, J., Professional judgment	2

Risk evaluation score -The level of risk associated with each restoration project was determined by assessing the erosion potential, measured setback and inundation hazard at each project location. Erosion potential had three nested criteria those being shoretype, exposure, shore orientation and intact up-drift sediment supply. Exposure, or maximum fetch (the unobstructed distance the wind can blow across water before hitting land), was measured using the ARC GIS measuring tool, and then qualified as low (< 5 mi), medium (5-15 mi), or high (>15 mi), respectively, as modified from Cox (1996). The shore orientation of each site was also recorded. Then the geomorphic shoretype was determined using a data set produced by CGS, which characterizes shores as one of the following shoretypes: Feeder Bluff Exceptional (FBE), Feeder Bluff (FB), Transport Zone, Accretion Shoreform or Modified. If the shore of interest was mapped as an Accretion Shoreform, then by definition it is a depositional landform and should not be erosional, assuming the sediment sources that historically supplied the shoreform with sediment are currently functioning and intact. If the shore of interest was

not an Accretion Shoreform or is an Accretion Shoreform with impounded (impacted or eliminated) up-drift sediment sources, then erosion potential was exclusively determined by the shore orientation and exposure. If however, the shore of interest was an Accretion Shoreform with intact up-drift sediment sources, it was scored as having low erosion potential.

Regional predominant and prevailing winds are from the south, thus shores oriented to the south (SW, S, SE), typically receive the greatest wave energy and have higher erosion potential than other shore orientations. As a result, south-oriented shores that were also considered to have high exposure had high erosion potential. South-oriented shores with moderate exposure were considered to have mod-high erosion potential, while more sheltered shores (low exposure) had low erosion potential. Other shore orientations were exclusively west facing. Erosion potential along these shores was moderate-high along highly exposed shores, while those with moderate exposure had moderate erosion potential.

Setbacks were measured from the Shorezone shoreline to the nearest infrastructure. Setback distance and risk were inversely related. Inundation hazard potential was scored at each site, by viewing the FEMA flood hazard GIS data, which shows inundation hazard areas for a hypothetical 100-year flood. Anywhere restoration actions would likely enhance the threat of an existing inundation hazard was considered to enhance the risk associated with the project. Risk evaluation factors are summarized in Table 5.

Table 5. Risk evaluation scores and rationale

Risk Evaluation	Rationale	Citation	Points
Geomorphic type	If shore of interest is an AS, then it is a depositional landform, by definition not erosional, as long as sediment sources are intact	Johannessen and Chase 2005	*Nested in erosion potential*
Up-drift sediment source	Sediment supply and transport functioning and naturally supplying beaches with sediment	Cox 1996, Johannessen and MacLennan 2006a	*Nested in erosion potential*
Exposure	Maximum measured fetch, direct correlate with wave energy	Cox 1996, Johannessen and MacLennan 2006a	*Nested in erosion potential*
Orientation	Orientation relative to prevailing and predominant conditions	Downing 1983	*Nested in erosion potential*
Erosion potential	Salmonid forage food, MRC mandate	Simenstad et al. 2006	3
Setback distance	Distance from Shorezone shoreline to nearest infrastructure		3
Inundation hazard	Could restoration action result in heightened inundation hazard?		2

Results

Restoration List Augmentation

Twelve additional restoration projects were identified by CGS in the reconnaissance process. Five potential projects were identified in Birch Bay: 5 in Point Roberts, and 2 in Chuckanut Bay (Table 6). Prior to CGS fieldwork, Tim Wahl, with the City of Bellingham (COB) Parks Department, conceptualized an additional opportunity in the inner part of Chuckanut Bay (Chuckanut Bay – Wetland Reconnection and Backshore Restoration).

The original list of restoration opportunities provided to CGS by the County included 15 restoration projects. It was then augmented by CGS (and COB) resulting in a new total of 30 sites. Following field visits the list was reduced to 22 projects for scoring. A total of 7 restoration opportunities were eliminated by CGS from the list of restoration projects produced as part of the County's Shoreline Master Program update. Sites were removed from the list for a variety of reasons including: completion of the recommended restoration action (remove old telephone building at Lighthouse

Park, conserve/acquire Lily Point Feeder Bluff), actions that were largely outreach campaigns, such as improving water quality within the shores of the County's marinas, and due to a general lacking habitat benefits, such as the enhancement of marine riparian vegetation landward of several homes located at the base of the bluff along southern Point Roberts.

Table 6. Complete list of restoration opportunities in Whatcom County focus areas.

Shoreline Reach	Recommended Project	Source	Status	Scored?
Point Roberts	West Shore - Gulf Rd right-of-way remove 100+ pilings from intertidal	CGS		Yes
	West Shore - Remove infringing rockery from Breaker's property and enhance MRA	CGS		Yes
	Lighthouse Park - Remove old telephone building at point	SMP	Completed (County)	No
	Lighthouse Park - Remove shore defense and derelict structures	SMP	In process (BCTC)	Yes
	Pt Roberts Marina - Restore connectivity of wetlands, daylight culvert/tidegate	SMP		Yes
	Pt Roberts Marina - Improve marine water quality at marina	SMP	Outreach action	No
	Pt Roberts Marina – Lower elevation of intertidal rock sill	CGS		Yes
	South Shore - Restore marine riparian vegetation along south shore	SMP	No habitat benefit	No
	South Shore - Remove gabion baskets and groins	CGS		Yes
	Southeast Shore - Gabion baskets at base of FBE	CGS		Yes
	Lily Point - Remove derelict structures (pilings and slag)	SMP		Yes
	Lily Point - Acquire Lily Point Feeder Bluff property	SMP	In process (Land Trust)	No
	Lily Point - Conserve Feeder Bluffs	SMP	In process (Land Trust)	No
	Maple Beach - Investigate outfall at beach to determine treatment need	SMP	No Treatment/NA	No
	Maple Beach - Beach nourishment for habitat	CGS		Yes
	Maple Beach - Remove outfall and old pilings	SMP		Yes
Birch Bay	Birch Bay (Village) - Sunset Beach bulkhead removal	CGS		Yes
	Roger's Slough - Restore/enhance historic extent of intertidal marsh	SMP		Yes
	Birch Bay Dr. - Old boat ramp	CGS		Yes
	Birch Bay Dr - Remove groin field, nourish beach	SMP	County study	Yes
	Birch Bay Dr. - Bluefish restaurant -relict boat	CGS	County study	Yes
	Birch Bay Dr. - Bluefish restaurant - pier footings	CGS	County study	Yes
	Birch Bay - Lower Terrell Creek reconnection	CGS		Yes
	Birch Bay Dr - Create riparian buffer	SMP	County study	No
Chuckanut Bay	Inner Chuckanut Bay - Backshore & wetland restoration	SMP		Yes
	Inner Chuckanut Bay - Beach cleanup, remove piles, groins, etc	CGS		Yes
	Chuckanut Bay N - Remove rail causeway and restore tidal prism/flushing	CGS/COB		Yes
	Chuckanut Bay N - Teddy Bear Cove N nourishment	SMP		Yes
	South Chuckanut Bay - Remove old cannery footings	CGS		Yes

The restoration actions, attributes and associated scores for each potential project are found in Table 7, located in the Appendix. Table 8 displays a summary of the final scores for each scoring category

as well as cost estimates, and can also be found in the Appendix. The location and restoration area for each scored restoration opportunity are shown in Figures 4-6 (also found in the Appendix).

Project scores ranged from 42-74 points (36-63%), with an average of 57 (49%). Scores within each target area spanned comparable ranges, with a slightly smaller range in Birch Bay. Pt Roberts had the highest average scoring restoration opportunities, and Chuckanut Bay had the highest scoring single restoration site.

The recommended restoration actions at each site could generally be classified as one of the four following restoration project types (followed by the number occurring in this prioritization): Pocket estuary restoration (PER) (4), remove shore armoring (RSA) (7), beach nourishment for habitat (BNFH) (2), and structure removal (SR) (9) (Table 9). Pocket estuary restoration projects scored the highest average in the targeted response and ecological function categories, followed by projects aimed at removing shore armoring, beach nourishment for habitat and structure removal.

Table 9. Summary of results of prioritization scores by the type of recommended restoration action. Scores were averaged by the type of restoration action.

Restoration type	Count	Total Average Score	Targeted Response	Sustainability	Risk	Ecosystem Function	Feasibility
PER	4	66.2	29.3	4.3	3.8	18.5	10.5
RSA	7	57.8	24.0	5.4	2.6	14.0	11.7
BNFH	2	54.5	18.0	5.5	3.0	16.0	12.0
SR	9	53.3	15.3	5.7	2.7	15.1	14.3

Highest Priority Sites

This section summarized scored attributes and restoration recommendations for each of the top 5 ranked restoration opportunities.

Site 1. Chuckanut Bay – Wetland Reconnection and Backshore Restoration - This project entails multiple restoration actions encompassing wetlands, and portions of the backshore and intertidal at the bayhead in northern Chuckanut Bay. The site is located at the end of Fairhaven Avenue where it reaches the beach. Restoration opportunities are located on both the southeast and northwest sides of the road end and landward of the small parking lot. Restoration actions at the site would ideally be comprised of enhancing the hydrologic connectivity and the tidal prism of the backshore wetland, recovering lost backshore habitat that is currently occupied by a parking lot and associated fill (Figure 7), and removing rock and derelict concrete structures from the upper intertidal/backshore (Figure 8). A 16-inch concrete culvert runs under the gravel road end with flow observed during all site visits. The road is only 12 ft wide in this area, with no shoulder and is in poor condition. Enlarging the tidal channel and installing a much larger culvert that extended lower and would enhance tidal flow in and out of the backshore wetland complex, which extends approximately 500 ft alongshore and 200 ft landward of the backshore berm (Figures 9 and 10). Decommissioning the last reach of road (90 ft long from end of pavement to the parking lot on the beach and backshore) and installing a simple footbridge would enhance the marine riparian and could also provide additional recreation area, in the area currently acting as a parking lot. This would likely require putting in some form of parking in the right-of-way for recreation access.

A detailed topographic survey of the wetland and surrounding area would need to be completed to determine the extent of saltwater inundation at several tidal levels and the exact estuarine area available for enhancement. The site would also need to be mapped for existing habitat types and drainage modifications.

These actions would potentially enhance this feature's ability to provide several pocket estuary functions such as rearing, foraging and osmoregulation for migrating juvenile salmonids from nearby Chuckanut Creek as well as potentially improving water quality (Shared Strategy 2005). Wetland ecosystems provide several ecosystem services including; water pollution abatement and flood mitigation, which would likely be additional indirect benefits of these restoration actions. Potential

water quality impacts resulting from parking lot run-off could also improve as a result of these restoration actions.

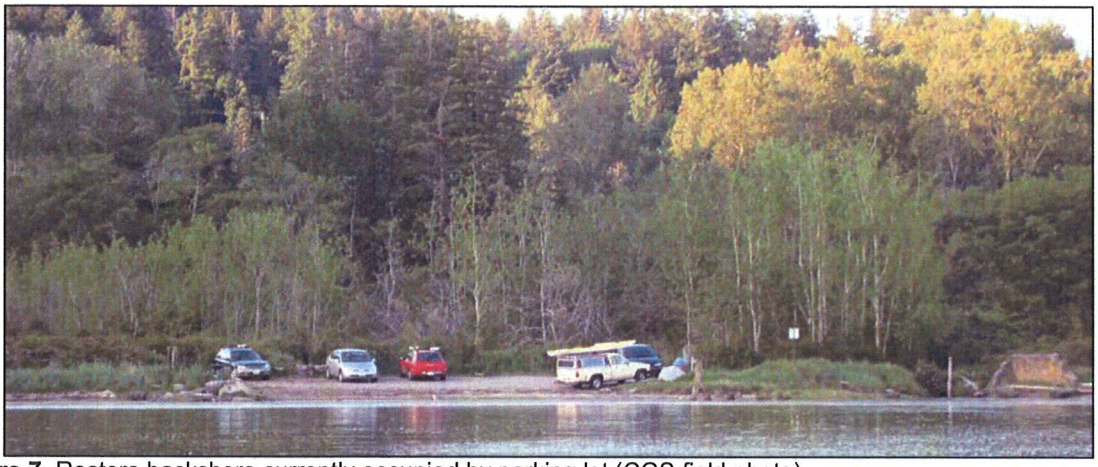


Figure 7. Restore backshore currently occupied by parking lot (CGS field photo).

Figure 8. Remove relict concrete structure from backshore and enhance connectivity between backshore marsh/wetland and marine environment (CGS field photo).

Figure 9. Chuckanut Bay backshore wetland looking south (Pictometry International Corp 2004).

Figure 10. Chuckanut Bay backshore wetland looking north (Pictometry International Corp 2004).

This site was tied as the highest scoring restoration opportunity and received a total of 74 out of 117 points (Tables 7 and 8). It scored 30 targeted response points due to the number of ecosystem benefits that could result from the previously outlined restoration actions. Broadening and possibly day-lighting the stream channel flowing from the wetland to the beach would enhance hydrologic

processes, nutrient exchange, ecosystem structure in the form of estuarine, tide channel and marine riparian habitats, as well as juvenile salmonid connectivity within Mud or North Chuckanut Bay.

The sustainability of this restoration site was rated as moderate, and should require a low level of maintenance (depending on tide channel configurations and how the channel would be opened up). Controlling factors within the bay have been heavily altered due to the Burlington Northern Santa Fe rail causeway, which has resulted in dampened wave energy within the Bay. Reduced wave energy at this site further decreases the level of risk and required maintenance. The risk level was qualified as low due to minimal erosion potential at the site and the generous setback distances for houses surrounding the site. The FEMA flood hazard zone shows this area as being located within the 100-year flood zone, however, as discussed above, the site is already connected to the marine system by a culvert and very low elevation backshore. The enlargement of the tidal channel would not constitute a substantial change to coastal flooding hazards as there is already a culvert in place and it appear that the parking lot is overtopped by waves at times. It also appears that surrounding houses were constructed high enough to be above the high hazard area for flooding.

Ecological function within the bay rated 17 out of a possible 35 points. The site scored for the presence of marsh vegetation, well establish riparian vegetation (across over half of the shore unit), patchy eelgrass (DNR 2001), a source of freshwater and its proximity to a salmonid bearing stream (Chuckanut Creek-only 1,000 ft distant). Additionally, the fine substrate in the bay likely contributes positively to invertebrate productivity.

The feasibility of this restoration opportunity scored 16 out of 21 points, and was one of the highest scoring in the feasibility category. The site is completely encompassed within public shores managed by the City of Bellingham Parks Department, which could potentially partner in the restoration. Several sources of funding exist for this type of restoration throughout the Puget Sound Region. Permitting should be not be overly burdensome, as all work would be conducted below the ordinary high water mark, and some actions may be waived from full permit requirements by the Corps due to the restorative nature of the action. The relative anticipated cost of this restoration opportunity were approximated as moderate ($40,000 - $80,000), relative to other nearshore restoration actions discussed or considered in this study.

Site 2. Point Roberts - Hydrologically Reconnect Wetland - A culvert system and outfall are located on the beach just east of the Point Roberts Marina jetties that drain a large (historic) wetland complex that used to occupy much of the southwest corner of the Point Roberts peninsula (Figure 11). The outfall is buried under a groin-like structure that crosses much of the intertidal beach width (Figure 12). The rock covering the outfall measured 24 ft across on average and extended approximately 135 ft across the shore. The concrete culvert measured 48-inches in diameter (Figure 13). The culvert discharges at approximately – 0.5 ft MLLW, and delivers considerable freshwater flow to the marine environment. The culvert extends approximately 700 ft from the lower intertidal, up the beach and beneath the backshore, under a cleared lot owned by Point Roberts Marina and Point Roberts Marina Resort (Whatcom County Assessor's Database 2007).

The property appeared to have been filled and the elevation increased, and at the time of the fieldwork, consisted of a flat area covered with driftwood, grasses and weeds (Figure 14). This area was historically encompassed within the historic salt marsh. Currently, part of this property is used for harvesting and hauling bypass sediment from the beach east of the marina jetties to the west side, by permit requirement dating back to the original marina permits (Johannessen 1998).

Freshwater flow out of the wetlands was controlled by a large tide gate, located the tide gate was located at the sharp turn in the road, adjacent to the new buildings at "Marina Mist" development, and just north of "Oceanside Estates" at 1728 Edwards Drive (Figure 15). The tide gate was located at the south end of an expansive pond (3150 ft^2)), which connects to other larger sloughs and channels of standing water and has a considerable drainage area to the north and east. A detailed topographic study would also be required for this area to determine the degree of potential hydrologic connectivity and that would occur and the degree of channel or wetland enhancement that would be possible with

the proposed project. Feasibility research should also address whether flood hazards would be increased with the proposed project, but since the entire area appears to have been raised at the time of development, and the fact that the marina basin is located adjacent to the site, that would not appear to be a major issue.

Similar to Site 1, day-lighting the channel and restoring the connectivity between the fresh water and marine environment could enable this site to provide several pocket estuary functions such as rearing, foraging and osmoregulation for migrating juvenile salmonids from both the Fraser River Delta and other nearby salmonid bearing streams within Boundary Bay. Additional ecosystem services such as water pollution abatement and flood mitigation may also be an indirect result of this restoration action. Wetland ecosystems provide several ecosystem services including; water pollution abatement and flood mitigation, which would likely be additional indirect benefits of these restoration actions.

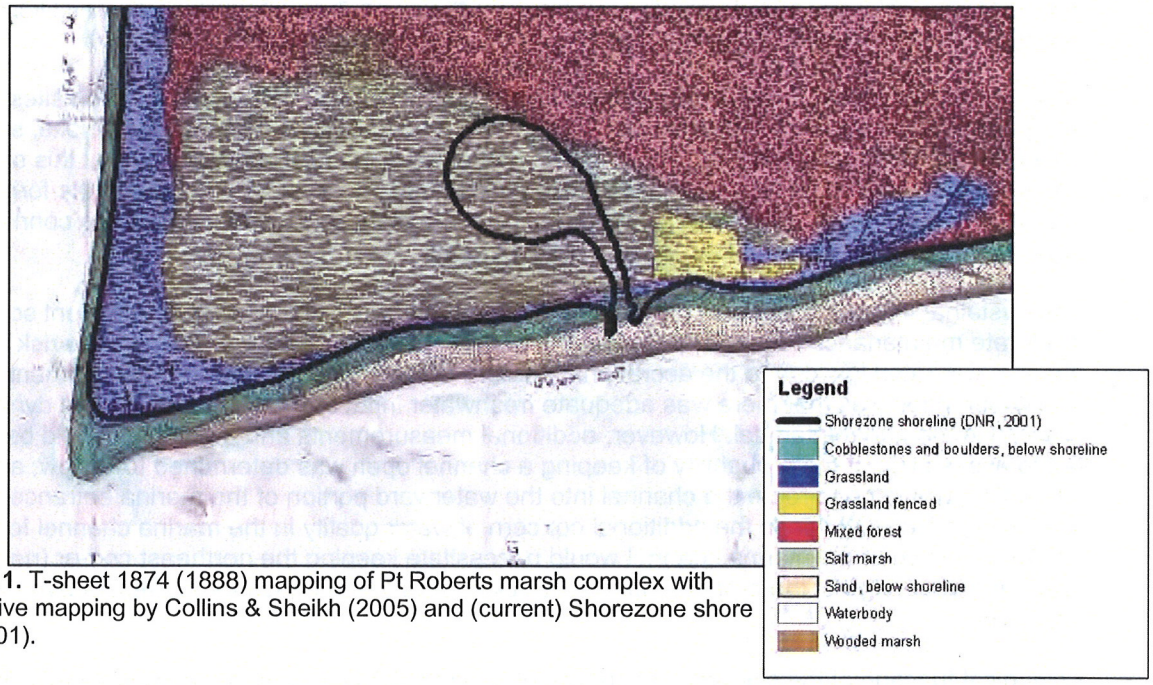


Figure 11. T-sheet 1874 (1888) mapping of Pt Roberts marsh complex with Interpretive mapping by Collins & Sheikh (2005) and (current) Shorezone shore -line (2001).

Figure 12. Looking east at armored culvert extending across shore (CGS field photo).

Figure 13. Culvert out-flow with considerable flow (CGS field photo).

Figure 14. Culvert/stream buried beneath backshore east of Pt Roberts marina (CGS field photo).

Figure 15. Tide gate and pond drained from Pt Roberts wetlands (CGS field photo).

Scoring 74 points total, this site was tied with Site 1 as the highest-ranking restoration sites in the study area. In the targeted response category, this site ranked higher than any other site, scoring 38 out of 45 points (Tables 7 and 8). The targeted response of the restoration actions at this site potentially encompasses restored tidal access and flushing, ecosystem structure in the form of estuarine, tide channel and intertidal habitats, enhanced alongshore and cross-shore connectivity, salmonid connectivity and indirect water quality benefits.

The sustainability of the site was rated as high due to the largely intact up-drift sediment sources and moderate maintenance required to sustain the restored site configuration. The relative risk rating at the site was rated low due to the accretionary nature of the site and intact up-drift sediment supply. The assumption was that there was adequate freshwater input to the site to maintain a dynamic tidal channel in the upper intertidal. However, additional measurements and modeling should be carried out to assess this. If the probability of keeping a channel open was determined to be low, an alternative would be to route the channel into the waterward portion of the marina entrance channel. This alternative would pose the additional concern of water quality in the marina channel for fish habitat. The use of the marina channel would necessitate keeping the northeast corner (near the road) and east edge of the property open for truck access to the beach for harvest of bypass sediment.

Ecological function at the site received 16 out of a total of 35 points. Enhancement of this site would benefit multiple forage fish spawning habitats including sand lance and surf smelt. Herring also spawn in the eelgrass beds found adjacent to the site (WDFW 2007). The presence of freshwater and LWD storage are additional contributors to the ecological function of this site. The feasibility rating of this restoration opportunity received 9 out of a total of 21 potential points. The opportunities to partner on this restoration project was rated as moderate, due to the tidelands being held in public ownership (WDNR). Restoration funding could also be funded as compensatory mitigation related to upcoming marina renovations, which is under new ownership. There are many potential funding sources for this type of restoration, though the cost and complexity would likely be relatively high (Table 8, $200,000-300,00). Permitting would encompass federal, state and local permits, and will likely require a biological assessment/evaluation and a wetland assessment.

Site 3. Birch Bay (Village) – Sunset Beach Riprap Removal

Located just west of the Birch Bay Village marina, this low-bank bulkheaded shore scored a total of 66 points, and is the third ranked restoration opportunity in the study area (Figures 16 and 17). This site was historically a pocket estuary of an unnamed creek. The basin includes two creeks, most of which drains Trillium property, and cumulatively measures approximately 1,167 acres (CH2MHill 2006. Figure 18 shows the historic T-sheet over Lidar imagery with the historic creek channel and confluence location (T-sheet no. 1873, 1888; Collins and Sheikh 2005). The creek has been channelized and culverted across Birch Bay Village residential areas, and its confluence relocated to within the northwest corner of Birch Bay Village Marina basin.

This site was originally identified and scored as a bulkhead removal site as the uplands do not have homes and/or other infrastructure. Although it appears quite challenging due to the dense development of the area, the feasibility of relocating the creek mouth to its original channel location was not fully explored in this prioritization and should be explored as part of a larger feasibility study. The site would have scored additional points if the restoration's targeted response had entailed restoring the historic pocket estuarine functions.

The rockery bulkhead extended well waterward of the adjacent bulkhead to the west and infringed on the upper intertidal beach (Figures 16 and 17). The site could be enhanced by removal of the rock and recreating a wider beach and backshore area. The site was filled to a higher elevation, likely during development of the marina, as shell fragments were observed in the eroding bank. An upper beach and backshore area would be created between retained (adjacent) bulkheads, resembling the upper part of a pocket beach. A small portion of the removed rock would likely be required for construction of return walls (running landward at the ends of adjacent bulkheads, designed to minimize end effects). These return walls would generally run landward along the property lines. The upper beach should also be nourished to aid in the reformation of lost forage fish spawning habitat area covered by riprap. Additional restoration recommendations for this site include enhancing the marine riparian area.

Removing the riprap and enhancing the marine riparian ecotone received 28 targeted response points, placing it in the top 5 scoring sites in that category. Restoring these features would potentially enhance ecosystem structure in the form of intertidal habitats and marine riparian habitats, ameliorate cross-shore, alongshore and salmonid connectivity, and provide indirect water quality improvements (in the form of marine riparian water pollution abatement). Despite the fact that this is a bulkhead/riprap removal project, it did not score for restoring ecosystem processes, as it was not a historic sediment source. However if restoration were to entail restoring the historic pocket estuary, it would score 5 additional points.

The sustainability of this restoration opportunity was ranked as high, as it will likely require minimal maintenance due to the number of intact up-drift sediment sources. The level of risk measured relatively low due to the lack of structures located in the uplands, the site occurring within a historic accretion shoreform and outside the 100-year flood hazard zone (FEMA/CZA 1998). Despite the fact that the fetch and exposure of this site measure relatively high, the presence of the marina jetties a short distance down-drift have resulted in the rapid accretion of the beach immediately east of the site in recent decades. Also, the historic creek delta on the lower intertidal, forces waves to break slightly farther from shore, somewhat decreasing the erosion potential of the site.

This opportunity scored 17 points in the ecological function category out of 35 possible points. Surf smelt spawning has been documented at this site and herring are known to spawn in the patchy eelgrass beds located waterward and adjacent to the site. This opportunity is also located within just 3-miles of salmonid-bearing Terrell Creek, which emphasized the function of this shore for juvenile salmonid migration.

The feasibility of these restoration actions received 11 out of 21 possible points. The site is encompassed within privately owned upland and tidelands, managed by the Birch Bay Village community. The opportunity to partner with the community seems apparent. Restoration could be integrated into compensatory mitigation if the opportunity were to arise. The potential funding sources appear slightly limited due to the private nature of the beach, however it is a "community" owned shore. The anticipated cost of the recommended restoration actions was estimated as moderate, in relative terms ($30,000 - $60,000, Table 8). Permitting the project would likely entail applying for state and county permits, which would require a moderate time commitment.

Figure 16. Air photo of Sunset Beach site, note toppled and infringing riprap at west end of site (Pictometry International Corp 2004)

Figure 17. Infringing riprap at Sunset Beach (CGS field photo).

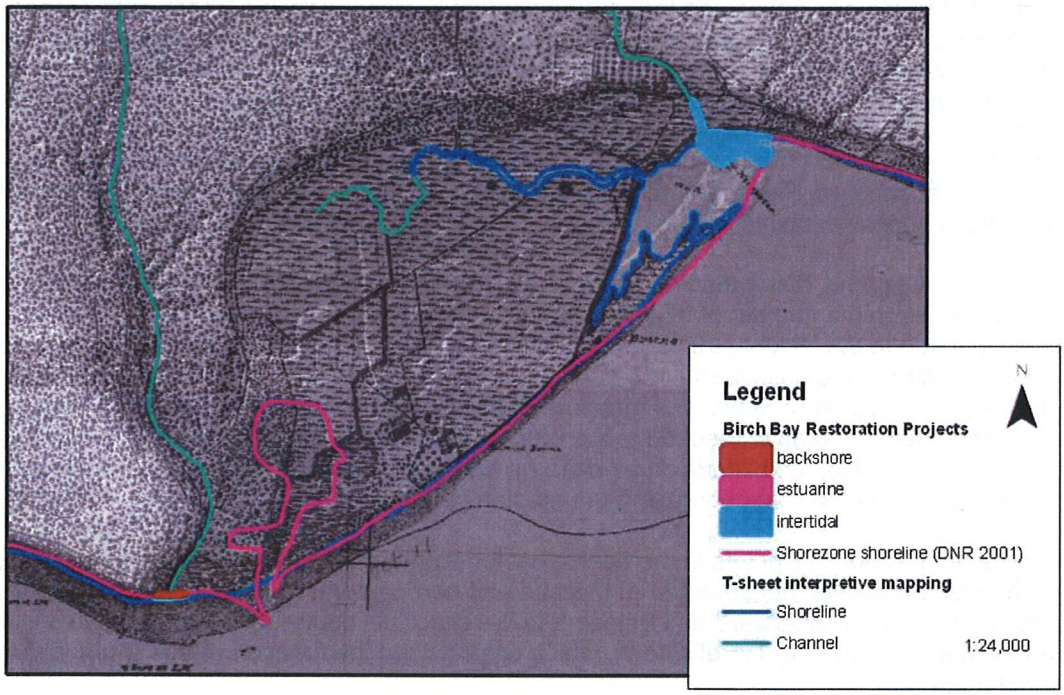


Figure 18. Historic T-sheet with interpretive mapping (Collins and Sheikh 2005) with Lidar imagery (USGS 2007), current shoreline (DNR 2001) and proposed restoration sites.

Site 4. Chuckanut Bay – Open Burlington Northern Santa Fe (BNSF) Rail Causeway

This forth-ranking restoration opportunity entails restoring the natural wave regime and tidal hydrodynamics within northern Chuckanut Bay (also called Mud Bay) by removing or modifying the BNSF rail causeway. A large-scale feasibility study should be performed to determine exactly how the restoration should be conducted, as described below. The BNSF rail causeway, constructed prior to the turn of the century, has largely closed off much of northern Chuckanut Bay to its natural wave regime (Figure 19), which appears to have caused a substantial increase in the sedimentation rates and a shift in the habitat types found in the Bay.

The causeway currently covers 153,040 sq ft of subtidal and intertidal area. The beach was historically composed of coarser material and apparently eelgrass beds were found throughout the inner shore of the Bay (Pers. Comm. T. Wahl 2007). Currently inner Chuckanut Bay beaches are comprised of relatively fine sediment (sands and silt) and patches of eelgrass are only found in the waterward end of the Bay. It is likely that if sedimentation rates continue at the current accelerated rate the Bay will experience further habitat degradation in the form of water quality issues, exceeded temperature thresholds for salmonids, and the progressive loss of intertidal area. It is likely that the tidal prism has already been substantially reduced in volume due to the accelerated sedimentation occurring within these shores. This process will likely be slowed by sea level rise, however, the native substrate of the beaches and the natural tidal hydrodynamics will not be recovered without restoration actions.

The causeway created additional shoreline along the revetment and the open shaded area beneath the causeway opening is the only access to the bay (Figure 20). The shading and additional riprap shoreline, provides an abrupt transition from shallow to deep water, likely increasing migrating juvenile salmonids' vulnerability to predation. The causeway opening was also constructed of heavily creosoted pilings, which likely adversely impacts water quality.

This site scored a total of 65 points, and 29 points in the targeted response category. Targeted response scores were higher than any other site except Site 1. The targeted response of the proposed restoration actions at this site encompasses restored hydrodynamic processes and wave regime within the bay, ecosystem structure in the form of intertidal habitats lost beneath the large causeway footing, enhanced alongshore, cross-shore and salmonid connectivity and indirect water quality benefits resulting from enhanced tidal flushing and creosote removal.

The sustainability of this restoration was rated very high, as the restored condition is likely more sustainable than the currently altered condition. Additionally little maintenance would be required under natural conditions. The level of risk of this restoration opportunity was also relatively low, though risk ratings may change depending on how restoration is approached and if the causeway will be entirely removed or just altered to allow for more flushing.

Ecosystem function within northern Chuckanut Bay received 10 of 21 points and was one of the lowest scoring sites within the study area. This shore scored for having or providing the following ecosystem functions: eelgrass beds (patchy), freshwater, and being in close proximity to a salmonid bearing stream.

This restoration opportunity scored 15 of 21 points in the feasibility category. The tidelands and intertidal zone within which the BNSF rail causeway is located, are publicly owned and managed by the City of Bellingham (Whatcom County Assessor's Database, 2007). The potential to partner in moving forward with this restoration opportunity was deemed high, and there are likely many available funding opportunities. Additionally restoration and/or enhancement could be encompassed within compensatory mitigation if it were required for BNSF. The projected cost of performing the restoration would be relatively high ($800,000-$2,500,000, Table 8) and permitting would require federal approval, thus the time required to gain permits would be high.

Specific restoration actions for restoring natural processes at Northern Chuckanut Bay was outside the scope of this restoration prioritization, and needs further examination. Quantifying physical parameters and further understanding trends within the Bay, such as sediment character, altered sedimentation rates, and the degree of tidal prism reduction would be a first step in this process. Sediment coring and associated dating could be carried out to determine sedimentation rates across different time periods (over the course of the last 150 years). Topography and bathymetry of the bay and comparison with early data sets would also be useful for determining the degree of change. Historic eelgrass mapping could be conducted by compiling oral histories, historic photos, and maps, followed by comparison with more current eelgrass mapping. Sedimentation, erosion, and hydrodynamic flushing could be modeled under different causeway bridging/removal scenarios, once data collection was completed. This larger scale feasibility study would require additional involvement

relative to the other proposed projects and would need considerable funding, however the benefit to the larger estuarine/nearshore system may reach beyond the metrics applied in this prioritization.

Figure 19. Aerial view of Chuckanut Bay causeway (Pictometry International Corp 2004).

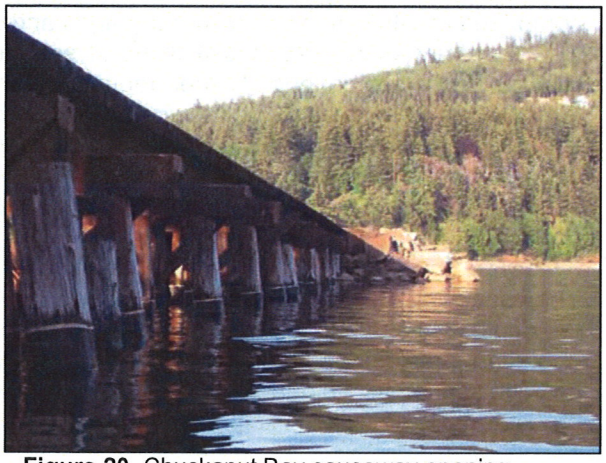


Figure 20. Chuckanut Bay causeway opening, creosote pilings (CGS field photo).

Site 5. Point Roberts – Lily Point Slag, Piles and Car Parts Removal - The fifth-ranked restoration opportunity is comprised of recovering lost intertidal habitat by removing relict piles, slag (metallic waste piles from canning operations) deposits and abandoned car parts along Lily Point, located at southeast Point Roberts. This site scored a total of 65 points. The proposed project is a straightforward debris removal project on the shore of the large Accretion Shoreform waterward of the high bluff. The piles and pile remnants extend across the width of the sloping beachface (Figure 21) with large slag piles covering portions of the mid-intertidal beach (Figure 22), all of which should be removed. Additional debris should be removed from the backshore from the same general area.

Removal of these relict items would restore intertidal habitat structure and ameliorate adverse impacts to water quality caused from the further decay and erosion of the slag and car parts. The field of over 100 relict piles would recover lost intertidal substrate, and enhance alongshore sediment transport that appears diminished due to wave attenuation caused by the piles and slag deposit. Juvenile salmonid migration pathways would likely also be enhanced as a result of the restoration. The cumulative targeted response of these actions was awarded 18 out of 45 points for these reasons.

The sustainability of these restoration actions was the highest rated site within this prioritization, due to the accretionary nature of the site, intact up-drift sediment sources, and the lack of required maintenance. The relative risk of this opportunity was also ranked lower than any other opportunity due to the absence of erosion risk and upland improvements, and since the proposed removal project would not alter the inundation threat during coastal flooding events.

The ecosystem function of the Lily Point site scored 11 out of 35 possible points. Herring spawn in the continuous eelgrass beds waterward of the site, which functions as a migratory pathway for juvenile salmonids from the Fraser River estuary and nearby salmonid-bearing streams in Boundary Bay. Large woody debris is also stored along the upper beach at this site, which likely contributes to the ecological function of this site.

This site was the highest rated restoration opportunity in the feasibility category, scoring 19 of 21 possible points. The shore was scored as being encompassed within public shores as it is in the process (acquiring funding) of being acquired and protected by the Whatcom County Land Trust. As a result, partnership opportunities with other agencies seemed highly probable. Many possible funding opportunities likely exist to conduct this type of restoration. The cost of completing this restoration would be relatively low ($30,000-$60,000, Table 8). Permitting efforts would likely require minimal

time, as exemptions are potentially available for restoration comprised exclusively of removing exotic material to eliminate adverse impacts to nearshore habitats such as these.

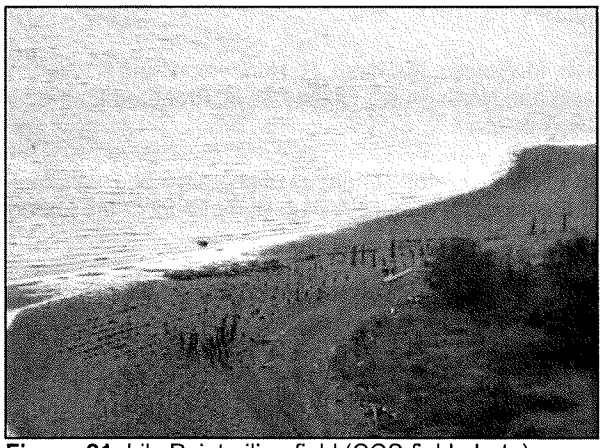


Figure 21. Lily Point piling field (CGS field photo).

Figure 22. Slag deposits in lower beachface left from old cannery (CGS field photo).

Conclusions

This targeted restoration prioritization was designed be a relatively user-friendly, straightforward approach that integrates the goals of the Whatcom County Marine Resource Committee. Project sustainability, risk, feasibility and the MRC's stated restoration objective (of the site's ability to support forage fish spawning, juvenile salmonids rearing and migration and aquatic vegetation) were built into the in the prioritization to rank sites with the greatest likelihood of achieving successful restoration. In total over 262,596 ft^2 of recoverable intertidal habitat, 15,150 ft^2 of estuarine habitat and 25,241 ft^2 of marine riparian habitat were assessed and prioritized for restoration throughout the Point Roberts, Birch Bay and Chuckanut Bay target areas. It is likely that the site dimensions used in these calculations were under-estimated, and additional nearshore area can be recovered as part of these restoration projects.

The results of this restoration prioritization can be used both with and without feasibility considerations. Without consideration for feasibility, two different sites would have been in the top 5 ranking sites. These opportunities entail removing infringing riprap and enhancing the marine riparian ecotone along a forage fish spawning beach on the west shore of Point Roberts (Pt Roberts – The Breakers riprap removal) and enhancing the intertidal and tide channel habitat within Roger's Slough (Figure 18), located in northeast Birch Bay. However, these potential projects would be both quite expensive and would involve additional challenges due to private ownership (which is why they fell below the top 5 with feasibility considered). Other high scoring restoration opportunities can be reviewed in Appendix 2.

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Appendix 1

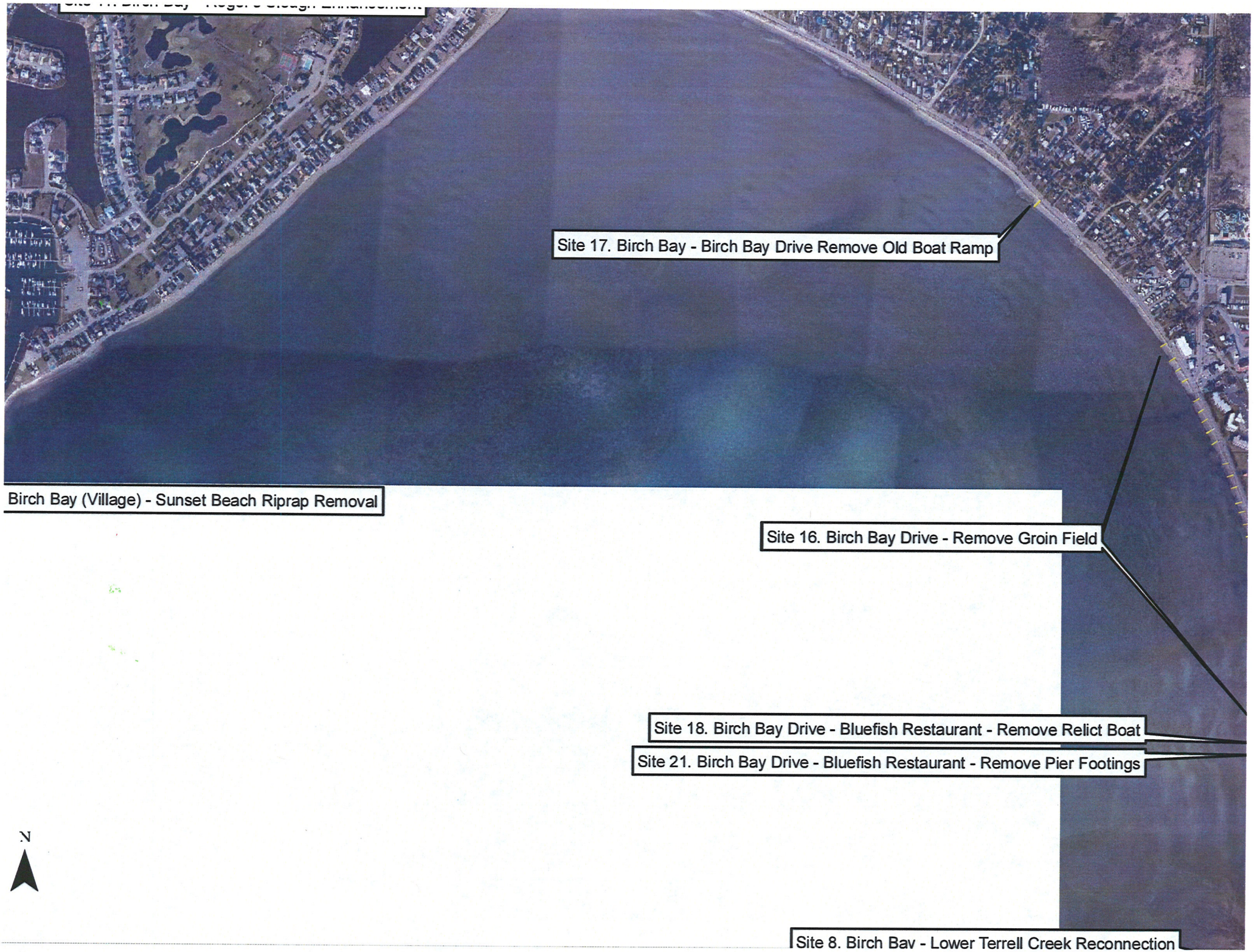
Figure 4. Point Roberts restoration opportunities
Figure 5. Birch Bay restoration opportunities
Figure 6. Chuckanut Bay restoration opportunities
Table 7. Restoration actions, attributes and associated scores for each potential restoration project
Table 8. Summary of the final scores for each scoring category as well as cost estimates

Restoration Action	Restores ecosystem process(es)?	Restores ecosystem structure? function?	Enhances juv. Salmonid connectivity?	Enhances alongshore connectivity?	Enhanced cross-shore connectivity?	Recoverable backshore area?	Recoverable estuarine area?	Recoverable intertidal area?	Direct or indirect water quality improvements?	Sustainability	Intact sediment source up-drift? impaired, maintain. e=eliminated	Required maintenance?	Risk level	Inundation hazard?	Setback distance? (ft)	Erosion potential	Exposure?	Shore orientation?	Geomorphic shoretype?	Herring spawning?	Surf smelt spawning?	Sand lance spawning?	Eelgrass? (patchy/continuous)	Marsh vegetation?	Riparian vegetation (%)	Distance to Salmonid-bearing stream? (miles)	Source of freshwater?	LWD recruitment or storage?	Ownership (pvt/pb)	Parcel density (<3, 3-8, >8)	Partnerships (low-med-high)	Mitigation? (y/n)
	Restoration Target									Sustainability			Risk Level							Target habitat characteristics												Final Feasibility and
Remove 105 piles (low beach), nourish upper beach	n	y	n	n	n	0	0	3350	y	v.high	l	none	mod	n	10	mod-high	high	W	AS	y	y	n	p	n	0	8.5	y	s	pvt&pub	2	mod	n
Remove revetment and edge of parking lot, minor nourishment, restore marine riparian	n	y	y	y	y	1775	0	5106	y	high	l	low	high	y	20	mod-high	high	W	AS	y	y	n	p	n	0	8.5	y	n	pvt	2	mod	y
Remove riprap and old piles, nourish upper beach	n	y	y	y	n	4175	0	1854	n	mod	l	mod	mod	y	140	high	high	SW	AS	y	y	n	n	n	0	9.0	n	s	pub	2	mod	y
Daylight channel and reconnect tidal hydrologic connectivity with wetland/ponds	y	y	y	y	y	0	10455	2168	y	high	n	mod	low	y	90	low	high	S	AS	y	y	n	n	n	0	9.5	y	s	pvt	1	med	y
Lower crest elevation of intertidal rock sill	n	y	y	n	n	0	0	3530	n	v.high	n	low	low	n	101	high	high	S	AS	y	y	y	n	n	0	9.5	y	n	pub	1	med	y
Remove gabion baskets and groins, (unpermitted?)	y	y	y	y	y	132	0	1105	n	high	n	mod	mod-high	y	85	high	high	S	FB	y	n	n	p	n	70	10.0	n	r	pub	1	med	n
Remove gabion baskets, likely unpermitted	y	y	n	n	y	859	0	0	n	high	n	mod	high	y	45	high	high	SW	FBE	y	n	n	n	n	100	10.0	n	r	pvt	2	med	n
Remove piles, slag deposits left from old cannery and carry farther west	n	y	y	y	n	0	0	1279	y	v.high	n	none	low	n	250	low	high	S	AS	y	n	n	c	n	0	11.0	n	s	pub	1	high	n
Nourish for forage fish habitat; recreate beach profile	n	y	y	n	n	9674		60721	n	high	n	mod	mod	n	0	mod-high	mod	SE	AS	y	y	y	p	n	0	8.0	y	n	pub	1	high	n
Remove piles and relict outfall pipe from upper beach	n	y	y	y	n	0	0	88	y	v.high	n	low	high	y	0	mod-high	mod	SE	AS	y	y	n	n	n	0	8.0	y	s	pub	1	high	y
Remove riprap, nourish beach, restore/enhance marine riparian	n	y	y	y	y	2854	0	3346	y	high	n	mod	low	n	101	mod-high	mod	SW	MOD	y	y	n	p	n	0	3.0	n	n	pvt	1	high	y
Larch bay drive - remove old boat ramp just north of Cottonwood Drive	y	y	y	y	y	0	0	822	n	high	l	low	high	y	15	high	high	SW	AS	n	n	n	c	n	0	1.2	n	n	pvt	1	high	n
Enhance tidal flushing and enlarge culverts	y	y	y	n	y	0	2458	0	n	low	l	mod	low	y	101	mod	high	SW	AS	y	n	n	c	y	0	2.0	y	s	pvt	2	high	y
Remove groins and nourish upper beach	y	y	y	y	n	0	0	4554	n	mod	l	mod	mod-high	n	10	high	high	SW	AS	y	n	n	c	n	0	1.0	y	n	pvt	12	high	n
Remove concrete boat	n	y	y	y	n	0	0	176	y	mod	l	mod	high	y	0	high	high	SW	AS	y	n	n	c	n	0	1.0	y	n	pvt	1	high	y
Remove old dock footings	n	y	y	y	n	0	0	204	n	low	l	mod	high	y	0	high	high	SW	AS	y	n	n	c	n	0	1.0	y	n	pvt	1	high	y
Remove tide gate, replace erosion control flood structure	y	y	y	n	y	0	886	0	y	mod	l	mod	mod-high	y	10	mod	high	SW	AS	y	n	n	c	y	0	0.0	y	n	pvt&pub	3	high	n
Remove pilings, concrete debris, and failing groin from intertidal and backshore	n	y	y	y	n	0	0	1296	n	v.high	l	none	low	y	>100	low	low	SW	AS	n	n	n	p	y	0	0.0	y	n	pub	1	high	n
Enlarge culvert and restore hydrology of backshr wetland, restore backshore, relocate parking lot off beach	y	y	y	n	y	501	1351	0	y	high	l	low	low	y	>100	low	low	SW	AS	n	n	n	p	y	60	0.0	y	s	pub	1	high	n
Enlarge or open additional portion of causeway, restore tidal flushing, reverse adverse sedimentation	y	y	y	y	y	0	0	153040	y	v.high	l	none	low	y	n/a	mod	mod	S	MOD	n	n	n	p	n	5	0.0	y	n	pub	1	high	y
Remove boulder lag, create 900 ft pocket beach north of Eddy Bear Cove	n	y	y	n	n	4983	0	19954	n	high	l	low	mod	n	8	mod-high	mod	SW	MOD	n	n	n	c	n	5	0.1	n	n	pvt&pub	2	high	y
Remove relict steel structure and foundation	n	y	y	y	n	289	0	0	y	mod	l	mod	mod-high	y	15	mod	mod	W	MOD	n	n	n	p	n	30	2.0	y	r	pvt	1	high	y
Restoration Action	Restortation Target									Sustainability			Risk Level							Target habitat characteristics												Final Feasibility and
Remove 105 piles (low beach), nourish upper beach	0	3	0	0	0	0.0	0.0	8.0	3	7	2	5	3	2	0	1				5	5	0	3	0	0	2	3	1	2	2	1	0
Remove revetment and edge of parking lot, minor nourishment, restore marine riparian	0	3	2	3	5	4.0	0.0	8.0	3	5	2	3	1	0	0	1				5	5	0	3	0	0	2	3	0	0	2	1	2
Remove riprap and old piles, nourish upper beach	0	3	2	3	0	5.0	0.0	7.0	0	4	2	2	3	0	3	0				5	5	0	0	0	0	2	0	1	4	2	1	2
Daylight channel and reconnect tidal hydrologic connectivity with wetland/ponds	5	3	2	3	5	0.0	10.0	7.0	3	6	4	2	5	0	2	3				5	5	0	0	0	0	2	3	1	0	3	0	2
Lower crest elevation of intertidal rock sill	0	3	2	0	0	0.0	0.0	8.0	0	7	4	3	5	2	3	0				5	5	5	0	0	0	2	3	0	4	3	0	2
Remove gabion baskets and groins, (unpermitted?)	5	3	2	3	5	2.0	0.0	7.0	0	6	4	2	2	0	2	0				5	0	0	3	0	3	0	0	2	4	3	0	0
Remove gabion baskets, likely unpermitted	5	3	0	0	5	3.0	0.0	0.0	0	6	4	2	1	0	1	0				5	0	0	0	0	3	0	0	2	0	2	0	0
Remove piles and slag deposit left from old cannery	0	3	2	3	0	0.0	0.0	7.0	3	9	4	5	8	2	3	3				5	0	0	5	0	0	0	0	1	4	3	2	0
Nourish for forage fish habitat; recreate beach profile	0	3	2	0	0	5.0	0.0	8.0	0	6	4	2	3	2	0	1				5	5	5	3	0	0	2	3	0	4	3	2	0
Remove piles and relict outfall pipe from upper beach	0	3	2	3	0	0.0	0.0	3.0	3	7	4	3	1	0	0	1				5	5	0	0	0	0	2	3	1	4	3	2	2
Remove riprap, nourish beach, restore/enhance marine riparian	0	3	2	3	5	4.0	0.0	8.0	3	6	4	2	6	2	3	1	no scores. nested in erosion potential.			5	5	0	3	0	0	4	0	0	0	3	2	2
Larch bay drive - remove old boat ramp just north of Cottonwood Drive	5	3	2	3	5	0.0	0.0	6.0	0	5	2	3	0	0	0	0				0	0	0	5	0	0	4	0	0	0	3	2	0
Enhance tidal flushing and enlarge culverts	5	3	2	0	5	0.0	9.0	0.0	0	2	2	0	5	0	3	2				5	0	0	5	3	0	4	3	1	0	2	2	2
Remove groins and nourish upper beach	5	3	2	3	0	0.0	0.0	8.0	0	4	2	2	2	2	0	0				5	0	0	5	0	0	4	3	0	0	0	2	0
Remove concrete boat	0	3	2	3	0	0.0	0.0	4.0	3	4	2	2	0	0	0	0				5	0	0	5	0	0	4	3	0	0	3	2	2
Remove old dock footings	0	3	2	3	0	0.0	0.0	4.0	0	2	2	0	0	0	0	0				5	0	0	5	0	0	4	3	0	0	3	2	2
Remove tide gate, replace erosion control flood structure	5	3	2	0	5	0.0	7.0	0.0	3	4	2	2	2	0	0	2				5	0	0	5	3	0	4	3	0	2	2	2	0
Remove pilings, concrete debris, and failing groin from intertidal and backshore	0	3	2	3	0	0.0	0.0	7.0	0	7	2	5	6	0	3	3				0	0	0	3	3	0	4	3	0	4	3	2	0
Enlarge culvert and restore hydrology of backshr wetland, restore backshore, relocate parking lot off beach	5	3	2	0	5	3.0	9.0	0.0	3	5	2	3	6	0	3	3				0	0	0	3	3	3	4	3	1	4	3	2	0
Enlarge or open additional portion of causeway, restore tidal flushing, reverse adverse sedimentation	5	3	2	3	5	0.0	0.0	8.0	3	7	2	5	5	0	3	2				0	0	0	3	0	0	4	3	0	4	3	2	2
Remove boulder lag, create 900 ft pocket beach north of Eddy Bear Cove	0	3	2	0	0	5.0	0.0	8.0	0	5	2	3	3	2	0	1				0	0	0	5	0	0	4	0	0	2	2	2	2
Remove relict steel structure and foundation	0	3	2	3	0	2.0	0.0	0.0	3	4	2	2	2	0	0	2				0	0	0	3	0	2	4	3	2	0	3	2	2
	5	3	2	3	5	5	10	8	3	9	4	5	8	**	**	**				5	5	5	5	3	3	4	3	2	4	3	2	2
	4%	3%	2%	3%	4%	4%	9%	7%	3%	8%			7%							4%	4%	4%	4%	3%	3%	3%	3%	2%	3%	3%	2%	2%

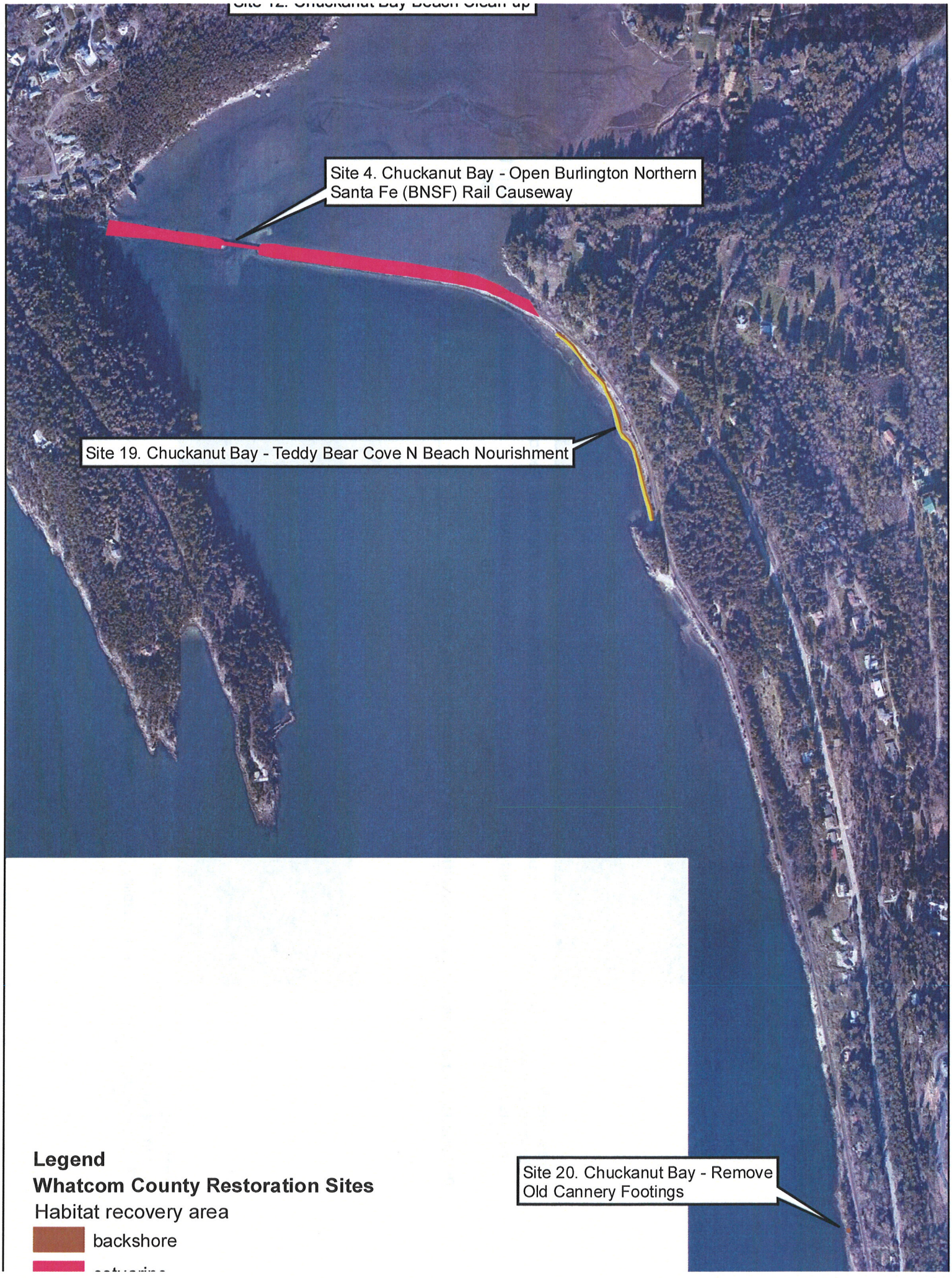
***nested level

Table 8. Summary of the final scores for each scoring category as well as cost estimates

	Name	Target area	Cost ($1000)	Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
1	Chuckanut Bay - Backshore wetland restoration	Chuckanut	40-80	38	6	5	16	9	74
2	Pt Roberts - Hydrologicaly reconnected wetlands	Pt Roberts	200-300	30	5	6	17	16	74
3	Birch Bay (Village) - Sunset Beach riprap removal	Birch Bay	30-60	28	6	6	17	11	68
4	Chuckanut Bay - Open BNSF causeway	Chuckanut	800-2500	29	7	5	10	15	66
5	Pt Roberts - Lily Pt Remove slag & piles	Pt Roberts	30-60	18	9	8	11	19	65
6	Pt Roberts - Maple Beach nourishment	Pt Roberts	100-150	18	6	3	23	13	63
7	Pt Roberts - Gabion baskets & groin removal	Pt Roberts	25-35	27	6	2	13	14	62
8	Birch Bay - Lower Terrell Ck reconnection	Birch Bay	100-400	25	4	2	20	10	61
9	Pt Roberts - The Breakers riprap removal	Pt Roberts	60-120	28	5	1	18	8	60
10	Pt Roberts - Pt Roberts marina sill	Pt Roberts	15-25	13	7	5	20	15	60
11	Birch Bay Dr. - Roger's Slough ehancement	Birch Bay	100-500	24	2	5	21	7	59
12	Chuckanut Bay - North beach cleanup	Chuckanut	20-40	15	7	6	13	16	57
13	Pt Roberts - Lighthouse Park remove riprap & nourish	Pt Roberts	70-110	20	4	3	13	16	56
14	Pt Roberts - W. Gulf Rd right-of-way piling removal	Pt Roberts	40-80	14	7	3	19	12	55
15	Pt Roberts - Maple Beach outfall pipe and pilings removal	Pt Roberts	20-35	14	7	1	16	16	54
16	Birch Bay Dr. - Groin field removal	Birch Bay	80-150	21	4	2	17	9	53
17	Birch Bay Dr. - Old boat ramp removal	Birch Bay	20-35	24	5	0	9	12	50
18	Birch Bay Dr. - Bluefish restaurant -relict boat	Birch Bay	10-20	15	4	0	17	13	49
19	Chuckanut Bay - Teddy Bear Cove N nourishment	Chuckanut	60-90	18	5	3	9	11	46
20	Chuckanut Bay - Old cannery footing removal	Chuckanut	15-25	13	4	2	14	13	46
21	Birch Bay Dr. - Bluefish restaurant - remove pier footings	Birch Bay	10-20	12	2	0	17	13	44
22	Pt Roberts - Gabion baskets removal at base of FBE	Pt Roberts	20-35	16	6	1	10	9	42


Site 17. Birch Bay - Birch Bay Drive Remove Old Boat Ramp
Birch Bay (Village) - Sunset Beach Riprap Removal
Site 16. Birch Bay Drive - Remove Groin Field
Site 18. Birch Bay Drive - Bluefish Restaurant - Remove Relict Boat
Site 21. Birch Bay Drive - Bluefish Restaurant - Remove Pier Footings
N
Site 8. Birch Bay - Lower Terrell Creek Reconnection

Site 15. Pt Roberts - Remove Old Outfall Pipe and Pilings
Site 6. Pt Roberts
Roberts - W. Gulf Rd Right-of-Way Creosote Pile Removal
t Roberts - Removing Infringing Riprap at The Breaker's
Site 5. Pt Roberts - Remove Slag Deposit, Pilings and Car Parts From Lily Point
Site 7. Pt Roberts - Remove Gabion Baskets and Groins
Roberts - Reconstruct Pt arina Sill at Lower Elevation
Site 2. Pt Roberts - Hydrologically Reconnect Wetland
Site 22. Pt Roberts - Gabion baskets at base of Feeder Bluff Exceptional


Site 4. Chuckanut Bay - Open Burlington Northern Santa Fe (BNSF) Rail Causeway
Site 19. Chuckanut Bay - Teddy Bear Cove N Beach Nourishment
Site 20. Chuckanut Bay - Remove Old Cannery Footings
Legend
Whatcom County Restoration Sites
Habitat recovery area
backshore

Whatcom County Nearshore Habitat Restoration Prioritization

Appendix 2: Recommendations for sites scoring below the top five, sorted geographically from north to south.

Pt Roberts, The Breakers Infringing Riprap

Restoration Recommendation: Remove revetment and edge of parking lot. Perform minor nourishment. Restore marine riparian.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
28	5	1	18	8	60

Pt Roberts, Lighthouse Park Shore Modifications Comprised of Piles and Riprap

Restoration Recommendation: Remove riprap and old piles. Perform upper beach nourishment.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
20	4	3	13	16	56

South Pt Roberts, Groins and Gabion Baskets

Restoration Recommendation: Remove gabion baskets and groins.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
27	6	2	13	14	62

South Pt Roberts, Gabions at Base of Feeder Bluff Exceptional

Restoration Recommendation: Remove gabion baskets.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
16	6	1	10	9	42

Pt Roberts, Maple Beach Nourishment

Restoration Recommendation: Perform nourishment to enhance eroded forage fish spawning habitat. Recreate beach profile.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
18	6	3	23	13	63

Pt Roberts, Maple Beach Old Outfall and Piles

Restoration Recommendation: Remove relic outfall pipe and old piles from upper beach.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
14	7	1	16	16	54

Birch Bay, Roger's Slough and Roger's Slough Side Channel and Confluence with Birch Bay

Restoration Recommendation: Enhance tidal flushing and enlarge culverts.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
24	2	5	21	7	59

North Birch Bay, Derelict Boat Ramp

Restoration Recommendation: Remove old boat ramp just north of Cottonwood Drive.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
24	5	0	9	12	50

Birch Bay, Groins and Scalloped Foreshore Resulting from Sediment Accretion at Up-Drift End of Net Shore-Drift Impediments

Restoration Recommendation: Remove groins. Perform upper beach nourishment.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
21	4	2	17	9	53

Birch Bay, Bluefish Restaurant

Restoration Recommendation: Remove concrete boat.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
15	4	0	17	13	49

Restoration Recommendation: Remove old dock footings.

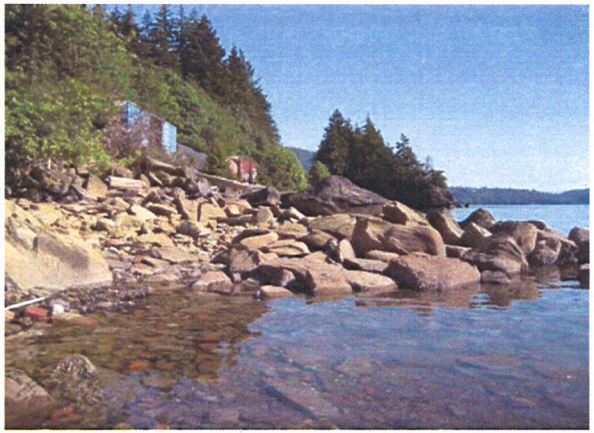
Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
12	2	0	17	13	44

Birch Bay, Lower Terrell Creek Reconnection

Restoration Recommendation: Remove tide gate. Replace erosion control flood structure.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
25	4	2	20	10	61

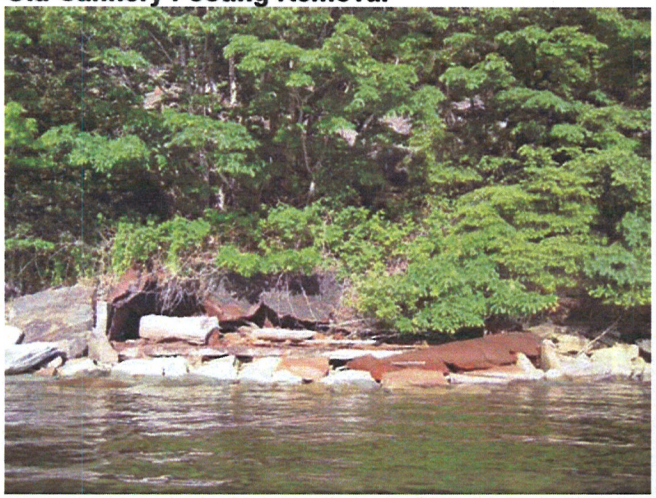
Chuckanut Bay, North Teddy Bear Cove Nourishment



Restoration Recommendation: Remove boulder lag. Create a 900-foot pocket beach north of Teddy Bear Cove.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
18	5	3	9	11	46

Chuckanut Bay – Old Cannery Footing Removal



Restoration Recommendation: Remove relic steel structure and foundation.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
13	4	2	14	13	46

Chuckanut Bay, North Beach Cleanup

Restoration Recommendation: Remove pilings, concrete debris, and failing groin from intertidal and backshore.

Targeted Response (45)	Sustainability (9)	Risk (8)	Ecological Function (35)	Final Feasibility (21)	Total (117)
15	7	6	13	16	57

WETLAND DELINEATION REPORT
FAIRHAVEN AVENUE ROW
BELLINGHAM, WA

DECEMBER 2009

prepared for
City of Bellingham Public Works
210 Lottie Street
Bellingham, WA 98225

prepared by
Northwest Ecological Services, LLC
1229 Cornwall Ave, Suite 313
Bellingham, WA 98225
360.734.9484

EXECUTIVE SUMMARY

Northwest Ecological Services, LLC (NES) conducted a wetland delineation for a proposed restoration project that involves removal of a culvert and relocation of parking away from the marine shoreline. The project site is located within road Right-of-way for Fairhaven Avenue, Bellingham, WA (NE quarter of Section 13, Township 37N, Range 02E, W.M.). The review area was located within the ROW west of 18th Street.

NES identified three wetlands within the Fairhaven ROW. Identified wetlands include one palustrine scrub-shrub and two estuarine emergent wetlands. The wetlands have WDOE Categories ranging from I to III. Wetland categorization is based on the Washington State Department of Ecology (WDOE) Wetland Rating System for Western Washington.

All project wetlands appear to be regulated by the City of Bellingham, The Corps, WDOE and possibly WDFW. Only regulatory agencies have the ability to make final jurisdictional determinations.

NES QUALIFICATIONS

Northwest Ecological Services, LLC (NES) is a small, service-oriented environmental consulting firm based in Bellingham, Washington. We provide a range of biological services including wetland assessments; biological assessments; wetland restoration and mitigation plans; natural resource analysis and regulatory compliance; landscape and ecological design; and environmental impacts assessments of plants, animals, fish and sensitive habitats to both the public and private sectors. NES staff have performed wetland and biological assessments on over 26,000 acres [1991-2008] in Whatcom, Skagit, Island, Snohomish and King Counties.

NES staff qualifications summary:

- Vikki Jackson is a senior ecologist with NES and has over 18 years of experience in providing environmental consulting services within the north Puget Sound area. Ms. Jackson obtained a Masters in Science from Western Washington University with emphasis on ecological processes and wetlands. She is certified through the Society of Wetland Scientists (SWS) as a Professional Wetland Scientist (PWS), #000514.
- Michele Bodtke is a senior ecologist with NES and has over seven years experience with environmental consulting services and has an extensive understanding of land use laws. Ms. Bodtke has Bachelors of Science degree in Geology from Michigan State University, and a certificate in wetland science and management from the University of Washington.
- Analiese Burns is a senior ecologist with NES and has over nine years of experience with environmental consulting services. Ms. Burns obtained a Bachelors of Science in Biology from the University of Washington. She is certified through SWS as a PWS, #1618; is a Leadership in Energy and Environmental Design ® (LEED) Accredited Professional; and is a Washington State Department of Transportation (WSDOT) Senior Biological Assessment Author.
- Molly Porter is a staff ecologist with NES and has over five years of experience with environmental consulting services. Ms. Porter obtained a Bachelors of Science in Environmental Science from Huxley College of the Environment at Western Washington University.
- Clover Muters is a staff ecologist with NES and has over two years experience with environmental consulting services. Ms. Muters has a Bachelor of Science in Environmental Science from Huxley College of the Environment at Western Washington University.

DISCLAIMER

Wetland and stream delineations and determinations are based upon protocols defined in manuals and publications produced by federal, state and local agencies. The wetland methodology used in this report is consistent with methods described in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Corps, 2008), the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987) and the *Washington State Wetlands Identification and Delineation Manuel* (WDOE, 1997). The maps included in this report were generated from field measurements, but not a professional survey. The findings were based on conditions at the time of the site visit. No guarantees are given that determinations or functional assessments will concur with those performed by regulatory agencies or other qualified professionals. This report is provided for the use of the named recipient only and is not intended for use by others parties for any other purpose.

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1.0 INTRODUCTION

1.1 Scope of Work

The City of Bellingham Public Works Department contracted with Northwest Ecological Services, LLC (NES) to conduct a wetland delineation within the road right-of-way (ROW) of Fairhaven Avenue west of 18th Street (referred to hereafter as "action area"). This report describes existing site conditions, including wetlands, streams, fish and wildlife habitat. This assessment also includes a wetland functional assessment. This report is intended for inclusion with future wetland, stream, and wildlife habitat permit submissions to City of Bellingham, the U.S. Army Corps of Engineers (Corps), Washington State Department of Ecology (WDOE), and Washington State Department of Fish and Wildlife (WDFW) as may be required.

This report identifies the presence of wetlands, streams, and priority wildlife habitat as observed within or near the action area. It does not include review of the following critical areas: geologically hazardous areas, frequently flooded areas, or critical aquifer recharge areas.

1.2 Project Location

The project review area was limited the Fairhaven Avenue ROW west of 18th Street, in Bellingham, WA (Section 13, Township 37N, Range 02E, W.M.) (Figure 1, Appendix B). Only wetlands within the ROW were flagged and formally delineated. Other identified wetlands are indicated on the wetlands delineation map for reference.

1.3 Background

NES identified three wetlands within the action area (Figure 2, Appendix B). Identified wetlands are palustrine forested, sloped and depressional palustrine forested and estuarine wetlands with categories ranging from I to III.

2009 Wetland Delineation Report Prepared by NES staff:
Vikki Jackson, PWS, Senior Ecologist
1229 Cornwall Avenue #313
Bellingham, WA 98225
T: 360.734-9484

Project Contact:
Renee LaCriox
City of Bellingham Public Works
210 Lottie Street
Bellingham, WA 98225
T: 360.778-7900

2.0 METHODS

NES's scope of services included conducting a wetland delineation and critical areas site assessment to determine the extent of wetlands, streams, and fish and wildlife habitats (HCA's) within the project area. The investigation consisted of an office review of existing documentation followed by a site investigation. NES conducted the site investigation in accordance with methodology specific to each critical area (wetlands, streams, and HCA's) as described below.

2.1 Document Review

NES conducted a review of available maps, drawings, and applicable reports pertaining to the subject property. Specifically, NES reviewed existing documents related to soils, hydrology, vegetation, wetlands, and fish and wildlife habitats. The following is a list of resources reviewed for this project:

- Aerial Photograph- Bing Map
- Whatcom County Wildlife Habitat Conservation Areas (HCA's) GIS Map (PDS, 2005)
- City of Bellingham, Wetland Inventories Map (COB Planning, 20004)
- Whatcom County Fish HCA's GIS Map (PDS, 2005)
- City of Bellingham Shoreline Management Program (SMP) Map (COB 1989)
- WDFW SalmonScape Interactive Map (WDFW, 2009a)
- WDFW Species of Concern Listing (WDFW, 209b)
- WDNR Forest Practices Interactive Water Typing Map (WDNR, 2009)
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) *Soil Survey of Whatcom County Area, Washington* (2009), NRCS Web Soil Survey (www.websoilsurvey.nrcs.usda.gov), and NRCS Whatcom County Area Hydric Soil List (2001)
- Wetland Characterization: Chuckanut Village Marsh (NES 2008)

2.2 Field Methods

2.2.1 Wetlands

The wetland delineation was conducted in accordance with the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Corps, 2008) and the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987). This methodology requires evidence that at least one positive wetland indicator must be found for each of three parameters (vegetation, soils, and hydrology) to make a positive wetland determination. An area is not considered a regulatory wetland if indicators for any

one of these three parameters are not observed under normal environmental conditions. Upland/wetland boundaries are delineated by locating the transition where soils, vegetation, or hydrology no longer indicate that wetland parameters are met. 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 the vegetation exhibits indicators of hydrophytic vegetation as defined in the delineation methodology (Corps, 2008). Most often the "Dominance Test" is used as the indicator. The sample plot meets the dominance test for hydrophytic 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). Dominant species are the most abundant species that individually or collectively account for more than 50 percent of the total coverage of vegetation in the stratum (absolute percent cover), plus any other species that, by itself, accounts for at least 20 percent of the total. The wetland indicator status for each dominant species is then used to determine whether the plant community is dominated by hydrophytic vegetation. Occasionally, the "Prevalence Index" is used as the indicator of hydrophytic vegetation. The Prevalence Index is a weighted-average of all plant species in the sample plot.
- **Soils:** Soil test pits are hand dug to approximately 20 inches and soils are examined for hydric soil indicators. These formal soil test pits are labeled with a data point number and located on the delineation map. Colors of the soil, including concentrations, depletions, or gleying, if present, are colored using a Munsell color chart (Gretag-Macbeth, 2000). *Field Indicators of Hydric Soils in the United States* (USDA, 2006) was used to determine hydric soils presence or absence.
- **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 but not limited to 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.
- **Growing Season:** Vegetation and hydrology indicators are dependent upon conditions during the "growing season". The growing season, as defined by *the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region*, is when non-evergreen plants show biological activity (plant growth) and/or the soil temperature at 12 inches below the surface is a minimum of 41 degrees Fahrenheit (F) (Corps, 2008, pp.66-67).

Wetlands were flagged in the field with orange field flagging. NES also flagged three sample plots associated with this project. The wetland delineation took place during at the end of the dry season. The wetlands were not professionally surveyed, but locations were field measured as indicated in Figure 2, Appendix B. Data sheets from the delineation are located in Appendix C of this report. Photographs taken at the time of the site visit are included in Appendix D.

2.2.2 Streams

Stream characterization included data collection of basic stream attributes including depth, vegetation, substrate, and habitat features. NES ecologists did not flag the OWHM of the stream within the review area, but it is documented in the Wetland Characterization report prepared by NES (NES 2008) (Figure 3, Appendix B).

2.2.3 Fish and Wildlife (HCA's)

Observations of any state Priority or federal Endangered Species Act (ESA) protected species presence was documented during the on-site review. NES also reviewed the site for general wildlife habitat conditions and habitat connectivity. If streams were present, NES documented any obvious fish passage barriers, characterized general stream attributes (as described above), and documented any observations of fish during the site visit.

2.2.4 Shorelines

The project area was located on City of Bellingham SMP maps to determine if shorelines of the state exist on-site and, if present, their documented Shoreline Area Designation. During the site visit, NES ecologists noted any obvious discrepancies with the SMP map. If shorelines were present, NES determined the lateral extent of the Shoreline jurisdiction based on floodplain, floodway, and/or wetland observations.

3.0 FINDINGS

3.1 Summary

NES staff conducted a site visit on October 23th of 2009. Three wetlands were identified within the review area (described in detail, below) (Figure 2, Appendix B). In addition a seasonal stream and a marine shoreline are located in the review area.

The project review area was limited the Fairhaven Avenue ROW west of 18th Street, in Bellingham, WA (Section 13, Township 37N, Range 02E, W.M.) (Figure 1, Appendix B). Only wetlands within the ROW were flagged and formally delineated. A more comprehensive review of the "Chuckanut Village Marsh" was documented in the "Wetland Characterization: Chuckanut Village Marsh" (NES 2008). An aerial photograph of the vicinity of the review area is included as Figure 3 (Appendix B).

3.2 Wetlands

Three wetlands (Wetlands A-C) were identified within the review area (Figure 2, Appendix B). Hydric vegetation, soils and primary indicators of hydrology were present within identified project wetlands. The wetland determination was based on the presence/ absence of vegetation, soils, and to a lesser degree hydrology (as wet season hydrology had not been restored to the site). Wetland hydrogeomorphic and Cowardin classifications, and wetland size are summarized in Table 1. A description of each wetland is provided below.

Table 1. Wetland Classification Summary

Wetland Unit	Hydrogeomorphic Class	Cowardin Classification	Wetland Size* (approx. square feet [s.f.])
Wetland A	Depressional outflow	PSS/PEM	3,700
Wetland B	Slope -outflow	Estuarine emergent	750
Wetland C	Depressional- outflow	Estuarine emergent	> 3 acres

(+ wetland extends off-site PFO: Palustrine Forested, PEM: Palustrine emergent:
*Wetland size based on field measurements, not a professional survey)

3.2.1 Wetland A

Wetland A is a palustrine scrub-shrub/emergent wetland. The wetland is dominated by native shrubs and herbaceous species, although non-native reed canarygrass (*Phalaris arundinacea*) is well established in portions of the wetland. Species observed include Hooker's willow (*Salix hookeriana*), hardhack (*Spiraea douglasii*), reed canarygrass (*Phalaris arundinacea*), bentgrass (*Agrostis* sp.), and Pacific silverweed (*Potentilla anserina*). Reed canarygrass is considered an invasive, non-native noxious species, and occupies a significant portion of the center of the wetland (Hruby, 2004 and Washington State Noxious Weed Control Board [NWCB], 2008).

The NRCS mapping indicates soils in the review area are dominated by Fishtrap Muck on 0 to 2% Slopes (54), tidal Hydraquents on 0 to 1% Slope (75), and Everett Urban Land Complex on 5 to 20% Slopes (52) (Figure 6). Fishtrap Muck 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. Tidal Hydraquents are mapped in the extreme southwest corner in the vicinity of the parking area and immediately to the east.

Soil observed in Wetland A had a black to a very dark brown (10YR 2/1 to 2/2) mucky peat that extended to beyond 20 inches. This soil appears consistent with the description of Fishtrap Muck. Soil in Wetland A meets NRCS hydric soil indicator A1 (histosol) (USDA, 2006).

Wetland A appears to be saturated throughout the year and may be shallowly inundated during the wet season. The wetland has an intermittently flowing, semi-constricted outlet that discharges via a culvert west under a driveway into Wetland B. At the time of the October 2009 site visit, soils were saturated to within four inches of the surface. The primary hydrology supporting this wetland appears to be from a mix of surface water runoff and a seasonal high water table possibly extending from Wetland C.

3.2.2 Wetland B

Wetland B is an estuarine emergent wetland dominated by native herbaceous species. The wetland is dominated by hydrophytic halophytes. Dominant species include saltgrass (*Distichlis spicata*) and Atriplex (*Atriplex patula*). Other representative species include Douglas aster (*Aster subspicatus*), marine plantain (*Plantago maritima*), pickleweed (*Salicornia virginica*) and field bindweed (*Convulvus arvensis*). Shrubs are present at the fringe of the wetland, but rooted more significantly in the upland. Shrubs include Nootka rose (*Rosa nutkana*), western crabapple (*Malus fusca*) and Himalayan blackberry (*Rubus armeniacus).*

Soil observed in Wetland B had a black to a very dark brown (10YR 2/1 to 2/2) mucky peat that extended to beyond 20 inches. Redox features with a color of 10YR 4/4 were present with a total percentage ranging from zero to thirty percent. This soil appears consistent with the description of Fishtrap Muck. Soil in Wetland B meets NRCS hydric soil indicator A1(Histosol) (USDA, 2006).

Wetland B is located in a sloped swale that has unrestricted outlet to the shoreline of Chuckanut Bay. The slope within the wetland is approximately 5%. The wetland is tidally influenced on regular basis. Other hydrology sources associated with this wetland include the outlet culvert from Wetland A. This culvert enters Wetland B at its eastern end. The outlet stream from Wetland C also has periodic flows that influence Wetland B. At the time of the site visit, Wetland B displayed saturated soils beginning at 5 inches from the surface. This wetland appears to be saturated year round and flooded by fresh and marine sources at frequent intervals.

3.2.3 Wetland C

Wetlands C is an estuarine emergent wetland commonly referred to as "Chuckanut Village Marsh". The marsh also includes Palustrine forested and palustine shrub-shrub and emergent vegetation classes outside of the review area for this project (see *Wetland Characterization: Chuckanut Village Marsh*, NES 2008 for more details). Wetland C is dominated by native hydrophytic plant species; many of which have a high tolerance to salt (halophyte). Dominant species include saltgrass (*Distichlis spicata*), Baltic rush (*Juncus balticus*), Douglas aster (*Aster subspicatus*), and Atriplex (*Atriplex patula*). Other representative species include marine plantain (*Plantago maritima*) and a well developed stand of Japanese knotweed (*Polygonum cuspidatum)* at the western edge of the wetland.

Soil observed in Wetland C had a black to a very dark brown (10YR 2/1 to 2/2) mucky peat that extended to beyond 20 inches. Redox features with a color of 10YR 4/4 were present with a total percentage ranging from zero to thirty percent. This soil appears consistent with the description of Fishtrap Muck. Soil in Wetland C meets NRCS hydric soil indicator A1 (Histosol) (USDA, 2006). Old fill material appears to be present at the western edge of the wetland, in the vicinity of the patch of Japanese knotweed.

Hydrology to Wetland C is provided via surface water runoff, tidal influence and groundwater. The Wetland Characterization report provides more specifics regarding the hydrology of this wetland (NES 2008). At the time of the site visit the soils were saturated to the surface within the review area of this wetland.

3.3 Wetland Categorization and Functional Assessment

NES completed a wetland rating and functional assessment of site wetlands using the WDOE's Wetland Rating System for Western Washington, revised 2004 (Rating System) (Hruby, 2004). 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 are classified as Category I through Category IV.

Table 2. Wetland Functional Assessment

	Qualitative Rating of Function		
Functional Value or Score	**Wetland A**	**Wetland B**	**Wetland C**
Total WDOE Score	52	48	69
WDOE Category	III	II*	I*
Overall Water Quality Potential	H	M	H
Overall Water Quality Opportunity? (Y/N)	Y	Y	Y
Overall Hydrologic Potential	M	L	M
Overall Hydrologic Opportunity? (Y/N)	Y	Y	Y
Total Habitat Score	13	18	29
Overall Wildlife Habitat Potential	L	L	H
Overall Wildlife Habitat Opportunity	M	M	M
Specific Habitat Functions:			
Vegetation Structure	M	L	H
Habitat Features	L	H	H
Buffer Quality	L	L	H
Priority Habitats	M	M	H
Habitat Connectivity	M	M	H

(H: High, M: Medium, L: Low, Y: yes, N: no, * these wetland ratings were determined by using the Special Characteristics sheets)

Wetland function (potential and opportunity) was determined using the WDOE Rating System, per recent guidance from WDOE (WDOE, 2008). The NES ecologists converted the

Rating System scores to a qualitative rating of "High", "Medium", and "Low" based on WDOE guidance. The qualitative rating provides more accuracy when comparing wetlands and evaluating their current status. The ecologists did not include a qualitative rating for the opportunity for water quality and hydrologic functions because the opportunity is either present or not. Instead, the table reflects the presence of opportunity as "Yes" and absence as "No" based on answers provided in the rating sheets. The qualitative ratings for specific habitat functions are based on NES ecologists' best professional judgment. A summary of WDOE rating and scores is shown in Table 2.

3.3.1 Wetland A

Wetland A has a high potential to perform water quality functions. This rating is based on the wetlands intermittently flowing outlet, moderate size, and moderate holding capacity. These features result in prolonged water retention and subsequent increased water quality treatment within the wetland. Under lying soils have a high organic content which increases the wetland to remove pollutants from surface water. The wetland supports dense herbaceous vegetation which is able to provide pollutant capture and conversion. This wetland is a seasonally saturated to shallowly ponded depression which provides some pollutant capture and conversion. Wetland A is receives runoff from Fairhaven Avenue and adjacent residential yards which provides the wetland with the "Opportunity" to serve water quality improvement functions.

Wetland A has a moderate potential to perform hydrologic functions. The wetland is a depresssional wetland with a semi-constrained outlet which allows it to retain surface flows, providing water storage functions. However Wetland A is located very low in the drainage basin reducing its potential to provide flood de-synchronization and baseflow functions. Wetland A has the "Opportunity" to provide some erosion and flood protection as it is upstream of Chuckanut Bay which has documented salmonid presence, but its location low in the drainage limit these functions.

Overall, Wetland A has a low "Potential" and moderate "Opportunity" to provide wildlife habitat functions. These ratings are based on the wetland's moderate vegetation structure, presence and cover of non-native plant cover, and limited habitat features. The wetland is moderately connected to other habitats, although roads and a driveway fracture direct corridor cover.

The buffer surrounding Wetland A includes Fairhaven Avenue, a narrow band of mixed forested and residential yards. Canopy cover is near 100 percent within the buffer, however shrub and herbaceous cover is sparse. Habitat features were not detected within the buffer area in the ROW.

3.3.2 Wetland B

Wetland B has a moderate potential to perform water quality functions. This is based on the high percent cover of persistent vegetation and the presence of soil with a high percentage of

organic content. The wetland's function for water quality improvement is impeded by the lack of retention within the wetland due to it unconfined outlet and exposure to the marine system. Under lying soils have a high organic content increasing the wetland's ability to remove pollutants from surface water. The wetland has dense herbaceous vegetation cover in most areas which also increases its pollutant capture and conversion functions. Wetland B receives runoff from Fairhaven Avenue and adjacent residential yards providing the wetland with the "Opportunity" to serve water quality improvement functions.

Wetland B has a low potential to provide hydrologic functions. The wetland's ability to provide this suite of functions is due to its reduced capacity to retain and detain surface water. Surface water entering the wetland can move freely through, since the wetland does not have any restriction at its outlet and flows directly into the marine system. Ponding within the wetland is limited to the duration of a narrow tidal cycle, limiting the range of biochemical processes that can occur within the wetland. The wetland is also located at the bottom of a drainage basin which also limits its function to provide hydrologic support to this system. The wetland is associated with Chuckanut Bay which is documented fish habitat. This provides the wetland with the "Opportunity" to provide these functions.

Overall Wetland B has a low "Potential" and moderate "Opportunity" to provide wildlife habitat functions based on its moderate vegetation structure, and limited habitat features. The location of the wetland between residential uses and Fairhaven Avenue provides limited buffer function protecting the wetland. Wildlife habitat is well connected to other habitats via the marine shoreline.

The buffer surrounding Wetland B includes Fairhaven Avenue, residential yards and Chuckanut Bay to the west. No canopy exists within the buffer of this wetland. Habitat features are not located in the buffer area located in the ROW.

3.3.3 Wetland C

Wetland C has a high "Potential" to perform water quality functions. This is based on high percent cover of persistent vegetation and the presence of soil with a high organic content. The wetland function for water quality improvement is enhanced by a semi constrained outlet and by influence by the regular tidal inundation. This results in varying hydro periods providing a range of biochemical actions that can provide water quality improvement. Under lying soils have a high organic content increasing the wetland's ability to remove pollutants from surface water. The wetland has dense herbaceous vegetation cover in most areas which also increases its pollutant capture and conversion functions. Wetland C receives runoff from Fairhaven Avenue and adjacent residential yards which provides the wetland with the "Opportunity" to serve water quality improvement functions.

Wetland C has a moderate "Potential" to provide hydrologic functions. The wetland's ability to provide this suite of functions is due to its reduced capacity to retain and detain surface water. Surface water entering the wetland is partially retained within the wetland due to a

outlet that is semi restricted. Ponding within the wetland is significant and could assist in hydrologic function in the system, except that the wetland is located at the bottom of a drainage basin which limits its function. The wetland is associated with Chuckanut Bay which is documented fish habitat. This provides the wetland with the "Opportunity" to provide these functions.

Overall Wetland C has a high "Potential" and moderate "Opportunity" to provide wildlife habitat functions based on its diverse vegetation structure, high presence and cover of native plants, and a wide range of habitat features. The location of the wetland between residential uses and Fairhaven Avenue provides limited buffer function protecting the wetland in some locations, although wildlife habitat is well connected to other habitats via the marine shoreline.

Land use within the buffer of this wetland is mix of forested uplands and residential development. Fairhaven Avenue abuts the southern edge of this wetland. The buffer area within the ROW for this wetland is residential year maintained in lawn. No habitat features are present.

3.4 Streams

3.4.1 Document Review

The following provides a summary of the findings contained within documents reviewed:

- **Basins Map (COB, 2004)**

  The project area is located within the South Bellingham Bay Watershed. The stream associated with Wetland C is indicated on this mapping. Chuckanut Creek Watershed is immediately south of the project area.

- **Salmonscape (WDFW, online)**

  Salmonscape only indicates Chuckanut Creek, south of the action area. It is documented habitat for fall chum and coho salmon. The identified stream in the project area is not mapped.

- **WDNR Forest Practices Interactive Water Typing map (WDNR, 2009)**

  The WDNR Forest Practices map also documents Chuckanut Creek. WDNR lists it as a type "S" stream. A type "S" stream is an inventoried water of the State.

3.4.2 Field Observations

A ditched seasonal stream associated with Wetland C (Chuckanut Village Marsh) is located within the project area. Chuckanut Creek is located 700' feet south of the project. The stream within the project area has been ditched and flows under Fairhaven Avenue via a culvert (this culvert would be removed in the proposed restoration project).

3.5 Fish and Wildlife

3.5.1 Document Review

The following provides a summary of the findings contained within documents reviewed:

- **Whatcom County Wildlife HCA's GIS Map (PDS, 2005) (Figure 4**)

  Wildlife HCA's are mapped within the review area for Peregrine Falcon, Bald eagle and commercially important shellfish.

- **Whatcom County Fish HCA's GIS Map (PDS, 2005)**

  County mapping does not include the South Bellingham Bay Watershed, but mapping does indicate documented fish presence in Chuckanut Creek.

3.5.2 Field Observations

No state or federal Threatened, Sensitive, or Endangered plant or animal species, were observed in the review area at the time of the site visit. However, concentrations of waterfowl were observed immediately off-shore. Bald eagles are common residents of this bay.
No fish were observed in the stream during recent site visits, but fish have been reported in the stream during other recent reviews.

3.6 Shorelines

3.6.1 Document Review

The following provides a summary of the findings contained within documents reviewed:

- **City of Bellingham SMP Map (COB, 1989)**

  The project review area is located within and adjacent to a Water of the State – Chuckanut Bay and Chuckanut Creek. Chuckanut Bay has a Natural designation under the existing SMP.

3.6.2 Field Observations

The project abuts the marine shoreline. Ditches and wetlands associated with the project discharge directly into the marine waters.

3.7 Upland Areas

3.7.1 Document Review

The following provides a summary of the findings contained within documents reviewed:

- **Aerial Photograph- Bing Maps (Figure 3)**

  The aerial photograph shows the vicinity of the proposed project area.

- **USDA, NRCS *Soil Survey of Whatcom County Area, Washington*, NRCS Web Soil Survey (USDA, NRCS, 2009), and NRCS Whatcom County Area Hydric Soil List (2001) (Figure 4)**

The NRCS mapping indicates soils in the review area are dominated by Fishtrap Muck on 0 to 2% Slopes (54), tidal Hydraquents on 0 to 1% Slope (75), and Everett Urban Land Complex on 5 to 20% Slopes (52) (Figure 6). Fishtrap Muck 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. Tidal Hydraquents are mapped in the extreme southwest corner in the vicinity of the parking area and immediately to the east.

3.7.2 Field Observations

The upland vegetation has been influenced by surrounding residential land use. The upland area south of the road in the ROW is a mixed deciduous forest dominated by red alder (*Alnus rubra*), Sitka spruce (*Picea sitchensis*), walnut species, Indian plum (*Oemleria cerasiformis*), English holly (*Illex* sp) and sword fern (*Polystichum munitum*). Vegetation on the north side of the road is primarily a mowed lawn.

The review area slopes north and west on the south side of the ROW, but is generally flat on the north side. Surface water is conveyed in a shallow ditch and into Wetland A on the south side of the ROW; whereas it disperses across the lawn into Wetland C on the north side.

Soils observed within the sampled upland had very gravelly loam soils with a very dark brown color extending beyond 20 inches in depth. No redox features were observed. No hydric soil indicators were indicated for this sample plot.

No indicators of wetland hydrology were observed within areas designed as upland on the project site.

4.0 REGULATIONS

Agencies with regulatory authority over site wetlands and streams are summarized in Table 3. A regulatory summary for each agency is provided below.

Table 3. Regulatory Summary

Unit	Wetland Size* (s.f.)	WDOE Category (habitat pts)	Corps Hydrologic Classification	Regulatory Status				Regulated Buffer (ft)
				Corps	WDOE	WDFW	City of B'ham	
Wetland A	3,700	III (13)	Abutting an RPW	yes	yes	no	yes	80
Wetland B	750	II sc III f (18)	Abutting an TNW	yes	yes	yes	yes	100
Wetland C	>3 acres	I sc II f (29)	Abutting an TNW	yes	yes	yes	yes	200

(sc: rating using Special Characteristics, f: rated using function, RPW: Relatively Permanent Water, TNW: Traditional Navigable Water: *Wetland size based on field measurements and were not professionally surveyed)

4.1 City of Bellingham

4.1.1 Critical Areas Ordinance

The City of Bellingham Critical Areas Ordinance (CAO) states that no activity may be conducted within a regulated wetland, stream, or buffer without Critical Areas review and approval. Activities impacting regulated wetlands generally must provide mitigation sufficient to maintain or enhance the wetland functions. The City of Bellingham requires a buffer around regulated wetlands and streams to protect functions. The buffer must remain naturally vegetated except where it can be enhanced to improve the functions. Buffers are measured from the ordinary high water mark (OHWM) of the stream or the wetland edge.

The City of Bellingham requires a buffer on all wetlands and streams and shorelines in the project area. The regulated wetland buffer width is based on the overall DOE rating score, the DOE habitat score, and the proposed land use (moderate).

The City regulates stream buffers based on stream type (BMC 16.55.500 D). The unnamed stream appears to qualify as Type 3/ Type "F" (fish bearing) streams, and therefore requires 75 to 150 foot buffers. A summary of regulated wetland and stream buffers are shown in Table 4 below.

Table 4. City of Bellingham Regulated Buffer Widths

	DOE Wetland Category	DOE Habitat Score	Regulated Buffer (feet)
Wetland A	III	13	75'
Wetland B	II	18	100
Wetland C	I	29	200

The City of Bellingham requires that buildings and other structures are setback a minimum of 15 feet from the edge of critical area buffers, or from the critical area where no buffer is required, to the extend that the critical root zone of trees in the buffer are not disturbed. Uses allowed within the 15-foot setback include: landscaping; uncovered decks; roof eaves and overhangs; impervious surfaces such as driveways and patios, provided such improvements may be subject to water quality regulations (BMC 16.55.340 G).

The City of Bellingham CAO requires applicants to avoid all impacts to on-site critical areas and their buffers to the furthest extent possible. In some cases, if alteration to the critical area is deemed unavoidable, impacts may be allowed if all adverse impacts resulting from a development proposal are mitigated using best available science so as to result in no net loss of critical area functions and values. When alteration or impact to a critical area is proposed, the applicant shall demonstrate that all reasonable efforts have been taken to mitigate impacts in the following, prioritized, order: 1)Avoid, 2) Minimize, 3)Rectify, 4)Reduce, 5)Compensate (CAO, 16.55.250).

4.1.2 Shorelines

Shorelines are protected under the SMA, RCW 90.58, and regulations are administered under the City of Bellingham Shoreline Management Program (SMP) (1989). The SMP defines "shorelines" as all "shorelines of the state" and all "shorelands". Shorelines of the state are areas of Puget Sound and adjacent saltwaters, natural rivers or streams west of the Cascade range downstream of the point measured as having a mean annual flow of 1,000 cubic feet per second (cfs) or more, and natural and manmade lakes with a surface area greater or equal to 1,000 acres. Shorelands are lands extending 200 feet from the OHWM, floodways and all contiguous floodplains 200 feet from such floodways, and all wetlands and river deltas associated with jurisdictional shorelines. Each jurisdictional shoreline is associated with one or more Shoreline Use Designation for the purposes of administering the SMP. The project area is located within a regulated shoreline area associated with Chuckanut Bay.

The City is currently revising their Shoreline Master Program. Under the current designation this area is considered Natural.

4.2 U.S. Army Corps of Engineers

Activities altering wetlands, streams, and drainage ditches may require permit authorization from the Corps under Section 404 of the federal Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. § 401). For Corps regional conditions under the 2007 Nationwide Permits see **Special Public Notic*e*** dated 7 November 2007 issued by the Seattle District Regulatory Branch (Corps, 2007).

The Corps regulates wetlands, streams, and other drainages that connect to Waters of the United States. The Corps requires notification for **all** disturbances to wetlands, streams, and potentially to other drainages (ditches), and it is incumbent upon the landowner to disclose disturbances. The Corps will automatically assert jurisdiction over some wetlands and will need to complete a significant nexus determination for others, depending on the degree of connection to other waters, and the classification of these associated waters. Wetland hydrologic classification and connectivity is described in this report as the Corps "hydrologic classification" (Table 3) using definitions provided in current Corps guidance documents.

The ditch and stream serving as the outlet to Wetland A and C respectively appear to meet the definition of Relatively Permanent Waters (RPWs) based on an assumption of a continuous flow of more than three months out of the year. The ditch and stream outlet into Chuckanut Bay which is recognized Traditional Navigable Water (TNW). Wetland B appears to be abutting a TNW, as it outlets directly into Chuckanut Bay.

A disturbance under one-half acre of non-isolated wetland requires an application for a Nationwide Permit from the Corps. Fills exceeding one-half acre require an Individual Permit from the Corps. Mitigation is required for most wetland fill. In all cases the Corps requires concurrence with Section 7 of the ESA. The Corps also has discretion to disallow disturbance to

high quality wetlands. The Corps requires certification that no federally listed or known Endangered or Threatened animal species or areas protected under Section 106 of the National Historic Preservation Act are present on the site.

4.3 Washington State Department of Ecology

Activities altering wetlands may require permit authorization from WDOE per Section 401 of the federal CWA as directed by the U.S. Environmental Protection Agency. WDOE has authority over discharge into **all** wetlands (including isolated wetlands) and streams and can impose buffers and compensatory mitigation for impacts (RCW 90.48). **The WDOE appears to have jurisdiction over all project wetlands, and potentially the ditches.** The WDOE reviews all permits received by the Corps for Water Quality Certification. WDOE requires an "individual" review of all wetland disturbances greater than one-half acre. Water Quality Certification is required for all Individual Permit applications.

4.4 Washington Department of Fish and Wildlife

The WDFW requires issuance of a Hydraulic Project Approval (HPA) prior to any activities that may directly or indirectly affect streams or associated wetlands. Mitigation may be required for impacts to regulated streams. Prior to any work proposed the land owner must contact WDFW, to determine if an HPA is required for site development.

APPENDIX A: REFERENCES

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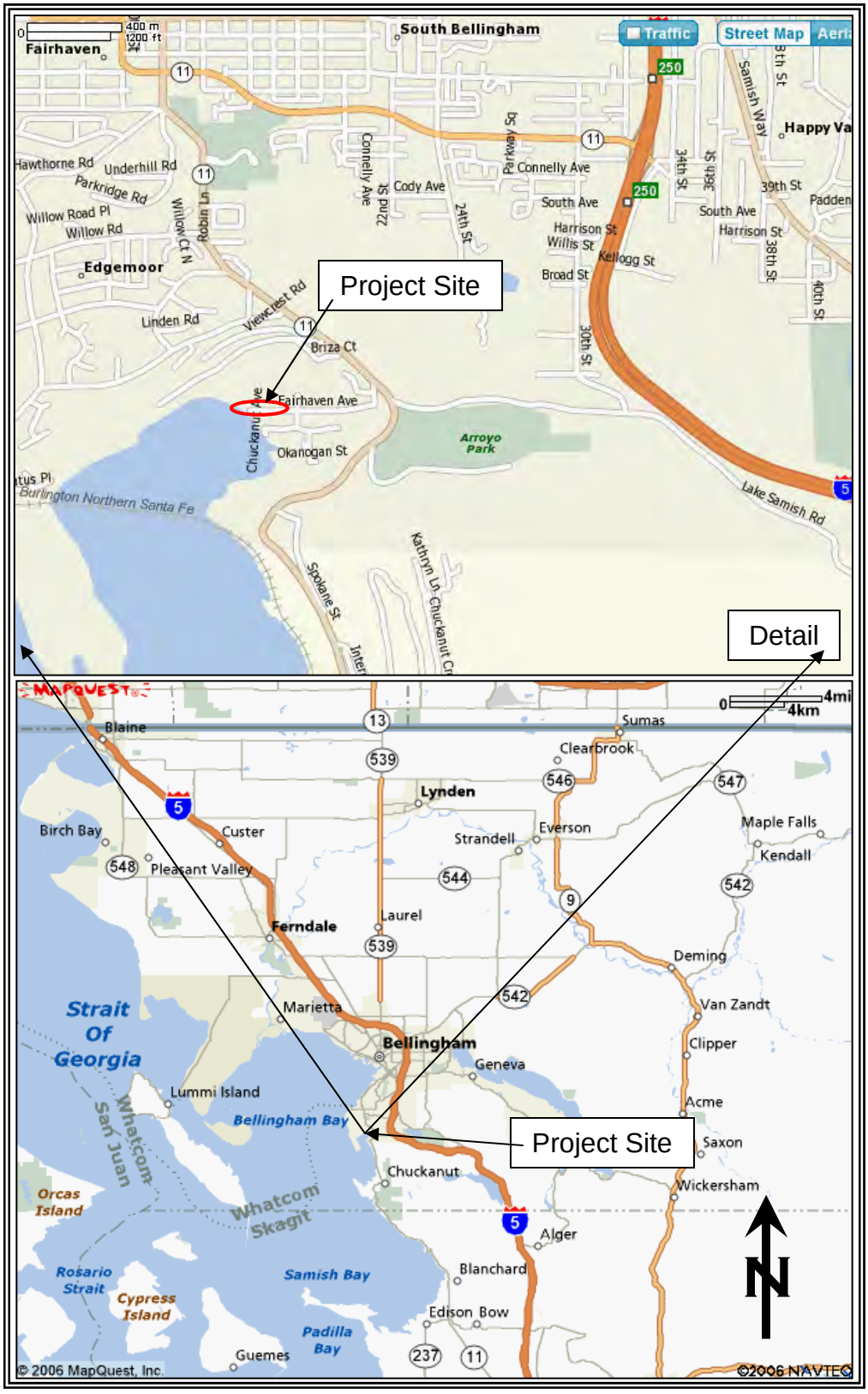
APPENDIX B: FIGURES



ECOLOGICAL NORTHWEST	**Vicinity Map** **City of Bellingham/ Chuckanut Village Marsh Delineation & Mitigation Report**	**Figure 1** **Oct. 2009**

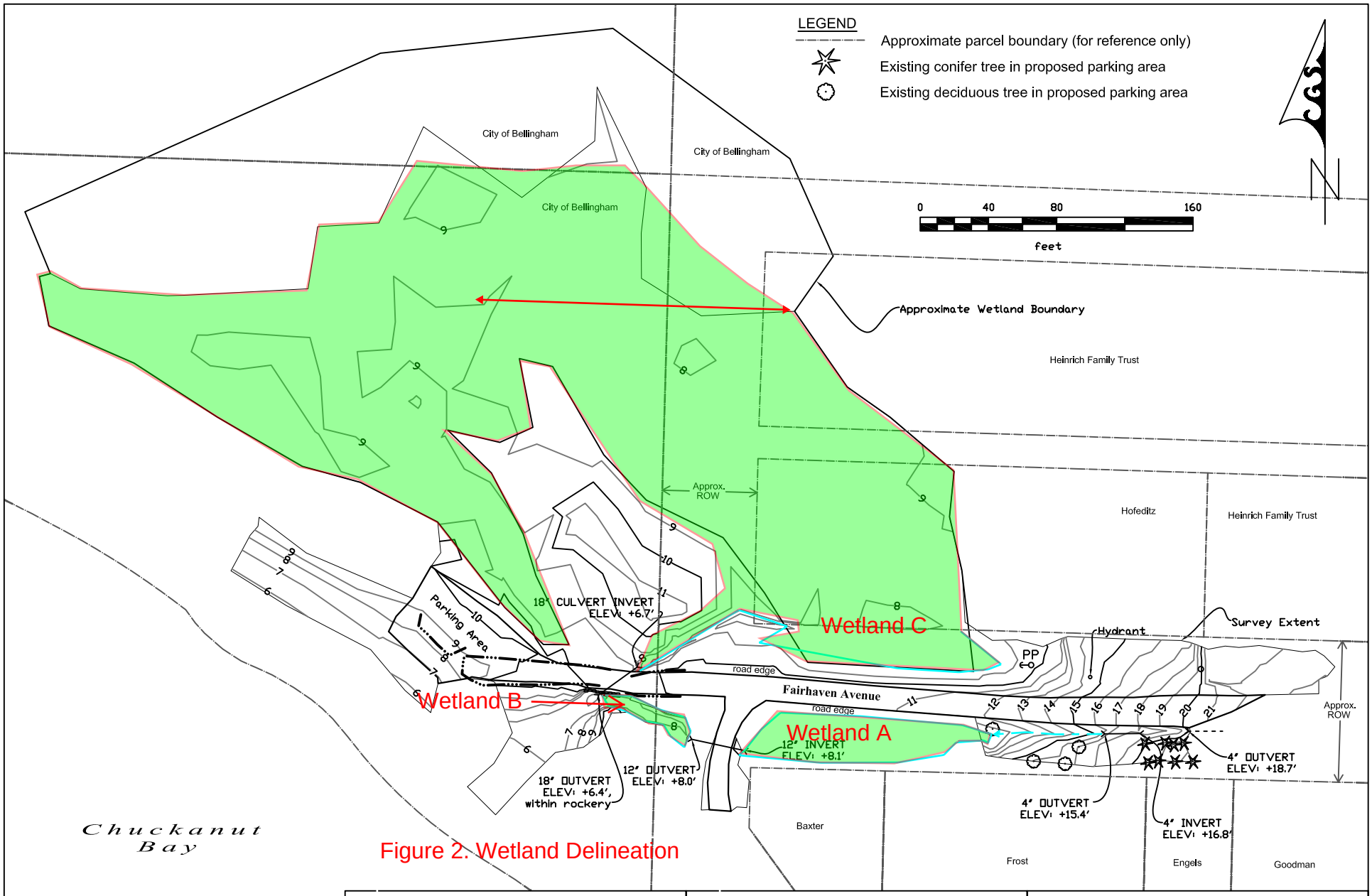


Figure 2. Wetland Delineation

PURPOSE: Culvert removal and beach restoration
DATUM: MLLW (MHHW = +8.4' MLLW)
ADJACENT PROPERTY OWNERS:
Burton Baxter
Patrick & Mary Frost
Kevin Engels
Heinrich Family Trust
Stephen & Marnie Hofeditz
John Goodman

CHUCKANUT VILLAGE MARSH
Site Plan - Existing Conditions
1"=80'
OWNER AND ADDRESS
City of Bellingham
210 Lottie Street
Bellingham, WA 98225

PROPOSED: Culvert removal and beach restoration
IN: Chuckanut Bay
COUNTY: Whatcom **STATE:** WA
APPLICATION BY: City of Bellingham

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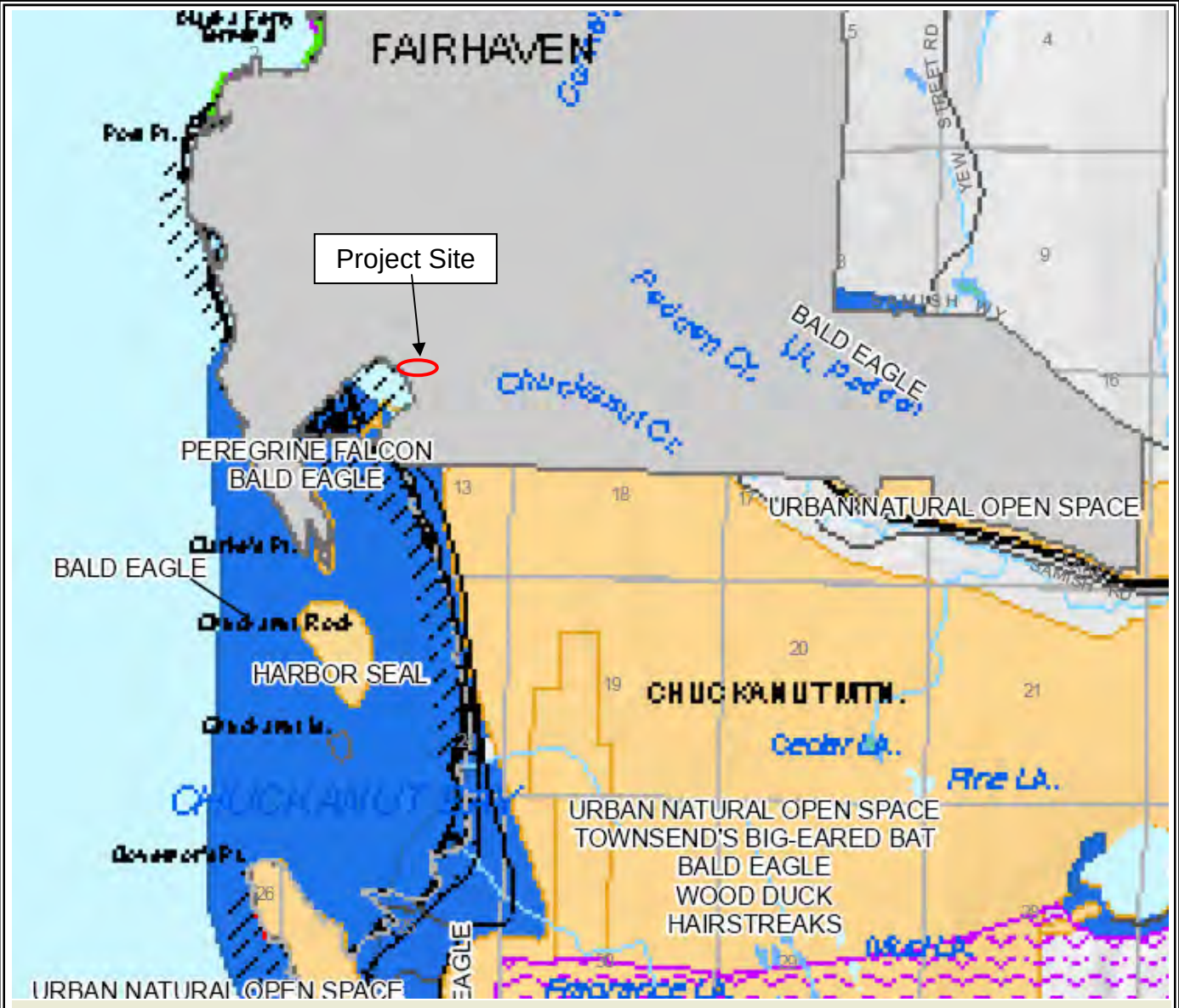
~\FairhavenMarsh\09-014_Corps_Drawings.dwg

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

ECOLOGICAL NORTHWEST	**Aerial Photograph** **(Bing Maps)** **City of Bellingham/ Chuckanut Village Marsh** **Wetland Delineation and Mitigation Report**	**Figure 3** **Dec. 2009**

Soil Series: Everett Urban Land Complex on 5 to 20% Slopes (52)
Fishtrap Muck on 0 to 2% Slopes (54)
Hydraquents, tidal on 0 to 1% Slope (75)

ECOLOGICAL NORTHWEST	**Soils Map** **(USDA NRCS)** **City of Bellingham/ Chuckanut Village Marsh** **Wetland Delineation and Mitigation Report**	**Figure 4** **Oct. 2009**



Article VII - Wildlife Habitat Conservation Areas (HCA)

HABITATS AND SPECIES

- HCA 2 - State and Federal listed Species Have a Primary Association
- HCA 3 - Habitats and Areas Associated with a State Priority Species
- HCA 10 - Habitats and Species of Local Importance *Includes marine beaches (see note)*
- HCA 4 - Commercial and recreational shellfish areas *Includes Shellfish Protection Districts (Drayton Harbor)*
- HCA 5 - Eelgrass Beds
- HCA 5 - Kelp Beds
- HCA 6 - Herring Spawning
- HCA 6 - Sandlance Spawning
- HCA 6 - Smelt Spawning
- HCA 7 + 8 - Lakes and Ponds less than 20 acres
- HCA 9 - Natural Area Preserves and natural resource conservation areas

OTHER MAP SYMBOLS

- City Jurisdiction
- Section Lines
- Mt. Baker/Snoqualmie National Forest
- Lummi Nation Boundaries

HCA 1 is found on the seperate Fish Habitat Conservation Areas Map

N

ECOLOGICAL NORTHWEST	**Wildlife Habitat Conservation Areas Map** **(Whatcom County Critical Areas Ordinance Maps)** **City of Bellingham/ Chuckanut Village Marsh Wetland Delineation and Mitigation Report**	**Figure 5** **Oct. 2009**

APPENDIX C: DATA SHEETS

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: COB/ Chuckanut Village Marsh	City/County: COB	Sample Date: 09/28/09
Applicant/Owner: COB	State: WA	Sample Point: 01
Investigator: Jackson, Porter	Section/Township/Range: 13/37N/02E	
Landform (hillslope, terrace, etc):	Local Relief (concave, convex, none) :	Subregion: LRR A
Soil Map Unit Name: Everett Urban Land Complex (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: Positive indicators for all three parameters were not observed at this location.	

VEGETATION

Tree Stratum (Plot size: 9 meters)	Absolute % Cover	Indicator Status	Dominant Species?
Picea sitchensis	30	FAC	☒
Alnus rubra	20	FAC	☒
Walnut	25	UPL	☒
		-	☐
Total Cover:	75		
Sapling/Shrub Stratum (Plot size: 3 meters)			
Oemleria cerasiformis	40	FACU	☒
Illex sp.	25	UPL	☒
Corylus cornuta	15	FACU	☐
Symphoricarpos albus	10	FACU	☐
Physocarpus capitatus	5	FACW	☐
Total Cover:	95		
Herb Stratum (Plot size: 1 meter)			
Polystichum munitum	5	FACU	☒
Hedera sp.	Trace	-	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:	5		
Woody Vine Stratum (Plot size:)			
n/a		-	☐
		-	☐
		-	☐
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:	6 (AB)	
Percent of dominant species that or OBL, FACW, FAC:	33% (A/AB)	
Prevalence Index worksheet		
OBL species:	x 1=	
FACW species:	x 2=	
FAC species:	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: The majority of dominant species observed at this location were hydrophytic.	**Hydrophytic Vegetation Present?** **Yes ☐ No ☒**

SOIL

Sample Point: 01

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 2/2	100			-	-	L	Very gravelly. Soil dry.
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[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: Soil observed at this location did not meet NRCS hydric soil indicators.

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)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ 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)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ FAC-neutral (D5)

Field Observations:

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

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

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

Wetland Hydrology Present?

Yes ☐ **No** ☒

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

Remarks: Positive indicators of wetland hydrology were not observed at this location.

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: COB/ Chuckanut Village Marsh	City/County: COB	Sample Date: 09/28/09
Applicant/Owner: COB	State: WA	Sample Point: 02
Investigator: Jackson, Porter	Section/Township/Range: 13/37N/02E	
Landform (hillslope, terrace, etc):	Local Relief (concave, convex, none) :	Subregion: LRR A
Soil Map Unit Name: Everett Urban Land Complex (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: **WETLAND A.** Positive indicators for all three parameters were observed at this location.	

VEGETATION

Tree Stratum (Plot size: 9 meters)	Absolute % Cover	Indicator Status	Dominant Species?
n/a		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum (Plot size: 3 meters)			
Salix hookeriana	5	FACW	☐
		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:	5		
Herb Stratum (Plot size: 1 meter)			
Phalaris arundinacea	50	FACW	☒
Agrostis sp.	50	FAC	☒
Potentilla anserina	10	OBL	☐
		-	☐
		-	☐
		-	☐
Total Cover:	110		
Woody Vine Stratum (Plot size:)			
n/a		-	☐
		-	☐
		-	☐
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/AB)

Prevalence Index worksheet	
OBL species:	x 1=
FACW species:	x 2=
FAC species:	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: The majority of dominant species observed at this location were hydrophytic.

Hydrophytic Vegetation Present?

Yes ☒ No ☐

SOIL

Sample Point: 02

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	mixed 10YR 2/1 & 2/2	100			-	-	Mucky peat	Soil disturbed, garbage at -5 and -14 inches.
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[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: Soil observed at this location met NRCS hydric soil indicators.

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)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ 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)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ FAC-neutral (D5)

Field Observations:

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

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

Saturation Present? Yes ☒ No ☐ Depth (inches): **-4** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ No ☐

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

Remarks: Positive indicators of wetland hydrology were observed at this location.

WETLAND DETERMINATION DATA FORM – Western Mountain, Valley Coast Region

Project Site: COB/ Chuckanut Village Marsh	City/County: COB	Sample Date: 09/28/09
Applicant/Owner: COB	State: WA	Sample Point: 03
Investigator: Jackson, Porter	Section/Township/Range: 13/37N/02E	
Landform (hillslope, terrace, etc):	Local Relief (concave, convex, none) :	Subregion: LRR A
Soil Map Unit Name: Everett Urban Land Complex (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: WETLAND B. Positive indicators for all three parameters were observed at this location.	

VEGETATION

Tree Stratum (Plot size: 9 meters)	Absolute % Cover	Indicator Status	Dominant Species?
n/a		-	☐
		-	☐
		-	☐
		-	☐
Total Cover:			
Sapling/Shrub Stratum (Plot size: 3 meters)			
Rosa nutkana	5	FAC	☒
Rubus discolor	Trace	FACU	☐
Malus fusca	5	FACW	☒
		-	☐
		-	☐
Total Cover:	10		
Herb Stratum (Plot size: 1 meter)			
Distichlis spicata	90	FAC	☒
Atriplex patula	40	FACW	☒
Aster subspicatus	25	FACW	☐
Plantago maritima	5	FACW	☐
Salicornia virginica	Trace	OBL	☐
Convolvulus arvensis	Trace	-	☐
Total Cover:	160		
Woody Vine Stratum (Plot size:)			
		-	☐
		-	☐
		-	☐
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/AB)

Prevalence Index worksheet	
OBL species:	x 1=
FACW species:	x 2=
FAC species:	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: The majority of dominant species observed at this location were hydrophytic.

Hydrophytic Vegetation Present?

Yes ☒ No ☐

SOIL

Sample Point: 03

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	mixed 10YR 2/1 & 2/2	70-100	10YR 4/4	0-30	C	M	Mucky peat	
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		
					-	-		

[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: Soil observed at this location met NRCS hydric soil indicators.

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)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ 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)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Front-heave Hummocks (D4)
- ☐ FAC-neutral (D5)

Field Observations:

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

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

Saturation Present? Yes ☒ No ☐ Depth (inches): **-5** (include capillary fringe)

Wetland Hydrology Present?

Yes ☒ No ☐

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

Remarks: Positive indicators of wetland hydrology were observed at this location.

APPENDIX D: PHOTOGRAPHS

View of Project area looking west

Wetland A looking west

Wetland B looking east

Wetland B looking east (outlet and Chuckanut Bay)

Wetland C near outlet looking east

Outlet of Wetland C looking north from road

APPENDIX E: WDOE RATING FORMS

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

WETLAND TYPE Check off any criteria that apply to the wetland. Circle the appropriate Category when the appropriate criteria are met.	**CATEGORY**
SC 1.0 Estuarine Wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal ☒ Vegetated, and ☒ With a salinity of greater than 0.5 ppt. YES = go to question SC 1.1 NO = not an Estuarine for the purpose of rating.	
SC 1.1 Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park, or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? YES = Category I NO = go to question SC 1.2	Category I
SC 1.2 Is the wetland at least 1 acre in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and less than 10% cover of non-native plant species). If the non-native *Spartina* spp. are the only species that cover more than 10% of the wetland, then the wetland should be given a dual rating of I/II. The area of Spartina would be rated as a Category II, while the relatively undisturbed upper marsh with native species should be rated a Category I. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	

SC. 2.0 Natural Heritage Wetlands. Natural Heritage Wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state threatened, endangered, or sensitive plant species.	
SC 2.1 Is the wetland being rated in a Section/Township/Range that contains a Natural Heritage Wetland? Verified through: ☐ S/T/R information in Appendix D, or ☐ Accessed from WNHP/DNR website YES = Contact WNHP/DNR and go to question SC3.2 NO = go to question SC 2.2	
SC 2.2 Has DNR identified the wetland as a higher quality undisturbed wetland or as a site with state threatened or endangered plant species? YES = Category I NO = not a Natural Heritage Wetland for rating purposes	Category I
SC 3.0 Bogs Does the wetland (or part of the wetland) meet both the criteria for soils and vegetation in bogs? Use the key below to identify if the wetland is a bog. NOTE: If the answer is YES, the wetland still needs to be rated based on its functions. 1. Does the wetland have organic soil horizons, either peats, or mucks, that compose 16 inches or more of the first 32 inches of the soil profile? YES = go to question 3 NO = go to question 2 2. Does the wetland have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? YES = go to question 3 NO = is not a bog for rating purposes 3. Does the wetland have more than 70% cover of mosses at ground level, AND other plants, is present, consist of the "bog" species listed in Table 3 as significant component of the vegetation (more than 30% of total shrub and herbaceous cover consists of "bog" species). YES = is a bog for purposes of rating NO = go to question 4 4. Is the wetland forested (>30% cover) with sitka spruce, sub alpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemenn's spruce, or western white pine, WITH any of the species (or combinations of species) on the bog species plant list as a significant component of the ground cover (>30% coverage of total shrub/herbaceous cover)? YES = Category I NO = is not a bog for the purposes of rating	Category I

SC 4.0 Forested Wetland Does the wetland have at least 1 acre of forest that meets one of the following criteria for the Department of Fish and Wildlife's forest as priority habitats? If the answer is YES the wetland still needs to be rated based on its functions. ☐ **Old-growth forests**: (west of the Cascade crest) Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/acres (20 trees/ha) that are at least 200 years of age OR have a dbh of 32 inches (81cm) or more. NOTE: The criterion for dbh is based on measurement for upland forests. Two-hundred year old trees in wetland will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do no necessarily have to have trees of this diameter. ☐ **Mature forests**: (west of the Cascade crest). Stands where the largest trees are 80 to 200 years old OR have average dbh exceeding 21 inches (53cm); 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 forests. YES = Category I NO = not a forested wetland for purposes of rating	Category I
SC 5.0 Wetlands in Coastal Lagoons Does the wetland meet **all** of the following criteria of a wetland in a coastal lagoon? ☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by a sandbank, gravel bank, shingle, or less frequently by rocks. ☐ The lagoon in which the wetland is located contains surface water that is saline or brackish (>0.5ppt) during most of the year in at least a portion of the lagoon (needs to be measured near the bottom). YES = go to question SC 5.1 NO = not a wetland in a coastal lagoon	
SC 5.1 Does the wetland meet all of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of invasive plant species. ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland is larger than 1/10 acre (4350 square feet). YES = Category I NO = Category II	Category I Category II

SC 6.0 Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership of WBUO)? In practical terms that mean the following geographic areas: ☐ The Long Beach Peninsula- lands west of SR 103 ☐ Grayland, Westport- lands west of SR 105 ☐ Ocean Shores, Copalis- lands west of SR 115 and SR 109 If the answer is YES the wetland still need to be rated based on its functions. YES = go to question SC6.1 NO = not an interdunal wetland for rating purposes	
SC 6.1 Is the wetland one are or larger, or is it a mosaic of wetlands that is one acre or larger? YES = Category II NO = go to question SC 6.2	Category II
SC 6.2 Is the wetland between 0.1 and 1 acre, or is it in a mosaic of wetlands that are between 0.1 and 1 acre? YES = Category III	Category III
Category of wetland based on Special Characteristics Choose the "highest" rating if wetland falls into several categories, and record on p. 1. If NO was answered for all types enter "Not Applicable" on p. 1.	

Wetland Rating Field Data Form- Western Washington

Background Information:

Name of Rater: Porter Affiliation: NW Ecological Date of site visit: 09/28/09

Name of Wetland (if known): COB/ Chuckanut Village Marsh/ Wetland A

Government Jurisdiction of Wetland: COB, Corps, DOE, WDFW

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

¼Section: NE 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	18
Score for Hydrologic Functions	16
Score for Habitat Functions	13
TOTAL score for Functions	47

Category based on SPECIAL CHARACTERISTICS of wetland

I ☐ II ☐ III ☐ **Does not apply** ☒

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

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?*	☐	☒
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.	☐	☒

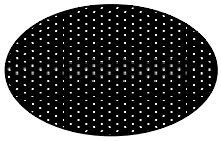
DEPRESSIONAL AND FLATS WETLANDS	Points
Water Quality Functions – Indicators that wetland functions to improve the water quality.	
D1 Does the wetland unit have the potential to improve water quality?	----------
D1.1 Characteristics of surface water which flows out of the wetland: ☐ Unit is a depression 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	0
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*	9
D2 Does the wetland unit have the opportunity 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
Total- Water Quality Functions Multiply the score from D1 by D2 *Add the score to the table on page 1*	18

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	3
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	3
Total for D3 *Add the points in the boxes above*	8
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: downstream fish habitat in 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*	16

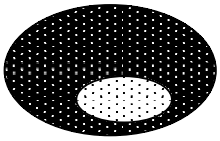
HABITAT FUNCTIONS Indicators that the wetland functions to provide important habitat			Points
H1 Does the wetland unit have the <u>potential</u> to provide habitat for many species?			----------
H1.1 Vegetation structure *Check the types of vegetation classes present (as defined in Cowardin) - Size threshold 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	1
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**	1
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	1

H1.4 Interspersion of Habitats

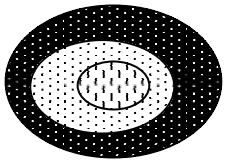
Decide from the diagrams below, whether interspersion between Cowardin vegetation classes (described in H1.1), or the classes and un-vegetated areas (can include open water or mudflats) is high, medium, low, or none.

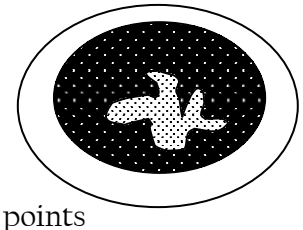


None = 0 points

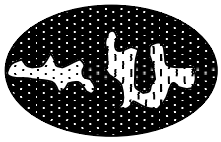


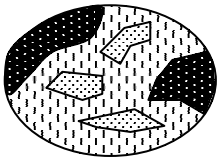
Low = 1 point

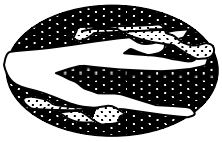




Moderate = 2 points







(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".

2

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

0

H1. Total Score – potential for providing habitat

Add the scores in all H1 columns above

5

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 any 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**	1
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**	1

H2.3 Near or adjacent to other priority habitats listed by WDFW *(updated Oct 2008)*	**Points**
Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*	
☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 0.4ha (1 acre).	3
☒ **Biodiversity Areas and Corridors:** Areas of habitat that are relatively important to various species of native fish and wildlife. (Full description in WDFW PHS report p. 152).	
☐ **Herbaceous Balds**: Variable size patches of grass and forbs on shallow soils over bedrock.	
☐ **Old-growth/ Mature Forests**: Old growth west of Cascade crest- Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 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.	
☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (full description in WDFW PHS report p. 158)	
☐ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.	
☐ **Westside Prairies**: Herbaceous, non-forested plant communities that can either take the form of a dry prairie or wet prairie (full description in WDFW PHS report p. 161).	
☐ **Instream**: The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.	
☒ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore (full description in WDFW PHS report p. 167-169, and glossary in Appendix A).	
☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice or other geological formations and is large enough to contain a human.	
☐ **Cliffs**: Greater than 7.6 m (25ft) high and occurring below 5000ft.	
☐ **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.	
☐ **Snags and Logs**: Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/ use by wildlife. Priority snags have a DBH of >51 cm (20 in) in Western Washington and are >2M (6.5 ft) in height. Priority logs are >30 cm (12 in) in diameter at the largest end and >6 m (20 ft) long.	
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*	8
Total for H1	5
Total Score for Habitat Functions- *Add the points from the total H1 and H2 boxes* *Add the score to table on page 1*	13

Wetland Rating Field Data Form- Western Washington

Background Information:

Name of Rater: Porter Affiliation: NW Ecological Date of site visit: 09/28/09

Name of Wetland (if known): COB/ Chuckanut Village Marsh/ Wetland B

Government Jurisdiction of Wetland: COB, Corps, DOE, WDFW

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

¼Section: NE 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	24
Score for Hydrologic Functions	8
Score for Habitat Functions	18
TOTAL score for Functions	50

Category based on SPECIAL CHARACTERISTICS of wetland

I ☐ II ☐ III ☐ Does not apply ☒

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

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?*	☐	☒
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.	☐	☒

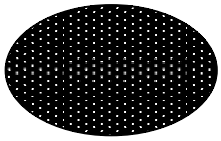
DEPRESSIONAL AND FLATS WETLANDS	Points
Water Quality Functions – Indicators that wetland functions to improve the water quality.	
D1 Does the wetland unit have the <u>potential</u> to improve water quality?	----------
D1.1 Characteristics of surface water which flows out of the wetland: ☐ Unit is a depression 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)*	1
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*	12
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*	24

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	1
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	3
Total for D3 *Add the points in the boxes above*	4
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: downstream fish habitat in 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*	8

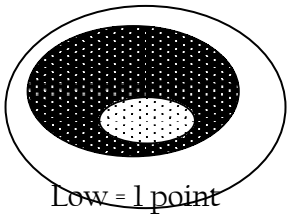
HABITAT FUNCTIONS Indicators that the wetland functions to provide important habitat	Points
H1 Does the wetland unit have the <u>potential</u> to provide habitat for many species?	----------
H1.1 Vegetation structure *Check the types of vegetation classes present (as defined in Cowardin) - Size threshold 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 4 pts 3 structures 2 pts 2 structures 1 pt 1 structure 0 pts	0
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 — 4 or more present — 3 pts ☐ Seasonally flooded or inundated — 3 present — 2 pts ☒ Occasionally flooded or inundated — 2 present — 1 pt ☒ Saturated only — 1 present — 0 pts ☐ Permanently flowing stream or river in, or adjacent to, the wetland ☒ Seasonally flowing stream in, or adjacent to, the wetland ☐ **Lake-fringe wetland** **2 pts** ☐ **Freshwater tidal wetland** **2 pts**	2
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 2 pts ☒ 5-19 species 1 pt ☐ <5 species 0 pts List of species counted (not required):	1

H1.4 Interspersion of Habitats

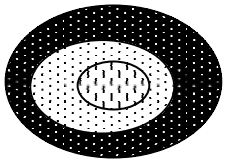
Decide from the diagrams below, whether interspersion between Cowardin vegetation classes (described in H1.1), or the classes and un-vegetated areas (can include open water or mudflats) is high, medium, low, or none.

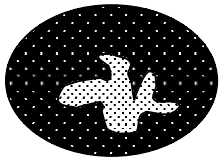


None = 0 points

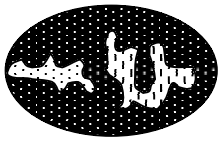


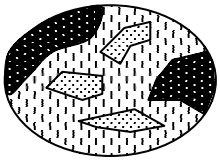
Low = 1 point





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".

1

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

2

H1. Total Score – potential for providing habitat

Add the scores in all H1 columns above

6

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 any 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**	1
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 *(updated Oct 2008)*	Points
Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*	
☐ **Aspen Stands**: Pure or mixed stands of aspen greater than 0.4ha (1 acre).	4
☒ **Biodiversity Areas and Corridors:** Areas of habitat that are relatively important to various species of native fish and wildlife. (Full description in WDFW PHS report p. 152).	
☐ **Herbaceous Balds**: Variable size patches of grass and forbs on shallow soils over bedrock.	
☐ **Old-growth/ Mature Forests**: Old growth west of Cascade crest- Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 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.	
☐ **Oregon White Oak**: Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (full description in WDFW PHS report p. 158)	
☒ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.	
☐ **Westside Prairies**: Herbaceous, non-forested plant communities that can either take the form of a dry prairie or wet prairie (full description in WDFW PHS report p. 161).	
☒ **Instream**: The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.	
☒ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore (full description in WDFW PHS report p. 167-169, and glossary in Appendix A).	
☐ **Caves**: A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice or other geological formations and is large enough to contain a human.	
☐ **Cliffs**: Greater than 7.6 m (25ft) high and occurring below 5000ft.	
☐ **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.	
☐ **Snags and Logs**: Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/ use by wildlife. Priority snags have a DBH of >51 cm (20 in) in Western Washington and are >2M (6.5 ft) in height. Priority logs are >30 cm (12 in) in diameter at the largest end and >6 m (20 ft) long.	
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**	5
H2. Total Score - opportunity to provide habitat *Add the scores in all of the H2 columns above*	12
Total for H1	6
Total Score for Habitat Functions- *Add the points from the total H1 and H2 boxes* *Add the score to table on page 1*	18

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 – Wetland C

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.	☒	☐

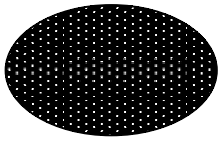
DEPRESSIONAL AND FLATS WETLANDS	Points
Water Quality Functions – Indicators that wetland functions to improve the water quality.	
D1 Does the wetland unit have the <u>potential</u> to improve water quality?	----------
D1.1 Characteristics of surface water which flows out of the wetland: ☐ Unit is a depression 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

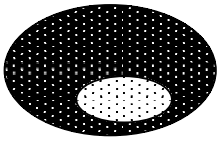
HABITAT FUNCTIONS Indicators that the wetland functions to provide important habitat			Points
H1 Does the wetland unit have the <u>potential</u> to provide habitat for many species?			----------
H1.1 Vegetation structure *Check the types of vegetation classes present (as defined in Cowardin) - Size threshold 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

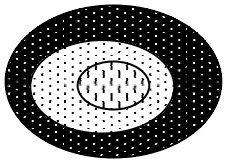
Decide from the diagrams below, whether interspersion between Cowardin vegetation classes (described in H1.1), or the classes and un-vegetated areas (can include open water or mudflats) is high, medium, low, or none.

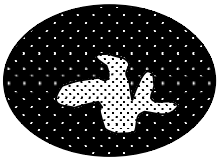


None = 0 points

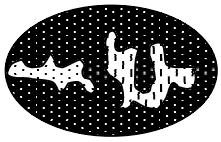


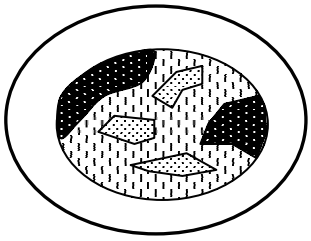
Low = 1 point





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".

3

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

4

H1. Total Score – potential for providing habitat

Add the scores in all H1 columns above

16

Comments:

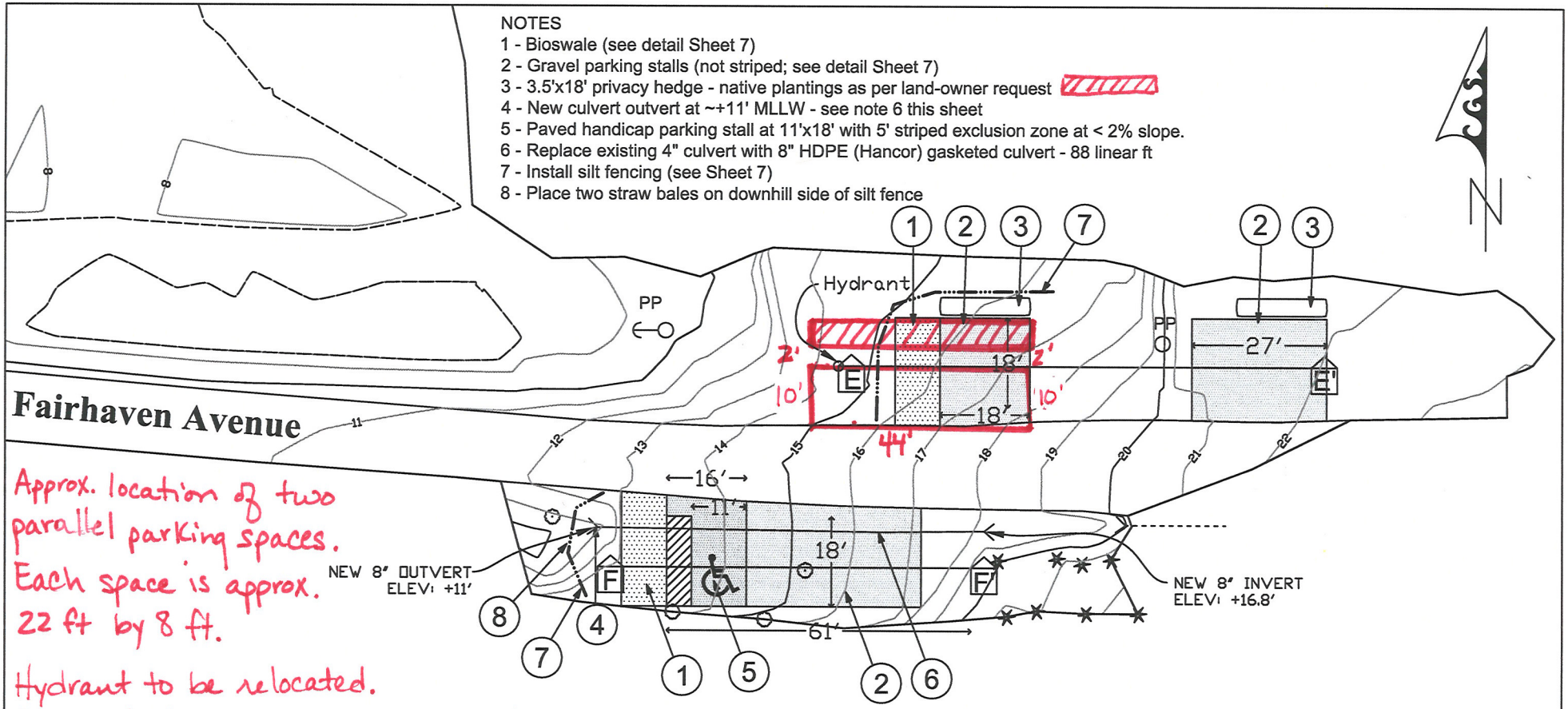
H2. Does the wetland unit have the <u>opportunity</u> to provide habitat for many species?	Points
H2.1 Buffers *Choose the description that best represents the condition of the buffer of the wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text 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

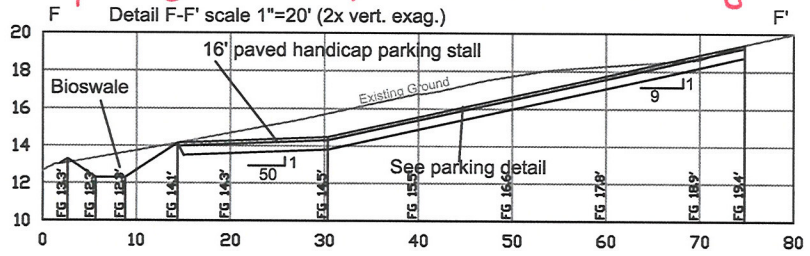
H2.3 Near or adjacent to other priority habitats listed by WDFW *(see p. 82)* Which of the following priority habitats are within 330ft (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.*	**Points**
☒ **Riparian:** The area adjacent to aquatic systems with flowing 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**	

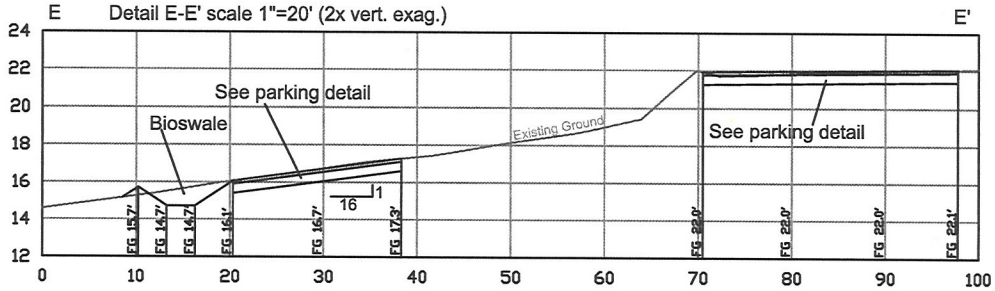
H2.4 Wetland Landscape (*see p.85)*	Points
Choose the one description of the landscape around the wetland that best fits. ☐ There are at least three other wetlands within ½ mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some 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

Chuckanut Village Marsh Restoration
EN-0031
18TH ST
FAIRHAVEN AVE
RAINIER AVE
CHUCKANUT BAY
CHUCKANUT AVE
Legend
City Limits
Urban Growth Boundary
Project Area
Feet
0
80
160
N
Author: E Haggith
PW/Engineering
Date: 12-10-2010

NOTES
1 - Bioswale (see detail Sheet 7)
2 - Gravel parking stalls (not striped; see detail Sheet 7)
3 - 3.5'x18' privacy hedge - native plantings as per land-owner request
4 - New culvert outvert at ~+11' MLLW - see note 6 this sheet
5 - Paved handicap parking stall at 11'x18' with 5' striped exclusion zone at < 2% slope.
6 - Replace existing 4" culvert with 8" HDPE (Hancor) gasketed culvert - 88 linear ft
7 - Install silt fencing (see Sheet 7)
8 - Place two straw bales on downhill side of silt fence







Revisions not to Scale.

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

PURPOSE: Culvert removal and beach restoration
DATUM: MLLW (MHHW = +8.4' MLLW)
ADJACENT PROPERTY OWNERS:
Burton Baxter
Patrick & Mary Frost
Kevin Engels
Heinrich Family Trust
Stephen & Marnie Hofeditz
John Goodman

CHUCKANUT VILLAGE MARSH
Parking Area
1"=30'
OWNER AND ADDRESS
City of Bellingham
210 Lottie Street
Bellingham, WA 98225

PROPOSED: Culvert removal and beach restoration
IN: Chuckanut Bay
COUNTY: Whatcom **STATE:** WA
APPLICATION BY: City of Bellingham

12AUG09
~\FairhavenMarsh\09-014_Corps_Drawings.dwg

HITACHI

CADDIS

REPORT

Chuckanut Bay Marsh Restoration Project: Community Survey

April, 2010

Pamela M. M. Jull, PhD
Rachel Williams, MA

APPLIED RESEARCH NORTHWEST, LLC
1313 East Maple Street Suite 201
Bellingham, Washington 98225
1-360-647-6067
www.arnorthwest.com

REPORT

Chuckanut Bay Marsh Restoration Project: Follow-up Community Survey

March 2013

APPLIED RESEARCH NORTHWEST, LLC
P.O. Box 1193
1116 Key Street Suite 203
Bellingham, Washington 98227
360.647.6067
www.arnorthwest.com

EXECUTIVE SUMMARY

The Chuckanut Village Marsh and beach in south Bellingham has undergone a substantial restoration. In 2010, prior to the project being finalized, the City of Bellingham engaged residents and users of the existing area in several public meetings and a survey. Once the restoration was completed and the area used, the survey was updated and distributed again in 2012 to a broader range of area residents to get feedback on the project. All together, the 2012 post-project survey included approximately 44 questions, including several opportunities for open-ended input. A total of 251 surveys were completed.

Restoration of the Chuckanut Village Marsh was designed to enhance the area's ability to provide pocket estuary functions, including improving water quality and providing habitat for newly hatched salmon migrating from nearby Chuckanut Creek. The project involved:

- Replacing an undersized culvert with a much larger box culvert to increase the tidal exchange between the marsh and the bay
- Creating an ADA accessible path to the shoreline from the end of Fairhaven Ave.
- Re-establishing a native salt marsh buffer along the publicly owned sections of the shoreline
- Protecting native vegetation and habitat elements by restricting vehicle access to sections of the shoreline and intertidal zones
- Relocating parking away from the shoreline
- Educating the public about the importance of marine nearshore environments, with the end goal of producing behavioral change that promotes a healthy nearshore habitat.

FINDINGS

Just under half (46%) of the respondents had been to the Chuckanut Village Marsh and beach area in the past year. This group identified litter, dog waste and illegal or improper parking as the most common problems, though few believed them to be *major problems*. Almost half (48%) of respondents knew about the salt marsh restoration, and the large majority said that area fishing and shell fishing had improved (66%) and that unwanted behaviors and questionable uses of the beach had been reduced (81%).

A key concern prior to the restoration was that changes would reduce parking for people using the beach and living in the neighborhood. According to the post-project survey,

over half of respondents who were aware of the project (59%) noted at least *a little* reduction parking for residents (28% of all respondents). A higher proportion noted reduced parking for kayakers -- 76% of those familiar with the project (36% of all respondents).

Overall, perceptions of the project were very positive, especially with regard to improved habitat and general aesthetics.

Environmental behaviors

Opportunities to improve water quality in the Chuckanut Bay area remain. With that in mind, the city also surveyed residents about environmental behaviors that could impact water quality. Among the findings:

- 29% of dog owners pick up their pet's waste from their yard daily
- 63% of residents with septic systems have had the system inspected within the past year
- 62% of those who washed their cars at home last year did so on pavement *every time*
- 34% applied chemical bug or weed killers in their yards at least once. A similar portion applied chemical fertilizers on their lawns.
- 42% had added native plants and 34% removed non-native plants. 16% removed non-native plants and then replaced them with native plants.
- 25% had reduced the size of their lawn in the past 3 years
- 88% never put toxics in the trash

Chuckanut Bay

Just 15% of respondents said that they were *not at all knowledgeable* about local wildlife and sensitivity of the Chuckanut Bay area. Among those with any knowledge, 34% said they had shared their knowledge with others in the past year. Most were not familiar with the Chuckanut Bay Pledge (70%) asking people to take steps like those mentioned in the Environmental Behaviors portion of the survey.

Most respondents (84%) had heard at least *a little* about educational and outreach events in 2012 that were developed to familiarize area residents with the salt marsh and the impacts of their behavior. Most who were aware of these events expressed some interest in seeing more events. When asked how they learned about the events, the most common response was the local newspaper, though direct mail was the most preferred method of contact. Respondents were also asked to identify trusted sources

of information about the area; the top mentions were Bellingham Parks and Recreation and RE Sources.

CONCLUSION

Overall the outcomes for the Chuckanut Village Marsh restoration project have been very positive. People reported a decrease in problems in the area and most expressed an appreciation for the improved quality of the area.

Although parking areas have been improved, many perceive that there was some lost capacity, either for the neighborhood or for kayakers. It is not clear from this research how much it has impinged upon their use of the park or conveniences in the neighborhood.

The salt marsh restoration piloted a new approach by the City of Bellingham to engage community members more fully prior to the finalization of plans and to engage them along the way. Although the initial pool of neighbors recruited into the plan was small (about 80 households), they tended to be the most prevalent users and in the end reported being well informed about the project, the bay and the events in the area.

There are some opportunities for further work in the area. Dog waste continues to be at least a minor problem at the site, and most dog owners are not picking up their dogs' waste at home on a daily basis (58% of dog owners). Car washing is prevalent on impermeable surfaces and occurs at a higher rate than in Puget Sound more broadly; the Puget Sound Partnership's 2012 study of area residents[1] found that only 10% of households washed their cars on pavement every time.

Replacing lawn with native plants or reducing lawn size is a relatively common activity, with 25% of respondents saying they had done so recently, some having reduced their lawns by half or more. These households would likely provide some examples of successful projects, which could inspire additional households to lose the lawn.

Reaching residents was fairly effective using conventional channels. The park area itself was a good channel for information, as was the Herald, direct mail, notices and signs. Respondents identified the Parks Department and RE Sources as two trustworthy sources of information which suggests some good sponsors for City messaging.

[1] Sound Behavior Index and Social Capital Index 2012 – Survey Report (www.psp.wa.gov)

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INTRODUCTION

The Chuckanut Village Marsh and beach in south Bellingham has undergone a substantial restoration. The project has restored a more natural flow pattern and function to one of Bellingham's few remaining salt marshes which provide robust and diverse habitat for plants and animals, and serve an important function in maintaining a healthy nearshore coastal environment.

Restoration of the Chuckanut Village Marsh was designed to enhance the area's ability to provide pocket estuary functions, including improving water quality and providing habitat for newly hatched salmon migrating from nearby Chuckanut Creek. The project involved:

- Replacing an undersized culvert with a much larger box culvert to increase the tidal exchange between the marsh and the bay
- Creating an ADA accessible path to the shoreline from the end of Fairhaven Ave.
- Re-establishing a native salt marsh buffer along the publicly owned sections of the shoreline
- Protecting native vegetation and habitat elements by restricting vehicle access to sections of the shoreline and intertidal zones
- Relocating parking away from the shoreline
- Educating the public about the importance of marine nearshore environments, with the end goal of producing behavioral change that promotes a healthy nearshore habitat.

In 2010, prior to the restoration project being finalized, the City of Bellingham engaged residents and users of the existing beach area in several public meetings, focus group research discussions and a survey. The purpose of the meetings and survey was to help the City raise people's awareness about the marsh, identify their needs and concerns about the restoration, and to plan for education and outreach efforts for a broader set of stakeholders in the area over the course of the restoration. Needs and concerns were discussed with the restoration team to incorporate what they could, given the engineering needs of the project and the several state and local laws that govern the area.

This winter (2012) the survey was updated and conducted with a broader range of area residents. As in 2010, this survey contained questions about site usage and current issues such as parking, pet clean up, and litter. Respondents were asked how much they knew about the salt marsh restoration project and to evaluate the impacts of the project on the park area. They were also asked about how much they knew about the Chuckanut Bay Pledge and recent City sponsored events held at Chuckanut Bay, their

interest in similar events in the future and the best way to publicize such events. Additionally, the survey included questions about environmental behaviors such as disposal of toxins and yard care practices.

The post-project survey included approximately 44 questions, including several opportunities for open-ended input. The surveys were sent out in the mail and there was also an online version available as an alternative. A total of 251 surveys were completed during December 2012.

This report presents the findings of the 2012 survey with comparisons to the 2010 survey where relevant. The report uses the convention of italicizing any verbatim response option from the survey in an effort to fully convey the voice of the residents' survey responses. A complete description of the research methods can be found in Appendix A. The distribution of responses can be found in Appendix B and the verbatim responses given to the open-ended questions can be found in Appendix C.

One note about place names in this report: The Chuckanut Village Marsh is not officially named as a park, but the public does have access to the beach area and visitors do engage in recreation activities on the site. The public views the area as a park. The survey adopted the convention of calling the area a "park" or "the park at Chuckanut Bay" to communicate with residents about the public access aspects of the marsh and beach. This report uses those terms to be consistent with the survey findings.

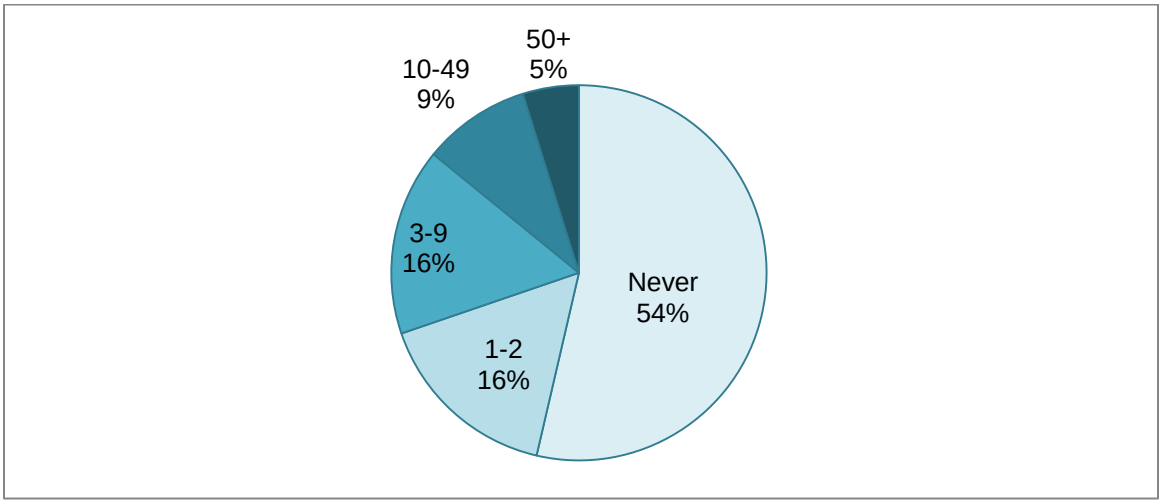
FINDINGS

This section presents how the respondents answered each item in the survey. The results are presented in graphical and written format. Survey questions that were the same or similar to questions that were included in the 2010 survey are identified; similarities and differences between the two points in time are discussed.

CHUCKANUT BAY USAGE

Just under half of respondents (46%) visited the park at Chuckanut Bay in the past year. Fourteen percent visited 10 or more times.

Figure 1. During all of this past year (2012), how many times did you visit the park at Chuckanut Bay?

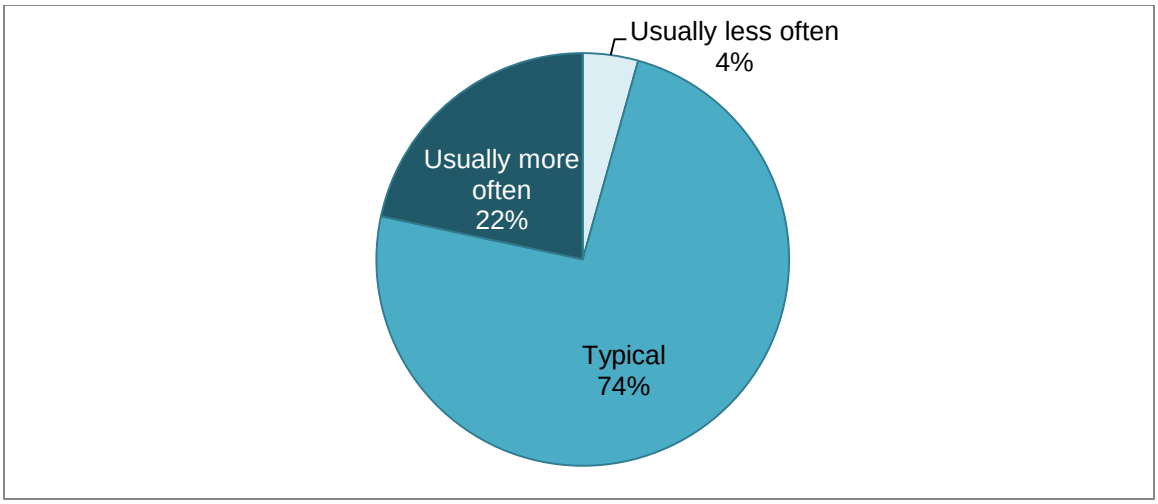


n=248

Just under one-third (30%) of those surveyed said that they live within ten minutes walking distance from the park. Not surprisingly, those who said that they lived within a ten minute walk were more likely to say that they visited the site in the past year (60% vs. 42% of those who live farther away).

Most respondents said that this last year was typical but just over one-fifth said that they usually go more often.

Figure 2. Was last year typical for you, or do you usually visit more or less often in a year?



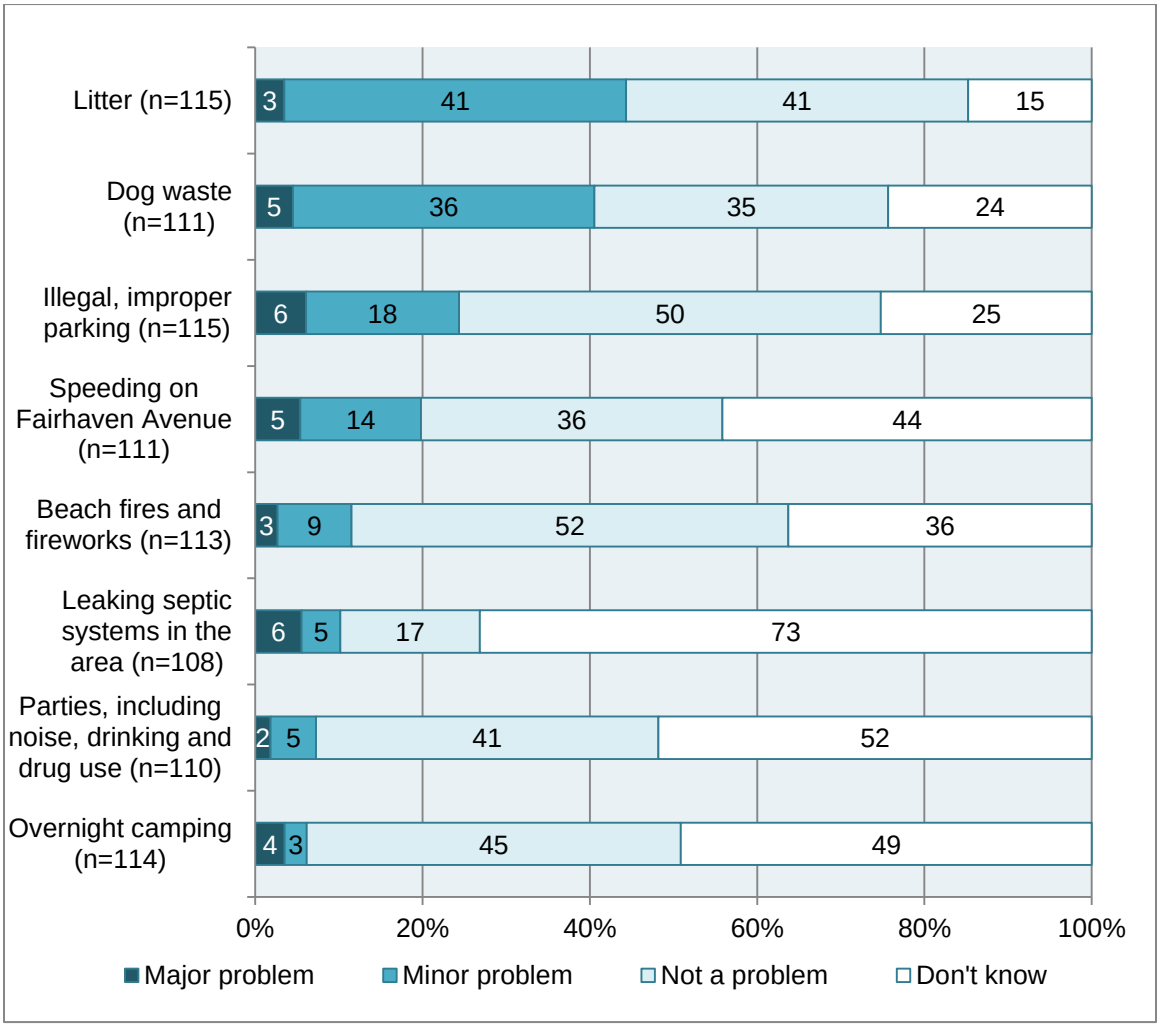
n=231

PARK PROBLEMS

Respondents who had visited the site in the past year were asked about various issues that had previously been identified by people familiar with the park. They were asked to identify if the issue was a major problem, a minor problem or not a problem in the area. They were instructed that an issue would be more of a problem if it happened often or if it had a very negative impact when it happened, even if it didn't happen often.

Figure 3 shows the issues sorted by the proportion who called the issue a problem (*major* or *minor*). Figure 3 shows that litter and dog waste were considered the biggest problems at the site. Litter was considered a problem by 44%, though most of those who considered it a problem called it a "minor" problem.

Figure 3. Problems *(sorted by major and minor problem combined)*



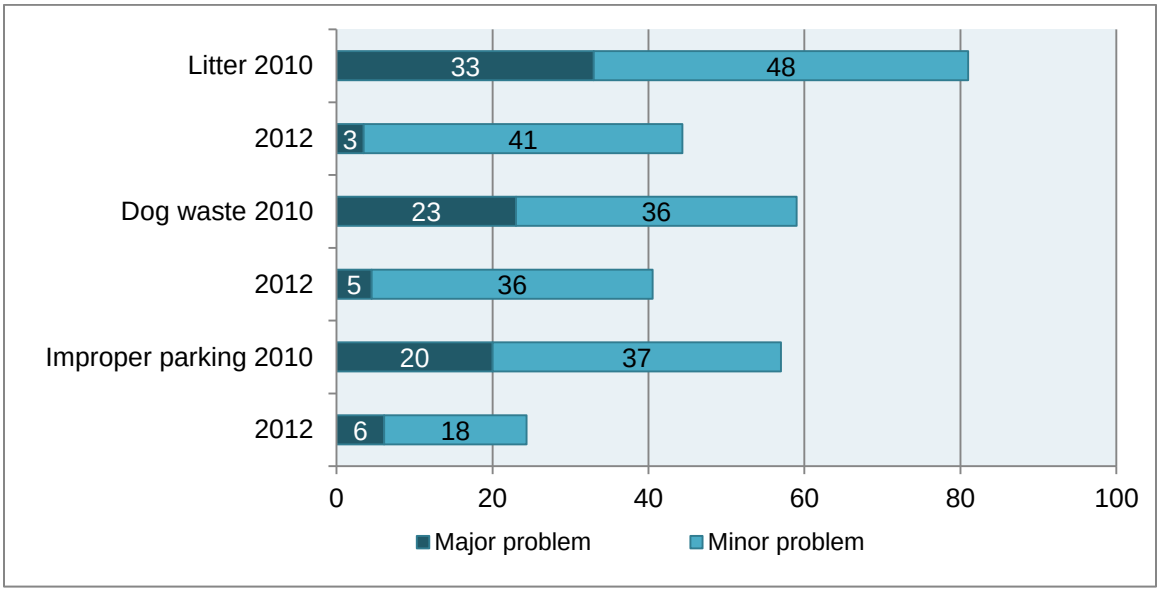
When asked to describe any other issues that are a major problem in the areas, 33 offered a comment. Comments were distinctive and varied. Five mentioned parking

(cars in undesignated spots, there isn't enough parking, parking spots are unclear, and that the disabled spot is not easily accessible to the beach). Other themes included signage and speeding. A full list of verbatim responses is included in Appendix C.

Perceived problems compared to 2010

In the 2010 survey, respondents also rated the same potential problems at the site. The order of severity was very similar to 2012; the top three problems in 2010 were still rated as the top three problems in 2012. Figure 4 shows the top three problem areas and the proportion who rated it as a problem (major and minor) in both 2010 and 2012. The proportion that identified the issue as a problem dropped significantly, but because the surveys were drawing from different samples the difference in scores is somewhat inconclusive. However the change in the proportion who called each of these issues a *major* problem was particularly striking—33% thought litter was a major problem in 2010 but only 3% said this in 2012.

Figure 4. How much would you say you know about the restoration of the salt marsh in the Chuckanut Bay park area?

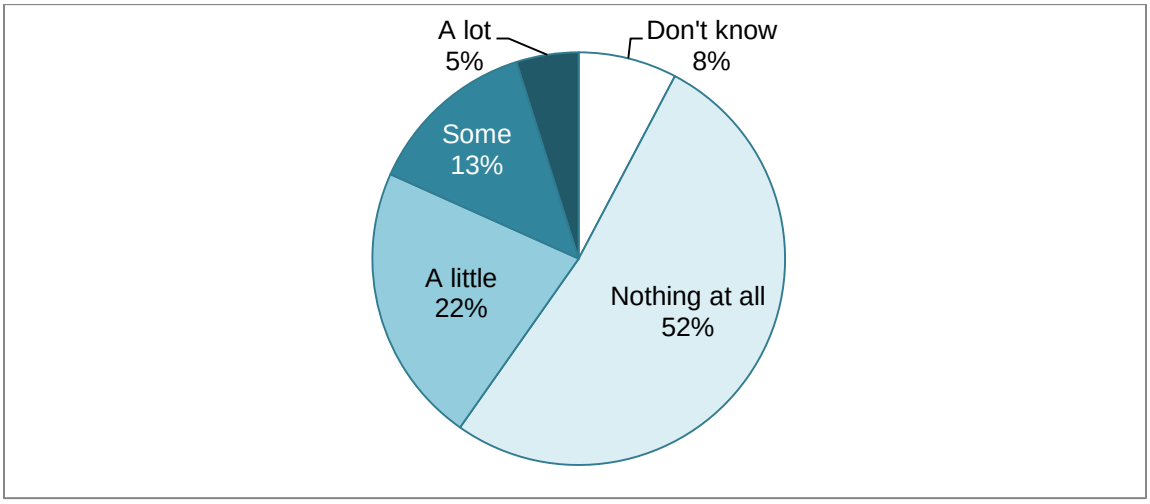


2010 n=64 to 65
2012 n=111 to 115

RESTORATION PROJECT

Respondents were asked how much they knew about the restoration project. Sixty percent said they knew *nothing at all* or *don't know*.

Figure 5. How much would you say you know about the restoration of the salt marsh in the Chuckanut Bay park area?



n=246

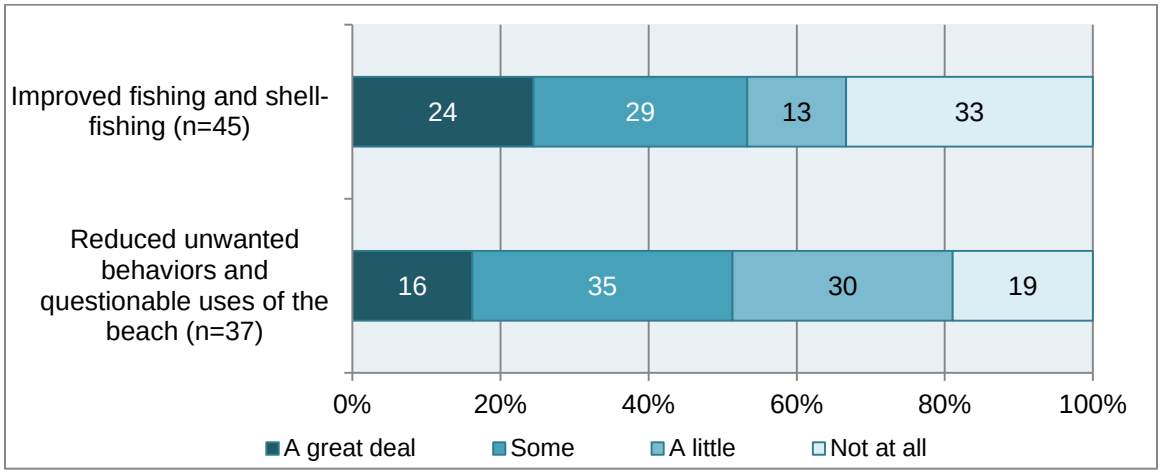
Respondents who have visited the park area of Chuckanut Bay in the past year were far more likely to have heard about the restoration project. Thirty-four percent of those who visited in the past year said they knew *some* or *a lot*, compared to only 8% of those who did not visit the site.

Restoration impacts

Respondents who said they knew at least *a little* about the restoration project were asked how much the area has changed as a result of the restoration. Specifically, they were asked how much the restoration improved fishing and shell-fishing and how much the project reduced questionable uses of the beach. Over half of respondents said that they *didn't know* how to assess the impact of the restoration.

Figure 6 shows the ratings of those who were able to offer an opinion. Nearly one-quarter (24%) said that the restoration improved fishing and shell-fishing *a great deal*; a slightly larger proportion (33%) said it did not improve *at all*. About half (51%) said the project reduced questionable uses of the beach *some* or *a great deal*.

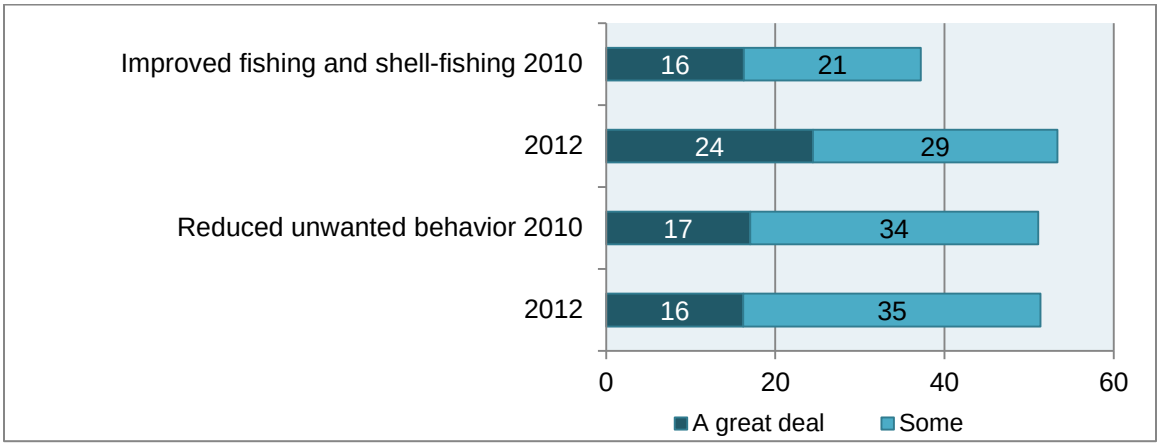
Figure 6. How much the area has improved as a result of the restoration



Respondents who had visited the area in the past year responded similarly to those who did not visit. However respondents who said that they live particularly close to the park area (within a 10 minute walk) were divided, with 40% saying it improved fishing *a great deal* and another 41% saying it didn't improve fishing in the area *at all*. Respondents who live slightly farther away were more likely to say that the restoration improved fishing *a little* or *some* (65%).

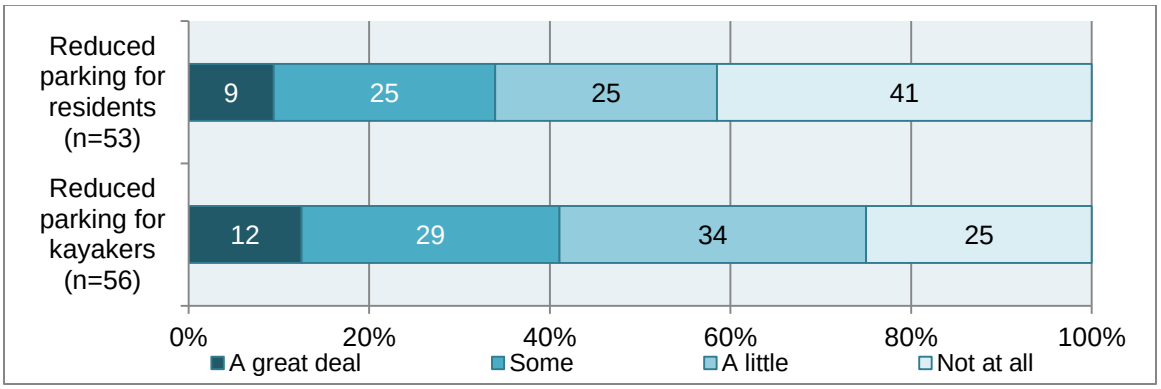
Figure 7 shows a comparison of these ratings to the expectations that were presented in the 2010 findings. In 2010, survey participants were asked how much they **expected** the area would be improved. Thirty-seven percent (37%) thought that fishing would improve *some* or *a great deal*, far lower than the 53% who said it actually did improve *some* or *a great deal*. Just over half (51%) expected that the project would reduce unwanted behaviors *some* or *a great deal*, exactly the same proportion who said it actually did improve to that degree.

Figure 7. 2010 expectations compared to 2012 perception of actual improvements



Respondents who said they knew at least *a little* about the restoration project were also asked how much the area has changed parking for kayakers and for residents. Figure 8 shows that about one-third (34%) said that the project reduced parking for residents *some* or *a great deal*. A slightly larger proportion (41%) said the project reduced parking for kayakers *some* or *a great deal*, though an equal portion (42%) said it did not reduce parking for kayakers at all.

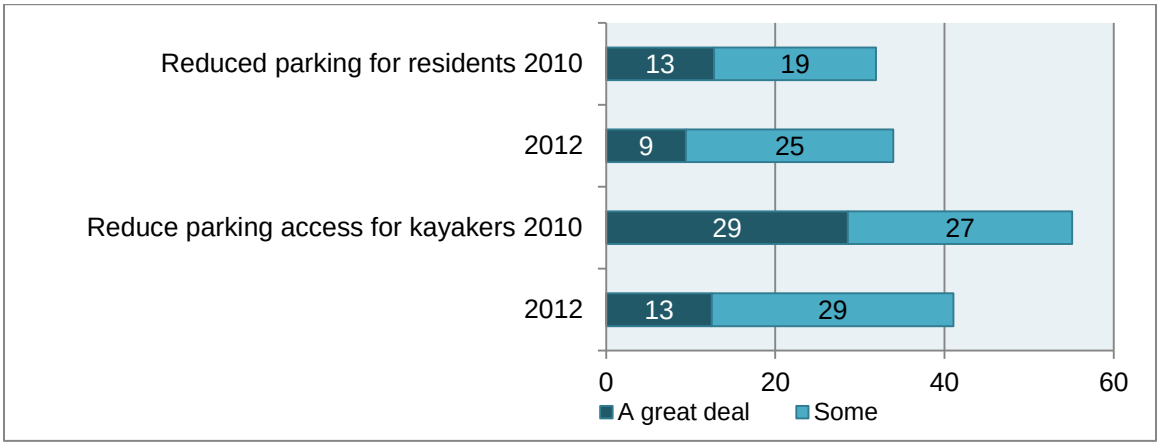
Figure 8. How much the restoration project has reduced space for parking



Respondents who had visited the park area in the past year answered the question similarly to those who had not. Likewise, residential proximity to the site didn't seem to have an impact on the ratings.

Nearly one-third (32%) of the 2010 respondents were concerned that the project would reduce parking for residents *some* or *a great deal*. A similar proportion in 2012 (34%) said that the project did reduce resident parking to that degree. Over half (56%) of 2010 participants thought it would reduce parking for kayakers *some* or *a great deal*; 42% felt that it did this in 2012. (See Figure 9)

Figure 9. 2010 expectations compared to 2012 perception of parking reductions



Respondents were asked to comment on any other beneficial changes they have seen in the area. Twenty-four respondents offered a comment. The majority of the comments mentioned improved habitat and general aesthetics.

"The vegetation effort has been very successful and I also enjoy the openness of the creek. It is visually very attractive."

This respondent commented on the success across multiple dimensions:
"Since the restoration, illegal activities have diminished tremendously. Pot smoking seems to have disappeared, dog waste reduced, late noises and loud music in general are gone, debris on the beach reduced and great improvement to the beauty of the beach area."

City public meeting participation

Nine percent (21 respondents) said that they participated in the City's public meetings or discussions regarding the salt marsh restoration. Respondents who had been to the site in the past year were more likely to have participated in the meetings than those who did

not visit. When asked to comment, several mentioned appreciation for the communications about the improvements and public discussion opportunities.

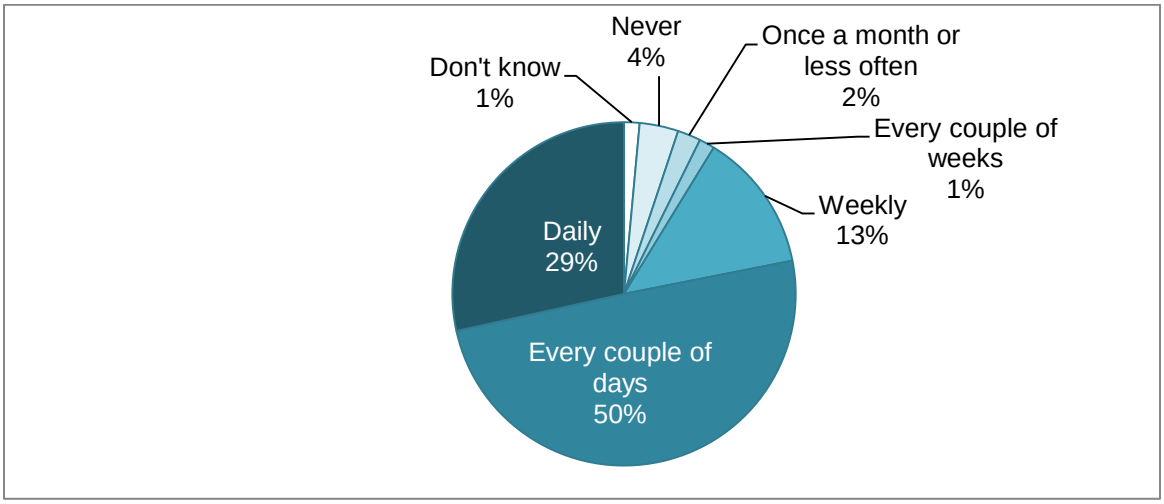
ENVIRONMENTAL BEHAVIORS

Respondents were asked about various environmental behaviors that could have an impact on environmental quality in the Chuckanut Bay area.

Pet waste

Just over a third (39%) of respondents said that they had a dog. These respondents were asked to identify how often pet waste was picked up from their yard and put in the trash. Figure 10 shows that over one-quarter (29%) said they picked it up *daily*; 20% said they picked it up *weekly* or less often.

Figure 10. How often is your pet's waste from your yard picked up and put in the trash?

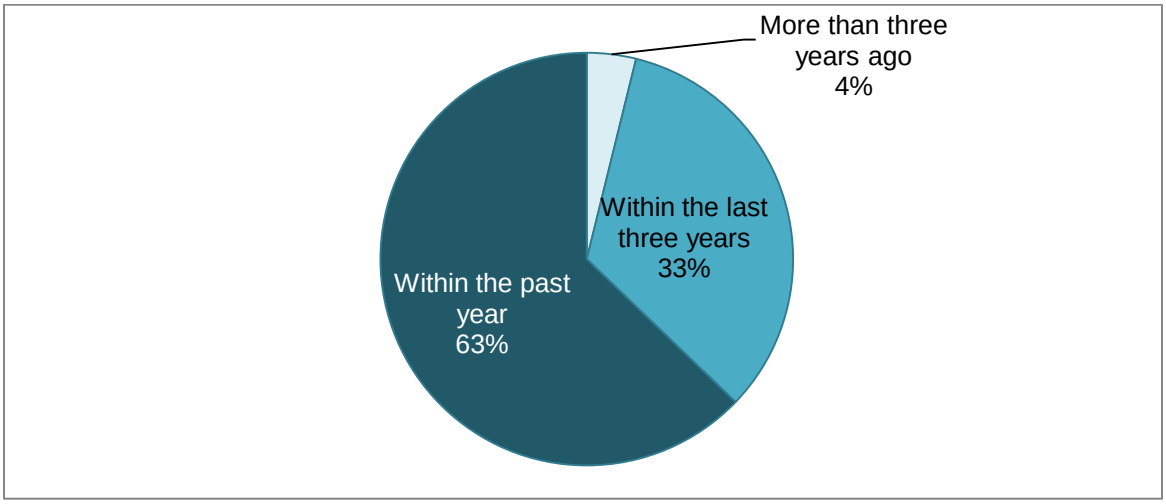


n=93

Septic

Nearly one-third (32%) of respondents said that they have a septic system on their property. Those respondents were asked when their system was last inspected. Figure 11 shows that nearly two-thirds said that they had their septic system inspected within the past year. Four percent said it was last inspected more than three years ago.

Figure 11. Last septic inspection

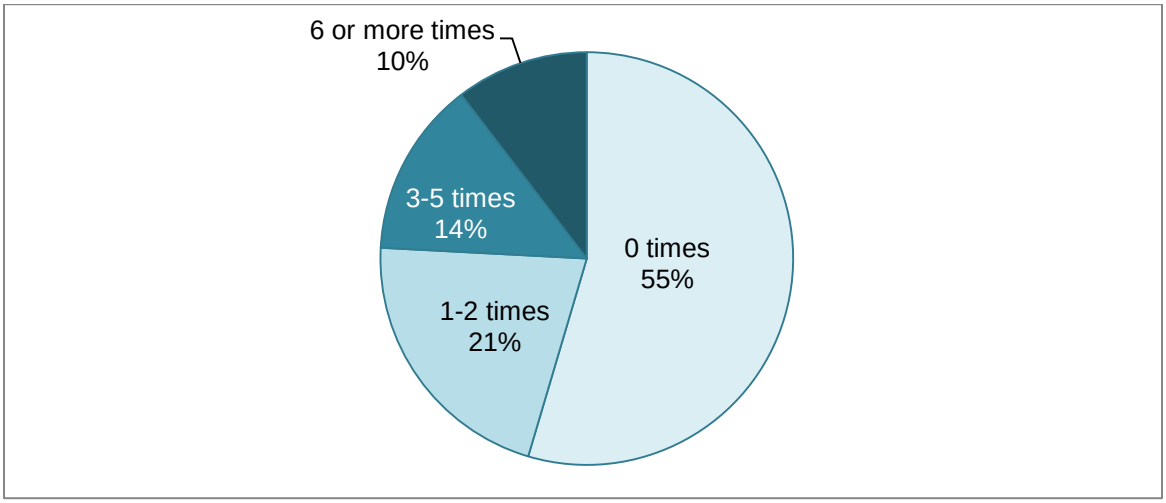


n=78

Car washing

Just over under half of the respondents (45%) have washed their car at home at least once in the past year; 10% said they have done it six or more times.

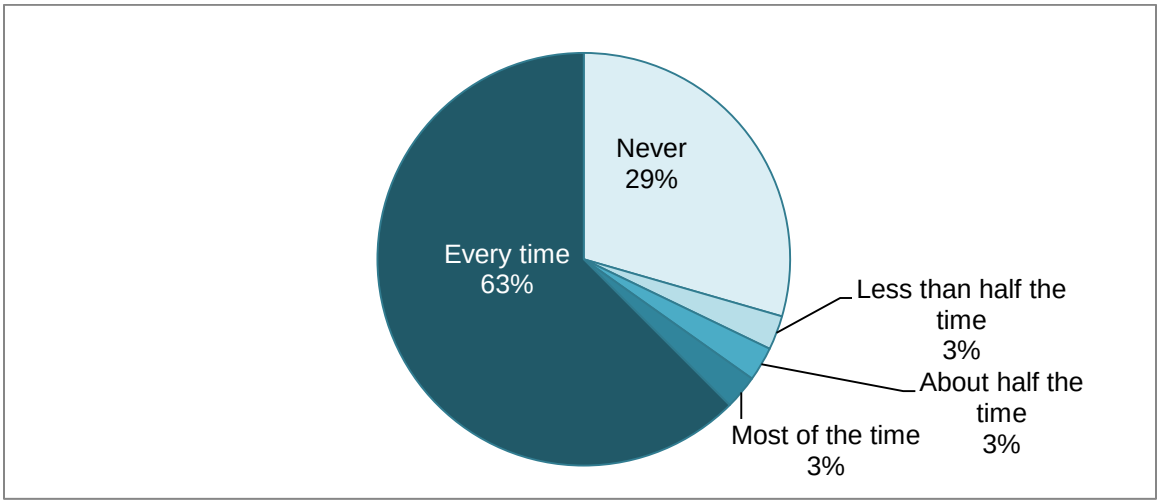
Figure 12. In the past year, how often did you wash your car at home, if at all?



n=240

Over half of those who washed their cars at home did so on an impervious surface *every time*. A little over one-quarter *never* did. Frequent home car washers did not wash their cars on pavement any more often than those who infrequently wash their cars at home.

Figure 13. In the past year, when you washed your car at home, how often was it parked on pavement while you washed it?



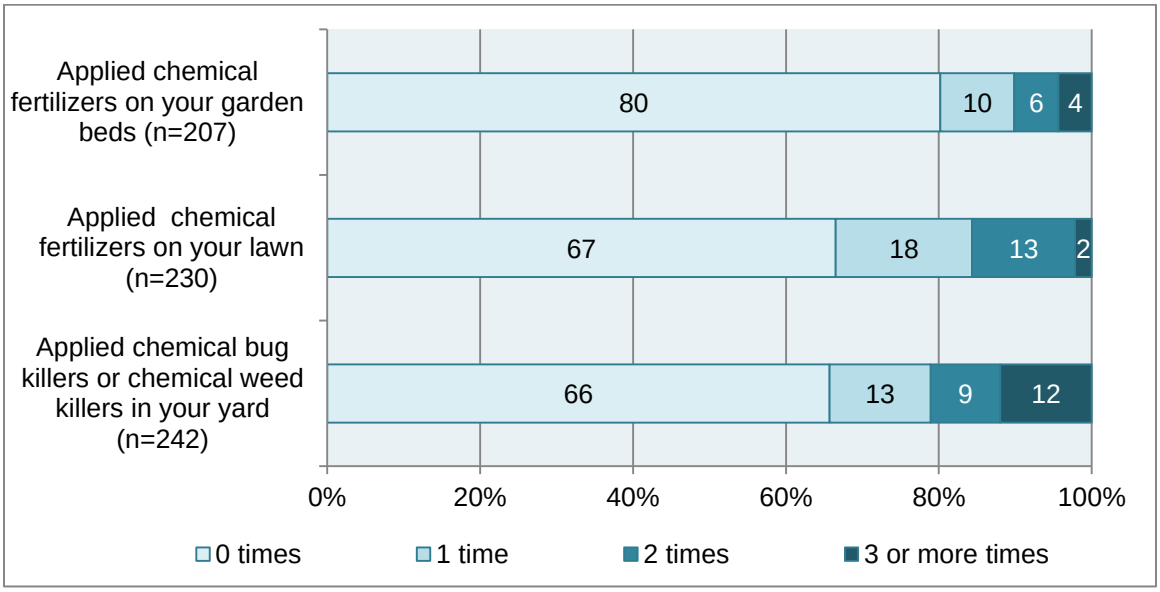
n=112

Although most people did not wash their cars at home, fully 523 car washings were reported last year by the 109 people who said they'd washed their cars at home. Of those, most were on pavement (estimated 334). If these respondents are representative of the area, we can estimate that 27% of households in the watershed are washing their cars at home, on pavement every time with a median number of home car washes per household of 3 (mean 4.8).

Yard and garden care

Respondents were also asked about the use of chemicals in their gardening, native plants, and reducing their lawn size. Figure 14 shows that the majority of respondents did not use chemicals regularly for garden care. Bug and weed killer was used with the greatest frequency; one-fifth (21%) did this two or more times.

Figure 14. Frequency of applying chemicals in garden care



Respondents were asked whether they have removed non-native plants, added native plants, or replaced non-native with native plants. Table 1 shows 62% have done at least one of these activities. Adding native plants was the most popular (42%). One-third (34%) have removed non-native plants.

Table 1. In the past three years, which of the following have you done?

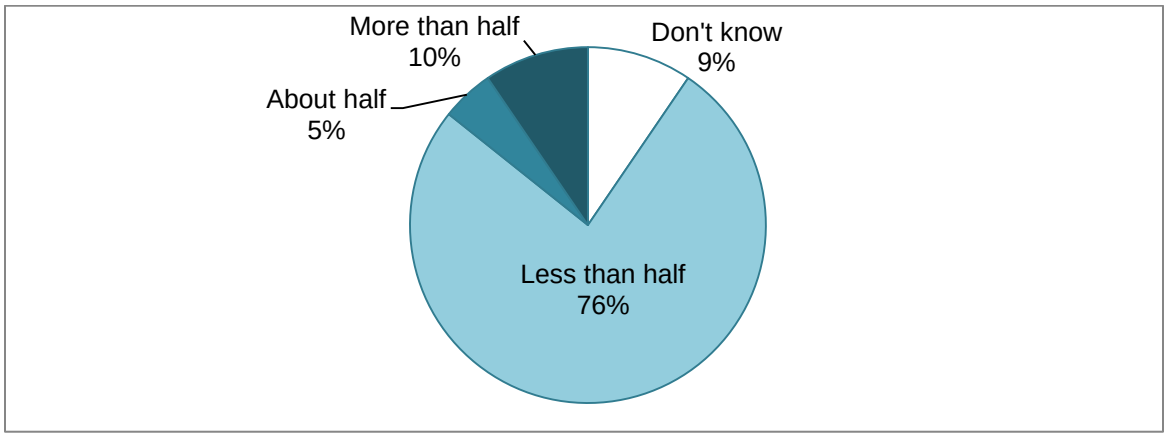
	n	%
Added native plants	105	42
Removed non-native plants	86	34
Replaced non-native with native plants	41	16
None of these	94	38

n=250; responses may total more than 100% due to multiple responses per case

Just over one-quarter said that they have reduced the size of their lawn in the past three years. Half of those respondents said that they added native plantings to the areas that used to be lawn (13% of overall survey sample).

Figure 15 includes those respondents who said that they did reduce the size of their lawn in the past three years. When asked for the size of the reduction, most (76%) said that the reduction less than half of the original yard. A small portion (15%) reduced their lawns by half or more.

Figure 15. Is the reduction in your lawn's size more than half, about half or less than half of what the lawn used to be?

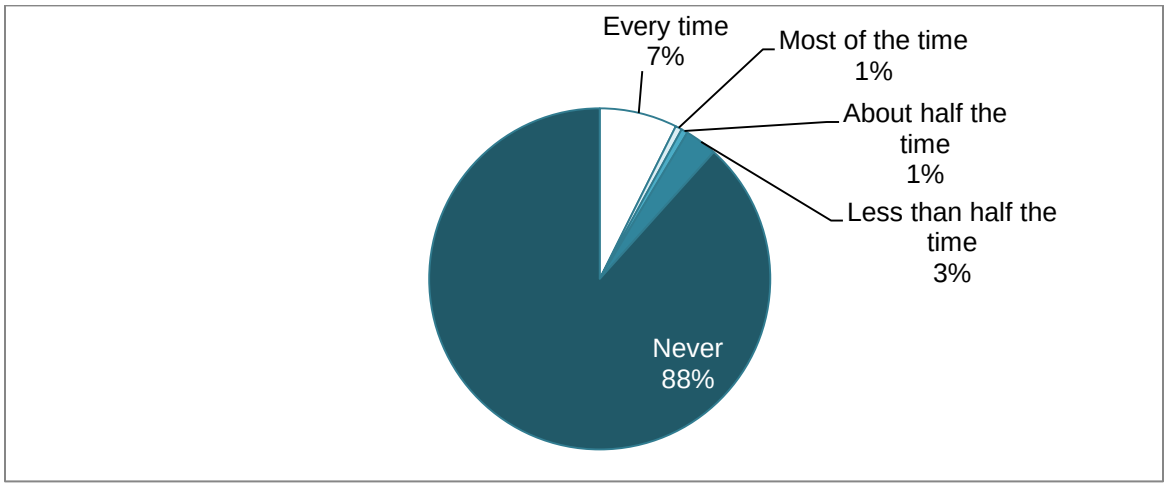


n=63

Disposal of toxics

Respondents were asked about how they dispose of toxics, including motor oil, antifreeze, paint and pesticides. The majority said they *never* threw these in the trash in the past year. Very few said they *did this occasionally,* and 7% said they do this every time.

Figure 16. In the past year, when you've had motor oil, antifreeze, liquid paint or pesticides to dispose of, how often did you put them in the trash?

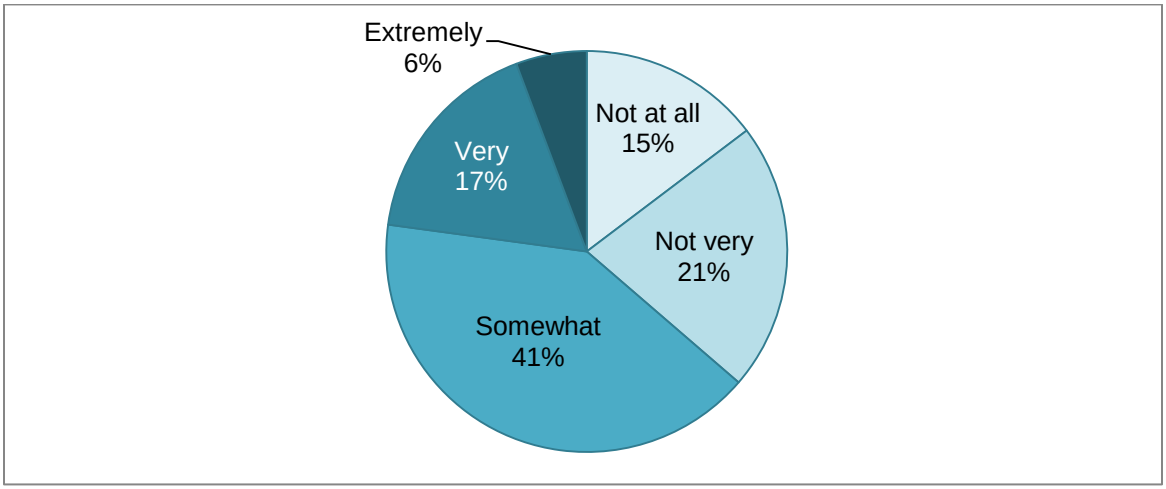


n=163

Knowledge of Chuckanut Bay wildlife

Respondents were asked to rate their own knowledge level regarding local wildlife and the sensitivity of the Chuckanut Bay area. Twenty-three percent said that they are *very* or *extremely knowledgeable*; on the other end of the spectrum 39% were *not very* or *not at all knowledgeable*.

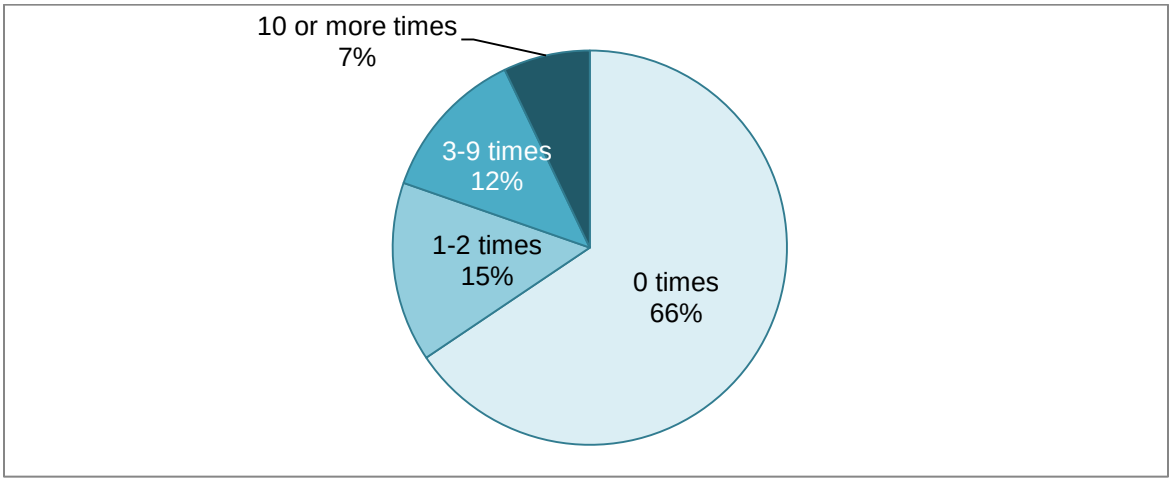
Figure 17. How knowledgeable are you about local wildlife and sensitivity of the Chuckanut Bay area?



n=245

Respondents who described themselves as remotely knowledgeable (even *not very*) were asked to estimate how often they have shared knowledge of wildlife and sensitivity of Chuckanut Bay area with others. One third (34%) said they shared their knowledge at least once.

Figure 18. In the past year, how often have you shared your knowledge of the local wildlife and sensitivity of the Chuckanut Bay area with others?

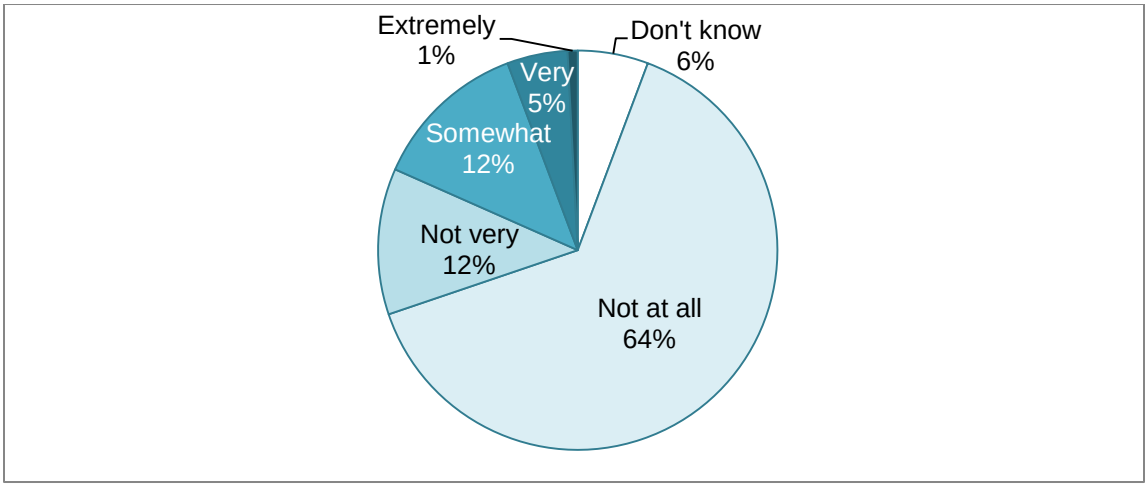


n=183

Familiarity with programming

Most respondents were not familiar with the Chuckanut Bay pledge (70%). Six percent were *very* or *extremely familiar*.

Figure 19. How familiar are you, if at all, with the Chuckanut Bay Pledge?

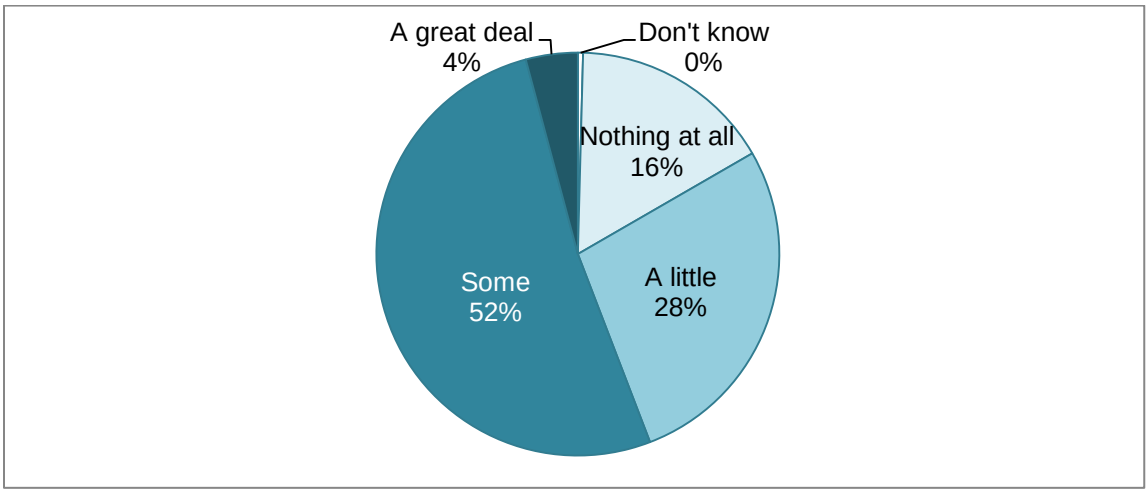


n=245

Respondents who had visited the Chuckanut Bay park area were more likely to be familiar with the pledge; 29% of those who visited this year were at least *somewhat familiar*, compared to 9% of those who did not visit in 2012. Likewise, respondents who live within a 10 minute walk were also more likely to be familiar with the pledge.

Respondents were told about four events that were held during the past six months at the Chuckanut Bay park area. A majority (85%) said that they had heard at least a little about these events.

Figure 20. How much, if anything, did you hear or see about these events?



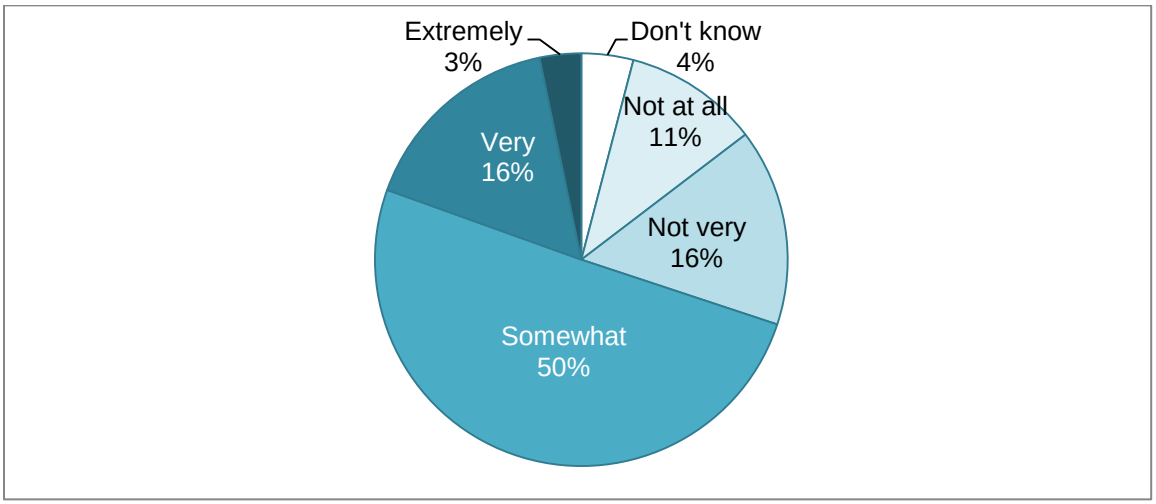
n=240

Respondents who had visited the park area in the past year and those who live within a 10 minute walk were more likely to have heard about the events.

Respondents who had heard about the events were asked to describe how they heard about the events. About one-third (33%) of those who had heard about the events said they heard about it in the local newspaper or "Bellingham Herald." About one-quarter mentioned receiving something in the mail. Thirteen percent (13%) mentioned signage or a poster. Others mentioned hearing about the events through the Cascadia Weekly, a flier, email or internet, local groups like MRC or the neighborhood association, as well as general word of mouth. The complete list of verbatim responses is included in Appendix C.

Among those who had heard about the events, 69% said that they would be at least *somewhat* interested in seeing more events like this.

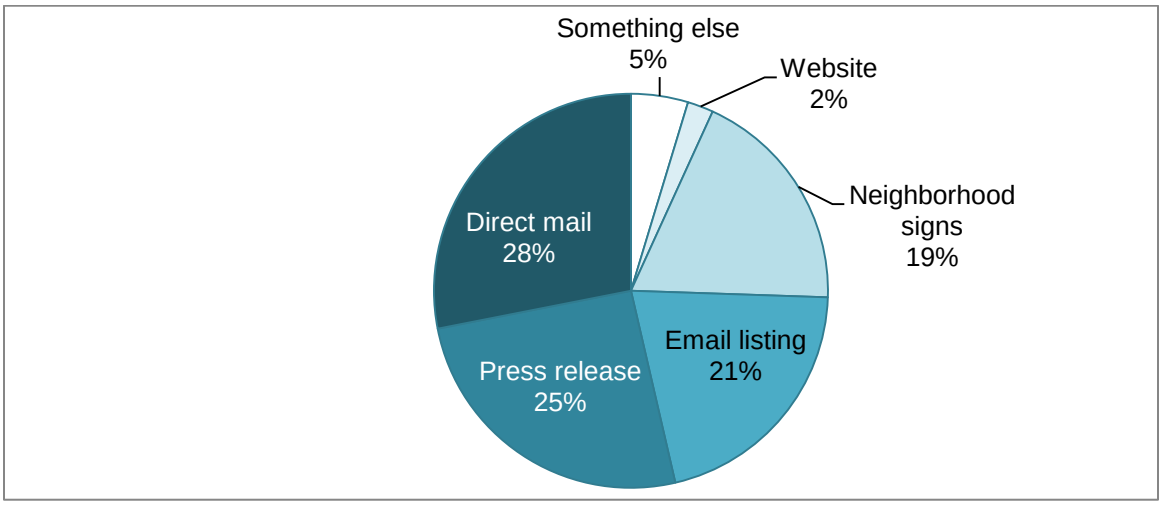
Figure 21. How interested would you be in seeing more events like these?



n=123

Respondents were asked what would be effective ways to reach them about these events in the future. Figure 22 shows that respondents were fairly evenly divided about the best approach, with the largest segment favoring direct mail (28%) followed by press release (25%).

Figure 22. What would be the most effective way to reach you about these events if there are more in the future?



n=123

When asked to identify a trusted source of information about the Chuckanut Bay area, the most frequent mention was Bellingham Parks and Recreation (41%) followed by ReSources (34%). Table 2 shows that 9% identified some “other” trusted source; Chuckanut Bay Community Association was the most frequent of these mentions.

Table 2. Which of the following organizations do you trust most to provide you with accurate information about the Chuckanut Bay area?

	n	%
Bellingham Parks & Recreation	103	41
RE Sources	84	34
City of Bellingham	68	27
WSU Extension	32	13
Shore Stewards	24	10
Others	22	9

n=250; responses may total more than 100% due to multiple responses per case

In the 2010 survey findings, Bellingham Parks and Recreation was also ranked as the highest trusted source for information about the Chuckanut Bay area (34%), followed by Shore Stewards (32%) which dropped substantially in 2012. Also of note, the City of Bellingham was considered a trusted source by only 15% of respondents in 2010, which

nearly doubled to 27% in the 2012 survey (which was distributed to a much larger pool of potential respondents).

CONCLUSION

Overall the outcomes for the Chuckanut Bay park area have been very positive. People reported a decrease in problems in the area and most expressed an appreciation for the improved quality of the area.

Although parking areas have been improved, many perceive that there was some lost capacity, either for the neighborhood or for kayakers. It is not clear from this research how much it has impinged upon their use of the park or conveniences in the neighborhood.

The salt marsh restoration piloted a new approach by the City of Bellingham to engage community members more fully prior to the finalization of plans and to engage them along the way. Although the initial pool of neighbors recruited into the plan was small (about 80 households), they tended to be the most prevalent users and in the end reported being well informed about the project, the bay and the events in the area.

There are some opportunities for further work in the area. Dog waste continues to be at least a minor problem at the park, and most dog owners are not picking up their dogs' waste at home on a daily basis (58% of dog owners). Car washing is prevalent on impermeable surfaces and occurs at a higher rate than in Puget Sound more broadly; the Puget Sound Partnership's 2012 study of area residents[2] found that only 10% of households washed their cars on pavement every time.

Replacing lawn with native plants or reducing lawn size is a relatively common activity, with 25% of respondents saying they had done so recently, some having reduced their lawns by half or more. These households would likely provide some examples of successful projects, which could inspire additional households to lose the lawn.

Reaching residents was fairly effective using conventional channels. The park itself was a good channel for information, as was the Herald, notices and signs. Experimenting with direct mail may help improve turnout since it was the most cited preferred means of contact. The Parks Department was considered trustworthy, as was RE Sources, which suggests some good sponsors for City messaging.

[2] Sound Behavior Index and Social Capital Index 2012 – Survey Report (www.psp.wa.gov)

APPENDIX A: RESEARCH METHODS AND DATA QUALITY

The survey was administered via postal mail and online. The printed version was mailed to 885 households on November 28, 2012, along with a letter of introduction from the City of Bellingham. The addresses were provided by the City of Bellingham. A sample of 885 was randomly chosen for the study.

To be as inclusive as possible, the letter provided the online website where additional household members could take the survey. A postpaid envelope was also provided. On December 6, 2012, a postcard was mailed to all 885 addresses, to thank them if they took the survey, or remind them to do so if they had not.

The online version was active from November 28 through December 19, 2012.
50 of the mailed surveys were returned due to address issues.

Two hundred forty one (241) surveys were returned by mail, and an additional ten were submitted online, for a total of 251 and a response rate of 30%.

APPENDIX B: FREQUENCY REPORT

Q1r During all of this past year (2012), how many times did you visit the park at Chuckanut Bay?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	133	53.0	53.6	53.6
	1-2 times	40	15.9	16.1	69.8
	3-9 times	40	15.9	16.1	85.9
	10-49 times	23	9.2	9.3	95.2
	50 or more times	12	4.8	4.8	100.0
	Total	248	98.8	100.0	
Missing	System	3	1.2		
Total		251	100.0		

q2 Was last year typical for you, or do you usually visit more or less often in a year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Typical	171	68.1	74.0	74.0
	Usually I visit more often	50	19.9	21.6	95.7
	Usually I visit less often	10	4.0	4.3	100.0
	Total	231	92.0	100.0	
Missing	Don't know	13	5.2		
	System	7	2.8		
	Total	20	8.0		
Total		251	100.0		

q3 Do you live within 10 minutes walking distance of the beach area at Chuckanut Bay?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	77	30.7	30.9	30.9
	No	161	64.1	64.7	95.6
	Don't know	11	4.4	4.4	100.0
	Total	249	99.2	100.0	
Missing	System	2	.8		
Total		251	100.0		

q4 This year, litter was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	4	1.6	3.5	3.5
	Minor problem	47	18.7	40.9	44.3
	Not a problem	47	18.7	40.9	85.2
	Don't know	17	6.8	14.8	100.0
	Total	115	45.8	100.0	
Missing	System	136	54.2		
Total		251	100.0		

q5 This year, illegal and improper parking was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	7	2.8	6.1	6.1
	Minor problem	21	8.4	18.3	24.3
	Not a problem	58	23.1	50.4	74.8
	Don't know	29	11.6	25.2	100.0
	Total	115	45.8	100.0	
Missing	System	136	54.2		
Total		251	100.0		

q6 This year, beach fires and fireworks were…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	3	1.2	2.7	2.7
	Minor problem	10	4.0	8.8	11.5
	Not a problem	59	23.5	52.2	63.7
	Don't know	41	16.3	36.3	100.0
	Total	113	45.0	100.0	
Missing	System	138	55.0		
Total		251	100.0		

q7 This year, overnight camping was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	4	1.6	3.5	3.5
	Minor problem	3	1.2	2.6	6.1
	Not a problem	51	20.3	44.7	50.9
	Don't know	56	22.3	49.1	100.0
	Total	114	45.4	100.0	
Missing	System	137	54.6		
Total		251	100.0		

q8 This year, dog waste was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	5	2.0	4.5	4.5
	Minor problem	40	15.9	36.0	40.5
	Not a problem	39	15.5	35.1	75.7
	Don't know	27	10.8	24.3	100.0
	Total	111	44.2	100.0	
Missing	System	140	55.8		
Total		251	100.0		

q9 This year, parties, including noise, drinking and drug use were…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	2	.8	1.8	1.8
	Minor problem	6	2.4	5.5	7.3
	Not a problem	45	17.9	40.9	48.2
	Don't know	57	22.7	51.8	100.0
	Total	110	43.8	100.0	
Missing	System	141	56.2		
Total		251	100.0		

q10 This year, speeding on Fairhaven Avenue was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	6	2.4	5.4	5.4
	Minor problem	16	6.4	14.4	19.8
	Not a problem	40	15.9	36.0	55.9
	Don't know	49	19.5	44.1	100.0
	Total	111	44.2	100.0	
Missing	System	140	55.8		
Total		251	100.0		

q11 This year, leaking septic systems in the area were…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	6	2.4	5.6	5.6
	Minor problem	5	2.0	4.6	10.2
	Not a problem	18	7.2	16.7	26.9
	Don't know	79	31.5	73.1	100.0
	Total	108	43.0	100.0	
Missing	System	143	57.0		
Total		251	100.0		

q13 How much would you say you know about the restoration of the salt marsh in the Chuckanut Bay park area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A lot	12	4.8	4.9	4.9
	Some	33	13.1	13.4	18.3
	A little	54	21.5	22.0	40.2
	Nothing at all	128	51.0	52.0	92.3
	Don't know	19	7.6	7.7	100.0
	Total	246	98.0	100.0	
Missing	System	5	2.0		
Total		251	100.0		

q14 How much, if at all, have the changes improved fishing and shell-fishing for those who use the area for those pursuits?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	11	4.4	10.7	10.7
	Some	13	5.2	12.6	23.3
	A little	6	2.4	5.8	29.1
	Not at all	15	6.0	14.6	43.7
	Don't know	58	23.1	56.3	100.0
	Total	103	41.0	100.0	
Missing	System	148	59.0		
Total		251	100.0		

q15 How much, if at all, have the changes reduced parking access for kayakers?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	7	2.8	6.9	6.9
	Some	16	6.4	15.8	22.8
	A little	19	7.6	18.8	41.6
	Not at all	14	5.6	13.9	55.4
	Don't know	45	17.9	44.6	100.0
	Total	101	40.2	100.0	
Missing	System	150	59.8		
Total		251	100.0		

q16 How much, if at all, have the changes reduced parking access for residents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	5	2.0	4.9	4.9
	Some	13	5.2	12.7	17.6
	A little	13	5.2	12.7	30.4
	Not at all	22	8.8	21.6	52.0
	Don't know	49	19.5	48.0	100.0
	Total	102	40.6	100.0	
Missing	System	149	59.4		
Total		251	100.0		

q17 How much, if at all, have the changes reduced unwanted behaviors and questionable uses of the beach?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	6	2.4	5.9	5.9
	Some	13	5.2	12.7	18.6
	A little	11	4.4	10.8	29.4
	Not at all	7	2.8	6.9	36.3
	Don't know	65	25.9	63.7	100.0
	Total	102	40.6	100.0	
Missing	System	149	59.4		
Total		251	100.0		

q18 Did you participate in the city's public meetings or discussions regarding the salt marsh restoration?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	8.4	8.6	8.6
	No	221	88.0	90.9	99.6
	Don't know	1	.4	.4	100.0
	Total	243	96.8	100.0	
Missing	System	8	3.2		
Total		251	100.0		

q19 Do you have a dog?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	95	37.8	38.6	38.6
	No	151	60.2	61.4	100.0
	Total	246	98.0	100.0	
Missing	System	5	2.0		
Total		251	100.0		

q20 How often is your pet's waste from your yard picked up and put in the trash?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never, it's left on the ground	5	2.0	5.4	5.4
	Daily	39	15.5	41.9	47.3
	Every couple of days	24	9.6	25.8	73.1
	Weekly	18	7.2	19.4	92.5
	Every couple of weeks	2	.8	2.2	94.6
	Once a month or so	2	.8	2.2	96.8
	Less than once a month	1	.4	1.1	97.8
	Don't know	2	.8	2.2	100.0
	Total	93	37.1	100.0	
Missing	System	158	62.9		
Total		251	100.0		

q21 When your dog is walked, how often is the pet's waste picked up and put in the trash?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every time	77	30.7	81.9	81.9
	Most of the time	10	4.0	10.6	92.6
	Less than half the time	3	1.2	3.2	95.7
	Never	2	.8	2.1	97.9
	Don't know	2	.8	2.1	100.0
	Total	94	37.5	100.0	
Missing	System	157	62.5		
Total		251	100.0		

q22 Is there a septic system on your property?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	78	31.1	32.2	32.2
	No	157	62.5	64.9	97.1
	Don't know	7	2.8	2.9	100.0
	Total	242	96.4	100.0	
Missing	System	9	3.6		
Total		251	100.0		

q23 Have you inspected your septic system in the past year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	49	19.5	65.3	65.3
	No	26	10.4	34.7	100.0
	Total	75	29.9	100.0	
Missing	System	176	70.1		
Total		251	100.0		

q24 When was the last time you inspected your septic system?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Within the last three years	26	10.4	89.7	89.7
	More than three years ago	3	1.2	10.3	100.0
	Total	29	11.6	100.0	
Missing	I don't know	1	.4		
	System	221	88.0		
	Total	222	88.4		
Total		251	100.0		

Q25r In the past year, how often did you wash your car at home, if at all?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	131	52.2	54.6	54.6
	1-2 times	51	20.3	21.3	75.8
	3-5 times	33	13.1	13.8	89.6
	6 or more times	25	10.0	10.4	100.0
	Total	240	95.6	100.0	
Missing	System	11	4.4		
Total		251	100.0		

q26 In the past year, when you washed your car at home, how often was it parked on pavement while you washed it?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every time	70	27.9	62.5	62.5
	Most of the time	3	1.2	2.7	65.2
	About half the time	3	1.2	2.7	67.9
	Less than half the time	3	1.2	2.7	70.5
	Never	33	13.1	29.5	100.0
	Total	112	44.6	100.0	
Missing	System	139	55.4		
Total		251	100.0		

Q27r Applied chemical bug killers or chemical weed killers in your yard

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	159	63.3	65.7	65.7
	1 time	32	12.7	13.2	78.9
	2 times	22	8.8	9.1	88.0
	3 or more times	29	11.6	12.0	100.0
	Total	242	96.4	100.0	
Missing	System	9	3.6		
Total		251	100.0		

Q28r Applied chemical fertilizers on your lawn

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	153	61.0	66.5	66.5
	1 time	41	16.3	17.8	84.3
	2 times	31	12.4	13.5	97.8
	3 or more times	5	2.0	2.2	100.0
	Total	230	91.6	100.0	
Missing	System	21	8.4		
Total		251	100.0		

Q28br Applied chemical fertilizers on your garden beds

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	166	66.1	80.2	80.2
	1 time	20	8.0	9.7	89.9
	2 times	12	4.8	5.8	95.7
	3 or more times	9	3.6	4.3	100.0
	Total	207	82.5	100.0	
Missing	System	44	17.5		
Total		251	100.0		

q29_1 Removed non-native plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	164	65.3	65.6	65.6
	Checked	86	34.3	34.4	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q29_2 Added native plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	145	57.8	58.0	58.0
	Checked	105	41.8	42.0	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q29_3 Replaced non-native plants with native plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	209	83.3	83.6	83.6
	Checked	41	16.3	16.4	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q29_4 None of these

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	156	62.2	62.4	62.4
	Checked	94	37.5	37.6	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q30 In the past three years have you reduced the size of your lawn?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	61	24.3	27.2	27.2
	No	163	64.9	72.8	100.0
	Total	224	89.2	100.0	
Missing	Don't know	3	1.2		
	System	24	9.6		
	Total	27	10.8		
Total		251	100.0		

q30a Did you add native plantings to areas that used to be lawn?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	32	12.7	50.8	50.8
	No	31	12.4	49.2	100.0
	Total	63	25.1	100.0	
Missing	Don't know	6	2.4		
	System	182	72.5		
	Total	188	74.9		
Total		251	100.0		

q30b Is the reduction in your lawn's size more than half, about half or less than half of what the lawn used to be?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More than half	6	2.4	9.5	9.5
	About half	3	1.2	4.8	14.3
	Less than half	48	19.1	76.2	90.5
	Don't know	6	2.4	9.5	100.0
	Total	63	25.1	100.0	
Missing	System	188	74.9		
Total		251	100.0		

q31 In the past year, when you've had motor oil, antifreeze, liquid paint or pesticides to dispose of, how often did you put them in the trash?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every time	12	4.8	5.0	5.0
	Most of the time	1	.4	.4	5.4
	About half the time	1	.4	.4	5.8
	Less than half the time	5	2.0	2.1	7.9
	Never	144	57.4	59.5	67.4
	Not applicable- I've not had anything like that to dispose o	79	31.5	32.6	100.0
	Total	242	96.4	100.0	
Missing	System	9	3.6		
Total		251	100.0		

q32 How knowledgeable are you about local wildlife and sensitivity of the Chuckanut Bay area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely knowledgeable	14	5.6	5.7	5.7
	Very knowledgeable	42	16.7	17.1	22.9
	Somewhat knowledgeable	100	39.8	40.8	63.7
	Not very knowledgeable	53	21.1	21.6	85.3
	Not at all knowledgeable	36	14.3	14.7	100.0
	Total	245	97.6	100.0	
Missing	System	6	2.4		
Total		251	100.0		

Q33r In the past year, how often have you shared your knowledge of the local wildlife and sensitivity of the Chuckanut Bay area with others?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	120	47.8	65.6	65.6
	1-2 times	27	10.8	14.8	80.3
	3-9 times	23	9.2	12.6	92.9
	10 or more times	13	5.2	7.1	100.0
	Total	183	72.9	100.0	
Missing	System	68	27.1		
Total		251	100.0		

q34 How familiar are you, if at all, with the Chuckanut Bay Pledge?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely	2	.8	.8	.8
	Very	12	4.8	4.9	5.7
	Somewhat	31	12.4	12.7	18.4
	Not very	29	11.6	11.8	30.2
	Not at all	157	62.5	64.1	94.3
	Don't know	14	5.6	5.7	100.0
	Total	245	97.6	100.0	
Missing	System	6	2.4		
Total		251	100.0		

q35 How much, if anything, did you hear or see about these events?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	1	.4	.4	.4
	Some	39	15.5	16.3	16.7
	A little	66	26.3	27.5	44.2
	Nothing at all	124	49.4	51.7	95.8
	Don't know	10	4.0	4.2	100.0
	Total	240	95.6	100.0	
Missing	System	11	4.4		
Total		251	100.0		

q37 How interested would you be in seeing more events like these?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely	4	1.6	3.3	3.3
	Very	20	8.0	16.3	19.5
	Somewhat	62	24.7	50.4	69.9
	Not very	19	7.6	15.4	85.4
	Not at all	13	5.2	10.6	95.9
	Don't know	5	2.0	4.1	100.0
	Total	123	49.0	100.0	
Missing	System	128	51.0		
Total		251	100.0		

q38 What would be the most effective way to reach you about these events if there are more in the future?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Direct mailings	66	26.3	28.1	28.1
	Neighborhood signs/sandwich board	44	17.5	18.7	46.8
	Press release in local papers	60	23.9	25.5	72.3
	Email listing	49	19.5	20.9	93.2
	Website posting	5	2.0	2.1	95.3
	Something else, please describe:	11	4.4	4.7	100.0
	Total	235	93.6	100.0	
Missing	System	16	6.4		
Total		251	100.0		

q39_1 ReSources

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	166	66.1	66.4	66.4
	Checked	84	33.5	33.6	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_2 Shore Stewards

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	226	90.0	90.4	90.4
	Checked	24	9.6	9.6	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_3 WSU Extension

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	218	86.9	87.2	87.2
	Checked	32	12.7	12.8	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_4 City of Bellingham

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	182	72.5	72.8	72.8
	Checked	68	27.1	27.2	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_5 Bellingham Parks and Recreation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	147	58.6	58.8	58.8
	Checked	103	41.0	41.2	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_6 Others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	228	90.8	91.2	91.2
	Checked	22	8.8	8.8	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q41 Have you visited the City's website for Chuckanut Bay?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	13.5	14.3	14.3
	No	199	79.3	83.6	97.9
	Don't know	5	2.0	2.1	100.0
	Total	238	94.8	100.0	
Missing	System	13	5.2		
Total		251	100.0		

APPENDIX C: VERBATIM OPEN-ENDED COMMENTS

If there are any other issues you think are a major problem in the area, please describe them below:

- "illegal and improper parking" especially along the right shoulder approaching the bridge. It caused erosion into the marsh. It did not help that leftover gravel in that area made for an easy parking area in an area not designated for parking! Government intrusion. Hostile mailing this past summer from city which included unnecessary color copy pages - wasting taxpayer money. Tone of mailing was accusatory, demeaning to our intelligence, and blaming die back of plantings to community when in fact, the plantings were not properly cared for during the crucial period when they take hold.
- People forgo empty parking spaces and park closer to loading areas but by the side of the road. They have crushed/killed any plants along there. 2. Litter and dog waste: Still a problem but we see less of it. We also see baggies of dog waste left by the side of the road and not disposed of in the garbage. 3. Speeding: A few, well-places signs and a couple of speed bump mags would help slow people down.
- 11. Used to be, not now. You can tell by the lack of growth of algae.
- Access to Clayton Beach - is this now blocked?
- Coal trains!
- Didn't know the Mud Flats are now officially "Chuckanut Bay".
- Disabled parking is too far away and too steep to the beach. There should be 1 disabled space by the bridge and 1 unload.
- Dogs chasing shorebirds and trampling the mud flat fauna and flora. Dogs barking and bothering people seeking solace. Way too many unleashed dogs.
- Harder for people to launch kayaks.
- I can't tell what is private property, both for knowing where I can park, where to lock my bike, where to launch my kayak, etc. More signage and explanations are needed.
- I resent that the city has pushed itself onto neighboring properties, using a "right of way" that was never designed or intended for this type of use. I do not like the signage. It is too commercial for a residential low key neighborhood.
- I visited in December so there was no one camping, using drugs, etc.
- I'd like more area for dogs and dog waste bags and garbage cans provided - unfortunately not all dog owners are responsible making it easy to get rid of waste and human trash would help.
- Leaking oil fuel tanks, old. I see oil film under the little bridge nearly every time I am there. Also sometimes on beach.
- Nice place. Usually sparsely attended.
- Not enough parking for the intended uses.
- Not marked as public.
- Not problems for me.
- Over regulation and too much money spent on something that could easily (and more effectively) be handled by willing parties in the neighborhood. Tax money, committees, surveys, etc. not necessary for this tiny little park.
- Parking at Woodstock Farm.
- Parking was not a problem only because there was no one else around except our one-car group. I don't know where another car or two could park around the end of Fairhaven Ave. (I don't know about most of the "problems" because we did not walk down to the water, and no one else was around when we visited the area.)
- Regarding litter, we mainly see plastic and aluminum cans that have likely been washed in with the tides.
- Removal of noxious weeds was supposed to occur. There is lots of giant hogweed still there.
- Smell.
- Speeding is a problem between Old Fairhaven Parkway and Old Samish on 30th. 30th needs a shoulder and maintenance of road.

- Speeding on Chuckanut drive - a major problem.
- The area is prone to landslides forcing bad closures. Self-sufficiency and emergency preparedness are important.
- The house next to the park was allowed to build septic system within the winter high tide zone.
- The speed on Chuckanut Drive. Motorcycles and very fast drivers all summer - especially going north past the fire department.
- The speed on Fairhaven Ave doesn't happen all the time, but often and many small children live along it. Also, fairly regularly I see cars parked in the loading zone - but typically only during quiet times of park use.
- There is a "no shellfishing" sign up most of the time - pollution?
- Too much noise from leaf-blowers around Viewcrest Rd and Sea Pines homes.
- We visit the area mostly by boat - rarely go to shore. It has been tidy when we do visit shore.

Please describe any other beneficial changes you've noticed in the area:

- The creek at the end of the road seems much healthier. 2. I appreciate the "naturalization" of the shoreline.
- Beach protected. Stream rehabbed.
- Cars off beach. Better natural system.
- Enjoyment of nature has been greatly improved.
- Great habitat gain for fish. Reduced pollutants to bay.
- I am happy for eelgrass restoration but didn't really know I could use this park.
- I rarely visit the beach area any more. Haven't seen the recent changes. Since 2005 visit 30 Nov 2012 very nice work. Good place to park.
- I was concerned about access for kayaking and the ability to load and unload kayaks. It seems to work just fine.
- It is much more pleasing to look at (the beach, etc.) More plants are there, etc. Better aesthetics.
- Less parking means less people can use this public resource. Is it really worth the money the city is spending on this for the few that actually use it?
- Less risk of high boat traffic and hopefully less crabbing but not sure about that.
- Loss of parking viewing of bay.
- Marsh area appears thriving. Beach cleaner than in 2008, my first year in the area.
- Since the restoration, illegal activities have diminished tremendously. Pot smoking seems to have disappeared, dog waste reduced, late noises and loud music in general are gone, debris on the beach reduced and great improvement to the beauty of the beach area.
- Thank you for keeping motor vehicles away from the water. When we visit, we walk or bike with our kayaks. Distances is a bit over a mile. Cars are responsible for much water pollution.
- The area is not getting destroyed by all the humans and some animals - good job.
- The beach looks much nicer and natural, no tire marks, litter and dog poop lying around.
- The city employee who previously used to snooze at the beach now has to use the parking area.
- The fact that the area is so well built (bridge, path, etc) and that the signs are so good, communicates that it is a public space and not private enough for criminal activity.
- The marsh drains out much more quickly now and this creates a drier habitat. Was this the intention?
- The project has helped to preserve the beach by not allowing vehicle traffic on the beach.
- The vegetation effort has been very successful and I also enjoy the openness of the creek. It is visually very attractive.
- There seemed to be a healthy grouping of baby cohos and the "nursery" was there for them - worthy!
- When I went it was pristine. I visited by boat in September, 2012. I live on Chuckanut Sh. Rd.

Did you participate in the city's public meetings or discussions regarding the salt marsh restoration? Your feedback regarding the process and its outcomes is welcome.

- Did not know about meetings.
- I appreciate having been informed of an event at the salt marsh restoration site, and regret that I was unable to attend that one. Thinking back, tho', I don't know where I would have been able to park, had I tried to attend....
- I thought the city did a great job soliciting opinions from all parties and presenting fair solns: I also thought the city communicated effectively w/residents regarding the planned activities.
- I went to one informational meeting talking about the restoration project and parking.
- Not sure if any beach improvements had any impact on septic pollution from Briza.
- Pleased to see protection of salt marsh along with continued ability to use area as kayak launch site.
- The elimination of vehicle access has improved the shoreline and the new growth of native vegetation for the area and habitat for birds, fish and wild animals.
- Was there a presentation to the Edgemoor Neighbors Association?

How did you hear about them?

- A flyer in mailbox.
- Bellingham Herald
- Bellingham Herald and direct mail.
- By mail.
- Cascadia Weekly? (not sure) Facebook.
- Chuckanut community.
- Couple times.
- Direct mailings.
- Don't recall - newsletter?
- Don't remember - Bellingham Herald?
- Don't remember.
- Emails, postcard.
- Emails, print mailings.
- Fire Hall newsletter and poster board.
- Fliers.
- Flyer, Cascadia Weekly
- Herald.
- Herald.
- I believe I saw a sandwich board sign by the Chuckanut Bay Gallery. (Were there any mailings to nearby and/or waterfront residents?)
- I believe it was mail and/or publications.
- I participate in the MRC and other local groups that promoted them.
- I saw a flyer for the Nov. party but we were out of town.
- I think a city publication or Cascadia Weekly.
- I wasn't here in summer; I read about Nov party in newspaper.
- Information in the mail and newspaper. Signs in area.
- Internet, neighborhood flyer.
- Local listings e.g. The Weekly, Take 5?
- Local media.
- Local paper or some other public notice.
- Local paper.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mailer.
- Mailing.
- mailings
- Mailings and posted signs in village.
- Mailings, reading events calendars in local publications, Cascadia Weekly.
- Mailings.
- Mailings.
- Marine Resource Committee (MRC)
- Neighbor or paper.
- Neighbors.
- Newsletters.
- Newspaper
- Newspaper - B. Herald.
- Newspaper (B'ham Herald)
- Newspaper (I think)
- Newspaper or perhaps direct mailing.
- Newspaper, other.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.

- Newspaper.
- Newspaper.
- Newspaper.
- Notices in the "B'ham Herald".
- Paper - Herald.
- Paper and mailing.
- Post card.
- Poster at Marine Park? B'ham Herald? Environmental group newsletter?
- Read it somewhere.
- ReSources, email.
- Sandwich board on Chuckanut Dr.
- Shoreline newsletter.
- Sign board.
- Sign in neighborhood, letter.
- Signs and newspapers.
- Signs,
- Signs.
- Signs.
- Take Five - B'ham Herald.
- Through South Neighborhood Association.
- Via email? Or the sign at the fire station?
- Weekly?
- Whatcom Marine Resources Committee meetings/fliers and sign boards.
- Word of mouth.
- Word of mouth.

What would be the most effective way to reach you about these events if there are more in the future? Something else:

- Don't know.
- email listing via Chuckanut HO Assoc.
- ENA
- KGMI
- Neighborhood newsletter.
- Not interested.
- Radio - local FM.
- Twitter, from a Bellingham feed.
- value-pack

Which of the following organizations do you trust most to provide you with accurate information about the Chuckanut Bay area? Others:

- All about equal. I don't really trust one over the other.
- Andy Bunn
- Bellingham Herald
- CBCA Chuckanut Bay Community Assoc.
- CCFA
- Chuckanut Association newsletter.
- Chuckanut Bay Community Assoc.
- Chuckanut Bay Community Organization
- Chuckanut Beaches Assoc.
- Chuckanut Community meetings.
- Chuckanut Neighborhood newsletter.
- Edgemoor Neighbors Association.
- Friends of Chuckanut
- High school requirement for Biology students.
- Just keep me informed of events.
- Neighborhood Associations.
- Neighborhood signs/sandwich boards, e-mail notices, and flyers posted in public places would be helpful in our case. Parking advice would be VERY welcome.
- Neighbors.
- Neighbors/people I personally know.
- None - too political.

- None of the above.
- None of those listed.
- Notify the community via the above
- Radio
- You should have several, in order for all to hear about it.

What else could the City do to make sure you can attend if we have more events?

- Early notification. 2. Not events just for children.
- Inform 2. Schedule often.
- Adequate parking.
- Advertise available parking.
- Advise WAKE. Current weekly publications.
- Be more scientific and less political.
- Better advertising.
- Can or "do" attend? First you must ask "why" you need attendance. 1. Output literature needs to stress the need for attendance. 2. Combine event with another as in this is one stop on a tour. Example: city park wide treasure hunt where each stop has an educational "finding" and all must be collected placed in for a winner. Win what? make something up/have a sponsor.
- Consider time, place and parking.
- Email
- Email list.
- Email.
- Email.
- Events should be when most workin gpeople can go - not 8 - 5 M - F.
- Flyers.
- Give adequate notice particularly through neighborhood associations.
- Hard to say... kids' scavenger hunt?
- Have less people show up. I hate crowds and commotion.
- I am happy with the notices I now see.
- I am most likely to attend the family friendly events at Chuckanut Bay on the weekend or during the summer (although we often have conflicts.)
- I do not care to attend any events.
- I don't need events. I love the quiet and solitude.
- I have never heard of this park but I wish I knew how to get to the area. I assume it is close by, on Chuckanut Bay.
- I would not attend.
- I'm too old to go anywhere.
- Increased use impacts wildlife, a balance needs to be found with higher use and the need of this rare place where wildlife come to rest, especially in winter.
- Just being notified would increase the chances of us attending.
- Keep trying!
- Leave the bay alone!
- Mail notice.
- Mail something.
- Make announcements in the paper.
- Make it known and applicable to me. I have lived here for 25 years and owned my property on Chuckanut Drive for over 40 years and didn't know there was a park at "Chuckanut Beach" or even heard of Chuckanut Beach.
- Make presentations to n'hood assoc. meetings.
- Make sure they give plenty of notice and maybe have snacks.

- No idea.
- No ideas to offer.
- Nothing.
- Nothing.
- Nothing.
- Nothing.
- Notices in paper, email. Didn't know about the website. We'll look at it, just to be sure people know of events, direct contact by mail or email is necessary.
- Please include detailed information about where the events take place and where Chuckanut Bay Park is located.
- Post notices on CBCA website. Chuckanut Bay Community Assoc.
- Press release.
- Probably nothing since I'm so highly committed and involved in other community activities.
- Publicize events more.
- Put info out.
- Put notices in B'ham Herald Events calendar.
- Put on RESources website and include in their monthly e-newsletter.
- Stop sending Chuckanut neighbors threatening letters. Work to stop coal trains.
- Stop the events. They bring people!
- Street sign.
- Try harder to make sure I understand the purpose of the event, I would attend.
- Variety of dates in summer.
- Water cooler postings, notices with utility bills.
- We are new to the area and rebuilding a house. Hopefully, we will become more aware of our surroundings with time.
- We are over-taxed as a county. As a result, I work most available hours/times.
- Weekend...
- You know that blue value-pack that everybody gets in the mail. I've seen non-profits and other causes use that to get the word out. You could post events and calendars in a slip of paper in that. Gotta be cheap and everybody gets it.

Please provide your email address if you would like the city to send you periodic information about Chuckanut Bay. (sent under separate cover)

If you would like to add any comments about your responses to the questions above, please do so here

- Teddy Bear Cove? which park? not clear. I live on CB across from Chuckanut Island. I sometimes walk to Teddy Bear Cove mostly in the winter.
- 27. We used what was considered "environmentally friendly" chemicals.
- 28: I live at condo - contractor handles all landscape maintenance.
- Appreciate the work. Thanks!
- Are you referring to Larrabee State Park? Is there another park on our bay? Our 5 beaches are not a park.
- Changes have reduced access for small boat launching for fishing and crabbing. Changes have limited access for people with disabilities. The handicapped parking spot is too far away. Suggest changing one of the two launch/load-unload spots to handicapped parking. We've witnessed people leaving because they're discouraged by this lack of access. Thank you.
- City paid $1.10 to mail this survey to me. Don't know how many you sent, but pretty expensive since the city should have a bulk permit.
- Concern: Fire! Will beach fires be permitted?
- Follow up to #40 "why" want attendance. 1. Need to justify money spent. 2. Want to educate. 3. Need financial support. 4. Just part of the program for these type project. 5. Want support

from citizens for more projects. *Define success: If 1,000 folks showed up in a six hour period? Yikes! Craft message to fit outcome and match program/event to fit message.
- FYI - I've only recently moved here. Looking forward to getting to know the area better.
- Good try at getting local community involved with the project.
- How much did this survey cost and who is paying for it?
- I apologize for the negative tone of my responses. I just don't see the need for this type of spending in the midst of a recession, when I can barely afford the basics.
- I appreciate your efforts although I myself will most likely not be actively involved.
- I dearly love the Chuckanut Bay area and would love to be more involved with what goes on there. I have been in Europe the past 2 1/2 months which is why I haven't been to visit more. I hope this is helpful and please let me know if there is anything I can do in keeping the Chuckanut area a beautiful, healthy and natural environment.
- I don't go to Chuckanut Bay very often but I do hike in the Chuckanuts every week.
- I have been unaware of the park, but now that I know about it, I'm very concerned about its vulnerability to pollution from the proposed increase in trains carrying coal and oil! I urge the agencies involved in restoration to submit scoping comments that urge the inclusion of imports to all shoreline parks in the Els for the Gateway Pacific Terminal.
- I miss seeing the fireworks!
- I own the property above the bay so I am happy you are improving conditions. We need to get rid of the trestle. The bay is filling in.
- I really like the improvements the city has made with one exception, the handicap area parking - which is huge and yet I have never seen anyone use it. Okay...and one other thing, I don't love having the interpretive signs, but if they are needed I think they are good ones. Thank you!
- I strongly support environmental stewardship of our land and water including Chuckanut Bay. Not attending the 4 events listed is not an indication of indifference nor lack of knowledge about water issues in general. Invasive species, pollution, climate and public use/abuse are major issues of concern.
- I think this survey is a waste of money.
- I was pleased to learn about Chuckanut Bay, and heartily endorse plans for restoration and improvement.
- I would like an effort made, either through the state or local, to negotiate with BNSF to put more openings in the rock roil causeway. The goal to increase tidal flow in Chuckanut Bay, which is not silting up.
- If more coal trains come this won't matter. Has the railroad answered this. Coal falls off cars now. Railroad ties and defoliant spray may kill anything... sorry, but the facts.
- I'm concerned about the cost of this in time and money to the city. After seeing all that has been spent for Woodstock Farm and the Chuckanut Ridge properties it seems the city is spending too much and the public is not getting a good return on investment.
- In these times of budget deficits, this survey is a blatant waste of taxpayer funds. I am highly offended with plans to increase property taxes when money is spent on such nonessential things as this survey. Obviously government is clueless about how wasteful they are. Looks like people are trying to create government jobs for themselves.
- It wasn't clear where the park at Chuckanut Bay was located.
- It would be interesting to know what would do more harm to the environment. 1. A dock that would extend 100 feet for use by the public or 2. kayakers and paddle boarders walking on the mud flats to launch their watercraft. BAN ALL DOGS! Thank you.
- It's been wonderful living down here in Chuckanut Village after retiring. We love the beach, the neighbors, the deer and our fruit trees.
- Keep up the good work. Chuckanut Bay is a great resource.
- Live on Whatcom Creek formerly Southsider. Got involved a bit thru Parks Board and Greenways.
- Living on Sea Pines Lane, high above shoreline, doesn't provide much identity with the community below. I certainly appreciate what is happening there and do my part by not

having toxic runoff from my property. Perhaps next time there's an event I'll go!
Make results of surveys more readily available.

- My family does not live near or in the watershed of Chuckanut Bay.
- My friend Emily Smith (now Flerry) was part of the restoration project along Post Point. I think the work done has been well executed and very beneficial.
- My husband and I value all efforts to protect the bay and the shoreline and the creatures that inhabit it. However, we get way too much email as it is. We would prefer information to be updated on your website so we could check it occasionally. Also could post info on signs at the site itself. Thanks for this information.
- Need a "No Beach Access" sign on the corner of Fairhaven Ave and 18th St to prevent people from parking on Rainier Ave.
- Note: We've just moved to Chuckanut area last Nov. 2011. We may be in the loop, now, to hear about C.B. happenings.
- Our address is 1329 Chuckanut Dr, about 1/4 mile s. of city limit. We use that park access to launch kayaks at high tide but have no visual or sound access from our home. Thanks for your efforts for the park.
- Our car habits are a major source of water pollution! Does the general public know this? Doubtful as it's normally referred to in terms of "storm water run off". If the public was given clear information about all the water pollution caused by motor vehicles and really encouraged to drive less for the health of our waters, I firmly believe many would choose to drive less and walk, bike and transit more. Please educate the public beyond fertilizers and dog poop!
- Parking is needed and signs from the lots would increase use - like-> "Places of interest: 1. Chuckanut Bay Park (description) 2. Arroyo 3. Teddy Bear Cove 4. Interurban Trail 5. Woodstock Farm -to learn more visit website" Print signs on metal, plastic coat, place on plastic post to increase longevity. Add pointer signs. Add trail from trailhead to Chuckanut Bay and Woodstock. -Best to you, Jody (former Greenway co-chair) Hi to Tim Wahl!
- Please note: we just moved to Bellingham in late May 2012.
- RR work has spread white taps covered with oil along the intertidal zones. The RR ties that weren't on the track itself were left and are floating in the bay - with oil oozing out of them. All the good work the city has done is being offset by BNSF. Multiple complaints have to correct these problems.
- Sadly, knew nothing about any of this, and I'm relatively active in the Chuckanut Bay Community Association. http://www.chuckanutcommunity.org/cbcahome.htm
- Sorry I am so ignorant of subject. Hope to learn more in the future.
- Sorry. I don't give my e-mail to surveys.
- Sounds all great... I just never heard or became aware of this project or location. I'll go visit soon.
- Stop wasting tax dollars on surveys etc. Hydrocarbons are never an issue!
- Suggest you read "King of Fish" by professor Michael Montgomery @ UDub. Issue for this county is simple rules and effective enforcement!
- Thank you for ever increasing the quality of life in Whatcom County!
- Thank you for the survey and opportunity to be included. I will be visiting this area now.
- Thank you for your concern for the environment and for compatible use of our public sites while protecting the environment.
- Thanks for protecting our natural resources - now stop coal and oil. 27: I've seen my neighbors spraying - especially the OLD, set in their ways.
- Thanks!
- The oil slick concerns me - I wasn't sure who to call.
- The rebuilt bridge and signs are quite ostentatious and detract from the original quiet natural beauty of the bay. The logs interspersed with boulders sure looks less natural and unattractive. The largest threat to this shoreline and marsh is goal train invasion and air and noise pollution from increased air traffic. We are sad that plantings did not get proper follow up care - many were choked out by grass or died from not being watered. What a waste of taxpayer money!

- The use of the term Chuckanut Bay is confusing. I think Teddy Bear Cove is in Chuckanut Bay and Woodstock Farm.
- The Whatcom Watch would be a good place to have an article on Chuckanut Bay - contact them.
- There are several (3) Chuckanut Bay beach access points - being specific re: which location would be helpful. Thanks!
- This seems to be a huge effort over a little project. I prefer all agencies to stay out of our natural resources except to protect them.
- This survey serves as a reminder. Perhaps consider: materials directed toward other household members? Mom has buy-in but reinforcing messages to spouse, kids, etc.
- Undesirable use of public parks is a real, valid concern and should be dealt with through policing and prosecution, not limiting access. I also worry that surveys like this and the org. behind them want to control and limit property rights of owners/taxpayers around these parks. We have gone too far intruding on private property rights and this "smells" like more intrusion. If government is going to reduce the rights of property owners to use their land... then the taxes they collect from those owners should be reduced. It is just another great government hypocrisy... take their money, take their rights. I worry about these things.
- Was not aware of reason which led to parking changes or limiting access to area.
- We are older and never use parks. It's not that we are not interested, it's just that we have other forms of recreation.
- We are opposed to the Special Park District, Dan Pike misappropriated $ to buy Chuckanut Ridge and now there is a group wanting to find a way to pay for part of the purchase to pay back the Park fund by taxing property owners more thru a Special Park District. No more taxes.
- We first heard of the park at Chuckanut Bay from this survey and went down for a visit. It's a beautiful spot. Very happy to know about it and pleased it is being cared for. There was a bit of trash on the shoreline which we placed in the well placed trash can. Thank you!
- We have lived here for two years. Since the city has bought the Hundred Acre Woods, we have spent a lot of time exploring it, and all of the adjoining trails. It's very close to our house - without driving anywhere. Besides checking out Chuckanut Bay, we haven't spent time there.
- We have not heard of the Chuckanut Bay area park or the Marsh Restoration Project. We do not know the boundary of the Chuckanut Bay area. We will look it up online to become more knowledgeable about this project. We are sensitive to the use of chemicals/fertilizers, sudsy water into sewers but not in relation to this project - just in general - to keep our waters clean.
- We spend our time "on" the bay, rarely going on shore. We have a 34' wooden cruiser so we anchor and fish, crab, explore with our two shore boats. Our experience is always fine, water clean, etc.
- We were unaware of the existence of this park. Why are there no signs about the park on Chuckanut Drive?
- Were the culprits of the recent vandalism in the park apprehended? Will there be a monitoring program for the park established?
- What a beautiful, functional improvement to Chuckanut Bay Marsh!
- Where is the "park" at Chuckanut Bay?
- Why would you include residents in this survey after all of this time - with no prior communication. It seems like a waste of time and money.
- Will not provide my email on this survey because it should be anonymous.
- You can see by my crossed out responses that I didn't know what park to which you were referring. There are many parks on Chuckanut Bay (5 owned by Chuckanut Beaches Assoc) and Larrabee Park, so referring to "the park at Chuckanut Bay is confusing to people.
- You might want to contact Frank James for so excellent photography of Chuckanut Bay wildlife, sunsets, natural beauty.

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INTRODUCTION

The City of Bellingham contracted with Applied Research Northwest to conduct a survey about the Chuckanut Bay park area. The area is in the final planning stages to restore natural flow and function to one of Bellingham's few remaining salt marshes. Salt marshes provide robust and diverse habitat for plants and animals, and serve an important function in maintaining a healthy nearshore coastal environment.

The City has engaged residents and users of the existing park in several public meetings and focus group research discussions. The purpose of the meetings was to help the City raise people's awareness about the marsh, identify their needs and concerns about the restoration, and to plan for a education and outreach to a broader set of stakeholders in the park over the course of the restoration. Needs and concerns have been discussed with the restoration team, which is balancing them with the engineering needs of the project and the several state and local laws that govern the area.

The survey contained questions about park area usage and current issues such as parking, pet clean up, and litter. Respondents were asked to identify which issues were the most problematic, what they thought contributed to the issues, and which potential solutions would be the most helpful. Respondents were also asked to evaluate overall goals for the park area as well as statements that might be used in communications about the goals. Participants who know about the plans for salt marsh restoration were asked to tell how they believe the area will change as a result. Participants identified their preferences for potential environmental education programming and recommended sources of information.

The survey was conducted both online and in paper format during February and March of 2010. There were approximately 55 survey questions and multiple opportunities for open-ended input. A total of 65 surveys were completed from among the 85 mailed and 32 emailed invitations to participate. Residents who were mailed the survey were also invited to have other members of their household respond online if they wanted to provide input and feedback.

The frequency report, which includes the actual survey questions and the distribution of respondent answers, can be found in Appendix A. The verbatim responses given to the open-ended questions can be found in Appendix B, under separate cover.

This report uses the convention of *italicizing* any verbatim response option from the survey in an effort to fully convey the voice of the residents' survey responses.

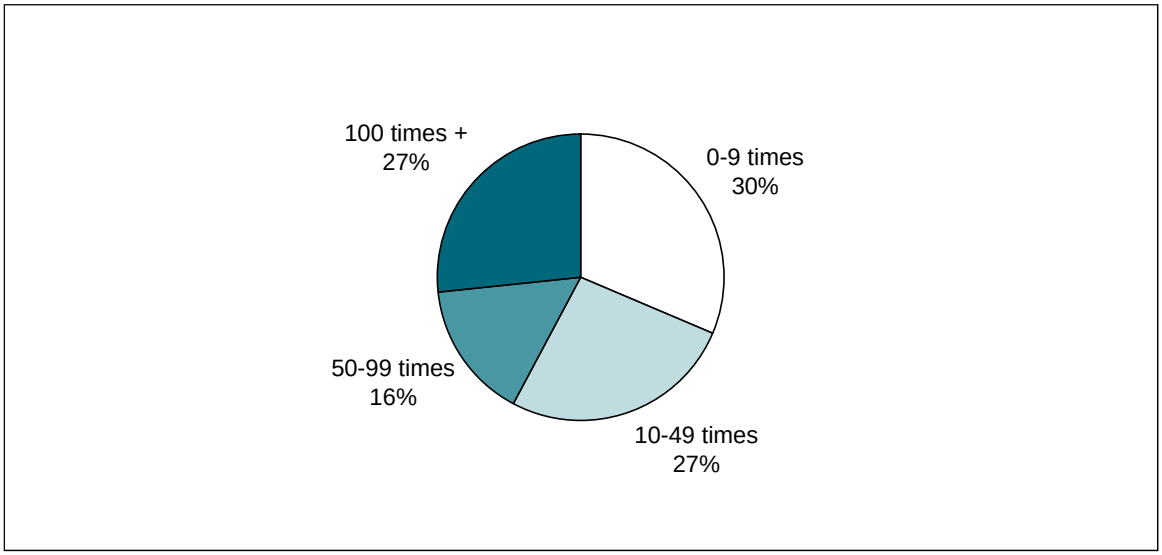
FINDINGS

This section describes the findings for each of the questions provided on the survey. Findings are presented in written and graphic format.

PARK USAGE

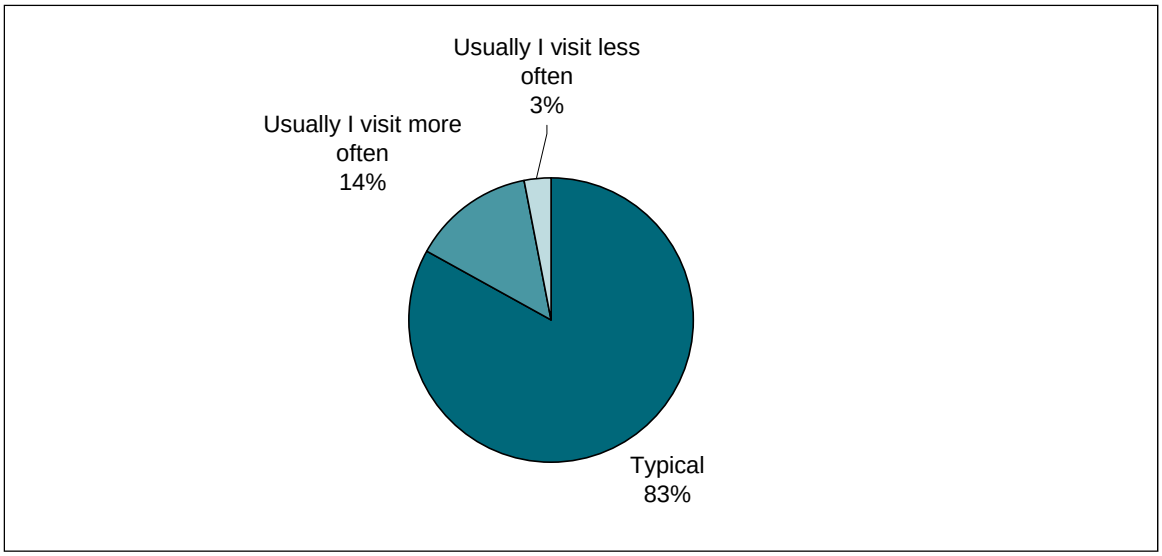
Respondents were asked how many times they visited the park area in 2009. Twenty-seven percent said they visited at least 100 times, which translates roughly to twice a week or more. Most (70%) had visited at least ten times during the year. The average was 90 visits, with the median being much lower at 32.5.

Figure 1. During all of last year (2009), how many times did you visit the park at Chuckanut Bay? (n=64)



Most respondents said that this was a typical year for them, though 14% said they usually visit more often (see Figure 2).

Figure 2. Was last year typical for you, or do you usually visit more or less often in a year? (n=65)



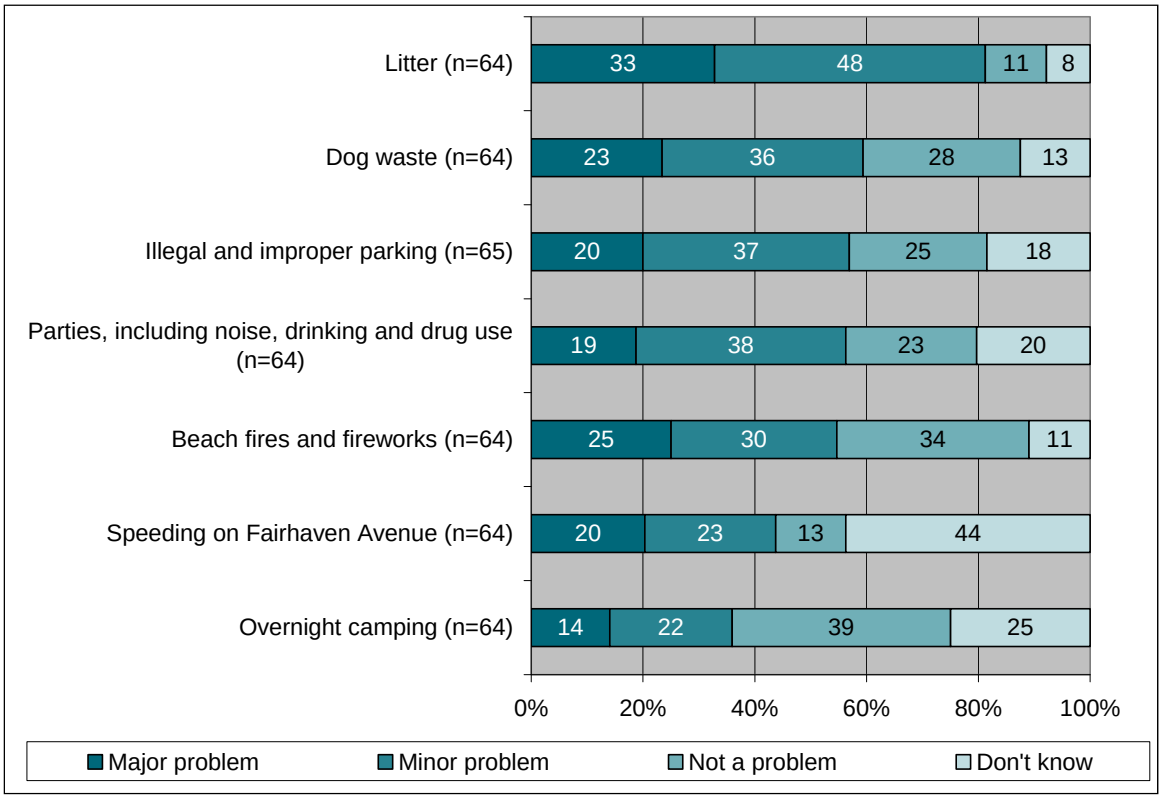
Respondents were also asked whether they live within 10-minutes walking distance of the beach area at Chuckanut Bay. Seventy-two percent said it was.

PARK PROBLEMS

Respondents were asked to review a list of issues that have been identified by people familiar with the park. They were asked to identify if the issue is a major problem, a minor problem or not a problem in the area. They were instructed that an issue would be more of a problem if it happens often or if it has a very negative impact when it happens, even if it's not often.

Figure 3 shows the issues sorted by the proportion who called the issue a problem (*major* or *minor*). Litter tops the list with one-third (33%) calling it a *major problem* and 81% recognizing it as a problem (*major* or *minor*). Dog waste was ranked second with 59% calling it a problem. Other issues that were considered to be a problem (*major* or *minor*) by over half of the respondents also included illegal parking, parties (including noise, drinking and drug use), and beach fires and fireworks. Fireworks showed the biggest split in opinion, with 34% saying it is *not a problem,* while 25% called it a *major problem.* Don't *know* responses are included in this graph and illustrates the relative awareness visitors felt they had about the given issues. Although 44% said they *don't know* about speeding on Fairhaven Avenue, about three out of four remaining respondents felt it is a problem.

Figure 3. Please let us know if you think the issue is a major problem, a minor problem or not a problem in the area.

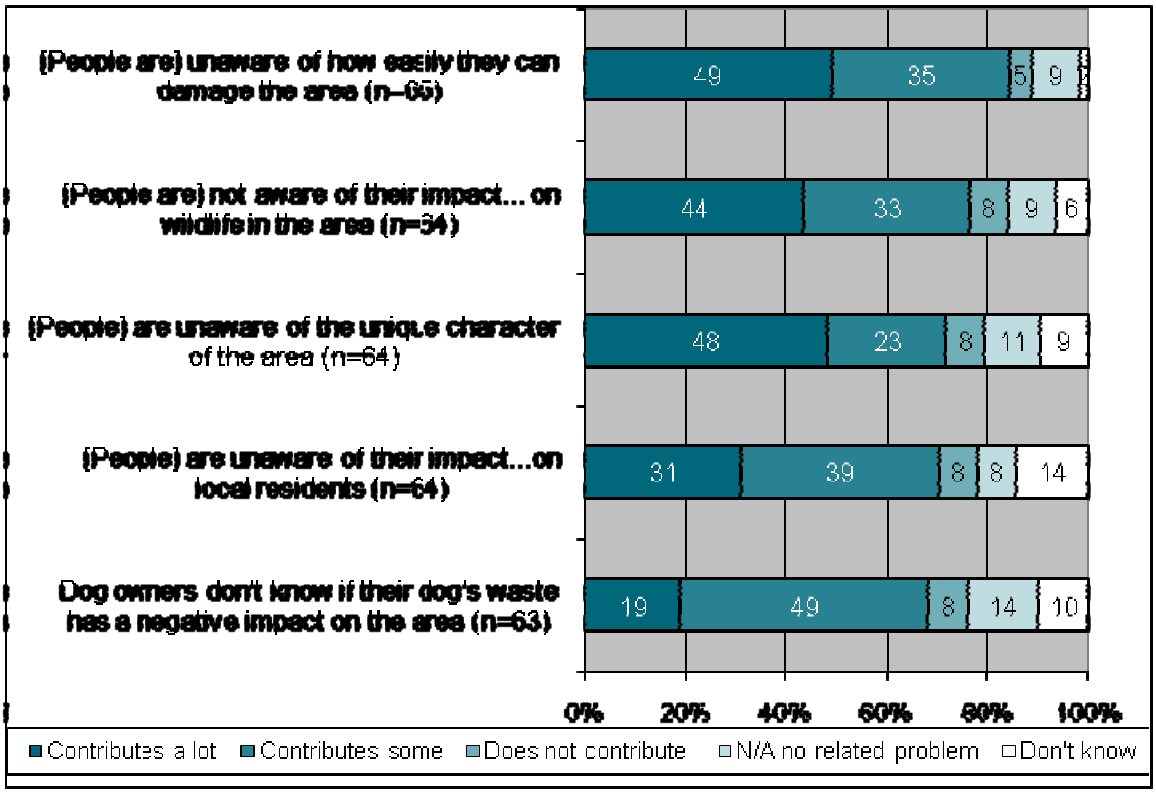


The more often people went to the park in the past year, the less likely they were to answer *don't know* to any of these questions. Six respondents felt that none of the items were a problem at the park (or didn't know if they were problems). Those who visited most often were more likely to say litter is a *major problem* than those who visited less often. All other issues were marked equally problematic by frequent and infrequent visitors.

Following this line of questions, respondents were asked if there were any other problems they had noticed at the park. Many reiterated the issues from the list or elaborated on them, providing recommendations for solutions such as speed bumps and more law enforcement presence. Two added to the list mentioning illegal shellfish harvesting, another two mentioned silt filling in the bay and two more mentioned the lack of restroom facilities. Other problems mentioned were poor street lighting, road conditions and the lack of access to the park when the parking lot is full. Additional issues can be seen in Appendix B of this report.

Respondents were then asked to consider ten different sources of the problems and evaluate which contribute to the issues. These were ranked by which sources contribute to the problems (*somewhat* or *a lot*). Figure 4 shows the top five contributors to identified problems at the park area.

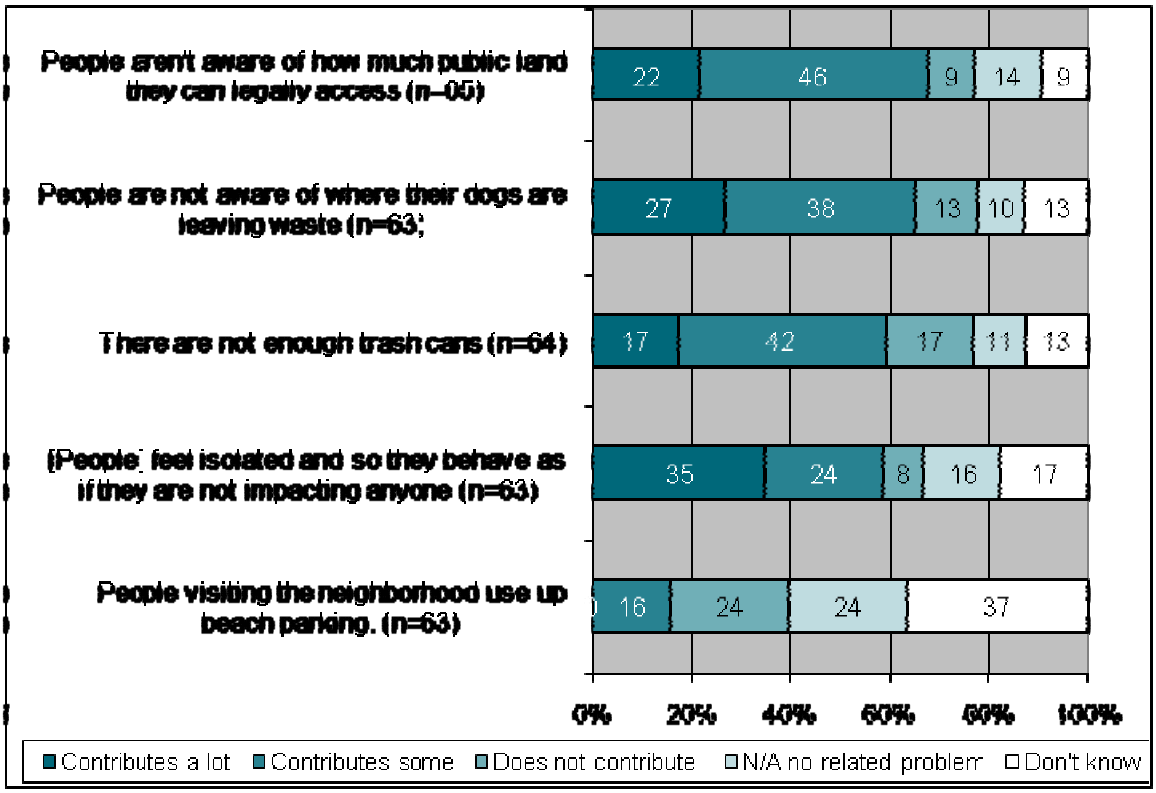
Figure 4. How much, if at all, do you think each of the following contributes to litter, poor parking, fires, camping, dog waste, parties and speeding at the park? (Part 1)



The top ranked contributors all involve a general lack of awareness of the visitors. Eighty-four percent agreed that visitors lack of awareness about how easily they can damage the area *contributes some* or *a lot* to the problems. Another top concern is that "some visitors are not aware of the impact of their noise, litter, etc on wildlife in the area".

Figure 5 shows the issues that were rated as contributing less to the park problems. Limited parking in the neighborhood was not seen as a major contributor to the problem. Lack of trash cans and a sense of isolation at the beach were also ranked fairly low in terms of contributing to the problems.

Figure 5. How much, if at all, do you think each of the following contributes to litter, poor parking, fires, camping, dog waste, parties and speeding at the park? (Part 2)



Following this line of questions, respondents were invited to describe anything else they think might contribute to the problems and nine responded with their thoughts. Lack of motivation (to pick up waste or use the trash can) and generally disrespectful behavior were expressed by some. One also mentioned the potential impact of many more visitors.

SOLUTIONS

Respondents rated potential solutions in regards to how helpful they would be in addressing park problems. These solutions were sorted by the proportion that rated them as *very helpful* and presented in Figures 6 and 7.

Figure 6 shows the solutions with the highest proportion of *very helpful* ratings. The top rated solution had to do with trash can placement and servicing (75% said this would be *very helpful*). Also rated highly was the idea of an educational display about the ecology of the area (65%) and provision of a pet waste bag station close to the beach (64%).

Figure 6. Please let us know how helpful you think it [potential solution] would be in addressing problems in the Chuckanut Bay park area. (Part 1)

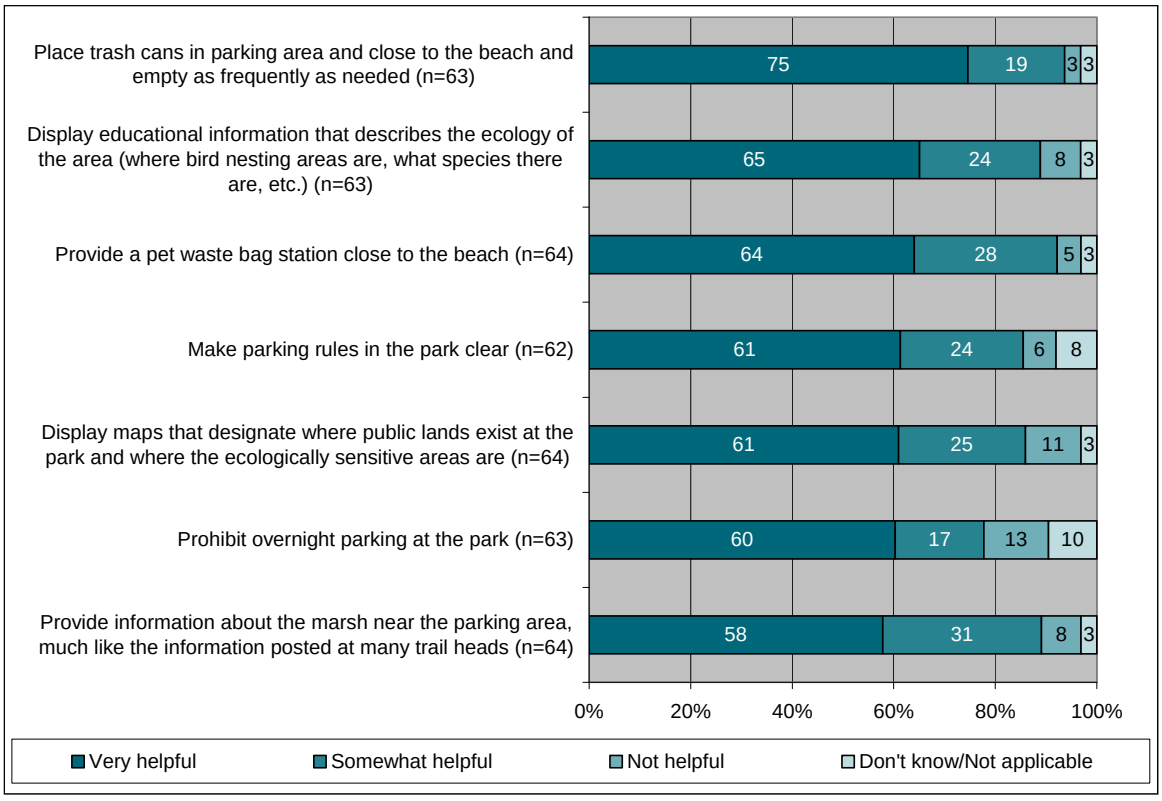
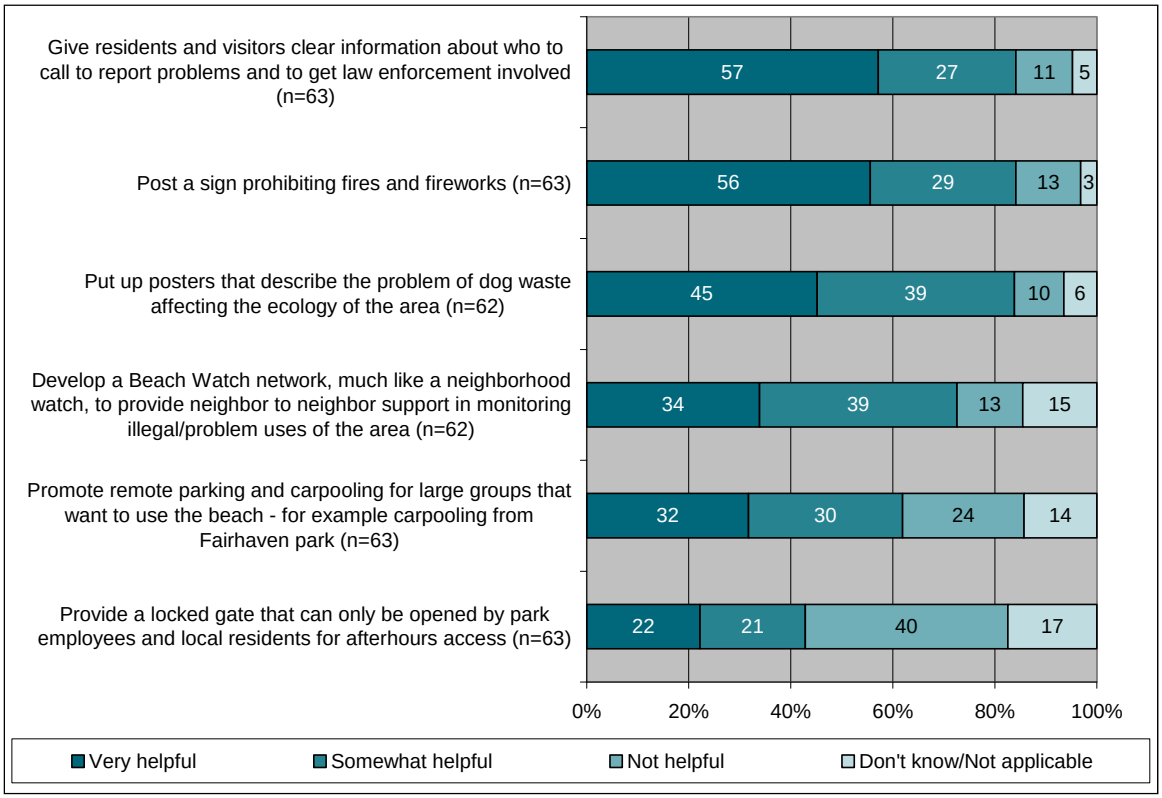


Figure 7 shows the solutions with less support, though a majority thought all would be helpful with one exception; provision of a locked gate to prohibit afterhours access was considered to be *not helpful* by 40% of respondents and helpful by 43%..

Figure 7. Please let us know how helpful you think it [potential solution] would be in addressing problems in the Chuckanut Bay park area. (Part 2)

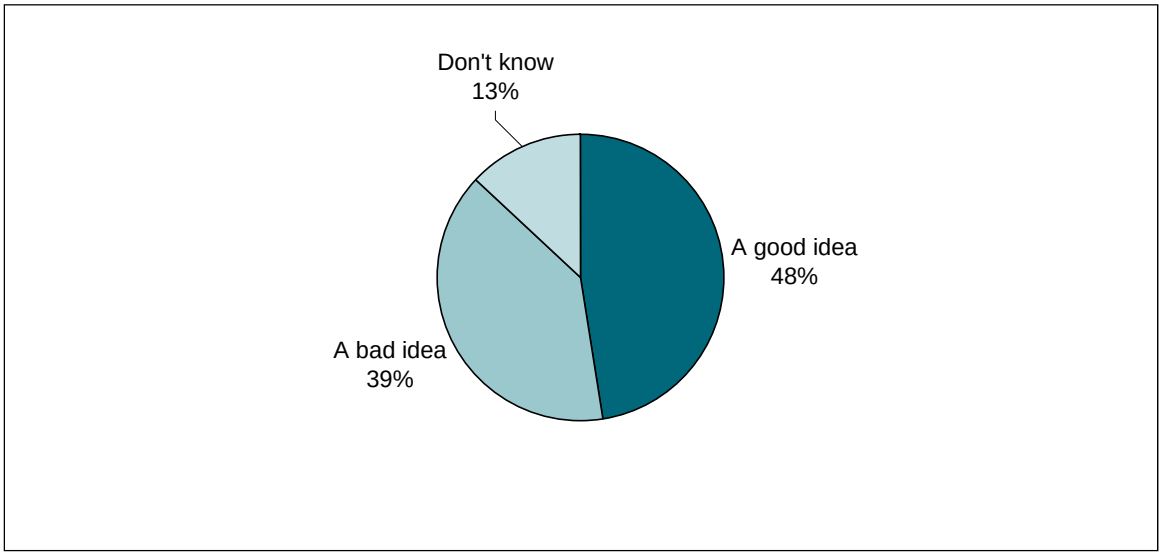


Promoting remote parking was seen as especially helpful by those who visit the park frequently. Judging by comments, infrequent visitors may be unlikely to encounter the occasions when parking is full and so may see the need for remote parking as unhelpful or too inconvenient.

Respondents were invited to comment on their responses throughout the survey. Many responded negatively to the idea of a locked gate. Two suggest a solution of a wildlife viewing area – platform or tower. Another noted the impact of cars on the beach, and another suggested that the railroad trestle needed to be changed to allow for better wash of water in and out of the bay. There are also several mentions of a need to preserve parking for kayakers and visitors, to provide restrooms and facilities for dog waste and litter along with stronger law enforcement to focus on the rare, problem visitors. Several wrote comments against prohibiting appropriate nighttime use of the park.

Because the park does not have restroom facilities, respondents were asked their opinion about the city providing an outhouse as a solution to problems with human waste. Figure 8 shows that just under half think this would be a good idea (48%), while a slightly smaller proportion think it is a bad idea (39%).

Figure 8. The park currently lacks restroom facilities. Some people leave human waste at the beach as a result. The city could provide and maintain an outhouse at the site. Do you think this is… (n=61)

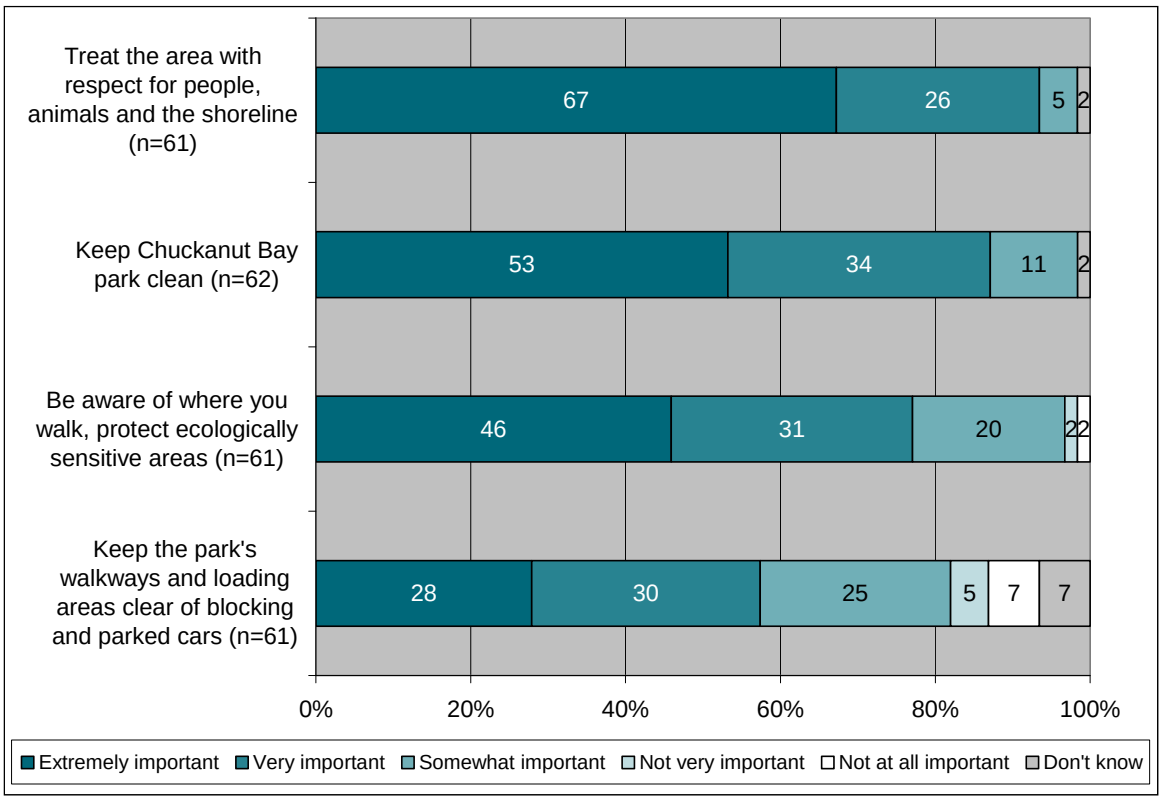


Respondents who visited the park less often were much more likely to see the addition of restroom facilities as a good idea, while frequent visitors were less likely to like it. The key concerns expressed included cost, visual impact, and potential for vandalism. Those interested in seeing facilities provided preferred a proper restroom rather than an outhouse, particularly one located near the parking and away from the beach.

GOALS

Respondents were presented with four goals that could address all the issues and concerns. They were asked to rate the importance of each of the goals. The top rated goal was to "treat the area with respect for people, animals and the shoreline" (93% call this *very* or *extremely important*).

Figure 9. Please let us know how important you think each of the goals are.



When asked to narrow their choice to just one goal, over half (52%) of respondents selected that same goal of treating the area with respect (see Table 1).

Table 1. You rated the importance of four different goals. Which one goal is the most important. (n=63)

	%
Treat the area with respect for people, animals and the shoreline	52
Keep Chuckanut Bay park clean	16
Keep the park's walkways and loading areas clear of blocked and parked cars	3
Be aware of where you walk, protect ecologically sensitive areas	3
Don't know	2
Prefer not to prioritize one goal	24

Respondents were asked to review statements that could be used in communicating goals to the park visitors. They were asked to rate which statements were the most compelling. Table 2 shows that there were two statements that resonated with respondents, both with about half of the respondents identifying it as most compelling.

Table 2. Which of the following statements do you find the most compelling when describing the Chuckanut Bay park area? (n=84)

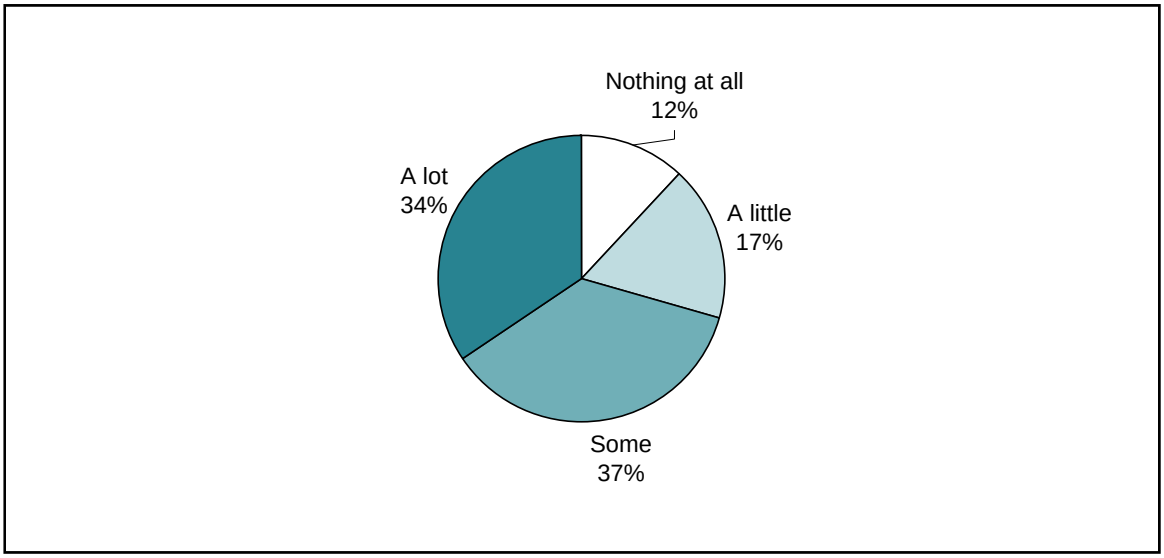
	%
This is a sanctuary. It is beautiful and has a unique character	53
By respecting the area people are protecting a nursery of wildlife where nesting, spawning and birthing takes place.	49
It is a magical spot, a wild space in the midst of a city.	16
It has been a socially transforming area for more than 100 years. It connects us to our history.	16
Save it.	12
The Golden Rule applies.	2

*Respondents were allowed to select up to two options, so percentages will total more than 100%

SALT MARSH RESTORATION

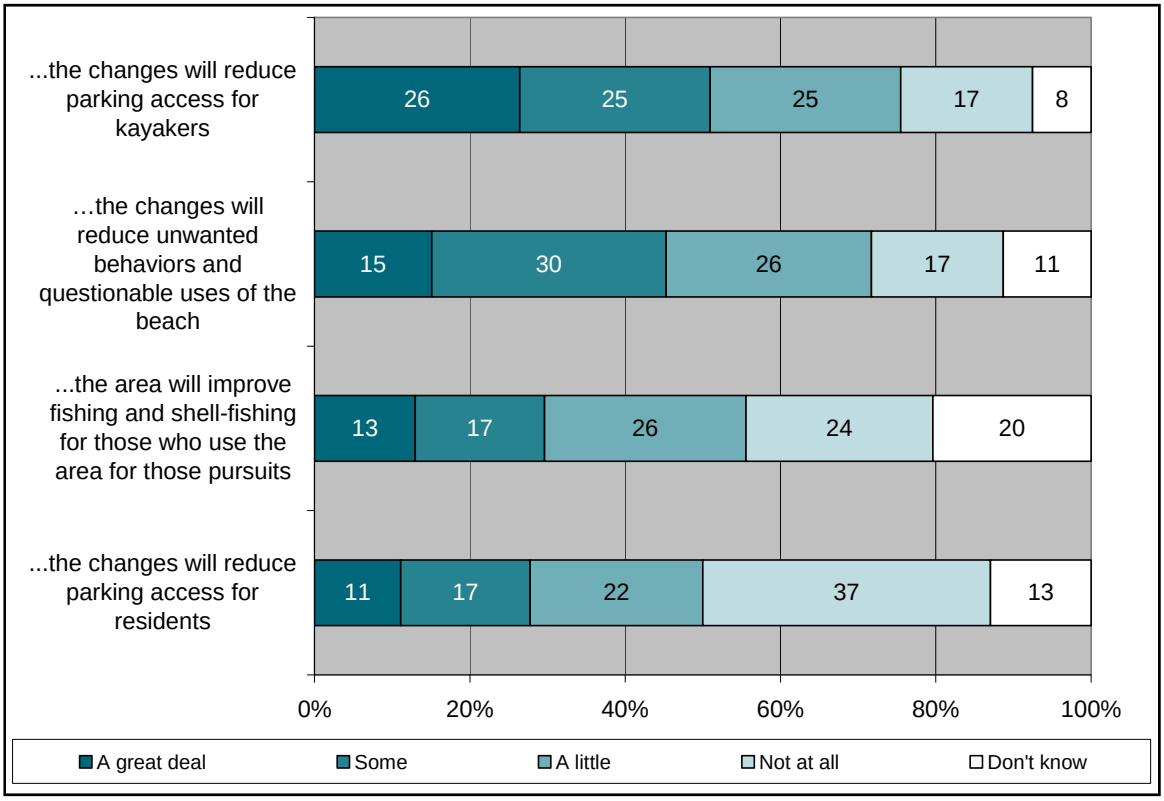
Respondents were asked how much they know about the planned restoration of the salt marsh in the Chuckanut Bay park area. Most new at least *a little* (88%) with about one-third (34%) saying they know *a lot* about the plans.

Figure 10. How much would you say you know about the planned restoration of the salt marsh in the Chuckanut Bay park area? (n=59)



Respondents who knew something about the restoration plans were asked how much they think the area will change as a result of the restoration. Half of respondents (51%) anticipate that the changes will reduce parking access for kayakers, either *some* or *a great deal*. A slightly smaller proportion (45%) believes that the changes will reduce unwanted behaviors and questionable uses of the beach, either *some* or *a great deal*. A smaller segment (28%) thinks that the changes will reduce parking for residents.

Figure 11. Please let us know how much you think the area will change as a result of the restoration. How much, if at all… (n=53)



The more people knew about the restoration, the more divided they were in their opinions of the changes in parking access. Those who knew *a lot* about the planned restoration were split about 50-50 between those who felt parking would be reduced and those who thought it wouldn't be reduced.

METHODS OF ENVIRONMENTAL EDUCATION

Respondents were informed that the city has a grant to provide environmental education to local residents and visitors to the park. They were asked to identify which methods they would recommend the city pursue. Nearly half of respondents (46%) said they would recommend a webpage describing seasonal highlights, birds and other species seen in the area, project updates and other information. The second most popular recommendation was on-site interpretive tours (38%).

Table 3. The city has a grant to provide environmental education to local residents and visitors to the park. Which of the following would you recommend for those programs? (n=82)

	%
A web page describing seasonal highlights, birds and other species seen in the area, project updates and other information	46
On-site interpretive tours for local residents and beach visitors	38
On-site workshop specially designed for local residents and visitors to show them the ecology of the area and how people can protect it.	29
Newsletters mailed to residents and visitors describing seasonal highlights, birds and other species seen in the area, project updates, and other information	29
Presentation on the social, cultural, economic and ecological history of the Chuckanut Bay area	15

*Respondents were allowed to select up to two options, so percentages will total more than 100%

When asked which organizations would be trustworthy for providing accurate information about the Chuckanut Bay area, the most frequent response was Bellingham Parks and Recreation (34%) followed by Shore Stewards (32%). Only fifteen percent selected City of Bellingham, though among those who visit the park frequently, the City was ranked at the top, second only to ReSources.

Table 4. Which of the following organizations do you trust most to provide you with accurate information about the Chuckanut Bay area? (n=76)

	%
Bellingham Parks and Recreation	34
Shore Stewards	32
ReSources	25
WSU Extension	19
Another organization	19
City of Bellingham	15

*Respondents were allowed to select up to two options, so percentages will total more than 100%

CONCLUSION

This survey showed that Chuckanut Bay Park users are very proud of and protective of this Park. They do not want it impacted by heavy use, and they would like to see its care improved. The primary cause of most problems at the park are believed to be based in awareness, which most feel could be improved with some thoughtful signage and appropriate facilities, such as trash cans. Also a stronger law enforcement presence may help with the illegal shellfish harvesting and other dangerous or inappropriate uses of the beach.

A few hot topics also showed up in the survey. As for problems, fireworks are a bit of a divided issue. A fairly recent and serious fire may have some people feeling that fireworks are a particular hazard, while others see their use as highly limited and relatively harmless (based on comments made in the survey). With the focus on nesting and nurturing the diverse birds and animals in the area, it would be reasonable for the city to ban fireworks at this beach if they are known to be disruptive. Consideration of litter from fireworks, pollution, and fire hazards from them could also inform the decision. In any case, the basis of the City's decision will need to be clearly articulated for the users of the park.

Installing a gate to prevent driving onto the beach or late-night use of the beach was soundly criticized by many respondents. Limiting access for late night and pre-dawn use is not popular – in fact, even camping was not seen as a prevalent problem (only camping that includes partying and littering). Some respondents saw it as a violation of citizen rights.

A restroom facility is also somewhat controversial. Those who use the park frequently are most opposed to an outhouse and concerned about maintenance and vandalism. A more permanent, plumbed structure was mentioned by some, but only if located away from the beach to maintain the sanctuary-like character of the area. This could be considered a low-priority item for the City. Issues of human waste being left may not require specific interventions if appropriate awareness-raising support is provided.

Key messaging in awareness should focus around the concept of treating the area with respect for people, animals and the shoreline. Two phrases resonated with respondents "This is a sanctuary. It is beautiful and has a unique character," and "By respecting the area people are protecting a nursery of wildlife where nesting, spawning and birthing takes place." Characterizing the area as a fragile sanctuary, as rare and unique, may evoke more responsible behavior on the part of visitors. However, it is important to users

that the park remains accessible and useable for appropriate pursuits, especially kayaking.

It is also clear from respondents that publicizing the park would be counter-productive. For those who know of it and find it easily, providing insights as to its nature and character and facilities to help people behave respectfully are important. But drawing more visitors to the park is believed by some respondents to be more impactful than some of the problems identified in the survey.

While a few people believe the park is best left alone, the restoration work at the park does not appear to be very controversial. Nevertheless, respondents were skeptical that the changes would produce significant benefits for the area. The railroad trestle's impact on the bay, the strength of winter storms, the amount of debris those storms bring to the beach and the potential for logs and other debris to damage the new culvert were mentioned. Case studies showing how similar restoration has improved marshlands for parks in other locations may be helpful in creating stronger support for the work.

A website and occasional onsite interpretive tours are favored methods for providing education and outreach, with Bellingham Parks and Shore Stewards favored sources of information.

APPENDIX A: SURVEY QUESTIONS AND FREQUENCIES

Version Online or Paper

		Frequency	Percent	Valid Percent
Valid	Online	21	32.3	32.3
	Paper (Data Entry)	44	67.7	67.7
	Total	65	100.0	100.0

Q1 During all of last year (2009), how many times did you visit the park at Chuckanut Bay?

		Frequency	Percent	Valid Percent
Valid	0	5	7.7	7.8
	2	2	3.1	3.1
	3	4	6.2	6.3
	4	2	3.1	3.1
	5	3	4.6	4.7
	6	2	3.1	3.1
	8	1	1.5	1.6
	9	1	1.5	1.6
	12	1	1.5	1.6
	15	2	3.1	3.1
	16	1	1.5	1.6
	20	3	4.6	4.7
	25	3	4.6	4.7
	30	2	3.1	3.1
	35	1	1.5	1.6
	36	1	1.5	1.6
	40	3	4.6	4.7
	50	6	9.2	9.4
	52	1	1.5	1.6
	75	2	3.1	3.1
	99	1	1.5	1.6
	100	4	6.2	6.3
	105	1	1.5	1.6
	150	1	1.5	1.6
	200	2	3.1	3.1
	250	1	1.5	1.6
	300	3	4.6	4.7
	325	1	1.5	1.6
	360	1	1.5	1.6
	365	1	1.5	1.6
	644	1	1.5	1.6
	720	1	1.5	1.6
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q2 Was last year typical for you, or do you usually visit more or less often in a year?

		Frequency	Percent	Valid Percent
Valid	Typical	54	83.1	83.1
	Usually I visit more often	9	13.8	13.8
	Usually I visit less often	2	3.1	3.1
	Total	65	100.0	100.0

Q3 Do you live within 10-minutes walking distance of the beach area at Chuckanut Bay?

		Frequency	Percent	Valid Percent
Valid	Yes	47	72.3	72.3
	No	18	27.7	27.7
	Total	65	100.0	100.0

Q4 Litter

		Frequency	Percent	Valid Percent
Valid	Major problem	21	32.3	32.8
	Minor problem	31	47.7	48.4
	Not a problem	7	10.8	10.9
	Don't know	5	7.7	7.8
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q5 Illegal and improper parking

		Frequency	Percent	Valid Percent
Valid	Major problem	13	20.0	20.0
	Minor problem	24	36.9	36.9
	Not a problem	16	24.6	24.6
	Don't know	12	18.5	18.5
	Total	65	100.0	100.0

Q6 Beach fires and fireworks

		Frequency	Percent	Valid Percent
Valid	Major problem	16	24.6	25.0
	Minor problem	19	29.2	29.7
	Not a problem	22	33.8	34.4
	Don't know	7	10.8	10.9
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q7 Overnight camping

		Frequency	Percent	Valid Percent
Valid	Major problem	9	13.8	14.1
	Minor problem	14	21.5	21.9
	Not a problem	25	38.5	39.1
	Don't know	16	24.6	25.0
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q8 Dog waste

		Frequency	Percent	Valid Percent
Valid	Major problem	15	23.1	23.4
	Minor problem	23	35.4	35.9
	Not a problem	18	27.7	28.1
	Don't know	8	12.3	12.5
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q9 Parties, including noise, drinking and drug use

		Frequency	Percent	Valid Percent
Valid	Major problem	12	18.5	18.8
	Minor problem	24	36.9	37.5
	Not a problem	15	23.1	23.4
	Don't know	13	20.0	20.3
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q10 Speeding on Fairhaven Avenue

		Frequency	Percent	Valid Percent
Valid	Major problem	13	20.0	20.3
	Minor problem	15	23.1	23.4
	Not a problem	8	12.3	12.5
	Don't know	28	43.1	43.8
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q12 Dog owners don't know if their dog's waste has a negative impact on the area, so they don't bother to pick it up.

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	12	18.5	19.0
	Contributes some	31	47.7	49.2
	Does not contribute to the problem	5	7.7	7.9
	Not applicable - I don't see a related problem	9	13.8	14.3
	Don't know	6	9.2	9.5
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q13 People have their dogs off leash and are not aware of where their dogs are leaving waste

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	17	26.2	27.0
	Contributes some	24	36.9	38.1
	Does not contribute to the problem	8	12.3	12.7
	Not applicable - I don't see a related problem	6	9.2	9.5
	Don't know	8	12.3	12.7
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q14 There is limited parking for people who are visiting friends who live in the neighborhood, so they use parking near the beach even though they aren't using the beach.

		Frequency	Percent	Valid Percent
Valid	Contributes some	10	15.4	15.9
	Does not contribute to the problem	15	23.1	23.8
	Not applicable - I don't see a related problem	15	23.1	23.8
	Don't know	23	35.4	36.5
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q15 There are not enough trash cans

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	11	16.9	17.2
	Contributes some	27	41.5	42.2
	Does not contribute to the problem	11	16.9	17.2
	Not applicable - I don't see a related problem	7	10.8	10.9
	Don't know	8	12.3	12.5
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q16 Some visitors to the beach are not aware of the impact of their noise, litter, etc. on wildlife in the area

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	28	43.1	43.8
	Contributes some	21	32.3	32.8
	Does not contribute to the problem	5	7.7	7.8
	Not applicable - I don't see a related problem	6	9.2	9.4
	Don't know	4	6.2	6.3
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q17 Some visitors to the beach are not aware of the impact of their noise, litter, etc., on local residents

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	20	30.8	31.3
	Contributes some	25	38.5	39.1
	Does not contribute to the problem	5	7.7	7.8
	Not applicable - I don't see a related problem	5	7.7	7.8
	Don't know	9	13.8	14.1
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q18 Some visitors to the beach are unaware of the unique character of the area

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	31	47.7	48.4
	Contributes some	15	23.1	23.4
	Does not contribute to the problem	5	7.7	7.8
	Not applicable - I don't see a related problem	7	10.8	10.9
	Don't know	6	9.2	9.4
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q19 Some visitors to the beach are unaware of how easily they can damage the area

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	32	49.2	49.2
	Contributes some	23	35.4	35.4
	Does not contribute to the problem	3	4.6	4.6
	Not applicable - I don't see a related problem	6	9.2	9.2
	Don't know	1	1.5	1.5
	Total	65	100.0	100.0

Q20 Some visitors to the beach feel isolated and so they behave as if they are not impacting anyone

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	22	33.8	34.9
	Contributes some	15	23.1	23.8
	Does not contribute to the problem	5	7.7	7.9
	Not applicable - I don't see a related problem	10	15.4	15.9
	Don't know	11	16.9	17.5
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q21 Public land is not designated clearly, so people aren't aware of how much they can legally access

		Frequency	Percent	Valid Percent
Valid	Contributes a lot	14	21.5	21.5
	Contributes some	30	46.2	46.2
	Does not contribute to the problem	6	9.2	9.2
	Not applicable - I don't see a related problem	9	13.8	13.8
	Don't know	6	9.2	9.2
	Total	65	100.0	100.0

Q23 Provide a pet waste bag station close to the beach

		Frequency	Percent	Valid Percent
Valid	Very helpful	41	63.1	64.1
	Somewhat helpful	18	27.7	28.1
	Not helpful	3	4.6	4.7
	Don't know/Not applicable	2	3.1	3.1
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q24 Put up posters that describe the problem of dog waste affecting the ecology of the area

		Frequency	Percent	Valid Percent
Valid	Very helpful	28	43.1	45.2
	Somewhat helpful	24	36.9	38.7
	Not helpful	6	9.2	9.7
	Don't know/Not applicable	4	6.2	6.5
	Total	62	95.4	100.0
Missing	System	3	4.6	
Total		65	100.0	

Q25 Place trash cans in parking area and close to the beach and empty as freQuently as needed

		Frequency	Percent	Valid Percent
Valid	Very helpful	47	72.3	74.6
	Somewhat helpful	12	18.5	19.0
	Not helpful	2	3.1	3.2
	Don't know/Not applicable	2	3.1	3.2
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q26 Provide a locked gate that can only be opened by park employees and local residents for after hours access

		Frequency	Percent	Valid Percent
Valid	Very helpful	14	21.5	22.2
	Somewhat helpful	13	20.0	20.6
	Not helpful	25	38.5	39.7
	Don't know/Not applicable	11	16.9	17.5
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q27 Promote remote parking and carpooling for large groups that want to use the beach - for example carpooling from Fairhaven park (some kayakers already are doing this)

		Frequency	Percent	Valid Percent
Valid	Very helpful	20	30.8	31.7
	Somewhat helpful	19	29.2	30.2
	Not helpful	15	23.1	23.8
	Don't know/Not applicable	9	13.8	14.3
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q28 Provide information about the marsh near the parking area, much like the information posted at many trail heads

		Frequency	Percent	Valid Percent
Valid	Very helpful	37	56.9	57.8
	Somewhat helpful	20	30.8	31.3
	Not helpful	5	7.7	7.8
	Don't know/Not applicable	2	3.1	3.1
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q29 Display maps that designate where public lands exist at the park and where the ecologically sensitive areas are

		Frequency	Percent	Valid Percent
Valid	Very helpful	39	60.0	60.9
	Somewhat helpful	16	24.6	25.0
	Not helpful	7	10.8	10.9
	Don't know/Not applicable	2	3.1	3.1
	Total	64	98.5	100.0
Missing	System	1	1.5	
Total		65	100.0	

Q30 Display educational information that describes the ecology of the area (where bird nesting areas are, what species there are, etc.)

		Frequency	Percent	Valid Percent
Valid	Very helpful	41	63.1	65.1
	Somewhat helpful	15	23.1	23.8
	Not helpful	5	7.7	7.9
	Don't know/Not applicable	2	3.1	3.2
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q31 Post a sign prohibiting fires and fireworks

		Frequency	Percent	Valid Percent
Valid	Very helpful	35	53.8	55.6
	Somewhat helpful	18	27.7	28.6
	Not helpful	8	12.3	12.7
	Don't know/Not applicable	2	3.1	3.2
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q32 Make parking rules in the park clear

		Frequency	Percent	Valid Percent
Valid	Very helpful	38	58.5	61.3
	Somewhat helpful	15	23.1	24.2
	Not helpful	4	6.2	6.5
	Don't know/Not applicable	5	7.7	8.1
	Total	62	95.4	100.0
Missing	System	3	4.6	
Total		65	100.0	

Q33 Prohibit overnight parking at the park

		Frequency	Percent	Valid Percent
Valid	Very helpful	38	58.5	60.3
	Somewhat helpful	11	16.9	17.5
	Not helpful	8	12.3	12.7
	Don't know/Not applicable	6	9.2	9.5
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q34 Give residents and visitors clear information about who to call to report problems and to get law enforcement involved

		Frequency	Percent	Valid Percent
Valid	Very helpful	36	55.4	57.1
	Somewhat helpful	17	26.2	27.0
	Not helpful	7	10.8	11.1
	Don't know/Not applicable	3	4.6	4.8
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q35 Develop a Beach Watch network, much like a neighborhood watch, to provide neighbor to neighbor support in monitoring illegal/problem uses of the area

		Frequency	Percent	Valid Percent
Valid	Very helpful	21	32.3	33.9
	Somewhat helpful	24	36.9	38.7
	Not helpful	8	12.3	12.9
	Don't know/Not applicable	9	13.8	14.5
	Total	62	95.4	100.0
Missing	System	3	4.6	
Total		65	100.0	

Q36 The park currently lacks restroom facilities. Some people leave human waste at the beach as a result. The city could provide and maintain an outhouse at the site. Do you think this is:

		Frequency	Percent	Valid Percent
Valid	A good idea	29	44.6	47.5
	A bad idea	24	36.9	39.3
	Don't know	8	12.3	13.1
	Total	61	93.8	100.0
Missing	System	4	6.2	
Total		65	100.0	

Q37 Keep Chuckanut Bay park clean

		Frequency	Percent	Valid Percent
Valid	Extremely important	33	50.8	53.2
	Very important	21	32.3	33.9
	Somewhat important	7	10.8	11.3
	Don't know	1	1.5	1.6
	Total	62	95.4	100.0
Missing	System	3	4.6	
Total		65	100.0	

Q38 Keep the park's walkways and loading areas clear of blocking and parked cars

		Frequency	Percent	Valid Percent
Valid	Extremely important	17	26.2	27.9
	Very important	18	27.7	29.5
	Somewhat important	15	23.1	24.6
	Not very important	3	4.6	4.9
	Not at all important	4	6.2	6.6
	Don't know	4	6.2	6.6
	Total	61	93.8	100.0
Missing	System	4	6.2	
Total		65	100.0	

Q39 Treat the area with respect for people, animals and the shoreline

		Frequency	Percent	Valid Percent
Valid	Extremely important	41	63.1	67.2
	Very important	16	24.6	26.2
	Somewhat important	3	4.6	4.9
	Don't know	1	1.5	1.6
	Total	61	93.8	100.0
Missing	System	4	6.2	
Total		65	100.0	

Q40 Be aware of where you walk, protect ecologically sensitive areas

		Frequency	Percent	Valid Percent
Valid	Extremely important	28	43.1	45.9
	Very important	19	29.2	31.1
	Somewhat important	12	18.5	19.7
	Not very important	1	1.5	1.6
	Not at all important	1	1.5	1.6
	Total	61	93.8	100.0
Missing	System	4	6.2	
Total		65	100.0	

Q40b You rated the importance of four different goals. Which one goal is the most important.

		Frequency	Percent	Valid Percent
Valid	Keep Chuckanut Bay park clean	10	15.4	15.9
	Keep the park's walkways and loading areas clear of blocked and parked cars	2	3.1	3.2
	Treat the area with respect for people, animals and the shoreline	33	50.8	52.4
	Be aware of where you walk, protect ecologically sensitive areas	2	3.1	3.2
	Prefer not to prioritize one goal	15	23.1	23.8
	Don't know	1	1.5	1.6
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q41_1 This is a sanctuary. It is beautiful and has a unique character

		Frequency	Percent	Valid Percent
Valid	UnChecked	33	50.8	52.4
	Checked	30	46.2	47.6
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q41_2 By respecting the area people are protecting a nursery of wildlife where nesting, spawning and birthing takes place.

		Frequency	Percent	Valid Percent
Valid	UnChecked	35	53.8	55.6
	Checked	28	43.1	44.4
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q41_3 It is a magical spot, a wild space in the midst of a city.

		Frequency	Percent	Valid Percent
Valid	UnChecked	54	83.1	85.7
	Checked	9	13.8	14.3
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q41_4 Save it.

		Frequency	Percent	Valid Percent
Valid	UnChecked	56	86.2	88.9
	Checked	7	10.8	11.1
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q41_5 The Golden Rule applies.

		Frequency	Percent	Valid Percent
Valid	UnChecked	62	95.4	98.4
	Checked	1	1.5	1.6
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q41_6 It has been a socially transforming area for more than 100 years. It connects us to our history.

		Frequency	Percent	Valid Percent
Valid	UnChecked	54	83.1	85.7
	Checked	9	13.8	14.3
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q42 How much would you say you know about the planned restoration of the salt marsh in the Chuckanut Bay park area?.

		Frequency	Percent	Valid Percent
Valid	Nothing at all	7	10.8	11.9
	A little	10	15.4	16.9
	Some	21	32.3	35.6
	A lot	20	30.8	33.9
	Don't know	1	1.5	1.7
	Total	59	90.8	100.0
Missing	System	6	9.2	
Total		65	100.0	

Q43 How much, if at all, the area will improve fishing and shell-fishing for those who use the area for those pursuits

		Frequency	Percent	Valid Percent
Valid	A great deal	7	10.8	13.0
	Some	9	13.8	16.7
	A little	14	21.5	25.9
	Not at all	13	20.0	24.1
	Don't know	11	16.9	20.4
	Total	54	83.1	100.0
Missing	System	11	16.9	
Total		65	100.0	

Q44 How much, if at all, the changes will reduce parking access for kayakers.

		Frequency	Percent	Valid Percent
Valid	A great deal	14	21.5	26.4
	Some	13	20.0	24.5
	A little	13	20.0	24.5
	Not at all	9	13.8	17.0
	Don't know	4	6.2	7.5
	Total	53	81.5	100.0
Missing	System	12	18.5	
Total		65	100.0	

Q45 How much, if at all, the changes will reduce parking access for residents

		Frequency	Percent	Valid Percent
Valid	A great deal	6	9.2	11.1
	Some	9	13.8	16.7
	A little	12	18.5	22.2
	Not at all	20	30.8	37.0
	Don't know	7	10.8	13.0
	Total	54	83.1	100.0
Missing	System	11	16.9	
Total		65	100.0	

Q46 How much, if at all, the changes will reduce unwanted behaviors and Questionable uses of the beach.

		Frequency	Percent	Valid Percent
Valid	A great deal	8	12.3	15.1
	Some	16	24.6	30.2
	A little	14	21.5	26.4
	Not at all	9	13.8	17.0
	Don't know	6	9.2	11.3
	Total	53	81.5	100.0
Missing	System	12	18.5	
Total		65	100.0	

Q47_1 On-site workshop specially designed for local residents and visitors to show them the ecology of the area and how people can protect it.

		Frequency	Percent	Valid Percent
Valid	UnChecked	48	73.8	76.2
	Checked	15	23.1	23.8
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q47_2 Newsletters mailed to residents and visitors describing seasonal highlights, birds and other species seen in the area, project updates, and other information

		Frequency	Percent	Valid Percent
Valid	UnChecked	48	73.8	76.2
	Checked	15	23.1	23.8
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q47_3 A web page describing seasonal highlights, birds and other species seen in the area, project updates and other information

		Frequency	Percent	Valid Percent
Valid	UnChecked	39	60.0	61.9
	Checked	24	36.9	38.1
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q47_4 Presentation on the social, cultural, economic and ecological history of the Chuckanut Bay area

		Frequency	Percent	Valid Percent
Valid	UnChecked	55	84.6	87.3
	Checked	8	12.3	12.7
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q47_5 On-site interpretive tours for local residents and beach visitors

		Frequency	Percent	Valid Percent
Valid	UnChecked	43	66.2	68.3
	Checked	20	30.8	31.7
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q48_1 ReSources

		Frequency	Percent	Valid Percent
Valid	UnChecked	50	76.9	79.4
	Checked	13	20.0	20.6
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q48_2 Shore Stewards

		Frequency	Percent	Valid Percent
Valid	UnChecked	46	70.8	73.0
	Checked	17	26.2	27.0
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q48_3 WSU Extension

		Frequency	Percent	Valid Percent
Valid	UnChecked	53	81.5	84.1
	Checked	10	15.4	15.9
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q48_4 City of Bellingham

		Frequency	Percent	Valid Percent
Valid	UnChecked	55	84.6	87.3
	Checked	8	12.3	12.7
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q48_5 Bellingham Parks and Recreation

		Frequency	Percent	Valid Percent
Valid	UnChecked	45	69.2	71.4
	Checked	18	27.7	28.6
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

Q48_6 Another organization

		Frequency	Percent	Valid Percent
Valid	UnChecked	53	81.5	84.1
	Checked	10	15.4	15.9
	Total	63	96.9	100.0
Missing	System	2	3.1	
Total		65	100.0	

REPORT APPENDIX B

Chuckanut Bay Marsh Restoration Project: Community Survey

April, 2010

Pamela M. M. Jull, PhD
Rachel Williams, MA

APPLIED RESEARCH NORTHWEST, LLC
1313 East Maple Street Suite 201
Bellingham, Washington 98225
1-360-647-6067
www.arnorthwest.com

APPENDIX B: OPEN ENDED RESPONSES

q11 If there are any other issues you think are a major problem in the area, please describe them below:

- 4 Lack of parking-Lack of Toilet & Lack of Garbage Receptacles
- 8 Introducing many "outsiders" into the neighborhood can potentially increase crime rates.
- 16 Street lighting
- 19 Lack of bathroom facilities. It forces people to "go" outdoors. That's part of litter problem.
- 20 The biggest issue is that the inner bay is filling with silt. We need more openings in the train crossing.
- 30 Keep trash cans in the parking area and empty them every couple of days.
- 32 Protect the integrity of the neighborhood!
- 33 Illegal shellfish harvesting (litter is mostly a waterborne problem)
- 36 Lack of a sign explaining where/what sensitive areas are and what you shouldn't do, if it's ok to walk in the marsh. Litter regularly is left both behind and washed ashore. People leave beer cans behind, needs to be kept cleaner. It's the major problem.
- 37 When cars were common there some of them (the pickups or campers) would back into the brush and destroy habitat. I prefer to have all autos out of the area.
- 38 no bus stop need connecting trails to interurban post point & the farm and fire pit/bbq area or areas the real problem is runoff from lawns & houses up on the hill above beach (Ridgemont) and further more city of Bellingham tries and does spray (pesticides) all along the side of Chuckanut creek sometimes within 8' of the creek where salmon spawn. I have tried to stop them.
- 39 We are unaware of any problems, but we just moved here in December
- 40 Please put a speed bump on the downhill on Fairhaven &18th. people have nearly missed being hit by speeders, not to mention animals that have been hit and killed.
- 41 Problem? Are you looking for justification for your actions?
- 45 Streets in the area have not been updated for years, with the exception of one bridge over the creek.
- A9 Usually walk to the beach during the day. Have never found dog waste to be a problem. Rarely do we find litter. Have never seen a problem with parking. Don't find beach use at night really a problem from our home, although occasionally we hear people there. Not usually a problem. Please DO NOT stir up problems where there are none (such as parking issues).
- A11 I think litter is not a problem (I see very little) because the residents here pick it up. My family and I have always found it easy to pick up litter. I never allowed my children to ride bicycles here because drivers of cars sped carelessly down Fairhaven Avenue passed the Chuckanut Avenue junction. I've never seen dog waste on the beach. The days surrounding July 4th are full of firework explosions. I believe that is legal in Bellingham. I've seen one accidental fire on the beach in 30 years.
- A14 We live adjacent to the parking at Chuckanut Bay, the parking area is planned to be in our front yard. Speed bumps on Fairhaven Ave. might be a good idea, we have children and there are lots of pets in the neighborhood that some outside visitors do not take into account when coming to visit the bay. It should be closed at dark, and someone patrolling occasionally would be good to decrease

amount of illegal activities. Items were stolen out of my husband's vehicle one night while we were home and it was parked in our driveway.

- A17 Compared to a lot of other parks near residential areas, this one is not a "problem park" that I can see, and a few preventive measures could go a long way to reducing even those issues. I go there often, and I haven't seen real "problem cases" of things from this list.
- A19 Illegal activities, like drinking and smoking pot
- A22 if full can't get to beach
- A23 if parking is full
- A24 shellfish overharvesting
- A25 Would appreciate more law enforcement presence (Bellingham PD) to prevent drinking parties
- A26 The fact that "Mud Bay" is filling in and no action is being taken to reverse that inevitable result.
- A29 1.Beach encroachment from a few of the houses in Briza. 2.Use of motor boats by the house next to the launch area. 3. Parking of a motor boat(on a trailer) and a kayak on the tidelands adjacent to the south tunnel entrance.
- A37 There is a group of people who seem to be related; who seem to be Asian who harvest every living thing animal and vegetable during the lowest tides of the year. They work together with wheel barrow like devices to remove their takings. Even the sea weed is gone when they are finished. I have heard other stories about this group from people in other areas including the Canadian Islands. I can relate those tales for you, too. I only report here what I have seen with my own eyes.

q22 If there are any other issues you think contribute to problems in the area, please describe them below:

- 3 have lived on Rainier Ave. For all my life 66 yrs and I don't see the damage or harm done to the area except by blocking access on the beach. I think this project will do a lot more harm than good.
- 4 lack of parking lack of toilet lack of garbage cans
- 9 Some visitors are unaware of the delicate, unique, and complex ecosystems in the area (wetland + bay).
- 22 Saw 2 groups yesterday with buckets to collect shellfish apparently, one Hispanic & one Asian
- 24 impacts of cars on beach to plants, shellfish, water quality.
- 32 Please protect the integrity of the neighborhood!
- 35 The railroad causeway completely alters Mud Bay ecology & should be retrofitted to improve tidal exchange
- 36 Drug dealing is still going on at the park.
- 37 I want to emphasize IF. I want to ensure minimum impact. call me at my home Dave Tuclcerz 671-1787 I have been unable to attend meetings.
- 38 Lack of access to other coastal areas postpoint, teddy bear cove. Open up more spots at least with trails to distribute impact.
- 44 I think you covered them well in your questions. Starting fires on the beach is very dangerous. Late night parties are distressing.

- 45 A wildlife viewing area would help people from causing damage. A view platform or tower would help.
- A4 Some visitors are lazy (can't walk 5-10 feet to the garbage can at the beach) and disrespectful when it comes to disposing of their litter. Some fling their bottles and cans into the marsh where it's difficult to reach for those of us who do pick up litter.
- A9 1) Have NEVER seen a problem with visitors using parking 2) Again, we have never seen dog waste at the beach - so it must not be a big problem. If the City is concerned - then supply dog waste bags and trash cans 3) Sometimes in the summer, we hear people on the beach at night - but this is not the norm.
- A11 It is the number of visitors which impact the area. Although being sensitive to the area and all the life in it is helpful, the area is small. If the number of visitors goes from twenty a day to forty then to fifty, no matter how conscientious, the impact will be negative. Creatures require solitude to reproduce and to nurture their young. A few days of Independence Day celebration is nothing compared to continuous daily traffic. Most people are appreciative of nature or they wouldn't visit. There are always a few disturbingly destructive individuals who can do a great deal of damage who must be dealt with. The question is, how.
- A15 There is the one trash can that is adequate most of the time and receives regular pick-up. Unfortunately, people ignore the trash can and leave their garbage, cigarette butts and beer cans where they toss them. They don't care.
- A19 I have talked to people from Toma and Whatcom County coming here to clam and they do not know anything about the area but leave dog waste and debris behind, especially empty beer bottles.
- A25 It is not an AWARENESS issue. It is a seemingly remote, unobserved and unsupervised area that attracts selfish, misdemeanor behavior. If police rolled through twice an evening, the parties would drink elsewhere. Post Point on the water side of the railroad tracks is a similar "at risk" area.
- A26 People are lazy.
- A29 At least one house on the Briza side has a bright light shining down towards the bay (at least sometimes) which is quite annoyingly visible when in a boat out on the bay (shining in my eyes).
- A33 Wildlife are being chased by dogs off leash at the bay area

C1 (Follows potential solutions) If you would like to add any comments about your responses to the questions above, please do so here:

- 3 If you think dog waste is a problem, put a waste bag station there so it can be used
- 4 #26 Local residents have no more right of access to a public are than anyone else.
- 8 Provide adequate parking for the beach; outhouse(s). Fines for pet owners not picking up after their dogs & actually enforcing it.
- 9 I strongly disagree with installing a locked gate to be opened "afterhours" by local residents and park employees. this is a public park-not a neighborhood association's park. I should have the same equal access to this park as one who lives within walking distance. Just because I live several miles from the park does not mean I treat it with disrespect. This proposal is personally insulting and upsets me greatly.
- 14 I just don't like the idea of a locked gate and the time and expense to maintain it. It seems like a lot of resources to prevent an infrequent problem.
- 16 a gate is 1. ugly and lakes away from the natural beauty of the beach. 2. Create more animosity between non-village folks % the locals 3. cause more illegal? parking situations encroaching on concerned parties-more angst

- Can see the benefits of having a locked gate... Unfortunately it is also an invitation to vandalize for some young people.
- 22 Need suitable access & parking for kayakers. This is a precious & safe launch site
- 30 What do you consider "Local Residents"?
- 32 Please protect the integrity of the neighborhood!
- 33 This is a public area. Don't lock it for residents only.
- 36 We need a speed bump at bottom of hill to slow down both residents and non residents. Also a sign that beach is patrolled be b'ham police and dept of wildlife officials!
- 38 Weakness in previous planning has created unsustainable situations for everyone.
- 41 More trash comes in with the tide that is left by visitors. A gate only takes access away without just cause. Are you looking for more money?
- 44 Who do we call? One big fire on the beach, we called 911 and the FIRE DEPARTMENT. They responded quickly.
- 45 26. This is a law enforcement problem and the wrong use of park funds.
- 46 Signs, bags, & garbage key! Thanks.
- A3 There is already a trash can there, it does overflow in the summer at times, maybe pick up could be daily during those months or at least on the weekends? I assume that the beach will not be accessible to vehicles once the restoration is completed, so I don't see how a locked gate would restrict access.
- A8 why do residents need keys to the park gate?
- A9 Again, we walk to the beach regularly and have NEVER seen dog waste. But... if residents request it, the City could put up posters about dog waste and provide waste bags. Do NOT prohibit pets from visiting the beach. In reality, it was old septic tanks that contributed more of a problem with waste than the few dogs who go down there.
- A11 I personally haven't encountered these problems, but if others have, it seems these measures wouldn't hurt.
- A17 Locked gate for "Afterhours" access? Unacceptable. Public land should be public use whether you live next to it or in Blaine.
- A19 I believe a city ordinance requires dog owners to carry a bag for the pick up of dog waste. The ordinance also provides violators be fined for not picking up the dog poop.
- A26 Trash can available seems sufficient. Locked gate will not help because beach can be accessed by walkway from Briza neighborhood.
- A29 If I come in after dark in my kayak and the gate is locked, what can I do? Kayaking in the evening can be a great pleasure.
- A33 I believe city ordinance requires that all dog owners carry a bag for waste pick up and can be fined if not having a bag with them. How will a sign

C2 Comments on potential solutions.

- 3 I don't kayak so i have neer seen over crowding at the launch point
- 4 People come down here to kayak, walk the beach, or dig clams-not many are aware of or care much about the "marsh"-it used to be a cow pasture, that's why there are old fence posts in the middle of it.
- 8 Display info/maps on where private lands are and where people may or may not go.
- 9 The more formal education available, the more visitors will understand and respect the natural beauty of this area. The more education, the better!
- 14 Rather than spend the money for a gate to prevent after-hour noise & litter, etc. -Educating the public about the unique & sensitive ecology of the area seems a much better use of resources & provides a better use of resources to all of the parks visitors!
- 24 It might be helpful to build a wood trail and wildlife viewing platform in the marsh behind the beach. have seen these throughout Canada, Lopez Island, etc. another education opportunity!
- 30 If you draw attention to the area if will bring more visitors. This will have a negative impact on the area. Leave it alone! neighbors will always keep an eye out and report illegal activities. Post some signs and keep the garbage cans assesime (sic).
- 32 Please protect the integrity of the neighborhood!
- 35 Mud Bay is special & unique let's make sure that those who utilize it understand & respects it.
- 36 I have never seen the parking lot full and see no problem with parking at ll. I don't remember seeing any animal or human feces in the park.
- 37 We hope some of these suggestions will help. The salt marsh are has provided us with unbelievable joy in watching the birds come down into our area. For example, the red and yellow winged blackbirds and pikeated woodpeckers
- 39 #28,39,30- Information is a very good thing to raise awareness and general knowledge.
- 44 What about Rest Rooms? Please people should not use the beach as a bathroom
- 45 This should be a park for small groups and the chuckanut village neighborhood certainly not a place for large groups or parties.
- A3 While information that could be provided may help educate folks to use the area more wisely and respectfully, I would discourage the use of a lot of signage. Maybe one concise sign near the parking area with a map and some text describing the ecology of the area. If further information is considered important, perhaps it could refer the reader to a website with more details about the Chuckanut bay marsh.
- A9 Instead of promoting "remote" parking, simply provide adequate parking for the park. Obviously, large groups should carpool. But, please -- do NOT take away parking for kayakers. This is one of the main wholesome uses of the beach.
- A11 I believe those who are interested in the wildlife of the area will put effort into learning about it. Many creatures have developed methods of hiding their young and the habits which sustain them because that is necessary for their survival. Why would you expose them to the ever present tiny percentage of human vandals who would damage them? Let them be hidden. All the areas here, the public lands and the legally designated ecologically sensitive lands are sensitive for the entire life cycle of most of the area's plants and animals.
- A17 A map of the public lands invites the creation of a network of social trails. Perhaps continued obscurity is the best protection?

- A19 Some of us have beach frontage and sometimes visitors are starting small camp fires at the beach that could be very dangerous and cause a fire hazard to our properties.
- A25 It's NOT an INFORMATION issue; it is a LAW ENFORCEMENT issue. Protecting sensitive ecological areas from young drunks is a challenge that cannot be solved without law enforcement cooperation.
- A26 Education information would be welcome. In addition to providing interest, it would encourage people to care. I think encouraging large groups is a bad idea for the sensitive area.
- A29 Please keep signage off the beach area. It disrupts the natural feel of the place.

C3 (following additional solutions) If you would like to add any comments about your responses to the questions above, please do so here:

- 9 Please do not prohibit overnight parking. as a paddler, I often plan overnight trips; prohibiting overnight parking eliminates this bay as a launching spot. Fisherman often use this bay in the late hours & early hours. This needs to be considered also.
- 23 There are no need for parking rules. Parking has been fine for the last 30 years. Quit making issues where there are none!
- 32 Protect the neighborhood!
- 38 STOP pesticide and herbicide use
- 39 #31. I hate to see too many signs. Perhaps a mention on the information displays
- 41 Are you looking for problems in my neighborhood? People know how to phone 911 if there is an emergency.
- 45 REMOTE PARKING IS A BAD IDEA. IT BRINGS TO AMNY PEOPLE TO A SMALL AREA.
- 46 a bi-annual beach cleanup would be great for neighbors to help.
- A4 We already have neighborhood watch going on in Chuckanut Village. It was because of calls I made to the police (overnight campers; abandoned vehicles) and to parks staff (illegal dumping) that signs were posted about "No Dumping" and "No parking dusk to 6 am. Police will impound vehicles". I hope these signs are left in place.
- A5 We already have & have had a Village watch since many of us locals walk the streets, beach, etc for exercise, cleanup (there's also a lot of garbage thrown out of car windows along the streets as they leave. Also, I'm a bit confused by the statement in this statement "if funding allows" Isn't this under the grant?
- A8 sings for parking only help if there is enough parking to begin with
- A9 We do not see a problem with parking at the park. Even on busy summer Saturdays, folks are considerate. The city should continue to offer parking down by the beach. We've never noted problems with parking; although sometimes the beach area is busy.
- A11 We already have a functioning neighborhood network and we have the business cards and phone numbers of those to call. Those in authority are small in number and have many, many calls. Our law enforcement ranks are too few. This is part of our current infrastructure collapse. There are not enough employees of the Fish and Game Department or the Highway Patrol to take care of the issues here. Further, I have been advised by the Fish and Game people not to confront those who rob or are destructive because some are very serious criminals. So, we are left in limbo to watch illegal activities. We need authorities who are available to respond and deal with our calls. The Bellingham Fire Dept. was the best responder.

- A14 The neighbors should not be involved in policing the neighborhood, a number to report is good, but local law enforcement should make intermittent passes thru to dissuade illegal activities.
- A15 Some signs already posted about "no dumping" and "park closed from dusk to 6 am; police will impound vehicles" which is good.
- A17 I paddle at night. I paddle early morning. I do day-long trips. I do things at odd hours. I'm quiet as a church mouse. Banning "overnight" parking sounds like a way that I will get tickets for no other reason than being there.
- A19 If a neighborhood watch is established, we would than need a good response to our complains.
- A25 Restricting access to kayakers and dog walkers will NOT solve the idiot drunk problems. Multiple Use can be sustained if the bad guys are cited and/or arrested.
- A26 People don't care. If rules are posted they will be ignored. I think the neighborhood would already report problems.
- A33 We have people coming from faraway places like Tacoma, WA and from Whatcom County to our bay area to do clamming, not caring how they leave the area and not caring at all when it comes to wildlife habitat.

Q36b Please explain your answer regarding adding an outhouse to the park.

- 3 IT WOULD BE A GOOD IDEA FOR GENERAL USE OF POEPLE USING THE BEACH AREA. IT IS BOUND TO HELP.
- 5 Cost $ too much
- 8 I don't want to walk into human waste on my beach walks!
- 10 Plastic honey buckets are an eyesore. They are usually not maintained property, which adds a bad odor to the rest of the aesthetic concerns. I have my doubts. However, something like the pine and cedar lakes facility might be doable if located in the present ad hoc parking area at the end of Fairhaven avenue.
- 16 An outhouse would encourage visitors to stay even longer, create more traffic & pose as greater threat to sensitive areas.
- 18 But probably a luxury in this economy and not the most important step.
- 19 A LOT OF THE LITTER FOUND IN THAT AREA IS CAUSED BY HUMAN WASTE.
- 23 I have Never seen human waste on the beach.. If you put an outhouse there people will poop in it and kids will knock the outhouse over and you will have poop on the beach.
- 27 I LIVE HERE.
- 32 See above!
- 33 Functionally useful Aesthetically bad.
- 35 Installation of a restroom will be a complicated process to connect to sewer lines, there is already enough human waste seeping from existing septic systems
- 38 maybe in the summer for a few months only would be helpful
- 42 Keep changes minimal
- 45 RESTROOMS ARE COSTLY TO UPKEEP, HOWEVER IT SOLVES THE PROBLEM OF JUST GOING TO THE RESTROOM YOURSELF, BEHIND A BUSH, TREE, OR ON THE BEACH.

- 46 Bathroom placement is key-so it doesn't affect the aesthetics of The Park.
- A3 Hopefully once parking is restricted, folks won't be partying on the beach or sleeping there which will make it much less likely that they will leave feces there. Occasional urination is not as much of a problem I assume...
- A4 I don't think this is as much a problem as other litter and dog waste. I think this may be more than the city can take on and maintain. I'd also be concerned about people trashing it.
- A5 This will promote vandalism & after the beach renovations of this project, if you put it on the beach, how do you pump it? Where else would you put it? Also, if the other traffic (human & vehicle) are addressed, this small problem will solve itself.
- A9 In all the years we have been visiting the beach (multiple times a week), we have NEVER seen human waste. If this truly is a problem (we doubt it), then provide an outhouse
- A11 I think parking and restroom facilities should be remote. Visitors might be attracted to the area for its isolation and comfort facilities not its natural beauties. I don't think that is a good idea.
- A14 the area should stay as natural as possible
- A15 I would be concerned about it being disrespected and vandalized. Concerned that the city doesn't have funds to provide and maintain it.
- A17 The community should take care of this. People need to speak out when they see someone leaving waste like this, and I think a regularly emptied trash can and some signs talking about how cool this spot is will give people a bit more respect. (We can only hope, right?) Outhouses are more cost, mess, and maintenance than they are worth, and they always stink like people.
- A19 Fairhaven park has excellent restroom facilities.
- A22 in parking area
- A23 in the parking area (less visual impact on beach)
- A25 Can't Hurt. I'd use a port-a potty if it were available and clean.
- A26 Outhouse only is a good idea if it is attractive and well maintained(not a portapotty)
- A29 Ok if not just porta john

C4 (following goals section) If you would like to add any comments about your responses to the questions above, please do so here:

- 3 THERE SHOULD BE SOME COMMON SENCE ABOUT WHAT YOU DO, AND WHERE YOU WALK, BUT SOMETIMES SOMMON SENCE JUST ISN'E THERE. I DON'T KNOW WHAT THE ANSWER FOR THAT IS.
- 5 Don't spend Any Tax $$
- 9 All are extremely important and intertwined-treating the area with respect by not blocking access, keeping it clean, respecting the whole ecosystem (shoreline, wetlands, animals, wildlife, etc.) & protecting sensitive issues. One is not more important than the other, as they are all part of the whole picture.
- 10 The ongoing and serious pollution of Puget sound is getting a lot of press. It should. WE all need help to understand how our local efforts (related to the beach, the saltwater marsh and the proposed park) contribute to this longer concern.

- 21 TOO MANY CLAM DIGGERS DO NOT COVER UP THEIR HOLES WHEN DIGGING. CLAMS ARE LEFT UNCOVERED AND VULNERABLE. DIGGERS NEED TO BE EDUCATED AS TO HOW TO PROTECT THIS RESOURCE.
- 23 Who comes up with these inane questions?
- 27 I'VE WALKED THE BEACH SINCE 1980.
- 32 Protect the neighborhood!
- 44 Set some penalties. Sweden has done that and their parks and shorelines remain pristine. The $$$ stiff fines reflect the extreme importance of all these issue for health welfare for all
- 45 THERE IS A NEED FOR SHORT TERM PARKING FOR PEOPLE WHO VISIT THE AREA. FAIRHAVEN STREET COULD IF UPGRADED ACCOMODATE 12 CARS OR SO IF UPGRADED. IT WOULD NEED A TIME LIMIT FOR PARKING.
- A9 During our walks at the park, we have yet to observe anyone abusing the park area.
- A11 The area is extremely clean. Cars and large numbers of people will not preserve the area.
- A14 The park has been in a similar condition which has been referred to as "very healthy biologically" by scientists. I don't see the necessity for additional protection for the area. The people should be able to enjoy the area as is. If a few signs need to be placed to label sensitive areas the public will respect that.
- A17 This is a great set of principles. Well done.
- A25 In my opinion, any analysis of multiple use of Mud Bay MUST admit to the existence of TWO DISTINCT USER GROUPS - daylight users who care, and nighttime miscreants who do not.

C5 (following impacts of restoration project) If you would like to add any comments about your responses to the questions above, please do so here:

- 6 WE NEVER QUITE KNOW THE CONSEQUENCES! DEPENDS ON HOW MANY FACTORS, HOW IT IS IMPLEMENTED.
- 9 Regarding question #46. It will improve the area to have parking off the district beach, yet still close for visitors, kayakers, etc.
- 22 Protect natural habitat allow kayak launching & parking at or nearby
- 26 Keep access for kayakers-a great way to experience the special beauty of the area
- 30 LEAVE THE AREA ALONE!
- 31 44-I'm guessing the changes will have an impact, but I don't know what the actual changes will be until they are done.
- 32 ect
- 35 Major restoration can only be achieved by increasing tidal exchange presently reduced by railroad causeway
- 38 People need natural places to visit day & night every neighborhood should have a community garden/fire pit/eating and gathering area
- 41 Many things are better left alone. This is one of those. The more we mankind gets involved the more we mess nature up.

- 45 THERE IS ONLY MONEY FOR SOME CHANGE IT'S NOT ENOUGH TO DO IT IN A BIG WAY. THE CITY NEEDS TO LOOK AT CHUCKANUT VILLAGE AS A BIGGER VILLAGE PLAN & SEPERATED NEIGHBORHOOD AND NOT AS PART OF SOUTH OR FAIRHAVEN.
- A9 Shellfish and fishing may improve over a long time. The main way to improve shellfish and fishing is to improve water quality by allowing more water in and out of the bay. This must be done by allowing more water through the train trestle. Right now, not enough water moves in and out.
- A11 The issue for me is law enforcement. We have to share a few law enforcement employees with many others over a very large area. It is not very effective. I like the ancient idea of a park manager living on the spot. Once again, a great number of well meaning, informed visitors is still a great number of humans intruding into a sensitive area. When the numbers of wildlife, fish, birds, etc. are dwindling, why would you add further challenge to nesting and feeding areas? Estuaries are not wise hunting and fishing grounds for human beings.
- A14 I believe the changes will create more of a hardship for the people in the neighborhood as the public parking is pushed to so close to private homes. I see no reason for the city not to use its own land (opposed to the PROW which is closer to the beach) for parking.
- A25 Multiple Public Use must trump the privacy concerns of the local residents.
- A26 My answers reflect my lack of faith in human character. Most will continue to behave as they want. Education will help for some of them.

q47b Please tell us any other suggestions for environmental education about Chuckanut Bay:

- 3 FOR YOUR INFORMATION THERE HASN'T BEEN A COHO RUN IN CHUCKANUT CREEK IN DECADES ASK BURT BAXTER ABOUT THE HATERY BOXES IF YOU WANT TO KNOW ABOUT THE SALMON RUNS
- 5 Don't Spend Tax $$
- 9 A kiosk at the bay area with environmental education with information about history, native plants, sea life, birds, and information regarding how to get involved with work parties for the bay
- 10 Many of my neighbors go back several generations have in Chuckanut village. These folks-the baxters, bauters, gerners, fodhunters, ect.-have strong opinions and extensive local knowledge. They are a valuable resource for any interpretive effort. They should be included and consulted from the outset.
- 30 LEAVE IT ALONE! NEIGHBORS WILL CONTINUE TO PICKUP GARBAGE AND POLICE THE AREA. THE MORE ATTENTION YOU BRING TO THE AREA, THE MORE PEOPLE YOU WILL DRAW TO THE AREA.
- 31 I like onsite education material-the silent 24/7 educators-and further details on-line-info on demand.
- 32 Protect our neighborhood!
- 46 An educational sign w/ pictures at entrance-showing visits the plants & animals and how to use the park with care.
- A9 Start a meager website... and give much of the money BACK!
- 17 As long as these tours are few and far between, go for it. They will also need a webpage.
- A25 Quality Informative educational signage will do.

- A26 I think a better idea would be educational signboards with information on the social, cultural, economic and ecological history of the Chuckanut Bay area. My interpretation of #1 was that you meant a talk, not a permanent feature. Do not mail Newsletters (kills trees)

Q48_6_other Who do you trust to provide accurate information?

- 3 NONE OF THE ABOVE
- 4 none of the above
- 13 W.A.V.E.
- 16 dept of natural resources
- 29 Local Residents
- 30 NEIGHBORS
- 36 department of ecology
- 45 WWU
- A10 Marine Resources Committee
- A25 Whatcom Association of Kayak Enthusiasts

REPORT

Chuckanut Bay Marsh Restoration Project: Follow-up Community Survey

March 2013

APPLIED RESEARCH NORTHWEST, LLC
P.O. Box 1193
1116 Key Street Suite 203
Bellingham, Washington 98227
360.647.6067
www.arnorthwest.com

EXECUTIVE SUMMARY

The Chuckanut Village Marsh and beach in south Bellingham has undergone a substantial restoration. In 2010, prior to the project being finalized, the City of Bellingham engaged residents and users of the existing area in several public meetings and a survey. Once the restoration was completed and the area used, the survey was updated and distributed again in 2012 to a broader range of area residents to get feedback on the project. All together, the 2012 post-project survey included approximately 44 questions, including several opportunities for open-ended input. A total of 251 surveys were completed.

Restoration of the Chuckanut Village Marsh was designed to enhance the area's ability to provide pocket estuary functions, including improving water quality and providing habitat for newly hatched salmon migrating from nearby Chuckanut Creek. The project involved:

- Replacing an undersized culvert with a much larger box culvert to increase the tidal exchange between the marsh and the bay
- Creating an ADA accessible path to the shoreline from the end of Fairhaven Ave.
- Re-establishing a native salt marsh buffer along the publicly owned sections of the shoreline
- Protecting native vegetation and habitat elements by restricting vehicle access to sections of the shoreline and intertidal zones
- Relocating parking away from the shoreline
- Educating the public about the importance of marine nearshore environments, with the end goal of producing behavioral change that promotes a healthy nearshore habitat.

FINDINGS

Just under half (46%) of the respondents had been to the Chuckanut Village Marsh and beach area in the past year. This group identified litter, dog waste and illegal or improper parking as the most common problems, though few believed them to be *major problems*. Almost half (48%) of respondents knew about the salt marsh restoration, and the large majority said that area fishing and shell fishing had improved (66%) and that unwanted behaviors and questionable uses of the beach had been reduced (81%).

A key concern prior to the restoration was that changes would reduce parking for people using the beach and living in the neighborhood. According to the post-project survey,

over half of respondents who were aware of the project (59%) noted at least *a little* reduction parking for residents (28% of all respondents). A higher proportion noted reduced parking for kayakers -- 76% of those familiar with the project (36% of all respondents).

Overall, perceptions of the project were very positive, especially with regard to improved habitat and general aesthetics.

Environmental behaviors

Opportunities to improve water quality in the Chuckanut Bay area remain. With that in mind, the city also surveyed residents about environmental behaviors that could impact water quality. Among the findings:

- 29% of dog owners pick up their pet's waste from their yard daily
- 63% of residents with septic systems have had the system inspected within the past year
- 62% of those who washed their cars at home last year did so on pavement *every time*
- 34% applied chemical bug or weed killers in their yards at least once. A similar portion applied chemical fertilizers on their lawns.
- 42% had added native plants and 34% removed non-native plants. 16% removed non-native plants and then replaced them with native plants.
- 25% had reduced the size of their lawn in the past 3 years
- 88% never put toxics in the trash

Chuckanut Bay

Just 15% of respondents said that they were *not at all knowledgeable* about local wildlife and sensitivity of the Chuckanut Bay area. Among those with any knowledge, 34% said they had shared their knowledge with others in the past year. Most were not familiar with the Chuckanut Bay Pledge (70%) asking people to take steps like those mentioned in the Environmental Behaviors portion of the survey.

Most respondents (84%) had heard at least *a little* about educational and outreach events in 2012 that were developed to familiarize area residents with the salt marsh and the impacts of their behavior. Most who were aware of these events expressed some interest in seeing more events. When asked how they learned about the events, the most common response was the local newspaper, though direct mail was the most preferred method of contact. Respondents were also asked to identify trusted sources

of information about the area; the top mentions were Bellingham Parks and Recreation and RE Sources.

CONCLUSION

Overall the outcomes for the Chuckanut Village Marsh restoration project have been very positive. People reported a decrease in problems in the area and most expressed an appreciation for the improved quality of the area.

Although parking areas have been improved, many perceive that there was some lost capacity, either for the neighborhood or for kayakers. It is not clear from this research how much it has impinged upon their use of the park or conveniences in the neighborhood.

The salt marsh restoration piloted a new approach by the City of Bellingham to engage community members more fully prior to the finalization of plans and to engage them along the way. Although the initial pool of neighbors recruited into the plan was small (about 80 households), they tended to be the most prevalent users and in the end reported being well informed about the project, the bay and the events in the area.

There are some opportunities for further work in the area. Dog waste continues to be at least a minor problem at the site, and most dog owners are not picking up their dogs' waste at home on a daily basis (58% of dog owners). Car washing is prevalent on impermeable surfaces and occurs at a higher rate than in Puget Sound more broadly; the Puget Sound Partnership's 2012 study of area residents[1] found that only 10% of households washed their cars on pavement every time.

Replacing lawn with native plants or reducing lawn size is a relatively common activity, with 25% of respondents saying they had done so recently, some having reduced their lawns by half or more. These households would likely provide some examples of successful projects, which could inspire additional households to lose the lawn.

Reaching residents was fairly effective using conventional channels. The park area itself was a good channel for information, as was the Herald, direct mail, notices and signs. Respondents identified the Parks Department and RE Sources as two trustworthy sources of information which suggests some good sponsors for City messaging.

[1] Sound Behavior Index and Social Capital Index 2012 – Survey Report (www.psp.wa.gov)

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INTRODUCTION

The Chuckanut Village Marsh and beach in south Bellingham has undergone a substantial restoration. The project has restored a more natural flow pattern and function to one of Bellingham's few remaining salt marshes which provide robust and diverse habitat for plants and animals, and serve an important function in maintaining a healthy nearshore coastal environment.

Restoration of the Chuckanut Village Marsh was designed to enhance the area's ability to provide pocket estuary functions, including improving water quality and providing habitat for newly hatched salmon migrating from nearby Chuckanut Creek. The project involved:

- Replacing an undersized culvert with a much larger box culvert to increase the tidal exchange between the marsh and the bay
- Creating an ADA accessible path to the shoreline from the end of Fairhaven Ave.
- Re-establishing a native salt marsh buffer along the publicly owned sections of the shoreline
- Protecting native vegetation and habitat elements by restricting vehicle access to sections of the shoreline and intertidal zones
- Relocating parking away from the shoreline
- Educating the public about the importance of marine nearshore environments, with the end goal of producing behavioral change that promotes a healthy nearshore habitat.

In 2010, prior to the restoration project being finalized, the City of Bellingham engaged residents and users of the existing beach area in several public meetings, focus group research discussions and a survey. The purpose of the meetings and survey was to help the City raise people's awareness about the marsh, identify their needs and concerns about the restoration, and to plan for education and outreach efforts for a broader set of stakeholders in the area over the course of the restoration. Needs and concerns were discussed with the restoration team to incorporate what they could, given the engineering needs of the project and the several state and local laws that govern the area.

This winter (2012) the survey was updated and conducted with a broader range of area residents. As in 2010, this survey contained questions about site usage and current issues such as parking, pet clean up, and litter. Respondents were asked how much they knew about the salt marsh restoration project and to evaluate the impacts of the project on the park area. They were also asked about how much they knew about the Chuckanut Bay Pledge and recent City sponsored events held at Chuckanut Bay, their

interest in similar events in the future and the best way to publicize such events. Additionally, the survey included questions about environmental behaviors such as disposal of toxins and yard care practices.

The post-project survey included approximately 44 questions, including several opportunities for open-ended input. The surveys were sent out in the mail and there was also an online version available as an alternative. A total of 251 surveys were completed during December 2012.

This report presents the findings of the 2012 survey with comparisons to the 2010 survey where relevant. The report uses the convention of italicizing any verbatim response option from the survey in an effort to fully convey the voice of the residents' survey responses. A complete description of the research methods can be found in Appendix A. The distribution of responses can be found in Appendix B and the verbatim responses given to the open-ended questions can be found in Appendix C.

One note about place names in this report: The Chuckanut Village Marsh is not officially named as a park, but the public does have access to the beach area and visitors do engage in recreation activities on the site. The public views the area as a park. The survey adopted the convention of calling the area a "park" or "the park at Chuckanut Bay" to communicate with residents about the public access aspects of the marsh and beach. This report uses those terms to be consistent with the survey findings.

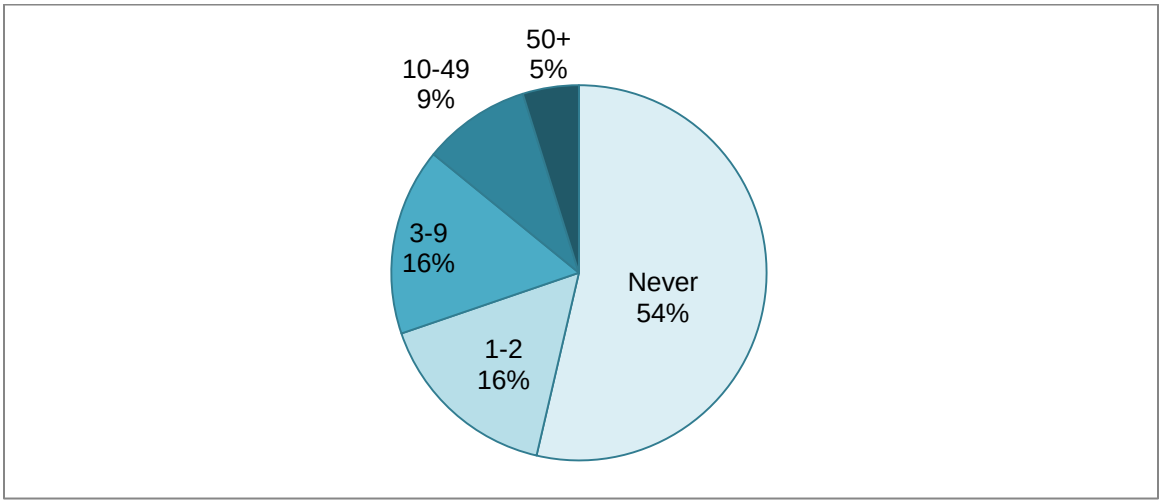
FINDINGS

This section presents how the respondents answered each item in the survey. The results are presented in graphical and written format. Survey questions that were the same or similar to questions that were included in the 2010 survey are identified; similarities and differences between the two points in time are discussed.

CHUCKANUT BAY USAGE

Just under half of respondents (46%) visited the park at Chuckanut Bay in the past year. Fourteen percent visited 10 or more times.

Figure 1. During all of this past year (2012), how many times did you visit the park at Chuckanut Bay?

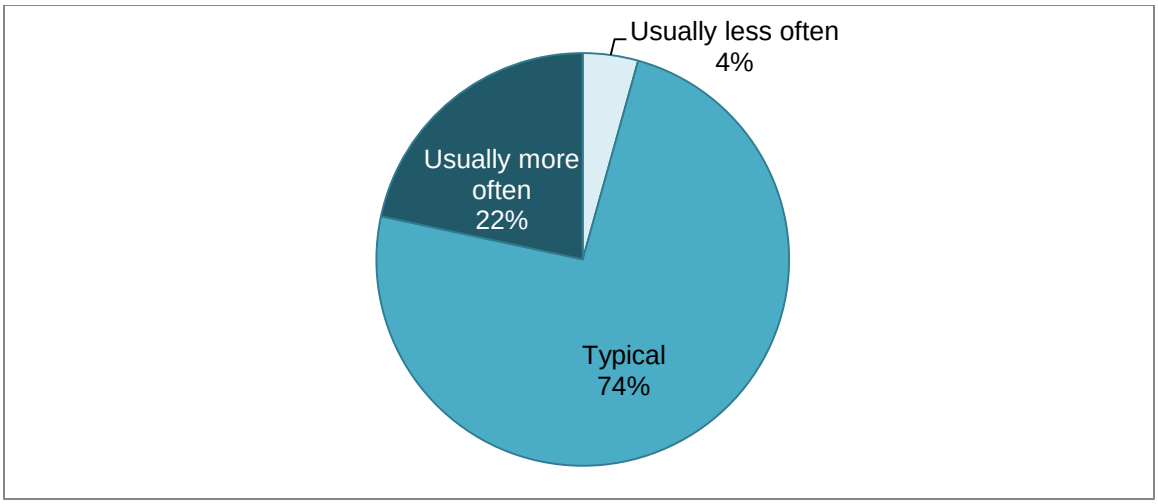


n=248

Just under one-third (30%) of those surveyed said that they live within ten minutes walking distance from the park. Not surprisingly, those who said that they lived within a ten minute walk were more likely to say that they visited the site in the past year (60% vs. 42% of those who live farther away).

Most respondents said that this last year was typical but just over one-fifth said that they usually go more often.

Figure 2. Was last year typical for you, or do you usually visit more or less often in a year?



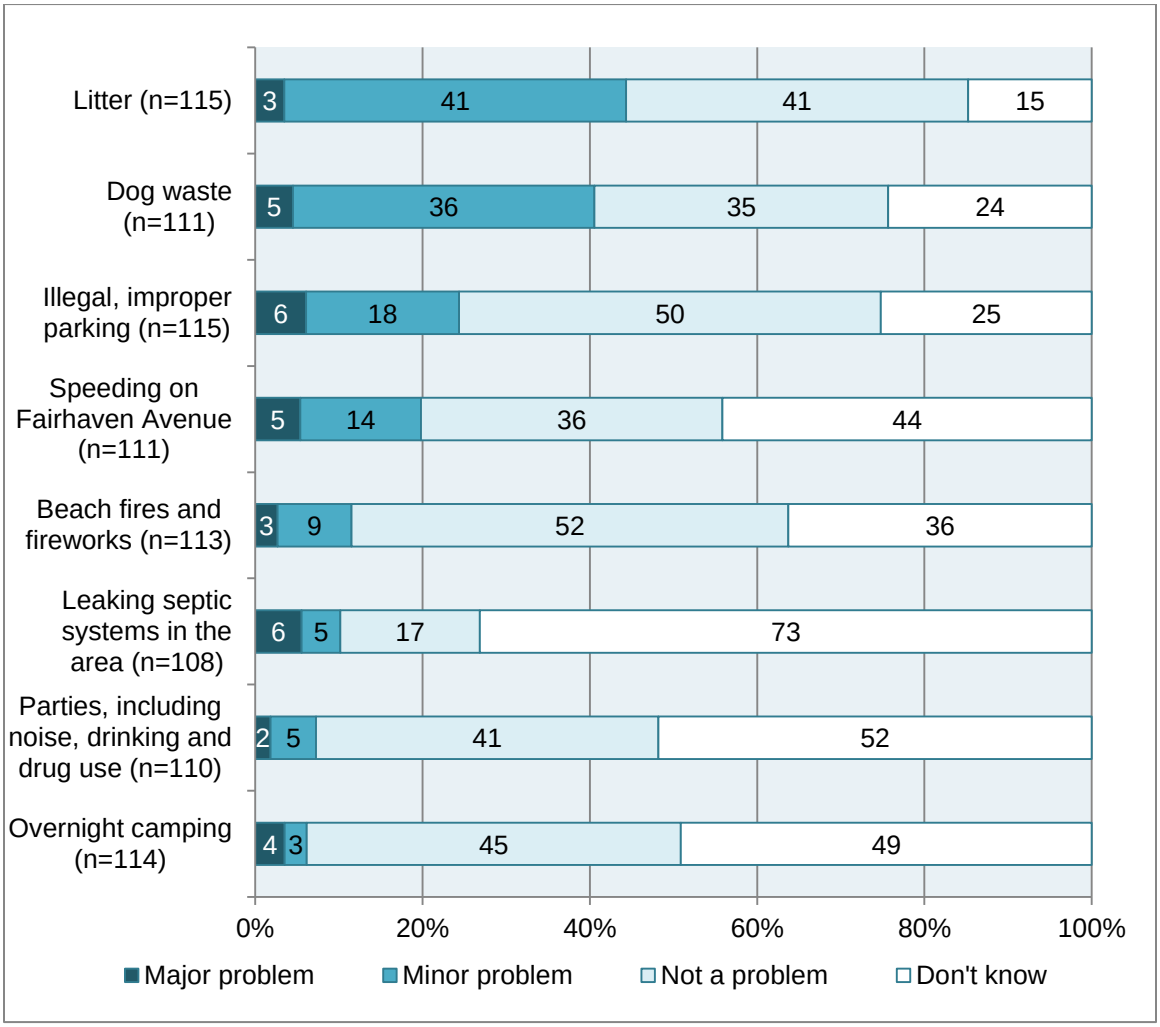
n=231

PARK PROBLEMS

Respondents who had visited the site in the past year were asked about various issues that had previously been identified by people familiar with the park. They were asked to identify if the issue was a major problem, a minor problem or not a problem in the area. They were instructed that an issue would be more of a problem if it happened often or if it had a very negative impact when it happened, even if it didn't happen often.

Figure 3 shows the issues sorted by the proportion who called the issue a problem (*major* or *minor*). Figure 3 shows that litter and dog waste were considered the biggest problems at the site. Litter was considered a problem by 44%, though most of those who considered it a problem called it a "minor" problem.

Figure 3. Problems *(sorted by major and minor problem combined)*



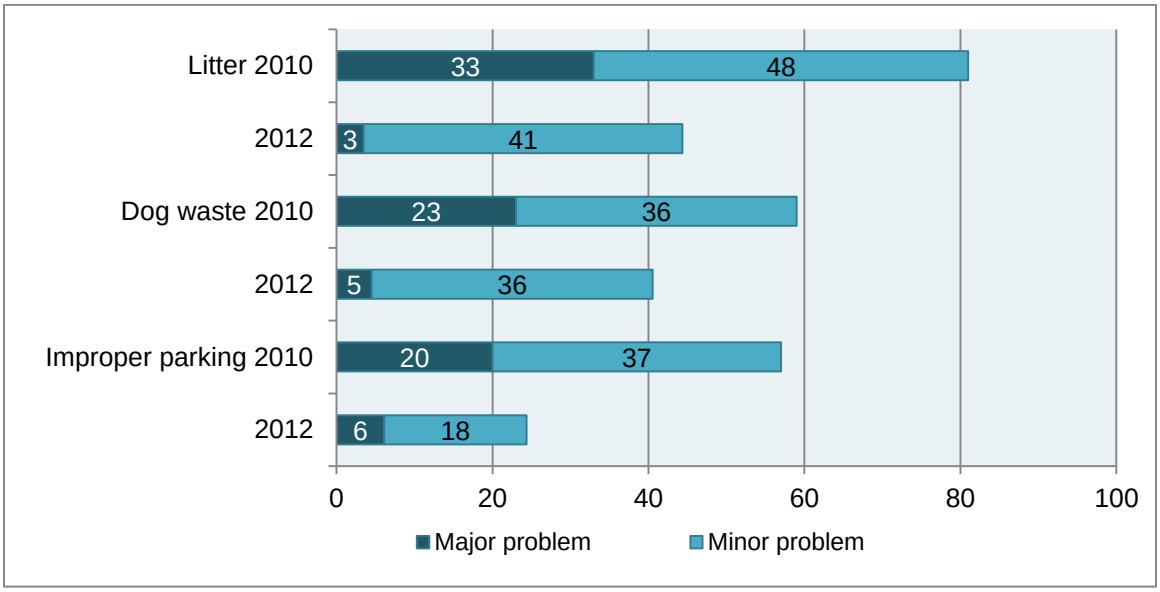
When asked to describe any other issues that are a major problem in the areas, 33 offered a comment. Comments were distinctive and varied. Five mentioned parking

(cars in undesignated spots, there isn't enough parking, parking spots are unclear, and that the disabled spot is not easily accessible to the beach). Other themes included signage and speeding. A full list of verbatim responses is included in Appendix C.

Perceived problems compared to 2010

In the 2010 survey, respondents also rated the same potential problems at the site. The order of severity was very similar to 2012; the top three problems in 2010 were still rated as the top three problems in 2012. Figure 4 shows the top three problem areas and the proportion who rated it as a problem (major and minor) in both 2010 and 2012. The proportion that identified the issue as a problem dropped significantly, but because the surveys were drawing from different samples the difference in scores is somewhat inconclusive. However the change in the proportion who called each of these issues a *major* problem was particularly striking—33% thought litter was a major problem in 2010 but only 3% said this in 2012.

Figure 4. How much would you say you know about the restoration of the salt marsh in the Chuckanut Bay park area?

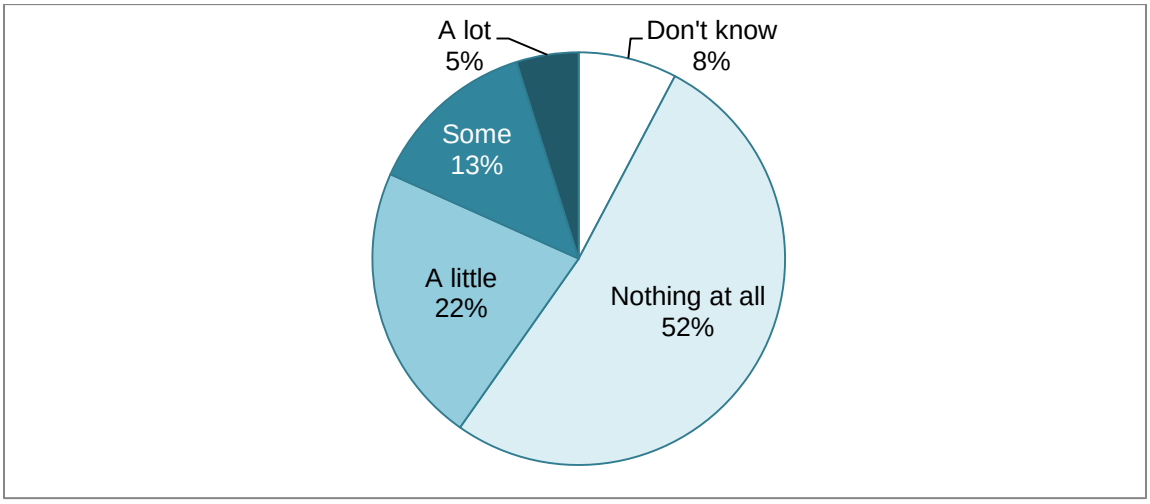


2010 n=64 to 65
2012 n=111 to 115

RESTORATION PROJECT

Respondents were asked how much they knew about the restoration project. Sixty percent said they knew *nothing at all* or *don't know*.

Figure 5. How much would you say you know about the restoration of the salt marsh in the Chuckanut Bay park area?



n=246

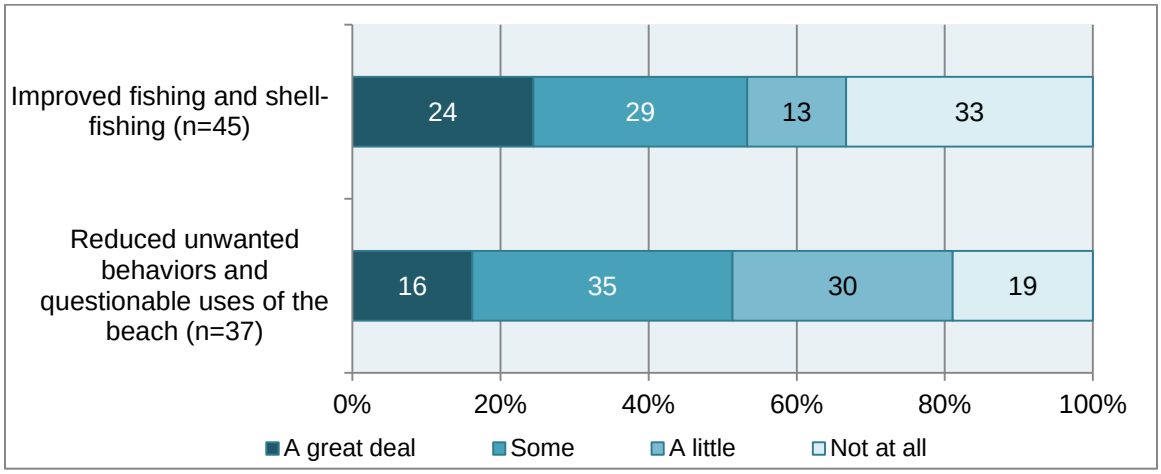
Respondents who have visited the park area of Chuckanut Bay in the past year were far more likely to have heard about the restoration project. Thirty-four percent of those who visited in the past year said they knew *some* or *a lot*, compared to only 8% of those who did not visit the site.

Restoration impacts

Respondents who said they knew at least *a little* about the restoration project were asked how much the area has changed as a result of the restoration. Specifically, they were asked how much the restoration improved fishing and shell-fishing and how much the project reduced questionable uses of the beach. Over half of respondents said that they *didn't know* how to assess the impact of the restoration.

Figure 6 shows the ratings of those who were able to offer an opinion. Nearly one-quarter (24%) said that the restoration improved fishing and shell-fishing *a great deal*; a slightly larger proportion (33%) said it did not improve *at all*. About half (51%) said the project reduced questionable uses of the beach *some* or *a great deal*.

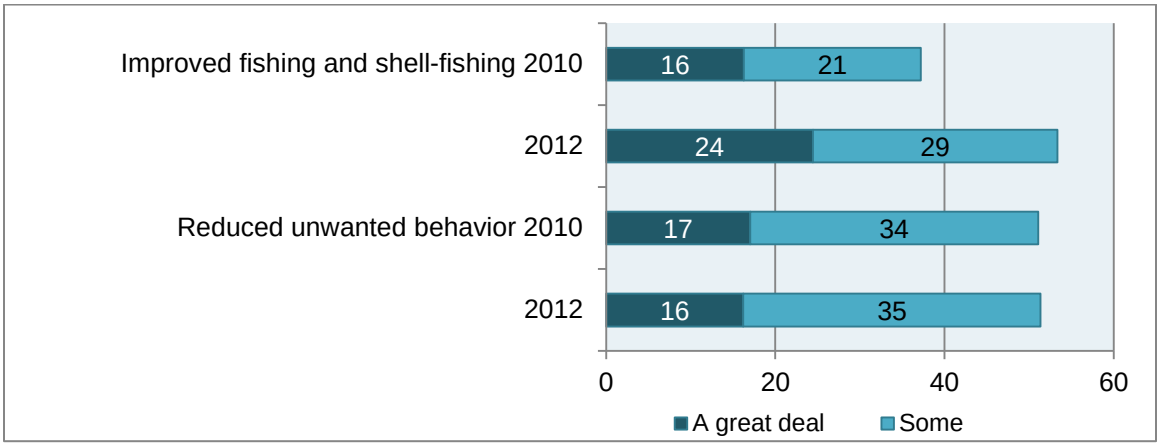
Figure 6. How much the area has improved as a result of the restoration



Respondents who had visited the area in the past year responded similarly to those who did not visit. However respondents who said that they live particularly close to the park area (within a 10 minute walk) were divided, with 40% saying it improved fishing *a great deal* and another 41% saying it didn't improve fishing in the area *at all*. Respondents who live slightly farther away were more likely to say that the restoration improved fishing *a little* or *some* (65%).

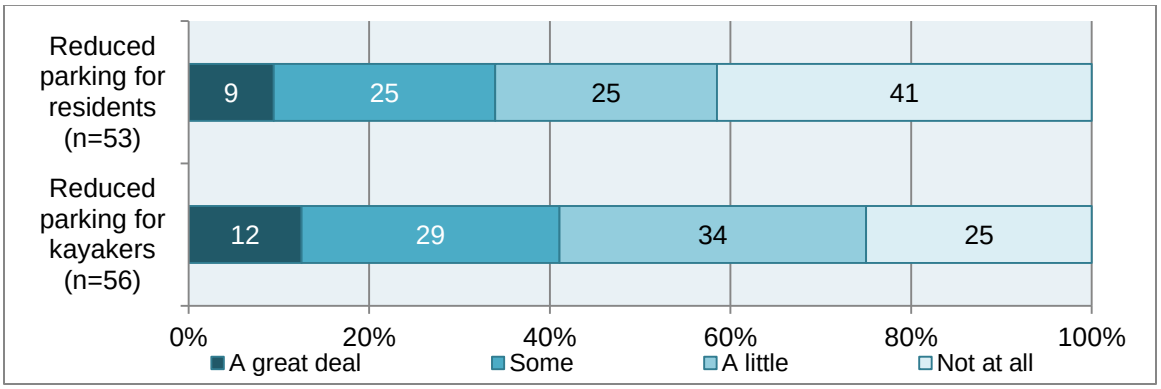
Figure 7 shows a comparison of these ratings to the expectations that were presented in the 2010 findings. In 2010, survey participants were asked how much they **expected** the area would be improved. Thirty-seven percent (37%) thought that fishing would improve *some* or *a great deal*, far lower than the 53% who said it actually did improve *some* or *a great deal*. Just over half (51%) expected that the project would reduce unwanted behaviors *some* or *a great deal*, exactly the same proportion who said it actually did improve to that degree.

Figure 7. 2010 expectations compared to 2012 perception of actual improvements



Respondents who said they knew at least *a little* about the restoration project were also asked how much the area has changed parking for kayakers and for residents. Figure 8 shows that about one-third (34%) said that the project reduced parking for residents *some* or *a great deal*. A slightly larger proportion (41%) said the project reduced parking for kayakers *some* or *a great deal*, though an equal portion (42%) said it did not reduce parking for kayakers at all.

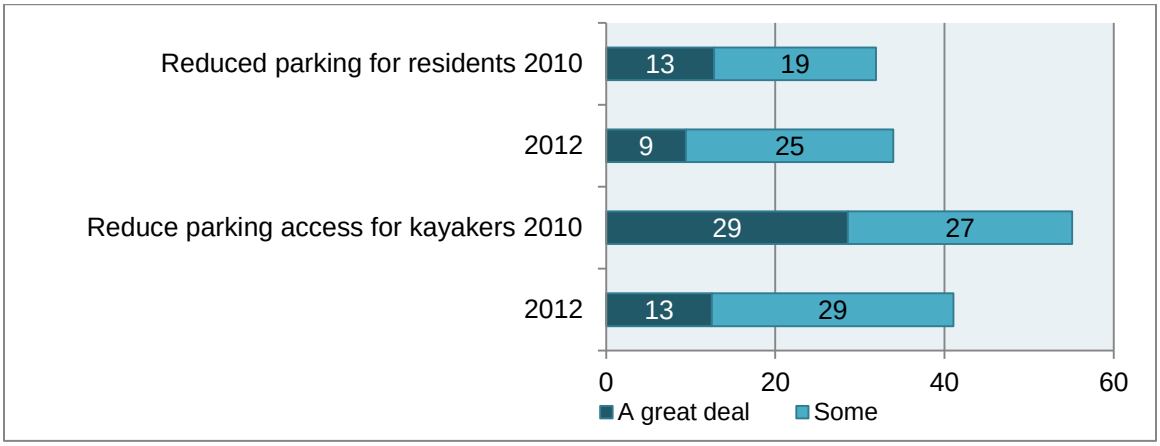
Figure 8. How much the restoration project has reduced space for parking



Respondents who had visited the park area in the past year answered the question similarly to those who had not. Likewise, residential proximity to the site didn't seem to have an impact on the ratings.

Nearly one-third (32%) of the 2010 respondents were concerned that the project would reduce parking for residents *some* or *a great deal*. A similar proportion in 2012 (34%) said that the project did reduce resident parking to that degree. Over half (56%) of 2010 participants thought it would reduce parking for kayakers *some* or *a great deal*; 42% felt that it did this in 2012. (See Figure 9)

Figure 9. 2010 expectations compared to 2012 perception of parking reductions



Respondents were asked to comment on any other beneficial changes they have seen in the area. Twenty-four respondents offered a comment. The majority of the comments mentioned improved habitat and general aesthetics.

"The vegetation effort has been very successful and I also enjoy the openness of the creek. It is visually very attractive."

This respondent commented on the success across multiple dimensions:
"Since the restoration, illegal activities have diminished tremendously. Pot smoking seems to have disappeared, dog waste reduced, late noises and loud music in general are gone, debris on the beach reduced and great improvement to the beauty of the beach area."

City public meeting participation

Nine percent (21 respondents) said that they participated in the City's public meetings or discussions regarding the salt marsh restoration. Respondents who had been to the site in the past year were more likely to have participated in the meetings than those who did

not visit. When asked to comment, several mentioned appreciation for the communications about the improvements and public discussion opportunities.

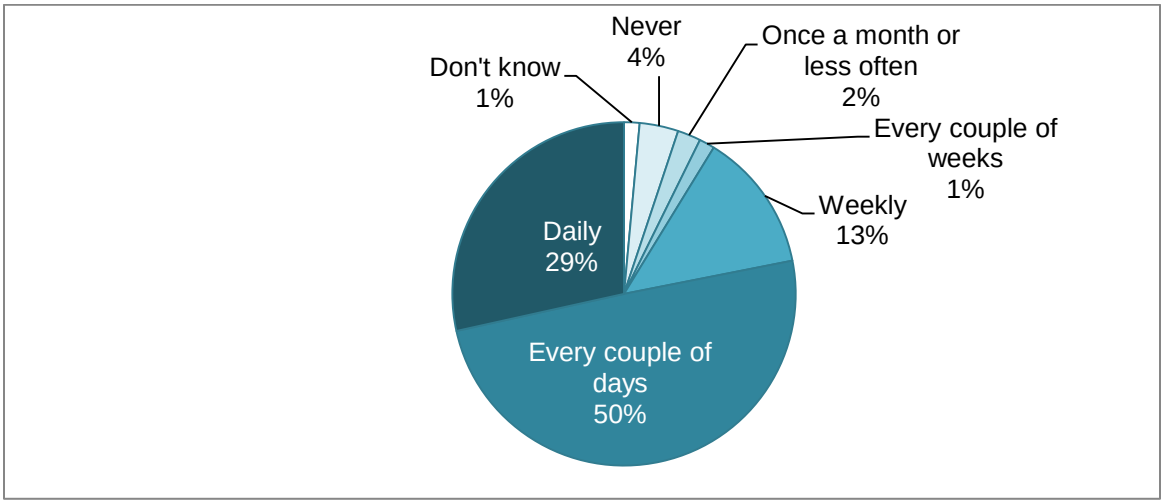
ENVIRONMENTAL BEHAVIORS

Respondents were asked about various environmental behaviors that could have an impact on environmental quality in the Chuckanut Bay area.

Pet waste

Just over a third (39%) of respondents said that they had a dog. These respondents were asked to identify how often pet waste was picked up from their yard and put in the trash. Figure 10 shows that over one-quarter (29%) said they picked it up *daily*; 20% said they picked it up *weekly* or less often.

Figure 10. How often is your pet's waste from your yard picked up and put in the trash?

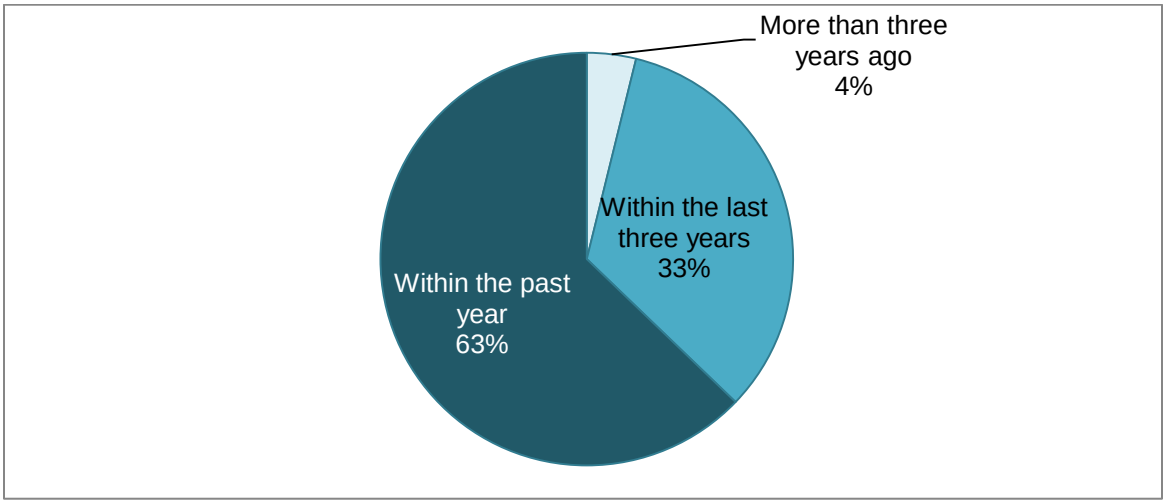


n=93

Septic

Nearly one-third (32%) of respondents said that they have a septic system on their property. Those respondents were asked when their system was last inspected. Figure 11 shows that nearly two-thirds said that they had their septic system inspected within the past year. Four percent said it was last inspected more than three years ago.

Figure 11. Last septic inspection

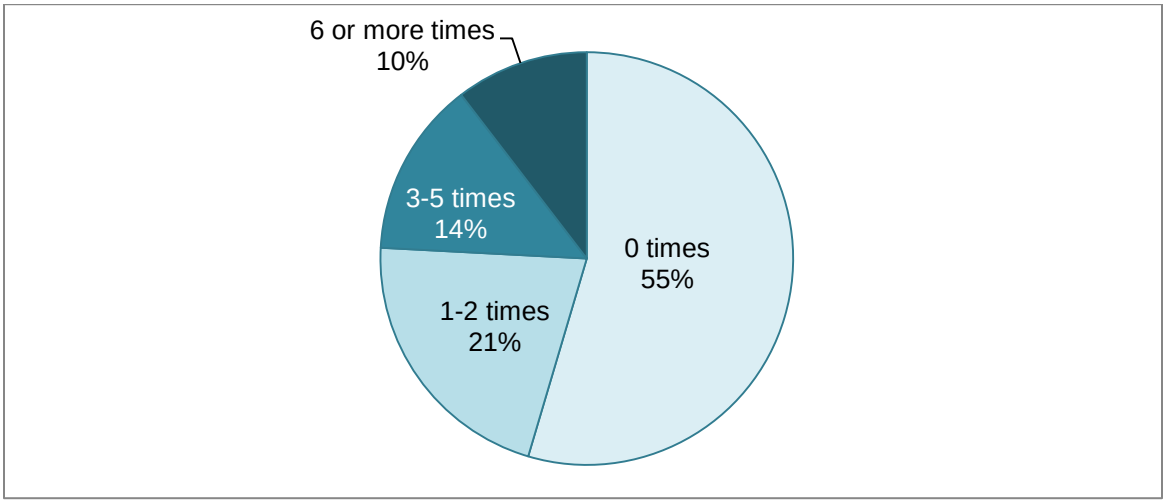


n=78

Car washing

Just over under half of the respondents (45%) have washed their car at home at least once in the past year; 10% said they have done it six or more times.

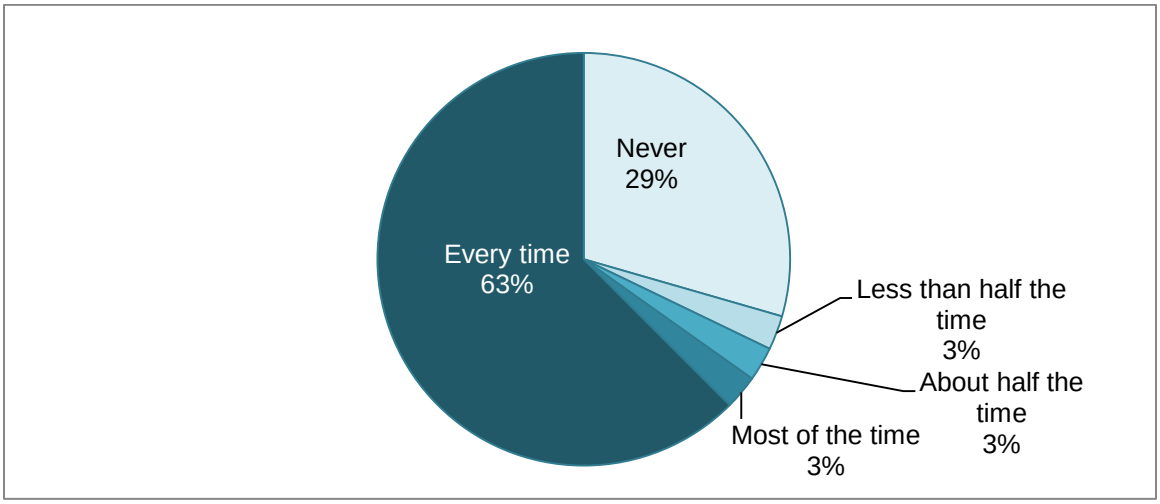
Figure 12. In the past year, how often did you wash your car at home, if at all?



n=240

Over half of those who washed their cars at home did so on an impervious surface *every time*. A little over one-quarter *never* did. Frequent home car washers did not wash their cars on pavement any more often than those who infrequently wash their cars at home.

Figure 13. In the past year, when you washed your car at home, how often was it parked on pavement while you washed it?



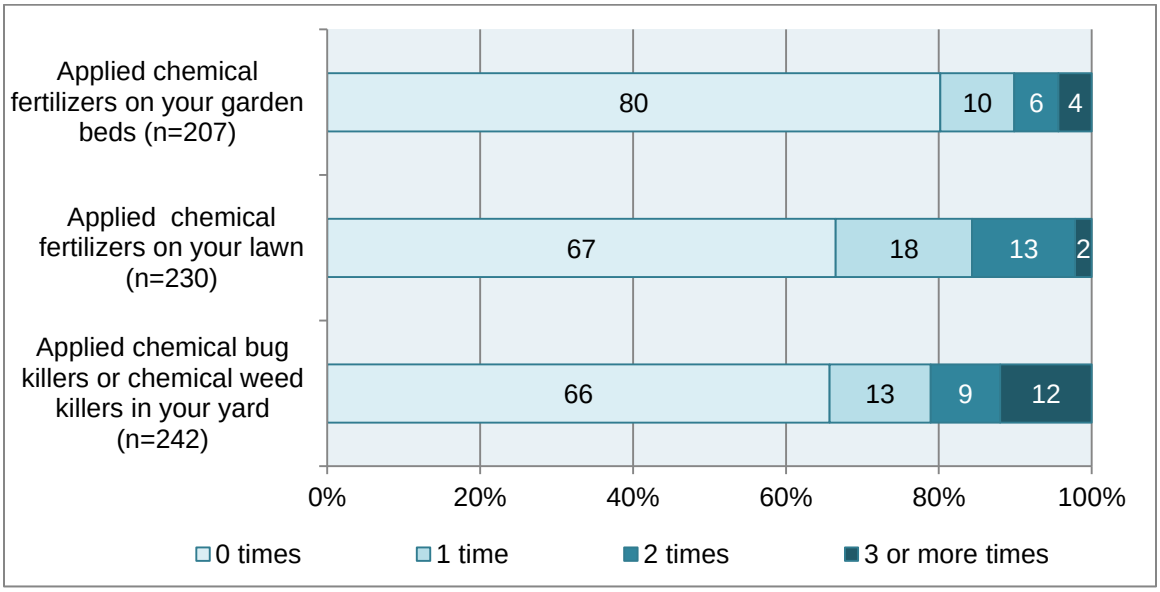
n=112

Although most people did not wash their cars at home, fully 523 car washings were reported last year by the 109 people who said they'd washed their cars at home. Of those, most were on pavement (estimated 334). If these respondents are representative of the area, we can estimate that 27% of households in the watershed are washing their cars at home, on pavement every time with a median number of home car washes per household of 3 (mean 4.8).

Yard and garden care

Respondents were also asked about the use of chemicals in their gardening, native plants, and reducing their lawn size. Figure 14 shows that the majority of respondents did not use chemicals regularly for garden care. Bug and weed killer was used with the greatest frequency; one-fifth (21%) did this two or more times.

Figure 14. Frequency of applying chemicals in garden care



Respondents were asked whether they have removed non-native plants, added native plants, or replaced non-native with native plants. Table 1 shows 62% have done at least one of these activities. Adding native plants was the most popular (42%). One-third (34%) have removed non-native plants.

Table 1. In the past three years, which of the following have you done?

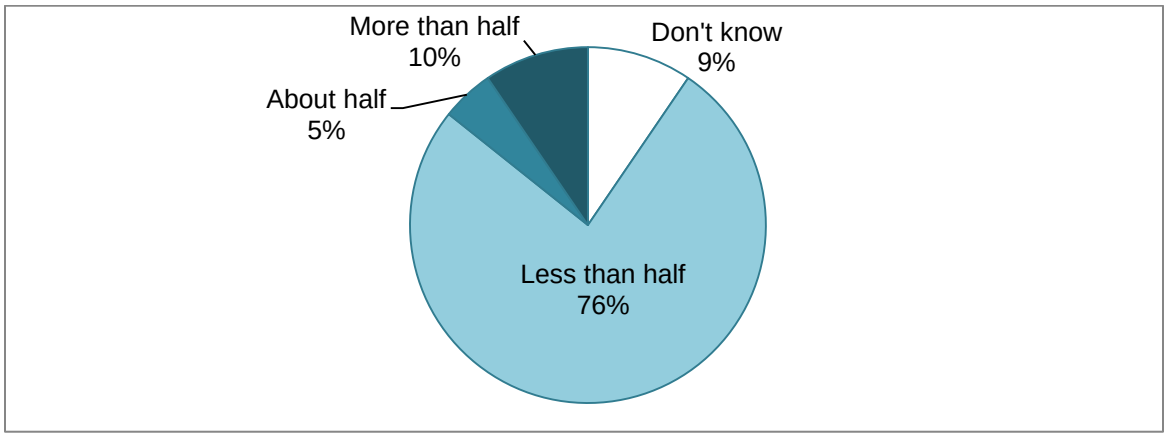
	n	%
Added native plants	105	42
Removed non-native plants	86	34
Replaced non-native with native plants	41	16
None of these	94	38

n=250; responses may total more than 100% due to multiple responses per case

Just over one-quarter said that they have reduced the size of their lawn in the past three years. Half of those respondents said that they added native plantings to the areas that used to be lawn (13% of overall survey sample).

Figure 15 includes those respondents who said that they did reduce the size of their lawn in the past three years. When asked for the size of the reduction, most (76%) said that the reduction less than half of the original yard. A small portion (15%) reduced their lawns by half or more.

Figure 15. Is the reduction in your lawn's size more than half, about half or less than half of what the lawn used to be?

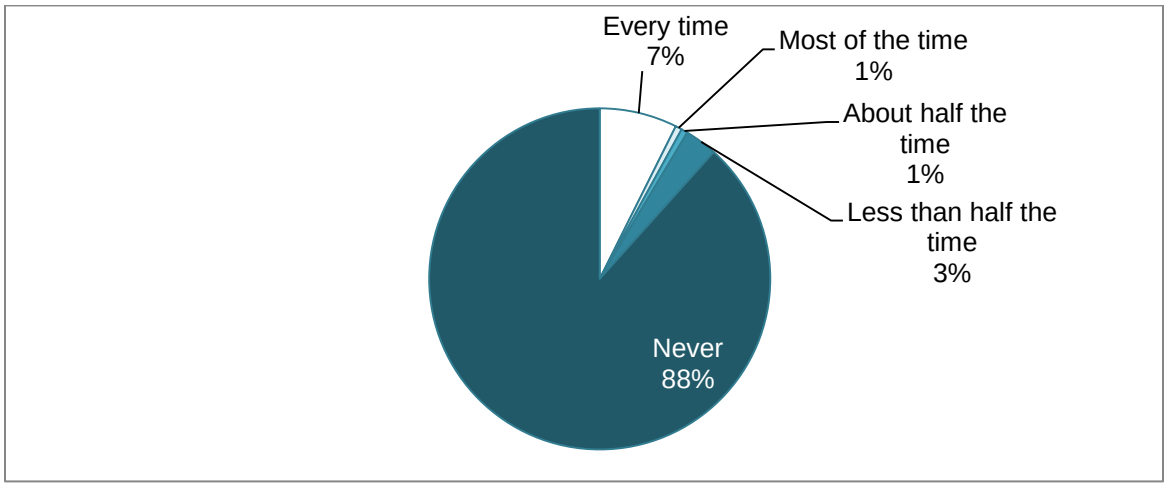


n=63

Disposal of toxics

Respondents were asked about how they dispose of toxics, including motor oil, antifreeze, paint and pesticides. The majority said they *never* threw these in the trash in the past year. Very few said they *did this occasionally,* and 7% said they do this every time.

Figure 16. In the past year, when you've had motor oil, antifreeze, liquid paint or pesticides to dispose of, how often did you put them in the trash?

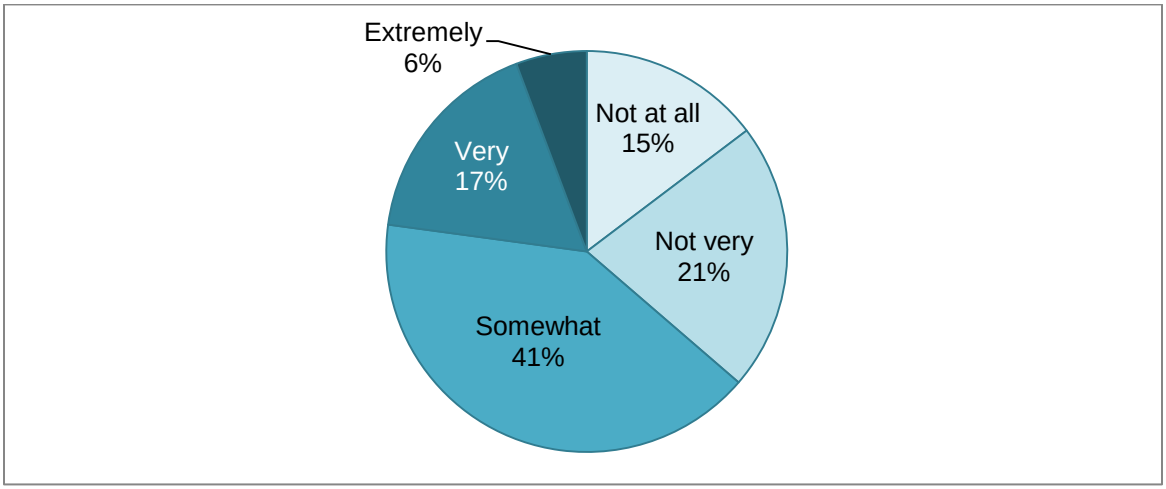


n=163

Knowledge of Chuckanut Bay wildlife

Respondents were asked to rate their own knowledge level regarding local wildlife and the sensitivity of the Chuckanut Bay area. Twenty-three percent said that they are *very* or *extremely knowledgeable*; on the other end of the spectrum 39% were *not very* or *not at all knowledgeable*.

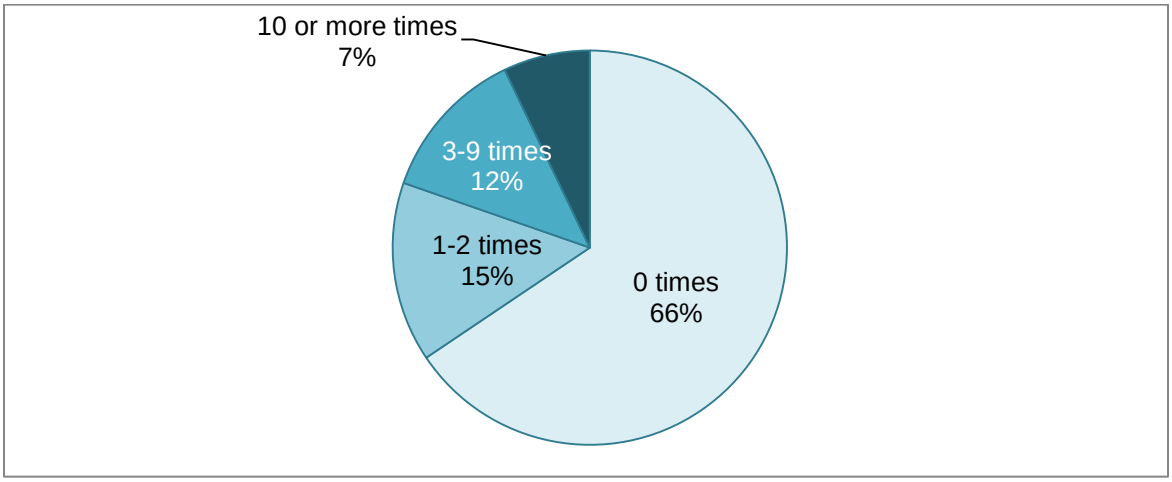
Figure 17. How knowledgeable are you about local wildlife and sensitivity of the Chuckanut Bay area?



n=245

Respondents who described themselves as remotely knowledgeable (even *not very*) were asked to estimate how often they have shared knowledge of wildlife and sensitivity of Chuckanut Bay area with others. One third (34%) said they shared their knowledge at least once.

Figure 18. In the past year, how often have you shared your knowledge of the local wildlife and sensitivity of the Chuckanut Bay area with others?

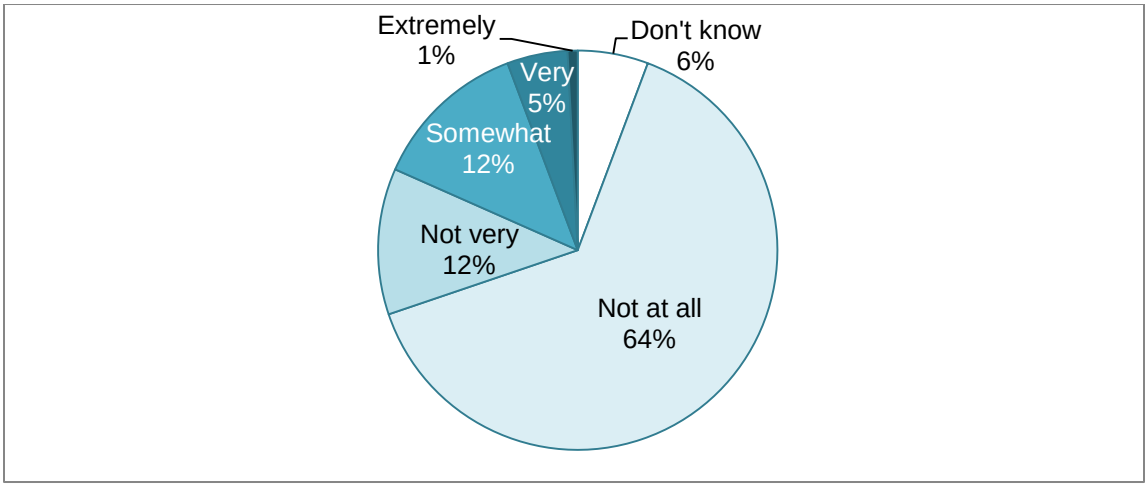


n=183

Familiarity with programming

Most respondents were not familiar with the Chuckanut Bay pledge (70%). Six percent were *very* or *extremely familiar*.

Figure 19. How familiar are you, if at all, with the Chuckanut Bay Pledge?

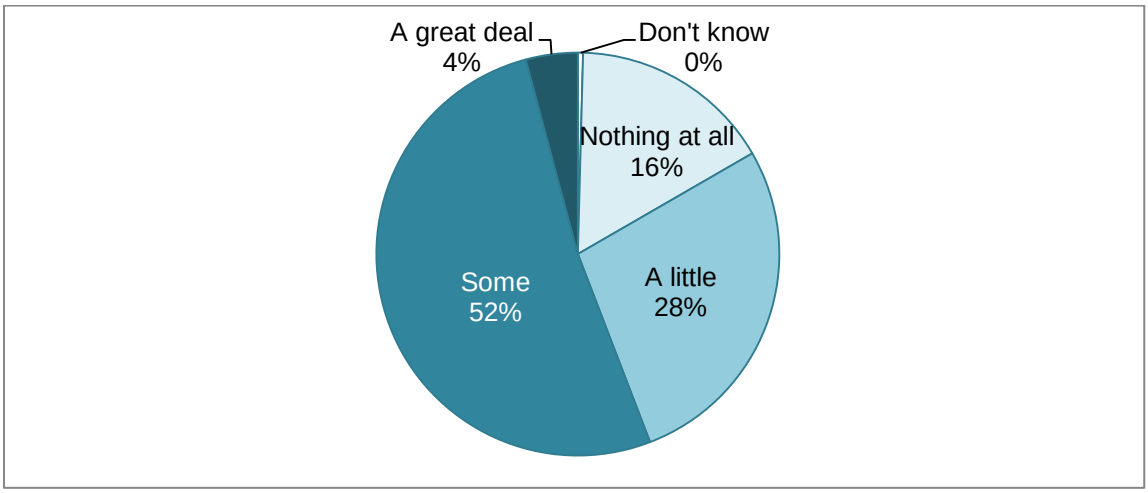


n=245

Respondents who had visited the Chuckanut Bay park area were more likely to be familiar with the pledge; 29% of those who visited this year were at least *somewhat familiar*, compared to 9% of those who did not visit in 2012. Likewise, respondents who live within a 10 minute walk were also more likely to be familiar with the pledge.

Respondents were told about four events that were held during the past six months at the Chuckanut Bay park area. A majority (85%) said that they had heard at least a little about these events.

Figure 20. How much, if anything, did you hear or see about these events?



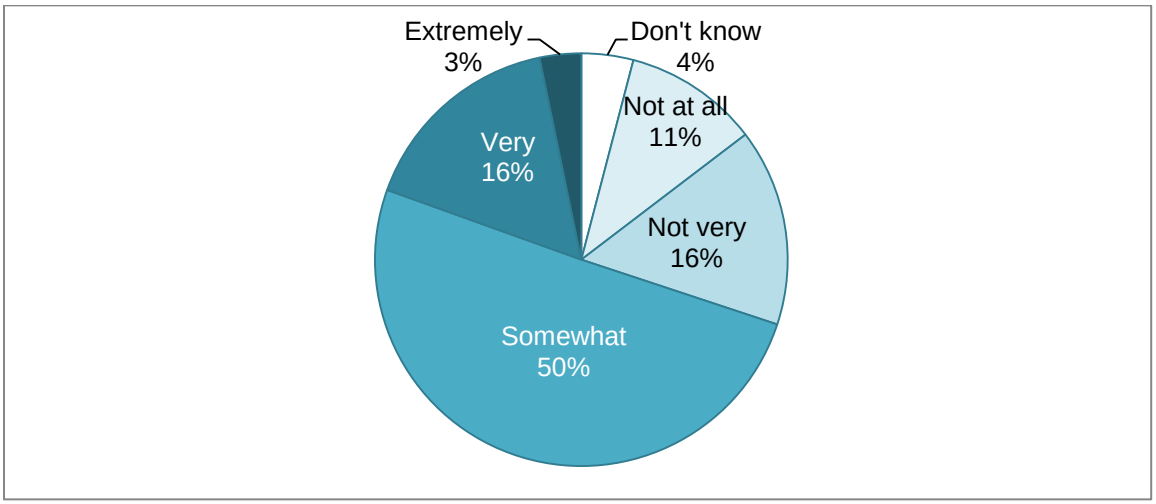
n=240

Respondents who had visited the park area in the past year and those who live within a 10 minute walk were more likely to have heard about the events.

Respondents who had heard about the events were asked to describe how they heard about the events. About one-third (33%) of those who had heard about the events said they heard about it in the local newspaper or "Bellingham Herald." About one-quarter mentioned receiving something in the mail. Thirteen percent (13%) mentioned signage or a poster. Others mentioned hearing about the events through the Cascadia Weekly, a flier, email or internet, local groups like MRC or the neighborhood association, as well as general word of mouth. The complete list of verbatim responses is included in Appendix C.

Among those who had heard about the events, 69% said that they would be at least *somewhat* interested in seeing more events like this.

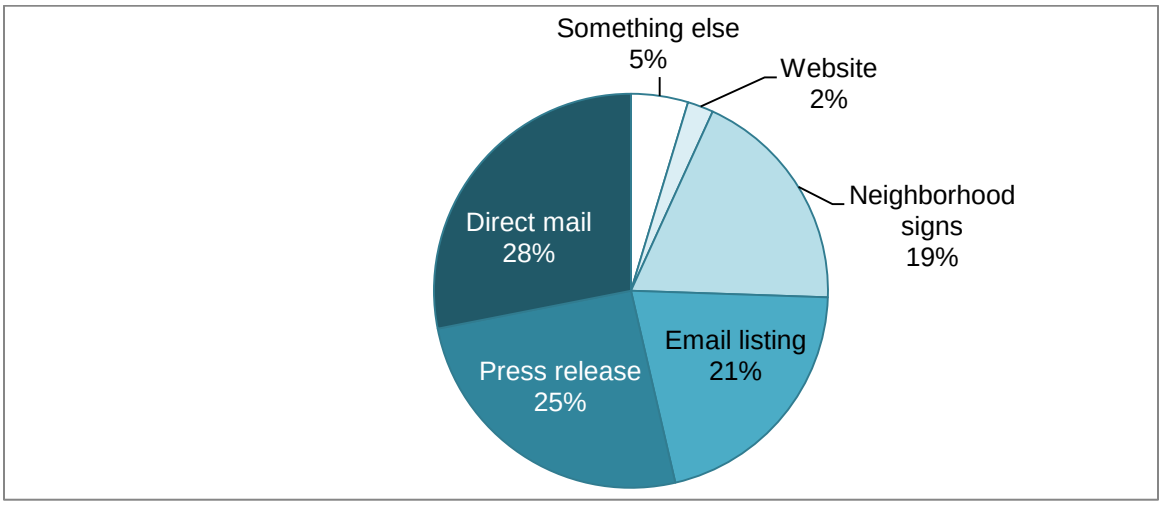
Figure 21. How interested would you be in seeing more events like these?



n=123

Respondents were asked what would be effective ways to reach them about these events in the future. Figure 22 shows that respondents were fairly evenly divided about the best approach, with the largest segment favoring direct mail (28%) followed by press release (25%).

Figure 22. What would be the most effective way to reach you about these events if there are more in the future?



n=123

When asked to identify a trusted source of information about the Chuckanut Bay area, the most frequent mention was Bellingham Parks and Recreation (41%) followed by ReSources (34%). Table 2 shows that 9% identified some “other” trusted source; Chuckanut Bay Community Association was the most frequent of these mentions.

Table 2. Which of the following organizations do you trust most to provide you with accurate information about the Chuckanut Bay area?

	n	%
Bellingham Parks & Recreation	103	41
RE Sources	84	34
City of Bellingham	68	27
WSU Extension	32	13
Shore Stewards	24	10
Others	22	9

n=250; responses may total more than 100% due to multiple responses per case

In the 2010 survey findings, Bellingham Parks and Recreation was also ranked as the highest trusted source for information about the Chuckanut Bay area (34%), followed by Shore Stewards (32%) which dropped substantially in 2012. Also of note, the City of Bellingham was considered a trusted source by only 15% of respondents in 2010, which

nearly doubled to 27% in the 2012 survey (which was distributed to a much larger pool of potential respondents).

CONCLUSION

Overall the outcomes for the Chuckanut Bay park area have been very positive. People reported a decrease in problems in the area and most expressed an appreciation for the improved quality of the area.

Although parking areas have been improved, many perceive that there was some lost capacity, either for the neighborhood or for kayakers. It is not clear from this research how much it has impinged upon their use of the park or conveniences in the neighborhood.

The salt marsh restoration piloted a new approach by the City of Bellingham to engage community members more fully prior to the finalization of plans and to engage them along the way. Although the initial pool of neighbors recruited into the plan was small (about 80 households), they tended to be the most prevalent users and in the end reported being well informed about the project, the bay and the events in the area.

There are some opportunities for further work in the area. Dog waste continues to be at least a minor problem at the park, and most dog owners are not picking up their dogs' waste at home on a daily basis (58% of dog owners). Car washing is prevalent on impermeable surfaces and occurs at a higher rate than in Puget Sound more broadly; the Puget Sound Partnership's 2012 study of area residents[2] found that only 10% of households washed their cars on pavement every time.

Replacing lawn with native plants or reducing lawn size is a relatively common activity, with 25% of respondents saying they had done so recently, some having reduced their lawns by half or more. These households would likely provide some examples of successful projects, which could inspire additional households to lose the lawn.

Reaching residents was fairly effective using conventional channels. The park itself was a good channel for information, as was the Herald, notices and signs. Experimenting with direct mail may help improve turnout since it was the most cited preferred means of contact. The Parks Department was considered trustworthy, as was RE Sources, which suggests some good sponsors for City messaging.

[2] Sound Behavior Index and Social Capital Index 2012 – Survey Report (www.psp.wa.gov)

APPENDIX A: RESEARCH METHODS AND DATA QUALITY

The survey was administered via postal mail and online. The printed version was mailed to 885 households on November 28, 2012, along with a letter of introduction from the City of Bellingham. The addresses were provided by the City of Bellingham. A sample of 885 was randomly chosen for the study.

To be as inclusive as possible, the letter provided the online website where additional household members could take the survey. A postpaid envelope was also provided. On December 6, 2012, a postcard was mailed to all 885 addresses, to thank them if they took the survey, or remind them to do so if they had not.

The online version was active from November 28 through December 19, 2012.
50 of the mailed surveys were returned due to address issues.

Two hundred forty one (241) surveys were returned by mail, and an additional ten were submitted online, for a total of 251 and a response rate of 30%.

APPENDIX B: FREQUENCY REPORT

Q1r During all of this past year (2012), how many times did you visit the park at Chuckanut Bay?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	133	53.0	53.6	53.6
	1-2 times	40	15.9	16.1	69.8
	3-9 times	40	15.9	16.1	85.9
	10-49 times	23	9.2	9.3	95.2
	50 or more times	12	4.8	4.8	100.0
	Total	248	98.8	100.0	
Missing	System	3	1.2		
Total		251	100.0		

q2 Was last year typical for you, or do you usually visit more or less often in a year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Typical	171	68.1	74.0	74.0
	Usually I visit more often	50	19.9	21.6	95.7
	Usually I visit less often	10	4.0	4.3	100.0
	Total	231	92.0	100.0	
Missing	Don't know	13	5.2		
	System	7	2.8		
	Total	20	8.0		
Total		251	100.0		

q3 Do you live within 10 minutes walking distance of the beach area at Chuckanut Bay?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	77	30.7	30.9	30.9
	No	161	64.1	64.7	95.6
	Don't know	11	4.4	4.4	100.0
	Total	249	99.2	100.0	
Missing	System	2	.8		
Total		251	100.0		

q4 This year, litter was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	4	1.6	3.5	3.5
	Minor problem	47	18.7	40.9	44.3
	Not a problem	47	18.7	40.9	85.2
	Don't know	17	6.8	14.8	100.0
	Total	115	45.8	100.0	
Missing	System	136	54.2		
Total		251	100.0		

q5 This year, illegal and improper parking was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	7	2.8	6.1	6.1
	Minor problem	21	8.4	18.3	24.3
	Not a problem	58	23.1	50.4	74.8
	Don't know	29	11.6	25.2	100.0
	Total	115	45.8	100.0	
Missing	System	136	54.2		
Total		251	100.0		

q6 This year, beach fires and fireworks were…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	3	1.2	2.7	2.7
	Minor problem	10	4.0	8.8	11.5
	Not a problem	59	23.5	52.2	63.7
	Don't know	41	16.3	36.3	100.0
	Total	113	45.0	100.0	
Missing	System	138	55.0		
Total		251	100.0		

q7 This year, overnight camping was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	4	1.6	3.5	3.5
	Minor problem	3	1.2	2.6	6.1
	Not a problem	51	20.3	44.7	50.9
	Don't know	56	22.3	49.1	100.0
	Total	114	45.4	100.0	
Missing	System	137	54.6		
Total		251	100.0		

q8 This year, dog waste was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	5	2.0	4.5	4.5
	Minor problem	40	15.9	36.0	40.5
	Not a problem	39	15.5	35.1	75.7
	Don't know	27	10.8	24.3	100.0
	Total	111	44.2	100.0	
Missing	System	140	55.8		
Total		251	100.0		

q9 This year, parties, including noise, drinking and drug use were…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	2	.8	1.8	1.8
	Minor problem	6	2.4	5.5	7.3
	Not a problem	45	17.9	40.9	48.2
	Don't know	57	22.7	51.8	100.0
	Total	110	43.8	100.0	
Missing	System	141	56.2		
Total		251	100.0		

q10 This year, speeding on Fairhaven Avenue was…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	6	2.4	5.4	5.4
	Minor problem	16	6.4	14.4	19.8
	Not a problem	40	15.9	36.0	55.9
	Don't know	49	19.5	44.1	100.0
	Total	111	44.2	100.0	
Missing	System	140	55.8		
Total		251	100.0		

q11 This year, leaking septic systems in the area were…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Major problem	6	2.4	5.6	5.6
	Minor problem	5	2.0	4.6	10.2
	Not a problem	18	7.2	16.7	26.9
	Don't know	79	31.5	73.1	100.0
	Total	108	43.0	100.0	
Missing	System	143	57.0		
Total		251	100.0		

q13 How much would you say you know about the restoration of the salt marsh in the Chuckanut Bay park area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A lot	12	4.8	4.9	4.9
	Some	33	13.1	13.4	18.3
	A little	54	21.5	22.0	40.2
	Nothing at all	128	51.0	52.0	92.3
	Don't know	19	7.6	7.7	100.0
	Total	246	98.0	100.0	
Missing	System	5	2.0		
Total		251	100.0		

q14 How much, if at all, have the changes improved fishing and shell-fishing for those who use the area for those pursuits?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	11	4.4	10.7	10.7
	Some	13	5.2	12.6	23.3
	A little	6	2.4	5.8	29.1
	Not at all	15	6.0	14.6	43.7
	Don't know	58	23.1	56.3	100.0
	Total	103	41.0	100.0	
Missing	System	148	59.0		
Total		251	100.0		

q15 How much, if at all, have the changes reduced parking access for kayakers?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	7	2.8	6.9	6.9
	Some	16	6.4	15.8	22.8
	A little	19	7.6	18.8	41.6
	Not at all	14	5.6	13.9	55.4
	Don't know	45	17.9	44.6	100.0
	Total	101	40.2	100.0	
Missing	System	150	59.8		
Total		251	100.0		

q16 How much, if at all, have the changes reduced parking access for residents?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	5	2.0	4.9	4.9
	Some	13	5.2	12.7	17.6
	A little	13	5.2	12.7	30.4
	Not at all	22	8.8	21.6	52.0
	Don't know	49	19.5	48.0	100.0
	Total	102	40.6	100.0	
Missing	System	149	59.4		
Total		251	100.0		

q17 How much, if at all, have the changes reduced unwanted behaviors and questionable uses of the beach?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	6	2.4	5.9	5.9
	Some	13	5.2	12.7	18.6
	A little	11	4.4	10.8	29.4
	Not at all	7	2.8	6.9	36.3
	Don't know	65	25.9	63.7	100.0
	Total	102	40.6	100.0	
Missing	System	149	59.4		
Total		251	100.0		

q18 Did you participate in the city's public meetings or discussions regarding the salt marsh restoration?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	8.4	8.6	8.6
	No	221	88.0	90.9	99.6
	Don't know	1	.4	.4	100.0
	Total	243	96.8	100.0	
Missing	System	8	3.2		
Total		251	100.0		

q19 Do you have a dog?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	95	37.8	38.6	38.6
	No	151	60.2	61.4	100.0
	Total	246	98.0	100.0	
Missing	System	5	2.0		
Total		251	100.0		

q20 How often is your pet's waste from your yard picked up and put in the trash?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never, it's left on the ground	5	2.0	5.4	5.4
	Daily	39	15.5	41.9	47.3
	Every couple of days	24	9.6	25.8	73.1
	Weekly	18	7.2	19.4	92.5
	Every couple of weeks	2	.8	2.2	94.6
	Once a month or so	2	.8	2.2	96.8
	Less than once a month	1	.4	1.1	97.8
	Don't know	2	.8	2.2	100.0
	Total	93	37.1	100.0	
Missing	System	158	62.9		
Total		251	100.0		

q21 When your dog is walked, how often is the pet's waste picked up and put in the trash?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every time	77	30.7	81.9	81.9
	Most of the time	10	4.0	10.6	92.6
	Less than half the time	3	1.2	3.2	95.7
	Never	2	.8	2.1	97.9
	Don't know	2	.8	2.1	100.0
	Total	94	37.5	100.0	
Missing	System	157	62.5		
Total		251	100.0		

q22 Is there a septic system on your property?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	78	31.1	32.2	32.2
	No	157	62.5	64.9	97.1
	Don't know	7	2.8	2.9	100.0
	Total	242	96.4	100.0	
Missing	System	9	3.6		
Total		251	100.0		

q23 Have you inspected your septic system in the past year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	49	19.5	65.3	65.3
	No	26	10.4	34.7	100.0
	Total	75	29.9	100.0	
Missing	System	176	70.1		
Total		251	100.0		

q24 When was the last time you inspected your septic system?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Within the last three years	26	10.4	89.7	89.7
	More than three years ago	3	1.2	10.3	100.0
	Total	29	11.6	100.0	
Missing	I don't know	1	.4		
	System	221	88.0		
	Total	222	88.4		
Total		251	100.0		

Q25r In the past year, how often did you wash your car at home, if at all?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	131	52.2	54.6	54.6
	1-2 times	51	20.3	21.3	75.8
	3-5 times	33	13.1	13.8	89.6
	6 or more times	25	10.0	10.4	100.0
	Total	240	95.6	100.0	
Missing	System	11	4.4		
Total		251	100.0		

q26 In the past year, when you washed your car at home, how often was it parked on pavement while you washed it?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every time	70	27.9	62.5	62.5
	Most of the time	3	1.2	2.7	65.2
	About half the time	3	1.2	2.7	67.9
	Less than half the time	3	1.2	2.7	70.5
	Never	33	13.1	29.5	100.0
	Total	112	44.6	100.0	
Missing	System	139	55.4		
Total		251	100.0		

Q27r Applied chemical bug killers or chemical weed killers in your yard

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	159	63.3	65.7	65.7
	1 time	32	12.7	13.2	78.9
	2 times	22	8.8	9.1	88.0
	3 or more times	29	11.6	12.0	100.0
	Total	242	96.4	100.0	
Missing	System	9	3.6		
Total		251	100.0		

Q28r Applied chemical fertilizers on your lawn

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	153	61.0	66.5	66.5
	1 time	41	16.3	17.8	84.3
	2 times	31	12.4	13.5	97.8
	3 or more times	5	2.0	2.2	100.0
	Total	230	91.6	100.0	
Missing	System	21	8.4		
Total		251	100.0		

Q28br Applied chemical fertilizers on your garden beds

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	166	66.1	80.2	80.2
	1 time	20	8.0	9.7	89.9
	2 times	12	4.8	5.8	95.7
	3 or more times	9	3.6	4.3	100.0
	Total	207	82.5	100.0	
Missing	System	44	17.5		
Total		251	100.0		

q29_1 Removed non-native plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	164	65.3	65.6	65.6
	Checked	86	34.3	34.4	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q29_2 Added native plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	145	57.8	58.0	58.0
	Checked	105	41.8	42.0	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q29_3 Replaced non-native plants with native plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	209	83.3	83.6	83.6
	Checked	41	16.3	16.4	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q29_4 None of these

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	156	62.2	62.4	62.4
	Checked	94	37.5	37.6	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q30 In the past three years have you reduced the size of your lawn?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	61	24.3	27.2	27.2
	No	163	64.9	72.8	100.0
	Total	224	89.2	100.0	
Missing	Don't know	3	1.2		
	System	24	9.6		
	Total	27	10.8		
Total		251	100.0		

q30a Did you add native plantings to areas that used to be lawn?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	32	12.7	50.8	50.8
	No	31	12.4	49.2	100.0
	Total	63	25.1	100.0	
Missing	Don't know	6	2.4		
	System	182	72.5		
	Total	188	74.9		
Total		251	100.0		

q30b Is the reduction in your lawn's size more than half, about half or less than half of what the lawn used to be?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More than half	6	2.4	9.5	9.5
	About half	3	1.2	4.8	14.3
	Less than half	48	19.1	76.2	90.5
	Don't know	6	2.4	9.5	100.0
	Total	63	25.1	100.0	
Missing	System	188	74.9		
Total		251	100.0		

q31 In the past year, when you've had motor oil, antifreeze, liquid paint or pesticides to dispose of, how often did you put them in the trash?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every time	12	4.8	5.0	5.0
	Most of the time	1	.4	.4	5.4
	About half the time	1	.4	.4	5.8
	Less than half the time	5	2.0	2.1	7.9
	Never	144	57.4	59.5	67.4
	Not applicable- I've not had anything like that to dispose o	79	31.5	32.6	100.0
	Total	242	96.4	100.0	
Missing	System	9	3.6		
Total		251	100.0		

q32 How knowledgeable are you about local wildlife and sensitivity of the Chuckanut Bay area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely knowledgeable	14	5.6	5.7	5.7
	Very knowledgeable	42	16.7	17.1	22.9
	Somewhat knowledgeable	100	39.8	40.8	63.7
	Not very knowledgeable	53	21.1	21.6	85.3
	Not at all knowledgeable	36	14.3	14.7	100.0
	Total	245	97.6	100.0	
Missing	System	6	2.4		
Total		251	100.0		

Q33r In the past year, how often have you shared your knowledge of the local wildlife and sensitivity of the Chuckanut Bay area with others?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 times	120	47.8	65.6	65.6
	1-2 times	27	10.8	14.8	80.3
	3-9 times	23	9.2	12.6	92.9
	10 or more times	13	5.2	7.1	100.0
	Total	183	72.9	100.0	
Missing	System	68	27.1		
Total		251	100.0		

q34 How familiar are you, if at all, with the Chuckanut Bay Pledge?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely	2	.8	.8	.8
	Very	12	4.8	4.9	5.7
	Somewhat	31	12.4	12.7	18.4
	Not very	29	11.6	11.8	30.2
	Not at all	157	62.5	64.1	94.3
	Don't know	14	5.6	5.7	100.0
	Total	245	97.6	100.0	
Missing	System	6	2.4		
Total		251	100.0		

q35 How much, if anything, did you hear or see about these events?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A great deal	1	.4	.4	.4
	Some	39	15.5	16.3	16.7
	A little	66	26.3	27.5	44.2
	Nothing at all	124	49.4	51.7	95.8
	Don't know	10	4.0	4.2	100.0
	Total	240	95.6	100.0	
Missing	System	11	4.4		
Total		251	100.0		

q37 How interested would you be in seeing more events like these?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Extremely	4	1.6	3.3	3.3
	Very	20	8.0	16.3	19.5
	Somewhat	62	24.7	50.4	69.9
	Not very	19	7.6	15.4	85.4
	Not at all	13	5.2	10.6	95.9
	Don't know	5	2.0	4.1	100.0
	Total	123	49.0	100.0	
Missing	System	128	51.0		
Total		251	100.0		

q38 What would be the most effective way to reach you about these events if there are more in the future?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Direct mailings	66	26.3	28.1	28.1
	Neighborhood signs/sandwich board	44	17.5	18.7	46.8
	Press release in local papers	60	23.9	25.5	72.3
	Email listing	49	19.5	20.9	93.2
	Website posting	5	2.0	2.1	95.3
	Something else, please describe:	11	4.4	4.7	100.0
	Total	235	93.6	100.0	
Missing	System	16	6.4		
Total		251	100.0		

q39_1 ReSources

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	166	66.1	66.4	66.4
	Checked	84	33.5	33.6	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_2 Shore Stewards

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	226	90.0	90.4	90.4
	Checked	24	9.6	9.6	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_3 WSU Extension

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	218	86.9	87.2	87.2
	Checked	32	12.7	12.8	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_4 City of Bellingham

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	182	72.5	72.8	72.8
	Checked	68	27.1	27.2	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_5 Bellingham Parks and Recreation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	147	58.6	58.8	58.8
	Checked	103	41.0	41.2	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q39_6 Others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	UnChecked	228	90.8	91.2	91.2
	Checked	22	8.8	8.8	100.0
	Total	250	99.6	100.0	
Missing	System	1	.4		
Total		251	100.0		

q41 Have you visited the City's website for Chuckanut Bay?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	13.5	14.3	14.3
	No	199	79.3	83.6	97.9
	Don't know	5	2.0	2.1	100.0
	Total	238	94.8	100.0	
Missing	System	13	5.2		
Total		251	100.0		

APPENDIX C: VERBATIM OPEN-ENDED COMMENTS

If there are any other issues you think are a major problem in the area, please describe them below:

- "illegal and improper parking" especially along the right shoulder approaching the bridge. It caused erosion into the marsh. It did not help that leftover gravel in that area made for an easy parking area in an area not designated for parking! Government intrusion. Hostile mailing this past summer from city which included unnecessary color copy pages - wasting taxpayer money. Tone of mailing was accusatory, demeaning to our intelligence, and blaming die back of plantings to community when in fact, the plantings were not properly cared for during the crucial period when they take hold.
- People forgo empty parking spaces and park closer to loading areas but by the side of the road. They have crushed/killed any plants along there. 2. Litter and dog waste: Still a problem but we see less of it. We also see baggies of dog waste left by the side of the road and not disposed of in the garbage. 3. Speeding: A few, well-places signs and a couple of speed bump mags would help slow people down.
- 11. Used to be, not now. You can tell by the lack of growth of algae.
- Access to Clayton Beach - is this now blocked?
- Coal trains!
- Didn't know the Mud Flats are now officially "Chuckanut Bay".
- Disabled parking is too far away and too steep to the beach. There should be 1 disabled space by the bridge and 1 unload.
- Dogs chasing shorebirds and trampling the mud flat fauna and flora. Dogs barking and bothering people seeking solace. Way too many unleashed dogs.
- Harder for people to launch kayaks.
- I can't tell what is private property, both for knowing where I can park, where to lock my bike, where to launch my kayak, etc. More signage and explanations are needed.
- I resent that the city has pushed itself onto neighboring properties, using a "right of way" that was never designed or intended for this type of use. I do not like the signage. It is too commercial for a residential low key neighborhood.
- I visited in December so there was no one camping, using drugs, etc.
- I'd like more area for dogs and dog waste bags and garbage cans provided - unfortunately not all dog owners are responsible making it easy to get rid of waste and human trash would help.
- Leaking oil fuel tanks, old. I see oil film under the little bridge nearly every time I am there. Also sometimes on beach.
- Nice place. Usually sparsely attended.
- Not enough parking for the intended uses.
- Not marked as public.
- Not problems for me.
- Over regulation and too much money spent on something that could easily (and more effectively) be handled by willing parties in the neighborhood. Tax money, committees, surveys, etc. not necessary for this tiny little park.
- Parking at Woodstock Farm.
- Parking was not a problem only because there was no one else around except our one-car group. I don't know where another car or two could park around the end of Fairhaven Ave. (I don't know about most of the "problems" because we did not walk down to the water, and no one else was around when we visited the area.)
- Regarding litter, we mainly see plastic and aluminum cans that have likely been washed in with the tides.
- Removal of noxious weeds was supposed to occur. There is lots of giant hogweed still there.
- Smell.
- Speeding is a problem between Old Fairhaven Parkway and Old Samish on 30th. 30th needs a shoulder and maintenance of road.

- Speeding on Chuckanut drive - a major problem.
- The area is prone to landslides forcing bad closures. Self-sufficiency and emergency preparedness are important.
- The house next to the park was allowed to build septic system within the winter high tide zone.
- The speed on Chuckanut Drive. Motorcycles and very fast drivers all summer - especially going north past the fire department.
- The speed on Fairhaven Ave doesn't happen all the time, but often and many small children live along it. Also, fairly regularly I see cars parked in the loading zone - but typically only during quiet times of park use.
- There is a "no shellfishing" sign up most of the time - pollution?
- Too much noise from leaf-blowers around Viewcrest Rd and Sea Pines homes.
- We visit the area mostly by boat - rarely go to shore. It has been tidy when we do visit shore.

Please describe any other beneficial changes you've noticed in the area:

- The creek at the end of the road seems much healthier. 2. I appreciate the "naturalization" of the shoreline.
- Beach protected. Stream rehabbed.
- Cars off beach. Better natural system.
- Enjoyment of nature has been greatly improved.
- Great habitat gain for fish. Reduced pollutants to bay.
- I am happy for eelgrass restoration but didn't really know I could use this park.
- I rarely visit the beach area any more. Haven't seen the recent changes. Since 2005 visit 30 Nov 2012 very nice work. Good place to park.
- I was concerned about access for kayaking and the ability to load and unload kayaks. It seems to work just fine.
- It is much more pleasing to look at (the beach, etc.) More plants are there, etc. Better aesthetics.
- Less parking means less people can use this public resource. Is it really worth the money the city is spending on this for the few that actually use it?
- Less risk of high boat traffic and hopefully less crabbing but not sure about that.
- Loss of parking viewing of bay.
- Marsh area appears thriving. Beach cleaner than in 2008, my first year in the area.
- Since the restoration, illegal activities have diminished tremendously. Pot smoking seems to have disappeared, dog waste reduced, late noises and loud music in general are gone, debris on the beach reduced and great improvement to the beauty of the beach area.
- Thank you for keeping motor vehicles away from the water. When we visit, we walk or bike with our kayaks. Distances is a bit over a mile. Cars are responsible for much water pollution.
- The area is not getting destroyed by all the humans and some animals - good job.
- The beach looks much nicer and natural, no tire marks, litter and dog poop lying around.
- The city employee who previously used to snooze at the beach now has to use the parking area.
- The fact that the area is so well built (bridge, path, etc) and that the signs are so good, communicates that it is a public space and not private enough for criminal activity.
- The marsh drains out much more quickly now and this creates a drier habitat. Was this the intention?
- The project has helped to preserve the beach by not allowing vehicle traffic on the beach.
- The vegetation effort has been very successful and I also enjoy the openness of the creek. It is visually very attractive.
- There seemed to be a healthy grouping of baby cohos and the "nursery" was there for them - worthy!
- When I went it was pristine. I visited by boat in September, 2012. I live on Chuckanut Sh. Rd.

Did you participate in the city's public meetings or discussions regarding the salt marsh restoration? Your feedback regarding the process and its outcomes is welcome.

- Did not know about meetings.
- I appreciate having been informed of an event at the salt marsh restoration site, and regret that I was unable to attend that one. Thinking back, tho', I don't know where I would have been able to park, had I tried to attend....
- I thought the city did a great job soliciting opinions from all parties and presenting fair solns: I also thought the city communicated effectively w/residents regarding the planned activities.
- I went to one informational meeting talking about the restoration project and parking.
- Not sure if any beach improvements had any impact on septic pollution from Briza.
- Pleased to see protection of salt marsh along with continued ability to use area as kayak launch site.
- The elimination of vehicle access has improved the shoreline and the new growth of native vegetation for the area and habitat for birds, fish and wild animals.
- Was there a presentation to the Edgemoor Neighbors Association?

How did you hear about them?

- A flyer in mailbox.
- Bellingham Herald
- Bellingham Herald and direct mail.
- By mail.
- Cascadia Weekly? (not sure) Facebook.
- Chuckanut community.
- Couple times.
- Direct mailings.
- Don't recall - newsletter?
- Don't remember - Bellingham Herald?
- Don't remember.
- Emails, postcard.
- Emails, print mailings.
- Fire Hall newsletter and poster board.
- Fliers.
- Flyer, Cascadia Weekly
- Herald.
- Herald.
- I believe I saw a sandwich board sign by the Chuckanut Bay Gallery. (Were there any mailings to nearby and/or waterfront residents?)
- I believe it was mail and/or publications.
- I participate in the MRC and other local groups that promoted them.
- I saw a flyer for the Nov. party but we were out of town.
- I think a city publication or Cascadia Weekly.
- I wasn't here in summer; I read about Nov party in newspaper.
- Information in the mail and newspaper. Signs in area.
- Internet, neighborhood flyer.
- Local listings e.g. The Weekly, Take 5?
- Local media.
- Local paper or some other public notice.
- Local paper.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mail.
- Mailer.
- Mailing.
- mailings
- Mailings and posted signs in village.
- Mailings, reading events calendars in local publications, Cascadia Weekly.
- Mailings.
- Mailings.
- Marine Resource Committee (MRC)
- Neighbor or paper.
- Neighbors.
- Newsletters.
- Newspaper
- Newspaper - B. Herald.
- Newspaper (B'ham Herald)
- Newspaper (I think)
- Newspaper or perhaps direct mailing.
- Newspaper, other.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.
- Newspaper.

- Newspaper.
- Newspaper.
- Newspaper.
- Notices in the "B'ham Herald".
- Paper - Herald.
- Paper and mailing.
- Post card.
- Poster at Marine Park? B'ham Herald? Environmental group newsletter?
- Read it somewhere.
- ReSources, email.
- Sandwich board on Chuckanut Dr.
- Shoreline newsletter.
- Sign board.
- Sign in neighborhood, letter.
- Signs and newspapers.
- Signs,
- Signs.
- Signs.
- Take Five - B'ham Herald.
- Through South Neighborhood Association.
- Via email? Or the sign at the fire station?
- Weekly?
- Whatcom Marine Resources Committee meetings/fliers and sign boards.
- Word of mouth.
- Word of mouth.

What would be the most effective way to reach you about these events if there are more in the future? Something else:

- Don't know.
- email listing via Chuckanut HO Assoc.
- ENA
- KGMI
- Neighborhood newsletter.
- Not interested.
- Radio - local FM.
- Twitter, from a Bellingham feed.
- value-pack

Which of the following organizations do you trust most to provide you with accurate information about the Chuckanut Bay area? Others:

- All about equal. I don't really trust one over the other.
- Andy Bunn
- Bellingham Herald
- CBCA Chuckanut Bay Community Assoc.
- CCFA
- Chuckanut Association newsletter.
- Chuckanut Bay Community Assoc.
- Chuckanut Bay Community Organization
- Chuckanut Beaches Assoc.
- Chuckanut Community meetings.
- Chuckanut Neighborhood newsletter.
- Edgemoor Neighbors Association.
- Friends of Chuckanut
- High school requirement for Biology students.
- Just keep me informed of events.
- Neighborhood Associations.
- Neighborhood signs/sandwich boards, e-mail notices, and flyers posted in public places would be helpful in our case. Parking advice would be VERY welcome.
- Neighbors.
- Neighbors/people I personally know.
- None - too political.

- None of the above.
- None of those listed.
- Notify the community via the above
- Radio
- You should have several, in order for all to hear about it.

What else could the City do to make sure you can attend if we have more events?

- Early notification. 2. Not events just for children.
- Inform 2. Schedule often.
- Adequate parking.
- Advertise available parking.
- Advise WAKE. Current weekly publications.
- Be more scientific and less political.
- Better advertising.
- Can or "do" attend? First you must ask "why" you need attendance. 1. Output literature needs to stress the need for attendance. 2. Combine event with another as in this is one stop on a tour. Example: city park wide treasure hunt where each stop has an educational "finding" and all must be collected placed in for a winner. Win what? make something up/have a sponsor.
- Consider time, place and parking.
- Email
- Email list.
- Email.
- Email.
- Events should be when most workin gpeople can go - not 8 - 5 M - F.
- Flyers.
- Give adequate notice particularly through neighborhood associations.
- Hard to say... kids' scavenger hunt?
- Have less people show up. I hate crowds and commotion.
- I am happy with the notices I now see.
- I am most likely to attend the family friendly events at Chuckanut Bay on the weekend or during the summer (although we often have conflicts.)
- I do not care to attend any events.
- I don't need events. I love the quiet and solitude.
- I have never heard of this park but I wish I knew how to get to the area. I assume it is close by, on Chuckanut Bay.
- I would not attend.
- I'm too old to go anywhere.
- Increased use impacts wildlife, a balance needs to be found with higher use and the need of this rare place where wildlife come to rest, especially in winter.
- Just being notified would increase the chances of us attending.
- Keep trying!
- Leave the bay alone!
- Mail notice.
- Mail something.
- Make announcements in the paper.
- Make it known and applicable to me. I have lived here for 25 years and owned my property on Chuckanut Drive for over 40 years and didn't know there was a park at "Chuckanut Beach" or even heard of Chuckanut Beach.
- Make presentations to n'hood assoc. meetings.
- Make sure they give plenty of notice and maybe have snacks.

- No idea.
- No ideas to offer.
- Nothing.
- Nothing.
- Nothing.
- Nothing.
- Notices in paper, email. Didn't know about the website. We'll look at it, just to be sure people know of events, direct contact by mail or email is necessary.
- Please include detailed information about where the events take place and where Chuckanut Bay Park is located.
- Post notices on CBCA website. Chuckanut Bay Community Assoc.
- Press release.
- Probably nothing since I'm so highly committed and involved in other community activities.
- Publicize events more.
- Put info out.
- Put notices in B'ham Herald Events calendar.
- Put on RESources website and include in their monthly e-newsletter.
- Stop sending Chuckanut neighbors threatening letters. Work to stop coal trains.
- Stop the events. They bring people!
- Street sign.
- Try harder to make sure I understand the purpose of the event, I would attend.
- Variety of dates in summer.
- Water cooler postings, notices with utility bills.
- We are new to the area and rebuilding a house. Hopefully, we will become more aware of our surroundings with time.
- We are over-taxed as a county. As a result, I work most available hours/times.
- Weekend...
- You know that blue value-pack that everybody gets in the mail. I've seen non-profits and other causes use that to get the word out. You could post events and calendars in a slip of paper in that. Gotta be cheap and everybody gets it.

Please provide your email address if you would like the city to send you periodic information about Chuckanut Bay. (sent under separate cover)

If you would like to add any comments about your responses to the questions above, please do so here

- Teddy Bear Cove? which park? not clear. I live on CB across from Chuckanut Island. I sometimes walk to Teddy Bear Cove mostly in the winter.
- 27. We used what was considered "environmentally friendly" chemicals.
- 28: I live at condo - contractor handles all landscape maintenance.
- Appreciate the work. Thanks!
- Are you referring to Larrabee State Park? Is there another park on our bay? Our 5 beaches are not a park.
- Changes have reduced access for small boat launching for fishing and crabbing. Changes have limited access for people with disabilities. The handicapped parking spot is too far away. Suggest changing one of the two launch/load-unload spots to handicapped parking. We've witnessed people leaving because they're discouraged by this lack of access. Thank you.
- City paid $1.10 to mail this survey to me. Don't know how many you sent, but pretty expensive since the city should have a bulk permit.
- Concern: Fire! Will beach fires be permitted?
- Follow up to #40 "why" want attendance. 1. Need to justify money spent. 2. Want to educate. 3. Need financial support. 4. Just part of the program for these type project. 5. Want support

from citizens for more projects. *Define success: If 1,000 folks showed up in a six hour period? Yikes! Craft message to fit outcome and match program/event to fit message.
- FYI - I've only recently moved here. Looking forward to getting to know the area better.
- Good try at getting local community involved with the project.
- How much did this survey cost and who is paying for it?
- I apologize for the negative tone of my responses. I just don't see the need for this type of spending in the midst of a recession, when I can barely afford the basics.
- I appreciate your efforts although I myself will most likely not be actively involved.
- I dearly love the Chuckanut Bay area and would love to be more involved with what goes on there. I have been in Europe the past 2 1/2 months which is why I haven't been to visit more. I hope this is helpful and please let me know if there is anything I can do in keeping the Chuckanut area a beautiful, healthy and natural environment.
- I don't go to Chuckanut Bay very often but I do hike in the Chuckanuts every week.
- I have been unaware of the park, but now that I know about it, I'm very concerned about its vulnerability to pollution from the proposed increase in trains carrying coal and oil! I urge the agencies involved in restoration to submit scoping comments that urge the inclusion of imports to all shoreline parks in the Els for the Gateway Pacific Terminal.
- I miss seeing the fireworks!
- I own the property above the bay so I am happy you are improving conditions. We need to get rid of the trestle. The bay is filling in.
- I really like the improvements the city has made with one exception, the handicap area parking - which is huge and yet I have never seen anyone use it. Okay...and one other thing, I don't love having the interpretive signs, but if they are needed I think they are good ones. Thank you!
- I strongly support environmental stewardship of our land and water including Chuckanut Bay. Not attending the 4 events listed is not an indication of indifference nor lack of knowledge about water issues in general. Invasive species, pollution, climate and public use/abuse are major issues of concern.
- I think this survey is a waste of money.
- I was pleased to learn about Chuckanut Bay, and heartily endorse plans for restoration and improvement.
- I would like an effort made, either through the state or local, to negotiate with BNSF to put more openings in the rock roil causeway. The goal to increase tidal flow in Chuckanut Bay, which is not silting up.
- If more coal trains come this won't matter. Has the railroad answered this. Coal falls off cars now. Railroad ties and defoliant spray may kill anything... sorry, but the facts.
- I'm concerned about the cost of this in time and money to the city. After seeing all that has been spent for Woodstock Farm and the Chuckanut Ridge properties it seems the city is spending too much and the public is not getting a good return on investment.
- In these times of budget deficits, this survey is a blatant waste of taxpayer funds. I am highly offended with plans to increase property taxes when money is spent on such nonessential things as this survey. Obviously government is clueless about how wasteful they are. Looks like people are trying to create government jobs for themselves.
- It wasn't clear where the park at Chuckanut Bay was located.
- It would be interesting to know what would do more harm to the environment. 1. A dock that would extend 100 feet for use by the public or 2. kayakers and paddle boarders walking on the mud flats to launch their watercraft. BAN ALL DOGS! Thank you.
- It's been wonderful living down here in Chuckanut Village after retiring. We love the beach, the neighbors, the deer and our fruit trees.
- Keep up the good work. Chuckanut Bay is a great resource.
- Live on Whatcom Creek formerly Southsider. Got involved a bit thru Parks Board and Greenways.
- Living on Sea Pines Lane, high above shoreline, doesn't provide much identity with the community below. I certainly appreciate what is happening there and do my part by not

having toxic runoff from my property. Perhaps next time there's an event I'll go!
Make results of surveys more readily available.

- My family does not live near or in the watershed of Chuckanut Bay.
- My friend Emily Smith (now Flerry) was part of the restoration project along Post Point. I think the work done has been well executed and very beneficial.
- My husband and I value all efforts to protect the bay and the shoreline and the creatures that inhabit it. However, we get way too much email as it is. We would prefer information to be updated on your website so we could check it occasionally. Also could post info on signs at the site itself. Thanks for this information.
- Need a "No Beach Access" sign on the corner of Fairhaven Ave and 18th St to prevent people from parking on Rainier Ave.
- Note: We've just moved to Chuckanut area last Nov. 2011. We may be in the loop, now, to hear about C.B. happenings.
- Our address is 1329 Chuckanut Dr, about 1/4 mile s. of city limit. We use that park access to launch kayaks at high tide but have no visual or sound access from our home. Thanks for your efforts for the park.
- Our car habits are a major source of water pollution! Does the general public know this? Doubtful as it's normally referred to in terms of "storm water run off". If the public was given clear information about all the water pollution caused by motor vehicles and really encouraged to drive less for the health of our waters, I firmly believe many would choose to drive less and walk, bike and transit more. Please educate the public beyond fertilizers and dog poop!
- Parking is needed and signs from the lots would increase use - like-> "Places of interest: 1. Chuckanut Bay Park (description) 2. Arroyo 3. Teddy Bear Cove 4. Interurban Trail 5. Woodstock Farm -to learn more visit website" Print signs on metal, plastic coat, place on plastic post to increase longevity. Add pointer signs. Add trail from trailhead to Chuckanut Bay and Woodstock. -Best to you, Jody (former Greenway co-chair) Hi to Tim Wahl!
- Please note: we just moved to Bellingham in late May 2012.
- RR work has spread white taps covered with oil along the intertidal zones. The RR ties that weren't on the track itself were left and are floating in the bay - with oil oozing out of them. All the good work the city has done is being offset by BNSF. Multiple complaints have to correct these problems.
- Sadly, knew nothing about any of this, and I'm relatively active in the Chuckanut Bay Community Association. http://www.chuckanutcommunity.org/cbcahome.htm
- Sorry I am so ignorant of subject. Hope to learn more in the future.
- Sorry. I don't give my e-mail to surveys.
- Sounds all great... I just never heard or became aware of this project or location. I'll go visit soon.
- Stop wasting tax dollars on surveys etc. Hydrocarbons are never an issue!
- Suggest you read "King of Fish" by professor Michael Montgomery @ UDub. Issue for this county is simple rules and effective enforcement!
- Thank you for ever increasing the quality of life in Whatcom County!
- Thank you for the survey and opportunity to be included. I will be visiting this area now.
- Thank you for your concern for the environment and for compatible use of our public sites while protecting the environment.
- Thanks for protecting our natural resources - now stop coal and oil. 27: I've seen my neighbors spraying - especially the OLD, set in their ways.
- Thanks!
- The oil slick concerns me - I wasn't sure who to call.
- The rebuilt bridge and signs are quite ostentatious and detract from the original quiet natural beauty of the bay. The logs interspersed with boulders sure looks less natural and unattractive. The largest threat to this shoreline and marsh is goal train invasion and air and noise pollution from increased air traffic. We are sad that plantings did not get proper follow up care - many were choked out by grass or died from not being watered. What a waste of taxpayer money!

- The use of the term Chuckanut Bay is confusing. I think Teddy Bear Cove is in Chuckanut Bay and Woodstock Farm.
- The Whatcom Watch would be a good place to have an article on Chuckanut Bay - contact them.
- There are several (3) Chuckanut Bay beach access points - being specific re: which location would be helpful. Thanks!
- This seems to be a huge effort over a little project. I prefer all agencies to stay out of our natural resources except to protect them.
- This survey serves as a reminder. Perhaps consider: materials directed toward other household members? Mom has buy-in but reinforcing messages to spouse, kids, etc.
- Undesirable use of public parks is a real, valid concern and should be dealt with through policing and prosecution, not limiting access. I also worry that surveys like this and the org. behind them want to control and limit property rights of owners/taxpayers around these parks. We have gone too far intruding on private property rights and this "smells" like more intrusion. If government is going to reduce the rights of property owners to use their land... then the taxes they collect from those owners should be reduced. It is just another great government hypocrisy... take their money, take their rights. I worry about these things.
- Was not aware of reason which led to parking changes or limiting access to area.
- We are older and never use parks. It's not that we are not interested, it's just that we have other forms of recreation.
- We are opposed to the Special Park District, Dan Pike misappropriated $ to buy Chuckanut Ridge and now there is a group wanting to find a way to pay for part of the purchase to pay back the Park fund by taxing property owners more thru a Special Park District. No more taxes.
- We first heard of the park at Chuckanut Bay from this survey and went down for a visit. It's a beautiful spot. Very happy to know about it and pleased it is being cared for. There was a bit of trash on the shoreline which we placed in the well placed trash can. Thank you!
- We have lived here for two years. Since the city has bought the Hundred Acre Woods, we have spent a lot of time exploring it, and all of the adjoining trails. It's very close to our house - without driving anywhere. Besides checking out Chuckanut Bay, we haven't spent time there.
- We have not heard of the Chuckanut Bay area park or the Marsh Restoration Project. We do not know the boundary of the Chuckanut Bay area. We will look it up online to become more knowledgeable about this project. We are sensitive to the use of chemicals/fertilizers, sudsy water into sewers but not in relation to this project - just in general - to keep our waters clean.
- We spend our time "on" the bay, rarely going on shore. We have a 34' wooden cruiser so we anchor and fish, crab, explore with our two shore boats. Our experience is always fine, water clean, etc.
- We were unaware of the existence of this park. Why are there no signs about the park on Chuckanut Drive?
- Were the culprits of the recent vandalism in the park apprehended? Will there be a monitoring program for the park established?
- What a beautiful, functional improvement to Chuckanut Bay Marsh!
- Where is the "park" at Chuckanut Bay?
- Why would you include residents in this survey after all of this time - with no prior communication. It seems like a waste of time and money.
- Will not provide my email on this survey because it should be anonymous.
- You can see by my crossed out responses that I didn't know what park to which you were referring. There are many parks on Chuckanut Bay (5 owned by Chuckanut Beaches Assoc) and Larrabee Park, so referring to "the park at Chuckanut Bay is confusing to people.
- You might want to contact Frank James for so excellent photography of Chuckanut Bay wildlife, sunsets, natural beauty.

Overview of Process for Public Input on Chuckanut Village Marsh Restoration Project

- 1st public meeting April 7, 2009
- Comments due April 17, 2009
- Comments provided by April 17 will be incorporated into comment matrix
- Comment by sending email to: rlacroix@cob.org
- Comment matrix with responses provided to public on website by April 22, 2009
- One alternative produced that incorporates as many comments as possible
- 2nd public meeting showing draft final alternative on April 23, 2009 at 7:00 pm

Welcome to Chuckanut Village Marsh Public Meeting!

Agenda

7:00	Welcome & Introductions
7:15	Presentation on Chuckanut Village Marsh and overview of public access alternatives
7:45	Question and Answer
8:10	Open house and discussion
8:30	Adjourn

Chuckanut Village Marsh Restoration

Renee LaCroix, City of Bellingham
Kym Fedale, City of Bellingham
Jim Johannessen, Coastal Geologic Services

Current uses and impacts

- Exploring families
- Beach walking
- Bird watching
- Kayaking
- Boating
- Clamming
- Driving & Parking

A97153U

VEHICLES
IN PARK
DUSK-6:00 AM
WILL BE
IMPOUNDED BY
POLICE DEPT.
NO
DUMPING

Unique Environmental Assets

- Amazing and rare marsh – mixture of fresh and salt water communities.
- Provides habitat for: heron, eagles, osprey, red legged frog, red fox, deer, western tanager, kingfisher, chum, coho, steelhead, cutthroat and salamanders, duck, clam.
- Chuckanut Bay pocket estuary provides highest level of function of all pocket estuaries in Bellingham Bay.
- Bellingham Bay is designated Critical Habitat for ESA listed chinook and bull trout. Will likely be designated critical habitat for recently listed steelhead.

Shoreline Master Plan

- Goals
- Shoreline is designated Conservancy
- Bay is designated Natural
- Setbacks

Funding Sources

- Whatcom County Marine Resource Committee (MRC)
- Department of Ecology Centennial Clean Water Fund grant (CCWF)

<u>Funding for:</u>

1. Educational Outreach ($55K from CCWF)
2. Design ($20K from MRC)
3. Implementation ($70K from CCWF)

Education and Outreach

Neighbors and area users will define the outreach program focus

Outreach program includes:

- Survey
- Focus groups
- Outreach program design and implementation
- On-site education workshops WSU Shore Stewards Program and RE Source Beach Naturalist Program
- Program evaluation

Overview of process for public input.

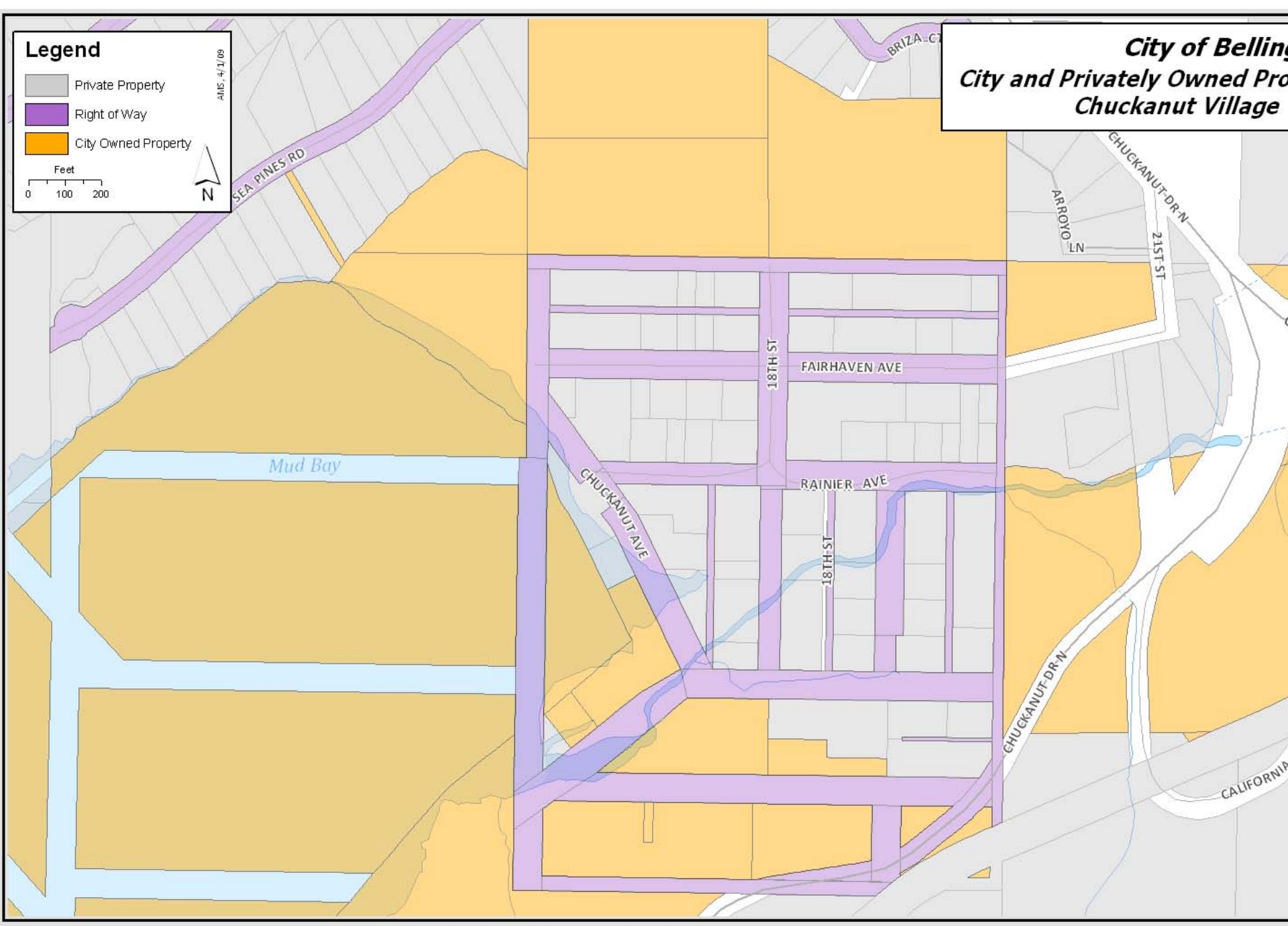
- 1st public meeting (we are here)
- Comments due April 17th.
- Comments provided by April 17th will be incorporated into comment matrix.
- Comment matrix w/ responses provided to public on website by April 22nd.
- One alternative produced that incorporates as many comments as possible.
- 2nd public meeting showing draft final alternative on April 23rd at 7:00pm.

Relevant Studies

- Whatcom County Nearshore Habitat Restoration (CGS, 2007)
- Management Recommendations for City of Bellingham Pocket Estuaries (NES 2006)
- Bellingham Bay Pilot Project Final Habitat Restoration Report (PIE and Anchor, 1999)
- Draft Shoreline Master Plan Restoration Plan (2009)

Property ownership

- Privately owned parcels
- Publicly owned parcels
- Publicly owned right-of-way


Legend
Private Property
Right of Way
City Owned Property
Feet
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N
AMS, 4/1/09
City of Bellin
City and Privately Owned Pro
Chuckanut Village
SEA PINES RD
BRIZA CT
CHUCKANUT DR N
ARROYO LN
21ST ST
18TH ST
FAIRHAVEN AVE
RAINIER AVE
CHUCKANUT AVE
Mud Bay
CALIFORNIA

Examples of marine nearshore restoration:

- Existing Projects:
  - Padden Lagoon
  - Marine Park
  - Post Point Lagoon
  - Whatcom Creek Estuary

- Future Projects:
  - Boulevard Park
  - Waterfront
  - Squalicum Creek Estuary
  - Little Squalicum Estuary

Opportunities for restoration, public access, trails and parking

- Three draft alternative sketches
- Several blank posters for suggestions

ALTERNATIVE 1.
DISABLED PARKING & LOADING ZONE
FAIRHAVEN AV
CITY
REMOVE PARKING LOT, RESTORE BEACH RE-VEGETATE
TURNAROUND
PARKING AREA
REMOVE CULVERT, OPEN CHANNEL
REMOVE GRAVEL ROAD END
NEW PED. BRIDGE & PATH
RAINIER AV

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(360) 671-5000
Windermere
Michelle Harrington
(360) 510-0638
New Price

Exclusively
(360) 671-5000
Windermere
www.windermere.com
Michelle Harrington
(360) 510-0638
New Price

ALTERNATIVE 2.
FAIRHAVEN AV
CITY R.O.W.
REMOVE CAR ACCESS, RE-VEGETATE
PARKING AREA
RAINIER AV
16TH ST

Rainier Av
Chuckanut Av

Duckabush

CHUCKANUT DRIVE
21ST ST
CITY PARKS PARCEL
POSSIBLE AREAS
ALTERNATIVE 3:
a
b
c
AVEN AV

Alternative 4

- Ideas put forward by public

Got comments?

- Provide comments on comment cards
- Write comments or suggestions on posters
- Email comments to: rlacroix@cob.org

Next steps

- Comments due April 17th.
- Comments provided by April 17th will be incorporated into comment matrix.
- Comment matrix w/ responses provided to public on website by April 22nd.
- One alternative produced that incorporates as many comments as possible.
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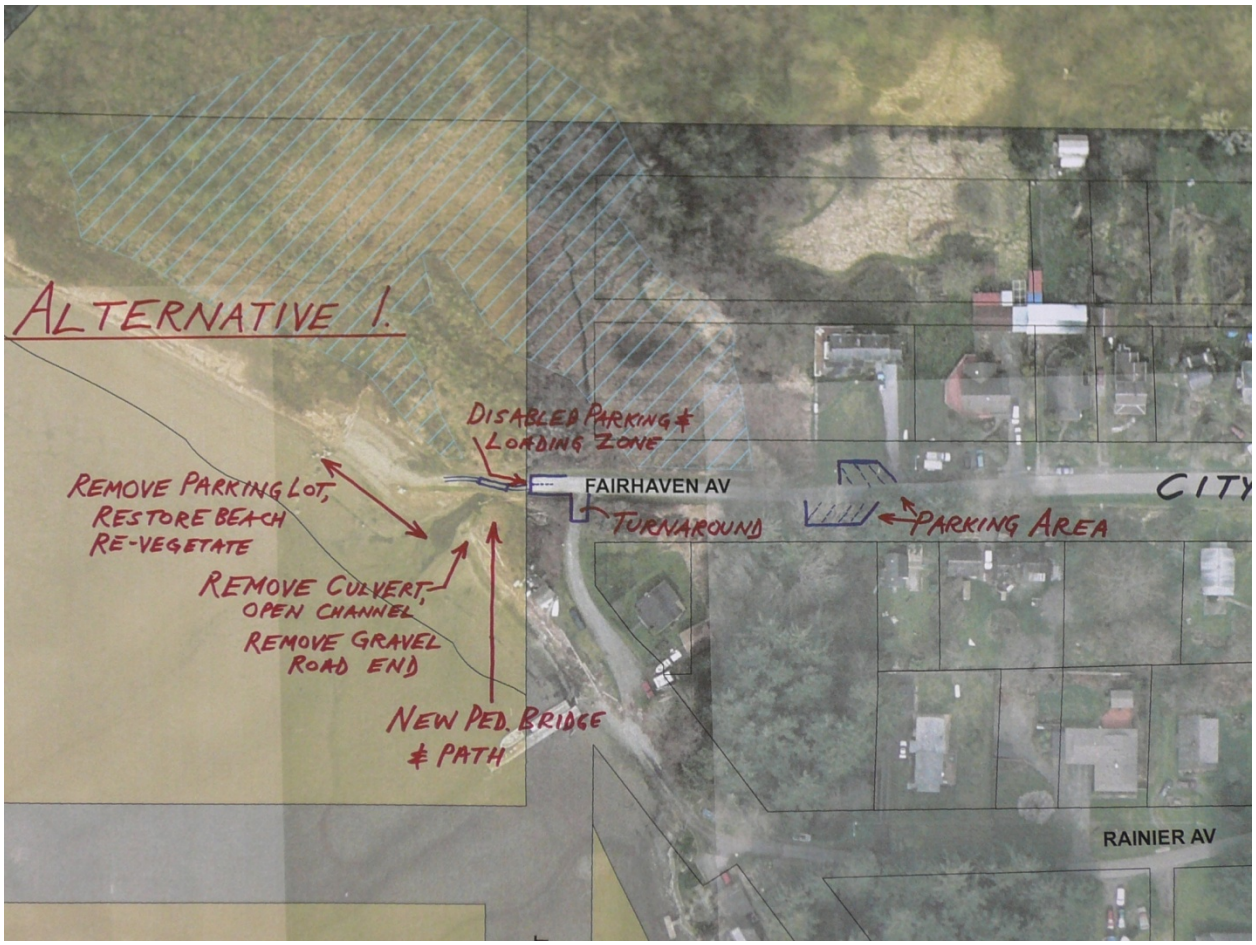
ALTERNATIVE 1.
DISABLED PARKING & LOADING ZONE
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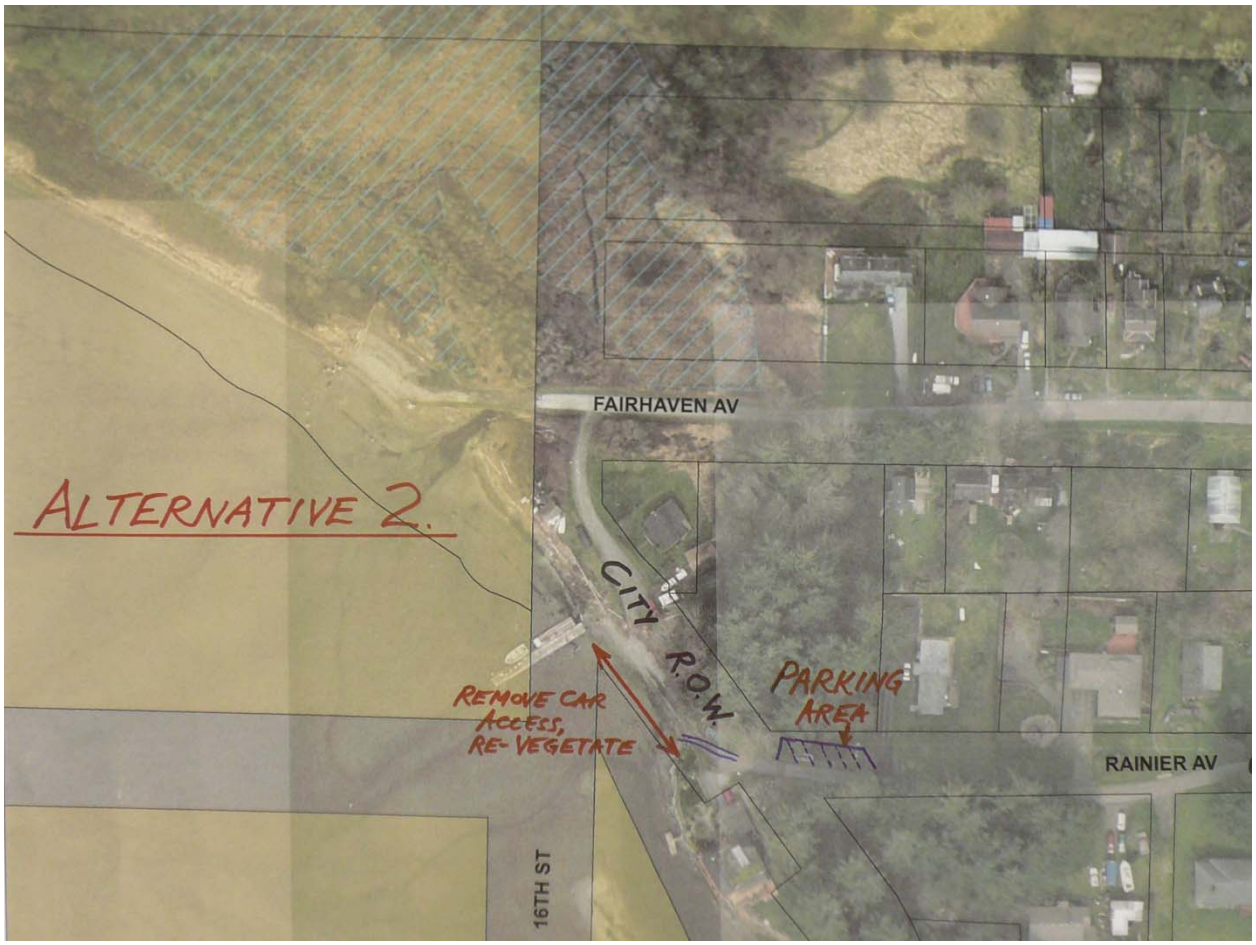
ALTERNATIVE 2.
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CITY R.O.W.
REMOVE CAR ACCESS, RE-VEGETATE
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RAINIER AV
16TH ST

CITY PARKS PARCEL
POSSIBLE AREAS
ALTERNATIVE 3:
a
b
c
21ST ST
CHUCKANUT DRIVE
VEN AV

Chuckanut Village Marsh Restoration Project

Chuckanut Bay is a unique place! It contains a rare marsh with a mixture of fresh and salt water wildlife communities. It provides habitat for heron, eagles, osprey, red-legged frog, red fox, deer, western tanager, kingfisher, chum, coho, steelhead, cutthroat and salamanders, duck, and clams. According to a recent study, Chuckanut Bay pocket estuary provides the highest level of function out of the seven pocket estuaries in Bellingham Bay (NES 2006). All of the nearshore marine shorelines within Bellingham City limits (including Chuckanut Bay) are listed as critical marine habitat for both Puget Sound Chinook (50 CFR 226) and bull trout (50 CFR 17), as well as providing habitat for the recently listed Puget Sound steelhead trout.

However, the health of the ecosystem is in jeopardy. Symptoms of ecosystem stress include declining stocks of salmon, closures of recreational shellfish beds, and degradation and losses of eelgrass beds and other marine habitats. Habitat degradation is considered the leading cause of the decline of salmonid populations in our Water Resource Inventory Area (WRIA 1). Bellingham Bay, including Chuckanut Bay, is currently on the Washington State 303(d) list as At Risk for exceeding acceptable levels of fecal coliform bacteria and pH, as well as a number of other constituents. Chuckanut Bay is currently closed to shellfish harvesting because of high levels of marine biotoxins.

Near-shore habitat, including estuaries associated with small non-natal tributary streams, has emerged in recent years as a priority for restoration and recovery of ESA listed Chinook salmon and bull trout (Beamer et al. 2003; Goetz et al. 2007).

The WRIA 1 Salmon Recovery Plan and Whatcom County Marine Resource Committee (MRC) state that the focus of nearshore restoration projects should be placed on projects that improve the quantity and diversity of habitat in pocket estuaries such as Chuckanut Bay (MRC 2006; Nooksack Natural Resources et al. 2005). As a result of the recent focus on nearshore marine habitats, the Whatcom County Marine Resources Committee commissioned an assessment and prioritization of nearshore restoration opportunities within three target regions of Whatcom County, including Chuckanut Bay. That study listed restoration of hydrologic connectivity at the Chuckanut Village Marsh as the top restoration priority within the target area.

Restoration of the Chuckanut Village Marsh would enhance the area's ability to provide pocket estuary functions including improving water quality and providing rearing, foraging and osmo-regulation for juvenile salmonids migrating into the area from nearby Chuckanut Creek (CGS 2007).

The goals of the project are to:

1) Improve water quality by protecting and preserving existing marine resources
2) Restore impaired areas while enhancing public access
3) Educate the public about the importance of marine water quality while changing behaviors that contribute to water quality impairments.

Chuckanut Village Marsh Public Comments Summary

	Name	Alternative Preferred	Comments	Response:
1	Comments provided during the April 7, 2009 public meeting		Don't want cars far from the shore more accessible to vandalism	Noted. Parking alternatives 1 & 2 are close to shore. Alternative 1 is probably least prone to vandalism.
2			Mary Frost property for sale, city should purchase property	The City is looking at sites to consider for acquisition to improve public access to the shoreline and will forward recommendations to City Council. The City Council directs staff activity related to land acquisitions and would have to revisit its current priorities for South Bellingham. The City will not discuss potential real estate purchases in public, except with the consent of the property owner. If parking were to be developed on any existing or future City land, wet areas and mature forest would be avoided. Clearing mature forest for parking is not desirable or practical. Existing critical areas will limit paving, filling and clearing.
3			Why can't the area just be left alone?	There are numerous studies that speak to the ecological importance of this project. To read the studies go to: http://www.cob.org/services/environment/restoration/chuckanut-village-marsh.aspx.
4			As development continues, more people will be in the area and there will be more use	Agreed.
5			Put in a gate to close the area at night-keep night users out	A gate or other traffic control measure would be essential once the beach area is closed to traffic. A gate would be less necessary at a properly designed, relocated parking area. Closing parking at night will encourage parking on Village streets.
6			Kayakers need parking-can't park ½ mile up the road –elderly kayakers need easy access	Noted. Parking alternatives 1 & 2 are close to shore.
7			Parks design-parking on street 2-3 vehicles and parking in right away 3-5 vehicles	Noted.
8			Stop Chuckanut development	Outside the scope of this project. Chuckanut Ridge development is in the Padden Cr watershed.
9			Use in the Chuckanut Bay area has effected habitat, less wildlife	Noted.
10			Install dog waste bags	With the increasing expense related to demand and use of dog dispenser bags, the Parks Department is promoting dog owner responsibility for providing their own bags and taking off site for disposal.
11			Kayak launching should be at Woodstock	Kayak storage and rentals are being considered at Woodstock but water depth constraints there are the same as at Chuckanut Village. Woodstock is not suited to car-top launching due to steep grades and a significant elevation change between the highway and beach. Preservation concepts being considered for Woodstock call for retaining the site's historic character and limiting parking and road building to the higher part of the site to protect the shoreline and its landscape. Boathouses, sheds, and lockable racks are for boats left at the shore and not regularly launched from vehicles. They are most feasible if the City has a partnership agreement with a supporting organization. A community boatshed for rentals or non-profit club type operation could be provided at Woodstock and at Chuckanut Village.
12			Invasive species removal	Invasive species will be removed from public land that is part of this project.
13			Have you looked at Railroad trestle and filling of Mud Bay?	City has grant funding to examine this issue. The Whatcom Marine Resources Committee has applied for a grant to study circulation and sedimentation issues related to the railroad trestle. The amount is approximately $10,000, and could supplement the City's grants.
14			Concern about septic systems and their effect on Mud Bay	Whatcom County Public Works is providing funding to the County Health Department for increased landowner outreach and compliance with new OSS regulations, with the specific purpose of improving water quality in shellfish growing areas and Lake Whatcom. Health Department staff are currently working in the Drayton Harbor watershed, with Birch Bay and Lake Whatcom next on the list, and Chuckanut Bay to follow shortly thereafter.

15			Doesn't seem like a large benefit to the project-small area	The benefits of the proposed project to open up the lower tide channel and move parking off the beach will be real. The consultant stated that the benefits were not huge—when compared to much larger and much, much more expensive projects—but the benefits in this case do appear to outweigh the costs. The salt marsh and beach adjacent to this semi-enclosed bay are two habitat types areas of the highest concern in the nearshore science community. This is further compounded by the fact that the site is immediately adjacent to the mouth of Chuckanut Creek. This type of nearshore system is referred to as a pocket estuary. Researchers at federal, state, tribal, consultant, and university levels have caught juvenile salmon in relatively high numbers in pocket estuaries in Whatcom and Skagit counties. Puget Sound salmon (genus Oncorhynchus) spawn in freshwater and feed, grow, and mature in marine waters. During their transition from freshwater to saltwater, juvenile salmon occupy nearshore ecosystems in Puget Sound to varying degrees. The period of nearshore residence is critical to the viability, persistence, and abundance of Puget Sound salmon. Naturally produced juvenile Chinook salmon and juvenile chum salmon use the nearshore extensively and have the highest documented use in pocket estuaries like north Chuckanut Bay. Nearshore assessments in the north Puget Sound region have found that large estuaries and small "pocket" estuaries provide very high value nearshore habitat for salmon as well as other species. Published papers and reports on this include those by: Eric Beamer et al. of Skagit System Coop, Casey Rice of NOAA Fisheries, Melissa Brown of Lummi Nation, Scott Redman of Puget Sound Partnership, Dr. Kurt Fresh of WDFW, Dr. Leo Bodensteiner of WWU Dr. Guy Gelfenbaum and others of USGS and Puget Sound Nearshore Partnership/UW. Protection and restoration of pocket estuaries has been a priority Sound-wide. A series of easily accessible nearshore science documents is found at: http://www.pugetsoundnearshore.org/publications.htm , including a white paper on juvenile salmon.
16			Have you looked at replacing bridge on 18th street, improving flood conditions, flushing and moving water out?	We are unaware of any problems at this location.
17			You should be looking at the larger picture	We did. This project ranked the highest in Whatcom County (CGS 2007).
18			There are 3 to 20 cars parking in the area	Noted
19			What is the current parking capacity?	Approximately 8- 10 depending on how closely cars are parked.
20			What is happening to the dock?	The dock is not part of the scope of this project. Having said that- the dock is in poor condition, does contain creosote treated wood beams, and is on public land but provides no benefit to the larger public.
21			Push the road on Mary Frost's property through, 75 feet, to improve access.	The SMP discourages creating new streets and parking on beaches if other options are available due to the high ecological impacts;
22			Have you evaluated what the effect of Chuckanut Ridge Development will be on the area?	The majority of land in the Fairhaven Highlands (AKA Chuckanut Ridge) development drains to the Padden Cr. Watershed and is not anticipated to negatively impact Chuckanut Bay water quality.
23			Look at the overall effect to the salt marsh	Noted
24			Improvement here strengthens improvement for habitat in general	Noted.
25			Wouldn't installing a box culvert be cheaper?	No- a pre-cast box culvert is the most expensive option.
26			Is removing culvert to stop access?	No- removing the culvert is to increase the hydrologic connectivity to the marsh area.
27			Have you talked to WDFW about salmon using the culvert?	Yes- WDFW supports the project.
28			Do you have money to do all alternatives? Is there concern about too much use? Are you limiting 100 parking spaces?	No- there is not enough funding for implementing all alternatives. The goal is to re-locate existing parking (about 8 -10 spaces).
29			Kayak parking needs to be closer, like 50 ft from shore.	Noted.
30	Phil Buly	**Not 3**	Some comments for you regarding the project after attending tonight's public meeting. I do wish that these be added to the matrix of public input. Please let me know if I should submit them in a different manner. Thanks for holding the meeting and taking comments. I'm concerned that you seemed to indicate at the meeting that there is no "maximum" number of parking spaces being considered; that if there was $ that there might be 2 or 3 alternatives utilized. That seems to make the assumption that the area could and should be put to greater use than it is currently. This seems wrong in many ways, for one, not regarding the local community's desire to keep "the status quo". Secondly has there been (or will there be) an investigation to see if additional parking / use is warranted? I spend a lot of time walking the area, and while there are times when more than 8 cars are parked in the area, there are extensive times throughout the year when the area is empty of visitors. It's wasteful to just add parking because you have $. Thirdly, while I understand that parking on the beach is the major concern, it is counter-intuitive to consider increasing nearby parking and accessibility to an environmentally sensitive area. To summarize, I recommend having more thought go into what is the maximum vehicle access desirable here. If it is the case that there is no environmental reason to limit visitors, then I believe that this "maximum usage" needs to be a top priority for planning and community input. Let's not have the end-use determined by happen-chance funding. Alternative 3 in particular (parking at the top of the hill) seems to not work for several reasons. The kayakers (which I am one) would not be willing or in some cases able to tote their kayak down and back up that hill. It would also be prohibitive to other users as well, for they would have a walk that half mile with no shoulder on what can be a busy and narrow street. In addition, the map you showed at the meeting had 6 spaces along 21st St, which is unlikely because there is a significant drop-off there down to a wetland (which you said you would investigate). I'm glad to see that you avoided tearing down the largest trees of that greenway for parking which are still stop-overs for herons and eagles.	The goal is to relocate existing parking (8- 10 spaces). Where that parking is located could be a combination of alternative 1 and 2 or 1 and 3 or 2 and 3 depending on public input. There isn't funding to implement more than 8-10 parking spaces. Alternative 3 was not well supported in the public comments we received and will not be pursued.

31	Larry Horowitz		Thanks for your very informative presentation last night regarding the Chuckanut Village Marsh Restoration. I am interested in the studies you mentioned that highlight the need to preserve and protect the Chuckanut Bay estuary. I believe there are several; but I wrote down only two: the Whatcom County Nearshore Habitat Restoration (CGS 2007) and the NOAA study. Are any of these studies available online? If so, would you please direct me to them. My primary comment about the restoration project being considered is to first determine what impact the proposed Chuckanut Ridge / Fairhaven Highlands development will have on the Chuckanut Bay estuary and the Chuckanut Village saltwater marsh. It would be prudent to ensure that, before any investment is made to restore the marsh, it won't ultimately be lost due to a project that is already underway. My secondary comment relates to the cost benefit of this particular restoration. Most people would likely support this project if they understand the real value behind it. On the other hand, given the costs - both financial and the reduced access resulting from the changes - the community would likely oppose the project unless the benefits clearly outweigh the costs. Last night's presentation was not clear (at least to me) how much benefit this project provides. Thanks again for your time last night and for steering me in the right direction to obtain the studies you referenced. Good luck with the restoration project.	Studies are posted on the City's website at: http://www.cob.org/services/environment/restoration/chuckanut-village-marsh.aspx The majority of land in the Fairhaven Highlands (AKA Chuckanut Ridge) development drains to the Padden Cr. Watershed and is not anticipated to negatively impact Chuckanut Bay water quality. The benefits of the proposed project to open up the lower tide channel and move parking off the beach will be real. The consultant stated that the benefits were not huge—when compared to much larger and much, much more expensive projects—but the benefits in this case do appear to outweigh the costs. The salt marsh and beach adjacent to this semi-enclosed bay are two habitat types areas of the highest concern in the nearshore science community. This is further compounded by the fact that the site is immediately adjacent to the mouth of Chuckanut Creek. This type of nearshore system is referred to as a pocket estuary. Researchers at federal, state, tribal, consultant, and university levels have caught juvenile salmon in relatively high numbers in pocket estuaries in Whatcom and Skagit counties. Puget Sound salmon (genus Oncorhynchus) spawn in freshwater and feed, grow, and mature in marine waters. During their transition from freshwater to saltwater, juvenile salmon occupy nearshore ecosystems in Puget Sound to varying degrees. The period of nearshore residence is critical to the viability, persistence, and abundance of Puget Sound salmon. Naturally produced juvenile Chinook salmon and juvenile chum salmon use the nearshore extensively and have the highest documented use in pocket estuaries like north Chuckanut Bay. Nearshore assessments in the north Puget Sound region have found that large estuaries and small “pocket” estuaries provide very high value nearshore habitat for salmon as well as other species. Published papers and reports on this include those by: Eric Beamer et al. of Skagit System Coop, Casey Rice of NOAA Fisheries, Melissa Brown of Lummi Nation, Scott Redman of Puget Sound Partnership, Dr. Kurt Fresh of WDFW, Dr. Leo Bodensteiner of WWU Dr. Guy Gelfenbaum and others of USGS and Puget Sound Nearshore Partnership/UW. Protection and restoration of pocket estuaries has been a priority Sound-wide. A series of easily accessible nearshore science documents is found at: http://www.pugetsoundnearshore.org/publications.htm , including a white paper on juvenile salmon. One of the main underlying issues is that good shore access in Bellingham is hard to come by. Unfortunately so are tidal wetlands, which can be termed an "endangered shoretype" and supply more ecosystem function goods and services than most other shoretypes in the region. Finding one where feasibility (completed in the previous phase of work) showed that restoration is doable is also hard to come by. The underlying issue of good beach access is a county-wide problem and should be put at the top of the list of ways that the City, County and the MRC can positively serve the public good (in addition to current mandate of protecting resources).
32	Julie Guy	**1 or 2**	Rene, I did not get a chance to talk to you directly last night at the meeting, but I was very interested in the presentation. It seems that the restoration work is relatively simple and will be helpful. The big problem is where does the realigned parking go.? I have already sent in comments supporting parking close by, but after seeing the possibilities, I want to reiterate my support for Fairhaven and Chuckanut Street parking as well as the three spaces on the east side of the stream and footbridge. Since I moved to Bellingham in 2003 I have been impressed with the parks, trails and open spaces already in place, but I have also seen the neglect and lack of concern for all the folks who pay their taxes and greenway levies but get short shrift when it comes to opening up opportunities for them to enjoy our limited shoreline . Boulevard park is overloaded as is the little marine park the port put in. Zanich is also great..... but not enough. Here's where you have a chance to make the beachcombers, families, kayakers and senior walkers very happy with additional access to one of the most beautiful spots in the whole northwest. I look forward to seeing all the comments you are going to post on your website April 22 and to the next public meeting on April 23.	Noted. Alternative #1 was well supported in the public comments and is the preferred alternative.

33	Janet Hosokawa		I strongly disagree with Proposal #3. 1) This greenway is an important "wildlife corridor" that links Chuckanut Mtn. to Chuckanut Bay. Since the city failed to acquire the "missing link" parcel (south of Chuckanut Bay Art Gallery) and this parcel was clear-cut and developed, my family and I have noticed a decrease in coyotes, barred and hoot owls in this greenway corridor (and an explosion in the rabbit population). Nonetheless, this segment of greenway proposed for parking/turnabout is still prime habitat for an incredible diversity of plants and animals, even in its "fragile" condition. It also acts as a noise buffer for the folks just south of it, in Chuckanut Village (CV). 2) At my house on the corner of Arroyo Lane and 21st Street, as soon as the weather turns warm, daylight traffic on Chuckanut Drive is so loud and constant that you can't have a conversation in our backyard (which runs along 21st just off of Chuckanut Dr.) without shouting. Ironically, when the weather turns nice and my family wants to enjoy being outside, the traffic noise makes this very unpleasant. At present, the only relative "quiet" on our property is in the front yard. This "quiet" will be destroyed by the placement of a turnaround/parking lot in the greenway. The prospect of being surrounded by all this traffic noise and auto fumes makes me fume! 3) I WOULD BE MORE CONFIDENT IN YOUR PROJECT IF ENVIRONMENTAL IMPACT CONSIDERATIONS WERE NOT LIMITED TO SHORELINE HEALTH BECAUSE, ULTIMATELY, THE ECOSYSTEMS ARE ALL INTERCONNECTED AND TAMPERING WITH ONE WILL ULTIMATELY IMPACT ANOTHER. "We all live downstream" and that 'stream' pours into Chuckanut Bay. As you and your team identified in the public presentation on 4/7/09, the natural environment in the Chuckanut Village area, is extremely valuable and rare. It is an extremely serious matter to reroute human patterns of use. Short of completely limiting access to the bay to foot traffic and banning parking, I believe any plan to accommodate traffic/parking/dropoffs/turnarounds, demands a comprehensive, thoughtful study about impact to the entire CV natural environment. I believe it is far better to let "deadlines" for planning funds (June?) expire and lose the funding, rather than hurriedly slap together a proposal because the funding is available. Potentially more harm could be done to nature.	Noted. Alternative #3 was not well supported in the public comments and will not be pursued. Based on comments received parking placing the primary parking in the North Chuckanut parking lot was not well supported and will not be pursued as part of this project.
34			4) I favor the proposal that has the least impact on the TOTAL existing natural environment in our neighborhood. My family walks with our kayaks from Arroyo Lane down to the bay using wagon-like devices we created to ease the weight load. Kayakers can put in at the proposed Woodstock Farm waterpark or park in the existing North Chuckanut Lot and devise their own "kayak wheels" to stroll down to Chuckanut Bay. It is unnecessary to park right at water's edge for convenience. I believe it is reasonable to strongly limit beach access to the bay NOW, before added stress is placed on this entire natural area in CV, caused by the influx of people seeking beach access, especially if the Chuckanut Ridge Development goes through. Beside one or two handicapped parking stalls within reasonable distance from the proposed pedestrian footbridge (Plan 1), I think the city should strongly discourage traffic into CV by posting a no-turnaround sign off Chuckanut Drive and 21st St. I think the City right of way in Plan 1 (by the red fire hydrant in front of the last house before the marsh, on the west side of Fairhaven Ave, (that is currently for sale)), is a good place to put in the handicapped parking (only 1 or 2 spaces). It's already a cleared area planted with grass. I like the proposal for a footbridge in Plan 1.In conclusion, I desire a proposal that is far-sighted in defending not only the shoreline but also the unique ecosystems within CV. I support a bold plan to ban parking for bay access and to discourage auto traffic through CV. Those who want to enjoy the bay can park in the existing North Chuckanut Parking Lot and walk a few hundred yards more than I do to get to the bay. (Have you tried walking down Fairhaven Ave ? Depending on the day of the week and time of day (weekdays at 5 pm., sunny weekends) it can be a very harrowing experience jumping into ditches to dodge all the auto traffic.) Thank you for your consideration of my ideas and concerns.	
35	Donna Buehler	**1**	Your proposal for removing vehicles from the beach area is very reasonable. I don't believe utility vehicles need to drive along the shoreline. There are several dead end streets in the Village and garbage and recycling are performed skillfully by the drivers backing down the street and driving forward out of the dead ends. Our recycling driver does this for 3514 Chuckanut Ave. UPS, garbage collectors, and most importantly fire trucks can use the same pattern. I don't believe it is necessary to drive around the block and onto the beach to complete those services.There is the issue of Burtrand Baxter and his friends reaching the dock that is on the shore in front of Baxter's rental property. Could the program you propose help build Baxter a gravel driveway from Fairhaven Avenue to his building which would provide him and his friends access to the building, their boats and the dock? This private driveway on his property would be perpendicular to Fairhaven Avenue. From this they in turn could create a lane perpendicular to the shore and the dock from Baxter's building. This would be entirely on private property instead of along the shore line. This seems fair since the dock is used by several people but is not a truly public facility. I think if Baxter, Ivan Bauter and their friends have easy access to their dock, their objections might be reduced.I think the notion of 'access' needs to be defined. Some take a broad view and contend access includes garbage trucks and UPS.The kayakers are a passionate group. I believe their needs would be easily satisfied by creating four diagonal parking places on each side (a total of eight) of Fairhaven Avenue on the city right of way where they were originally proposed. The issue for the kayakers is limited time parking. Realistically, can this be enforced? Why not remove the time limit for now. If it becomes an issue in the future, then rethink time limits. Eight parking spaces are currently adequate.It is quite sensible to keep vehicles off the beach. Protecting our exquisite estuary seems worth changing a few habits.	Points are well taken. Thanks for the suggestions. Unfortunately there are wetlands that may limit placement of a new driveway.

36	Jan Hadley		I'm writing to give my input on options for this project. 1. I think that utilizing city right-of-way on the Dow property is a good idea. I think it would be an even better idea to have the gravel area continue through from Fairhaven to Rainier. People who want to passively enjoy the Bay from their vehicles (and this is a frequent use for the parking area- "lunch with a view") would benefit from the higher elevation gained by pushing the parking area through, plus it would allow more room for vehicles with trailers (both kayaks and power boats are trailered in) as well as just regular parking for those who want to walk on the beach. Additionally, once the vehicle access to "16th" Street is blocked on the Rainier end of the beach, there would still be a way for vehicles to get through on the lower end of Fairhaven Ave, so traffic flow would be better, in a big loop if you will. It is still important to have trailer access to the water, and this could be done at the south end of the culvert area, with signage stating load/unload only. Parking/turnaround in the Green Space on upper Fairhaven is a bad idea due to wetlands, wildlife, and possible blockage of the fire hydrant serving the neighborhood. 2. IDEALLY, the property at 1517 Fairhaven could be purchased for an interpretive ed ctr and parking,(funded by the plethora of organizations concerned with salmon, saltwater, beach and watershed issues), Burlington Northern would remove the rip-rap restoring flushing action, but these things are probably not yet in the works. I think that we can still meet at Fairhaven Park if we take down the tables and get more chairs out.	The Shoreline Master Program discourages creating new streets on beaches due to the high ecological impacts. The City is looking at sites to consider for acquisition to improve public access to the shoreline and will forward recommendations to City Council. The City Council directs staff activity related to land acquisitions and would have to revisit its current priorities for South Bellingham. The City will not discuss potential real estate purchases in public, except with the consent of the property owner. If parking were to be developed on any existing or future City land, wet areas and mature forest would be avoided. Clearing mature forest for parking is not desirable or practical. Existing critical areas will limit paving, filling and clearing.
37	Greg& Colleen Hoffenbecker	**1**	My wife and I attended your public meeting Tues. night. Thanks for sharing the plan, its goals, and asking for citizen input. As environmental stewards, we support your goal of keeping motor vehicles off the fragile beach ecosystem. As nearby residents (we live 1.5 miles from Mud Bay) and long-time, frequent kayakers (we've enjoyed paddling there since 1994), we ask that you do whatever you can to maintain beach and water access to kayakers, birdwatchers and other nature lovers. As you know, Mud Bay and Chuckanut Bay are unique, not only for the incredible scenery and diversity of wildlife that all of us cherish and would like to protect, but also for the easy accessibility for kayakers. Mud Bay is one of only two places in Bellingham where kayakers can drop their boats off near a beach without competing for parking or with power boaters for launch space on concrete boat ramps. **Requirements for Mud Bay to maintain kayak accessibility:** **two or more drop-off zones** (10-minute parking max) as close to the beach as environmentally possible (100 feet max) **clear level path** from drop-off zone to beach where one could carry or roll a kayak **nearby parking** within easy walking distance to the beach (0.1 mile max) Thinking about the alternatives presented at the meeting, we preferred alternative 1 with the drop-off zone and parking on Fairhaven Ave. One final comment about something that others brought up at the meeting: Fairhaven Highlands. All of the good work you're doing here to help protect Mud Bay and Chuckanut Bay would seem like a complete waste of time and money if the Fairhaven Highlands project goes forward. It's hard to imagine developing 85 acres of land with 739 new housing units just upstream from Mud Bay, not having a major, negative impact on the Mud Bay ecosystem. Is there a way to get the goals of this project included in the EIS for Fairhaven Highlands? Thanks very much for considering our comments. We will continue to watch with interest as the project progresses. P.S. An idea for another project, another time: one way to improve water and shoreline quality would be to remove the public concrete boat ramps in Bellingham and put in eco-friendly kayak drop-off sites. We see oil slicks in the water almost every time we paddle (weekly, year-round). Bellingham is a world-class kayaking destination, it would be nice to encourage this eco-friendly use instead of the water, air and shoreline polluting power boats.	Noted. Alternative #1 was well supported in the public comments and is the preferred alternative.
38	Dirk Fabian	**1or 2**	Thanks for hosting the public meeting on Tuesday. Here is my suggestion regarding the restoration plan.Background: I use the mud bay put-in for kayaking (and crabbing via kayak). I use the site 30-50 times / year. In the summer for crabbing, I usually launch at sunrise to set pots and return in the evening, so I rack up the visits. Typically 2-4 hours for a visit... some night paddles when it's calm out.I favor making beach/water access points at the end of both Fairhaven and Rainier Roads with 4-6 parking gravel spaces each about 100 yds. from the beach. The Fairhaven road side is better for boaters (deeper water access), while Rainier may be better for walkers (though there shouldn't be any restrictions, it's just an access reality). One could then totally remove the beach connector road between Fairhaven and Rainier roads, which floods at high tide anyway washing car waste into the water. That seems like it would provide the maximum environmental benefit.I would like to see a 2 car pull-out unloading area at the Fairhaven road access point. A wood bridge over the creek is enough -- don't make it so you could ever drive across otherwise you'll have a never-ending stream of repairs as the yahoos try to break through whatever barrier is there. Similarly, lockable gates have to be maintained, and I hate getting locked behind them!Finally, to the people who favor the large parking lot at the upper part of the road, they would do well to remember they will be woken up and disturbed more by making people park up closer to their houses... better to put parking down close to the beach. :)Good luck with the project.	Public comments show wide support for parking on Fairhaven Ave. Public comments do not show wide support for parking on Rainier Ave. Loading zone space(s) can be provided at the end of Fairhaven Ave.

39	Mary Matyas		I am a sea kayaker that attended your presentation on April 7 regarding the Chuckanut Village Marsh Restoration Project. It is a favorite launch site for many of us. If things are going to change there, we will need easy access to the water with nearby secure parking so that we can easily carry our boats and gear to and from our vehicles. Parking up on Chuckanut is not acceptable. Carrying boats and gear approximately 50 yards is OK. Now that the site has been brought to everyone's attention, if you make changes, I wonder if more people will be going to the area. If so, more spots with easy access and nearby parking may be needed for those with small boats. Parking where we launch has never been a problem in that neighborhood. Some of our friends have had their vehicles broken into when parked at Wild Cat Cove. Thank you for the opportunity to comment.	The Alternative #1 provides the best "secure" parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave. Chuckanut Ridge/ Fairhaven Highlands development drains into the Padden Cr watershed. It will not likely impact the water quality of Chuckanut Bay.
40	Sue Madsen		Hi all - so sorry I missed the meeting; I was out of town all last week. I'd like to thank everyone for showing up on behalf not just of WAKE but the kayaking community in general. One of the things that makes our city great is that citizens are informed and get involved in government decision making, and that is a good thing. I do, however, have some concerns about characterizing those efforts as trying to "save the Mud Bay put in" from the forces of evil. The reality is that this project is a perfect opportunity to work with the city to both improve access for kayakers as well as address some real environmental concerns in a pro active manner. Those of you who have let me drag you out on those monthly moonlight paddles know that it is one of my favorite put-in's, and not one I'm willing to lose. In the interest of full disclosure, I shared Renee's job at the city with her for several years, and helped write the grant to get funds for restoring Fairhaven Marsh. Given that, I'd like to set WAKE folks straight on a few things. I no longer work for the city, and thus these represent my own personal opinion/understanding of the project. The project did NOT come up in response to neighbors complaints about rowdy kids, but is part of a larger package of a number of activities intended to improve water quality in Chuckanut Bay. For those of you who don't know, the Bay is listed on Ecology's 303(d) list as having impaired water quality. In addition, the marsh has been recognized by both the city and the local Marine Resources Council as one of the largest and most valuable wetland areas within the city limits. Tim Wahl of the Parks Department has been involved from the get go, and thus it is not an attempt by the Department of Public Works to "take away" an access point, but rather a cooperative effort between the Parks Department and Public Works to protect and restore the environment while developing recreational opportunities at Woodstock Farm and elsewhere in the neighborhood. The city's Environmental Resources Department has been well aware of the need to maintain of access for kayakers and other recreationists, and has had those concerns in mind from the get go. I have kayaked the area with Renee (yep, she's one of us) and talked in detail with her and Tim about just that issue on numerous occasions over the last few years. The marsh restoration project and other water quality improvement projects to be implemented in the area are funded by a Centennial Clean Water Fund grant from the Washington Department of Ecology. Those grant funds cannot be used to pay for things like parking and trail development; however, I believe it has been the City's intent all along to make sure those issues are addressed using other funding sources. The best way to ensure that happens is for all of you to continue to participate in the planning process, by attending meetings and providing constructive suggestions and feedback. It sounds like the kayakers who attended the meeting last week did just that. That sort of participation benefits the entire community and is the best way to ensure a win-win situation. I'm proud to be associated with such a great group of civic minded individuals!	Noted. Excellent points.
41	Susan Tommervik	**1 and 2**	Thank you for an informative meeting last week about the Chuckanut Bay Marsh project. I support protecting the Bay. I am also a kayaker. I request that parking for kayakers be located in both proposed spots in Alt. 1 and 2 ---Next to the current house for sale, as well as at the end of Rainier Ave. Parking at the top of the hill would not be an acceptable option, in my opinion. If 12-15 spots were available, that would cover use for busier weekends. 8 spots would be the minimum--anything less would be a decrease in access for kayakers. I also request no time limit on these spots. We have to wait for tidal changes to get back to shore, so limits would be impractical for us. I want to add an additional comment about kayak parking. I request that the new parking areas be completed before the beach parking is closed.	Alternative #1 was well supported in the public comments and is the preferred alternative. Parking on Rainier was not well supported in the public comments. The goal is to re locate existing parking which is 8- 10 spaces.

42	Chad Yunge	**1**	Thank you for the opportunity to comment on the proposed restoration and public access alternatives at Chuckanut Marsh. I attended the meeting last Tuesday but left early with the understanding that the information presented would be available on the City website. I am having trouble finding it but the following comments are based on what I remember from the meeting: Of the proposed alternatives, my preference would be to keep the public access and parking area as near to the existing access as possible. I believe this was Alternative One of your presentation that placed a turnaround and temporary loading area at the existing end of pavement and parking in the City ROW in front of the large house built in the wetland that is currently for sale. I believe this is the best area to relieve use conflicts between the general public and property owners in the area. The City-owned property further to the south feels too private....like you are recreating in someone's backyard. In addition, most beach walkers head north along the existing storm berm and over to the cliff areas at low tide. By accessing the area to the south (Alternative Two) will cause additional foot traffic over the very area you wish to restore. As a paddler, it would be my preference to keep the access as close as possible to the shoreline; however walking a couple hundred yards is fine for hand launching. Please do not consider alternative 3 for the obvious reason that it is not conducive to any existing public use of this shoreline and least consistent with the public access goals of the SMA. I am very interested in the actual restoration elements of the project which were not discussed in the meeting. Any information you can provide in future meetings or on the website would be greatly appreciated. Please include me as a party of record for notification of future meetings and correspondence associated with this project.	The Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave.
43	Eugene Davis		I was in attendance at the meeting last week at the Fairhaven Pavilion in which you presented options to the present situation at Mud Bay.I have lived in Bellingham for over 32 years and have kayaked for over 20 years. The Mud Bay area has always been one of my favorite launch sites. It provides a very safe and beautiful area to paddle in. I do hold a contrary view of the person at the meeting that stated that she has seen a huge decrease in bird and marine life in the area. I have noticed more Herons and migratory birds the last several years instead of less.I have always had a strong believe that we do need to protect and preserve areas for future generations. Over the past years I have volunteered photos plus time and effort to the Whatcom Land trust.As I said at the meeting I believe that the Kayak community wants to be able to continue to use this area and to have secure parking. Since the meeting I have talked with a number of the residents in the Mud Bay area and I believe that majority of the people welcome Kayakers.In my mind the best possible solution would be for Green Ways money to be used to purchase the property that the women has for sale that has water access. I believe that with the land that the city already owns plus the additional land that is available that parking could be provided away from the beach and access to the water would also be available. This would allow for the area in question to be discontinued.I am concerned that there does not seem to be any input or coordination with the City's Park Department and I believe this is a real problem. The general con census that I hear is that City Parks seems to want to provide opportunities for public use of land and that the Public Works wants to take it away.I sincerely hope that this situation can be resolved in way that benefits everyone.	The City is looking at sites to consider for acquisition to improve public access to the shoreline and will forward recommendations to City Council. The City Council directs staff activity related to land acquisitions and would have to revisit its current priorities for South Bellingham. The City will not discuss potential real estate purchases in public, except with the consent of the property owner. If parking were to be developed on any existing or future City land, wet areas and mature forest would be avoided. Clearing mature forest for parking is not desirable or practical. Existing critical areas will limit paving, filling and clearing. This project is a cooperative effort between the Parks and Public Works Departments to protect and restore the City's environmental assets while enhancing public access and recreational opportunities. Tim Wahl has been involved from the beginning.
44	Dan Barrett	**1,2,4**	I attended the meeting on April 7 to discuss the options for access to Mud Bay. This is a valuable launching spot for kayakers, particularly inexperienced ones for access to Chuckanut Bay. Of the 4 options (3 official and one from Tom Barrett) Options 1 (Fairhaven Ave parking), 2 (Rainier Ave parking), and 4 (parking along the access road) seem like they would work fine for kayakers. Option 3, parking at the top of the road would kill this area as a kayak launch site. I know there are other types of boats that launch here, option 1 seems like it might make life more difficult for those people. I haven't had a chance to drive down and look at options 2 and 4 myself yet, but will do so before the next meeting on this subject to see if one of them appeals more than the others. I look forward to finding the solution that provides the right balance of access and preservation of this area. please add to comment matrix.	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternatives 2 and 3 were not well supported in the public comments and will not be pursued. Alternative 4 (proposed by Tom Barrett) is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new parking on beaches if other options are available due to the high ecological impacts.
45	Keith Kemplin	**1, 2**	1. I like option 1 – parking for 6-8 on Fairhaven Avenue with a footbridge to the beach and a turnaround at the end of Fairhaven or at the parking lot. 2. Additional parking on Rainier would also be good. 3. I'm not in favor of option 3- parking up by the Gallery because that would just be a lot more traffic and be impractical for kayaking. 4. I'm not in favor of any parking on or above the beach between Fairhaven and Rainier-it would detract from the plan. 5. I am in favor of cutting off car access as much as possible between Fairhaven and Rainier-at the very least a barrier on the Fairhaven avenue end. A clearly marked public footpath between Fairhaven and Rainier would be great- partly to make it clear that this is public land. 6. Please minimize the time during construction that the beach is not accessible for kayaking. 7. I would appreciate minimal signage and no interpretive signs. 8. A lot of kayakers slide their boats off the back end of their cars so it would be nice to have room to pull a boat off without blocking the street. 9. I will probably end up rolling my boat on a cart from car to mean high water so a surface that can support 70 pounds on two lawnmower wheels would be good. 10. hope the plan includes revegetation from the current parking area to Rainier Ave. I've been using this as my main local kayak access for about 25 years. I applaud the goal of restoring the beach, estuary and tidelands.	1) Alternative #1 was well supported in the public comments and is the preferred alternative; 2 & 3) Alternatives # 2 and # 3 were not well supported in the public comments and will not be pursued; 4 &5) The SMP discourages creating new streets and parking on beaches if other options are available due to the high ecological impacts; 6) we will try; 7) there may be some signs needed; 8) Loading Zone parking spaces can be provided at the end of Fairhaven Ave.; 9) noted; 10) the plan does include extensive revegetation.

46	Julianna Guy		When Greenways levies were passed the public expected and voted for more access to parks, trails and open spaces. The proposal to fix the culvert and change the parking at the Salt Marsh seems to reduce the convenient access by the public to the bay and scenic shoreline. The proposed changes are understandable but the reduction of close parking is not. Bellingham's shoreline parks are fully utilized at the present time and it is clear that more shoreline access is in the best interests of the growing population. I urge you to pen up all parking available close to the shore on Chuck nut Street, just off Fairhaven. Thank you for your consideration.	Alternative #1 provides the closest allowable parking and was well supported in the public comments. This is the preferred alternative; The SMP discourages creating new streets and parking on beaches if other options are available due to the high ecological impacts;
47	Sid Williams		Consider paid parking with occasional reinforcement --handicap c permit - No Pay --to help defray costs	Noted.
48	John Groves		Consider parks plan proposed by Bellingham Parks.	Alternative 4 (proposed by Tom Barrett) is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new parking and streets on beaches if other options are available due to the high ecological impacts.
49	John Blethen		Need replacement parking on Fairhaven. Acquire 2 parcels to the south. One is about to go on the market. Acquire marsh from property for sale on north side of Fairhaven. Break it off from property--assuming Green ways money.	The City is looking at sites to consider for acquisition to improve public access to the shoreline and will forward recommendations to City Council. The City Council directs staff activity related to land acquisitions and would have to revisit its current priorities for South Bellingham. The City will not discuss potential real estate purchases in public, except with the consent of the property owner. If parking were to be developed on any existing or future City land, wet areas and mature forest would be avoided. Clearing mature forest for parking is not desirable or practical. Existing critical areas will limit paving, filling and clearing. The privately-owned part of the Village Marsh north of Fairhaven Avenue already has a conservation easement which cannot be built on by a public or private party. Expenditure of city funds would be better spent acquiring other properties.
50	John Calvin		Kayaker 11 years. Opposed to removing public access in the name of estuary restoration. Multiple use of public lands must take into account the established public precedent. Legal rights to public access have long been part of Mud Bay. Please consider Tom Barrett's comments of Paul Leuthold of Parks and Recreation. Multiple Use and Public Access	This project does NOT remove public access. The goal is to protect the marsh by relocating parking and removing the culvert. Alternative 4 (proposed by Tom Barrett) is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new parking and streets on beaches if other options are available due to the high ecological impacts.
51	Kathleen Murphy		I drive to use the put in for kayaks at Mud Bay and hope that whatever alternatives are chosen will include 1) launch for human powered boars 2) parking close to the launch site (not walking all the way back to Chuckanut Drive) 3) balance between human use and habitat restoration 4) consideration of very long term impact of the project.	The Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave. Alternative #3 was not well supported in the public comments and will not be pursued. Based on comments received parking placing the primary parking in the North Chuckanut parking lot was not well supported and will not be pursued as part of this project.
52	Dan Moos	**2**	Consider Parks plan for parking near beach. #2 alternative is preferred to parking a long distance away.	Alternative 4 (proposed by Tom Barrett) is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new parking and streets on beaches if other options are available due to the high ecological impacts.
53	Dave Church		This is a water town and this is in my opinion our most beautiful water access. The natural "sculptures" eroded in the Chuckanut Tare are extraordinary and best enjoyed from a canoe or kayak. Thus easy vehicle beach access is of great importance. I'm 72--a long haul from my roof rack would eliminate the wonder bay access for me. I strongly support the concept of CV Marsh Restoration provided it includes easy and respectful access to the beach for both foot and human powered boats. I am a kayaker Alternative evaluation must include discussion of probable drainage basin changes that could negate the restoration value of this particular project.	The Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave. The majority of land in the Fairhaven Highlands (AKA Chuckanut Ridge) development drains to the Padden Cr. Watershed and is not anticipated to negatively impact Chuckanut Bay water quality.
54	Christopher Grannis	**1 or 2**	Thanks for your good work. I support the best environmental alternative. If parking on the right of ways of Fairhaven and Rainier is not to negative from an environmental point of view I would support that.I am reminded of the people from the city who encourage planting trees but say nothing about the imm?? destruction of trees at Chuckanut Ridge. I suggest you let the Parks Director know there is not much point of trying to save a beach that will be overwhelmed and degraded by the high density development of Chuckanut Ridge.	The most environmentally sensitive Alternative is #1. Alternative #1 also provides the closest allowable parking and was well supported in the public comments. This is the preferred alternative. The majority of land in the Fairhaven Highlands (AKA Chuckanut Ridge) development drains to the Padden Cr. Watershed and is not anticipated to negatively impact Chuckanut Bay water quality.

55	Anonymous		Please keep easy access for families, children and seniors. Put in a box culvert, add a little gravel and save the rest of the $.	The project will provide a sturdy foot bridge. It will be wide enough for strollers, kayaks, and wheelchairs. Installing a box culvert is the most expensive option with the least amount of ecological benefit.
56	Nadine Kaaland		Consider how important it is to plan for protecting access for small boats and people as well as long term protection of the habitat. Moving parking too far away increases vandals to destroy cars and gear. 3 parking at end of street and then several more up the street as proposed by City Park Director.	Alternative #1 provides the best "secure" parking. It also provides the closest allowable parking and was well supported in the public comments. This is the preferred alternative; The SMP discourages creating new streets and parking on beaches if other options are available due to the high ecological impacts; Loading Zone parking spaces can be provided at the end of Fairhaven Ave.
57	Peter Frye	**do nothing**	Mud Bay, the beach and rocks around Mud Bay and the end of Fairhaven Ave. are one of the few areas in the city unchanged in time. It is a relaxed natural area where average people can enjoy nature. Me and my family bike to Mud Bay and explore or launch our canoe on a regular basis. The beach at the end of Fairhaven Ave. is an essential launch area for canoes, kayaks, and small boats on trailers. I am adamantly opposed to any change that would restrict public access in any way at any hour, or make it more difficult to launch a small boat including small boats on trailers. The current parking is fine as is and does not need to be changed. Parking off of Chuckanut Drive is unacceptable! Thank you!	The project does NOT take away public access. Alternative #3 was not well supported in the public comments and will not be pursued. Based on comments received parking placing the primary parking in the North Chuckanut parking lot was not well supported and will not be pursued as part of this project. The current boat launch is meant to be a hand launch. If it was never legally permitted as a trailer boat launch then it is not required to protect that use under the SMP.
58	Eugene Davis		Kayakers have used this area for many years. We need parking. This is city property and not just for the locals that are fortunate that live there!	Noted.
59	Steve Robey	**Do nothing**	It would be best to do nothing. This project is not needed. Not enough parking provided and parking too far from beach. Use the money to fill the pot holes in the road.Thanks.	There are numerous studies that speak to the ecological importance of this project. To read the studies go to: http://www.cob.org/services/environment/restoration/chuckanut-village-marsh.aspx. The funds cannot be used to fill pot holes. Funding is dedicated to water quality and marine nearshore restoration.
60	Donna Buehler		1) All parks cannot meet all needs. You have to make a choice. Will they be habitat and nature preserve or human recreation area. It is really too small for both. 2) Woodstock is owned by city and has an old boat house on the inside of Mud Bay. The water here is deeper for launching any kayak. 3) The end of Rainier Street is too shallow for kayak launching. The cars might be closer but one would have to carry her kayak further.	Kayak storage and rentals are being considered at Woodstock but water depth constraints there are the same as at Chuckanut Village. Woodstock is not suited to car-top launching due to steep grades and a significant elevation change between the highway and beach. Preservation concepts being considered for Woodstock call for retaining the site's historic character and limiting parking and road building to the higher part of the site to protect the shoreline and its landscape. Boathouses, sheds, and lockable racks are for boats left at the shore and not regularly launched from vehicles. They are most feasible if the City has a partnership agreement with a supporting organization. A community boatshed for rentals or non-profit club type operation could be provided at Woodstock and at Chuckanut Village.
61	Kenni Merrit	**1**	I am writing to provide input about parking at Mud Bay. First and foremost, it is very important that, before the current beach parking is closed, there be adequate replacement parking ready and available for use in close proximity to the beach. The public needs convenient access to the beach, including access for families, seniors, kayakers/canoers, dog walkers etc. If City Council decides that it has to close the current beach parking, I support replacement parking on the City's ROW on both sides of Fairhaven Avenue about 100 feet uphill from the current parking, with three to four spaces on each side of Fairhaven Ave., together with an additional three or four parking spots at the end of Fairhaven Ave. where it dead ends at the beach.	The project will provide a sturdy foot bridge. It will be wide enough for strollers, kayaks, and wheelchairs. Alternative #1 was well supported in the public comments and is the preferred alternative
62	Wayne Gerner & Laura Mackenzie	**1**	We are long time residents of Chuckanut Village (55 years for Wayne, 15 years for me). Wayne is disabled and uses a wheelchair. He is use to coming to the beach with our dog via the current approach to the existing parking lot. I walk here 2-3 times a day with our dog and I also do litter patrol. If this parking lot must be closed, then please consider the following: 1. Provide an ADA/Handicapped parking space. 2. Provide ADA access to the beach over the culvert (wheelchairs, walkers, canes, strollers, etc.) 3. Provide parking for loading/unloading as close to the beach as possible for kayakers. 4. Provide parking on City right of way on north side of Fairhaven Avenue (less invasive, likely to be less expensive). If parking is sited in front of the house that's for sale there, then provide the owners with a natural buffer or privacy screen (tall hedge?) to block this parking lot in their front yard. 5. Avoid putting parking opposite here (Dow property side) as that would be more expensive, invasive and disruptive to the wetlands, trees and local wildlife. 6. Keep the existing garbage can by the beach and add another one at the new parking area. 7. Provide a dispenser of bags for picking up dog waste (a la North Shore Trail). 8. Avoid the idea of a parking area and turnaround at 21st and Fairhaven Ave. and parking on Rainer Ave. These ideas make us cringe because they are poorly conceived and will do more harm than good to our neighborhood. Questions: 1. If there is a permanent gate installed to block car access, how will someone in a WC (or using a walker, etc.) be able to get through to the beach? 2. These proposed changes do not take into consideration that local Chuckanut Village crabbers launch their boats from this beach during crabbing season. They do so a few nights a week, tides permitting. How can the parking be designed to accommodate them as well? 3. Where would a car with a trailer and boat turn around if they do come down all the way and find the parking spaces are full? 4. If boaters are not to be accommodated, then signage at the entrance to the Village will be paramount to discourage this and redirect them to where they can go. We look forward to the next meeting to see and hear your summary of everyone's comments and ideas. Thank you.	1) Handicap parking will be available at the end of Fairhaven Ave.; 2) Pedestrian beach access will be maintained via a sturdy wooden footbridge that will provide access for strollers, wheelchairs, boat carts, and double kayaks; 3 &4) Alternative #1 provides the closest allowable parking and was well supported in the public comments. This is the preferred alternative; 5) There isn't enough room to put all parking on the North side of Fairhaven Ave. To accommodate the 8 -10 spaces we will need to have parking on both sides of Fairhaven Ave. Any parking installed will be the minimum impact to the environment; 6) Parks maintains garbage cans wherever there is public parking at an improved shoreline site, on an as-needed basis and provided that the area can be regularly visited by operations staff; 7) With the increasing expense related to demand and use of dog dispenser bags, the Parks Department is promoting dog owner responsibility for providing their own bags and taking off site for disposal; 8) Alternative #3 was not well supported in the public comments and will not be pursued. Based on comments received parking placing the primary parking in the North Chuckanut parking lot was not well supported and will not be pursued as part of this project.

63	Tom Barrett	**1**	I'm writing to provide input on the Chuckanut Village Marsh Restoration Project. I first question the cost/benefit aspects of this project. Your consultant stated during the April 7 meeting that closing the beach parking would have only minimal impact on the marsh. This project has caused quite an uproar in the community, so I question whether it is worth the considerable staff time, hard costs and community angst. Bellingham residents place very high value on shoreline access. This local taxpayer financed beach area is visited by residents from all parts of the City, not just the locals who are so fortunate to live there. With respect to parking, we must provide reasonable parking access for seniors, families, bird watchers, beach strollers, kayakers and others who have traditionally used this beach area. The proposed parking at the North Chuckanut Mountain Trailhead will not work nor will parking at the City-owned site near Chuckanut Drive. I would like to see parking on city owned rights of ways so that no additional funding would be required, other than minimal amounts to gravel and mark the parking spaces. People have traditionally parked on Fairhaven Avenue near the end of the paved portion. Parking should be available on both sides of Fairhaven Avenue. Some parking at the end of Fairhaven Avenue near the proposed foot bridge would be important too. There was discussion of parking on the City right of way in the north part Chuckanut Street, where there is an illegal structure and high ground. Parking could easily be done on the east part of Chuckanut Street also, in front of the house. Parking on Rainier Avenue should be a last resort. It is away from the beach and there would be concerns about vandalism. Before existing parking is blocked, replacement parking must be made available and usable.	The consultant did not intend to imply that benefit would be minimal; instead the intent was to convey that the benefit would not be huge on a regional level, but would be very beneficial to the local system (north Chuckanut/Mud Bay), which is an important area for salmon. In terms of benefit for cost, the proposed project is actually a very low cost one in terms of urban and semi-urban salmon habitat restoration/enhancement, which can often run into millions of dollars. Taking steps to protect this area now will cost under $90K. Letting the area degrade and then trying to restore it after is has been degraded will cost hundreds of thousands. The project will provide a sturdy foot bridge. It will be wide enough for strollers, kayaks, and wheelchairs. Alternative #1 was well supported in the public comments and is the preferred alternative. Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave. Alternative #3 was not well supported in the public comments and will not be pursued. Alternative 4 (proposed by you) is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new parking and streets on beaches if other options are available due to the high ecological impacts.
64	Sarah Collins	**1**	I am in favor of alternative 1 of the Chuckanut Village Marsh restoration project. Even though this alternative is considered not an option the because of the public access conflict, I really think it should be considered. With the removal of the parking lot, the amount of impervious surfaces and runoff will be lessened near the area adjacent to the beach. With the restoration of the beach, and the establishment of native vegetation, plant and animal diversity will increase. The removal of the culvert may improve fish access to the incoming streams. I think that the removal of the parking lot will not cause unintended traffic on the newly restored beach, as long as a new pedestrian bridge and path is built on the other side of the channel. Thank you for your consideration,	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave.
65	Bernie Walz		Thank you for hosting the community meeting on this subject. I sincerely hope that the public comment will be taking seriously. I think $100,000 is an excessive amount of money to spend on the shoreline restoration of Chuckanut Bay. I believe an excellent program, with much less funding would accomplish the same goal. It seems an adequate job of restoration could be accomplished with the following: 1) Blocking vehicle access as shown in red on the attachment.2) Providing vehicle parking as shown in orange on the attachment.3) Rebuilding a pedestrian bridge near end of Fairhaven Ave.4) Allow alternative driveway for house outlined in yellow on attachment (Address might 1602).5) Remove all non-natural debris from beach.6) Provide trash container at site & removal of trash as needed.7) Put up signs of do's & don'ts.8) Don't bother with wild black berries. The birds will just seed them again, unless someone is diligent about constant pulling unwanted plants.9) Let nature take its course. The salt water vegetation will fill in the bare spots in short order, if vehicle and foot traffic is controlled. I honesty believe, the above could accomplish restoration of said shoreline for a lot less than $100,000.This is not free money. It is public funds. Please be a good steward of those funds.	Attachment not found.

66	Steven and Sylvia Haffner		My husband and I live in Chuckanut Village. Although we were not available to sign the petition to protect access to Chuckanut Bay, we are in agreement with it. That being said, if the money is burning a hole in your pocket, please take the following into consideration. This is a small, but long-standing, neighborhood. Many of the families living here have been here for generations. Steve grew up in this neighborhood, just a block from where we now live. We want to preserve our neighborhood, while sharing its bounty with others. Take into consideration not only the needs of the visitors, but the needs of the residents and try to minimize the overall impact. We are particularly concerned about safety and traffic flow. Any changes made should consider foot traffic, including children. Any parking area should have sufficient room and visibility for safe entry and exit. Thank you for your time and your consideration of our concerns.	Noted. Any relocated parking will meet City of Bellingham parking standards
67	Laura Leigh Brakke	**1**	I am writing in support of Alternative 1 for restoration of the Chuckanut Village Marsh. We need to protect and preserve and in this case restore, natural habitats. The importance of maintaining high quality marine environments are so essential to this area. Whatcom county is one of the few places in the world that once was home to all 5 Pacific salmon and we must work hard to keep what we have left. Please support Alternative 1.	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave.
68	Wendy Steffensen North Sound Baykeeper RE Sources for Sustainable Communities	**1**	Please accept these comments on the Chuckanut Marsh Restoration project from the North Sound Baykeeper program at RE Sources for Sustainable Communities. RE Sources is a nonprofit community sustainability organization, based in Bellingham and founded in 1982. Our mission is to promote sustainable communities through recycling, education, advocacy, and conservation of natural resources. We implement a variety of programs, including The North Sound Baykeeper. The goals of the Baykeeper are to protect and restore marine waters and nearshore habitats and reduce the amount and toxicity of pollution entering our waterways. The Baykeeper represents over 500 individuals in the community. RE Sources and the North Sound Baykeeper are very supportive of Alternative 1 for the Chuckanut Village Marsh Restoration project. We find that Alternative 1 speaks directly to the goals of the Baykeeper program:· Restoration of marsh and fish habitat [through culvert removal]· Prevention of pollution from contaminated runoff [through revegetation and relocation of parking]. It is important that we act to protect and restore habitat at Chuckanut Marsh as it is one of the few areas where the ecosystem is relatively intact and healthy and simple actions can provide great benefit. Chuckanut Marsh contains our best pocket estuary, providing valuable rearing habitat to salmonids and a high functioning Class 1 wetland. The only concern I have regarding the project is one of process. I am unsure that the larger public had sufficient notice to provide comment. I learned of the comment period deadline only because I sit on the Marine Resources Committee and was alerted via e-mail on April 16! While the Bellingham Herald posted notice of the April 7 meeting they did not post that there was a comment period and deadline. As shown in the Whatcom County Marine Resources Committee prioritization study, restoration of the Chuckanut Bay backshore wetland was the highest prioritized habitat action in a study of potential actions to restore habitat in Chuckanut Bay, Birch Bay and Point Roberts. As such, I believe that the actions at Chuckanut Bay would be of interest to those in the wider Whatcom County community and would have far-ranging support from those who wish to see healthy salmon populations and restored habitat. Thank you for your efforts to protect and improve this valuable habitat.	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave.

69	John Rybczyk	**1 or 2**	I attended the April 7th public meeting regarding the proposed marsh and shoreline restoration project in Mud Bay and I thank you for the opportunity to both review and comment on the restoration proposals. By profession I am an estuarine ecologist. I am also a kayaker, open-water rower, and recreational crabber. I frequently park and launch from the Mud Bay parking lot. Personally, and selfishly, I will be sorry to see the beach parking go. It provides convenient and easy access to a special and unique ecosystem in Whatcom County. However, I also realize that as the city's population grows, more people, not less, will be visiting Mud Bay, and an as-of-now marginal parking situation will only get worse.Furthermore, I am familiar with Jim Johannessen's shoreline restoration work. He is rightly recognized as an expert in this regard and I have every confidence that we would all be pleased with the results (i.e. benefits to the ecosystem) if he and his firm were to direct the restoration efforts. That being said, it is also true that safe and public launching sites for human powered watercraft are at a premium in Whatcom County. The protected waters and shores of Mud Bay provide the safest and closest access to world-class sea kayaking in Chuckanut Bay. It is also a favored launching site during the crabbing season for those crabbing from kayaks, canoes and other light craft. It is a peaceful, quiet, and wonderful place for low-impact, local boaters to enjoy the water and escape the mayhem of the motorboat launches in the vicinity. Therefore, I believe that any restoration alternative should include close parking and easy access for boaters and beach-goers in general. A few in attendance at the April 7th meeting suggested that a reasonable alternative would be to use the North Chuckanut Trailhead parking lot for beach access. First, you would be hard pressed to find any boaters who would feel comfortable leaving their boats, paddles, lifejackets, crab traps, and other expensive gear, unattended on the beach while they hiked a mile up the hill to retrieve their car. Neither would any mother in her right mind even think about dropping her toddlers off at the beach while she drove back up to Chuckanut Drive to park the car. Second, this alternative violates the spirit, if not the intent, of the Shoreline Management Act, which is to "protect the resources and ecology of the shoreline; increase public access to publicly owned shoreline areas; and increase recreational opportunities for the public in the shoreline area." Third, I suspect that those who favor this alternative are more interested in restricting access, for whatever reason, than they are in providing real and reasonable solutions. Therefore, the North Chuckanut Trailhead Parking "solution", or any plan that includes parking spots located hundreds of yards from the launch site, is an untenable and unreasonable alternative that, I hope, receives the attention and consideration that it deserves, which is none.	
70	John Rybczyk		Others at the meeting argued that there were much greater threats to the Mud Bay ecosystem, such as the Chuckanut Ridge development, thus all money and efforts should go towards preventing those impacts. While it is certainly true that there are, and will be, other and potentially greater threats, we must not forgo the present opportunity to restore and enhance the Mud Bay wetlands and shorelines merely because greater threats loom. To do so would be akin to refusing a flu shot because one believes that all medical efforts and funds should go toward cancer research. Much like a healthy human body can overcome the annual onslaught of the flu virus, so a healthy ecosystem is resilient to environmental impacts. For example, we can promote ecosystem resiliency by enhancing the marsh's connectivity with the bay (by removing the restrictive culvert now in place). Increased tidal energy subsidizes the marsh by bringing in nutrient-rich, oxygenated water and flushing out natural toxins (sulfides) that accumulate in the sediments. In other words, restoration gives these systems, and the organisms that thrive in them, a fighting chance in the face of other impacts. We do what we can, when we can. So, in my perfect world, only me and a few of my closest friends would know about the Mud Bay access site, we'd have minimal impact, bother no one, park on the beach, our cars would leak no oils or other fluid, and the residents of Chuckanut Village would bring me a cold beer after a long row. Since that is an unlikely scenario, I favor an alternative that includes restoration and enhancement, easy access, and close parking; alternative 1 or 2 perhaps. The parking is too far away for alternative 3 to be viable. Alternative 1 appears to have the least impact on existing dwellings. I caution that any bridge built over where the culvert is now be wide and sturdy enough for two people carrying a double kayak or for a person using a boat cart. This is an important point regarding access; if we can't park on the beach, many of us will have to use a cart to roll our boat to the shoreline. Any bridge will have to be big enough to allow for the passage of such a cart. I also ask that you consider providing some access, somewhere on the Bay, while the restoration work is in progress. Don't just fence off the entire area for the project duration. Thank you again for this opportunity to comment.	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternative #1 provides the parking closest to existing parking. Loading Zone parking spaces can be provided at the end of Fairhaven Ave. Alternative #3 was not well supported in the public comments and will not be pursued. Based on comments received parking placing the primary parking in the North Chuckanut parking lot was not well supported and will not be pursued as part of this project. The majority of land in the Fairhaven Highlands (AKA Chuckanut Ridge) development drains to the Padden Cr. Watershed and is not anticipated to negatively impact Chuckanut Bay water quality. The project will provide a sturdy foot bridge. It will be wide enough for strollers, double kayaks, boat carts and wheelchairs.

71	Judy and Philip Shantz		After attending the initial meeting on this project April 7, and since talking with other residents, we feel that there does not seem to have been any serious analysis done of what the actual problems are at the beach parking strip in Chuckanut Village. The kayakers who don't live in the village do come down, park their cars and unload their kayaks – but almost exclusively on warm, sunny weekends with very few users during the week. As village residents for almost 30 years, we have never seen any of them "trash" the beach. There are also other incidental users – a few small boaters taking crab pots out – but that seems to be minimal. Some people come down, park and walk the beach. There is little degradation being caused by these users. The real abusers are those who come to party, hide out, drink, start fires and leave their trash. They back their vehicles into the shrubbery on the edge of the marsh attempting to avoid detection, use the marsh as their toilet, and have been known to stay for days. The mess they leave is usually cleaned up by residents. Within the past week we have heard the rumor that the folks from WAKE and other kayakers believe that the village residents "hate" them. We don't know where that is coming from. We have lived in the village for 29 years and have never heard anyone speak negatively towards them. It may only be the opinion of a few villagers or residents of Briza above – though some village residents directly adjacent to the bay might "hate" the few abusers who park on their lawns or block their driveways. We ourselves kayak in the bay and the fellow paddlers we meet are all looking for non-polluting and serene recreation opportunities and are definitely not inclined to damage the environment they want to paddle in. The issue doesn't need to be an us versus them, a villagers versus boaters issue. There needs to be a reasoned compromise – but that dialogue might be better started between the residents and the non-resident users – rather than having the City come up with their own plans that don't fill any of the needs. One suggestion we could work with would be to gate the roadway from dusk to dawn. There are enough people in Chuckanut Village with a commitment to the environment that we could form a committee and share the responsibility of locking and unlocking the gate each day. (We have thought this for years and would volunteer to be first). That being said, there should definitely not be any expectation that the City provide ample parking for every person who wants to come down and kayak. Just as there is a boat launch at Lake Padden Park and boaters must first launch their boats and then remove their vehicles up the hill to a lot near the road, the expectation should be no different for this tiny, fragile beach.	A gate or other traffic control measure would be essential once the beach area is closed to traffic. A gate would be less necessary at a properly designed, relocated parking area. Closing parking at night will encourage parking on Village streets. The City is looking at sites to consider for acquisition to improve public access to the shoreline and will forward recommendations to City Council. The City Council directs staff activity related to land acquisitions and would have to revisit its current priorities for South Bellingham. The City will not discuss potential real estate purchases in public, except with the consent of the property owner. If parking were to be developed on any existing or future City land, wet areas and mature forest would be avoided. Clearing mature forest for parking is not desirable or practical. Existing critical areas will limit paving, filling and clearing. With the increasing expense related to demand and use of dog dispenser bags, the Parks Department is promoting dog owner responsibility for providing their own bags and taking off site for disposal. Parks maintains garbage cans wherever there is public parking at an improved shoreline site, on an as-needed basis and provided that the area can be regularly visited by operations staff. These amenities could potentially provide for increased public access. With the kayak cart racks there should be a workable operating agreement with a partner, club or a community group for instance.
72	Judy and Philip Shantz		Likewise, although it is true that the City does own a great deal of right-of-way in Chuckanut Village that has been grassed over by residents – it is antithetical to the whole idea of "restoration" that those areas should be converted to parking spaces for the convenience of recreationists who don't want to walk down the hill after parking their cars. All of us who use the beaches and trails throughout Bellingham and park our cars in the lots provided run some risk of damage or vandalism. Those are calculated risks we accept in order to enjoy the many recreational opportunities available in our area.In addition, the idea that the City should spend Greenways money to buy up the large timbered lot adjacent to the beach at the bottom of Fairhaven Avenue (where our local geese breed each year) and turn it into parking is nothing short of destruction of the marshland, not restoration. A piece of property does come to mind that might serve; the small lot at 1910 Fairhaven Avenue. It has a tiny house that cannot be expanded and is virtually unsaleable as is. If the City has funds to buy property, that could become a small shelter – perhaps even an interpretive center with a screened off portable toilet and three or four diagonal parking spaces across the front.But in the final analysis, there needs to be some sense of scale. The village and the beach can only support a little traffic and parking before large-scale degradation begins to happen.Our preferences would be:• Leave the culvert as it is to drain the marsh and so the normal ebb and flow of tidal water can continue into the salt marsh across the current road.• Gate the road approximately where the pavement currently ends, closed from dusk to dawn• Provide, on the beach itself, two or three parking spaces at most with one handicap space and enough room to turn around and launch a boat• Provide a rack for people to lock up bicycles and kayak carts• *Provide a couple of trash receptacles*• Provide informational signage about the marshland and the bay itself• Provide berms or barriers to keep vehicles from driving into the marsh vegetationAbove all, we feel that plans should not be rushed through for permanent solutions until all the parties have had a chance to meet and discuss the many ideas and options in a reasoned discourse.	

73	Jody Chapman		Being as avid Kayaker, I would like to see some way to enlarge the window of kayaking for handicap people. Because of the mud flats/shallow water, I can launch only near high tide, and must return before the water recedes again. Could a narrow channel be dredged for hand powered boats? Could a launch site be established at the wood stock farm with easy access?	It would be very difficult (if not impossible) to get a permit to dredge a channel here. Kayak storage and rentals are being considered at Woodstock but water depth constraints there are the same as at Chuckanut Village. Woodstock is not suited to car-top launching due to steep grades and a significant elevation change between the highway and beach. Preservation concepts being considered for Woodstock call for retaining the site's historic character and limiting parking and road building to the higher part of the site to protect the shoreline and its landscape. Boathouses, sheds, and lockable racks are for boats left at the shore and not regularly launched from vehicles. They are most feasible if the City has a partnership agreement with a supporting organization. A community boatshed for rentals or non-profit club type operation could be provided at Woodstock and at Chuckanut Village.
74	Ross Marquardt	**1**	Keep all parking on Fairhaven Ave. No parking on Rainier Ave. Discourage driving onto beach off Rainier Ave.	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternatives 2 and3 were not well supported in the public comments and will not be pursued. Driving on the beach is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new streets and parking on beaches if other options are available due to the high ecological impacts.
75	Lee First	**1**	Please accept the following comments into the record for the Chuckanut Marsh Restoration Project: I support Alternative 1 for the Chuckanut Village Marsh Restoration project because it will be the alternative that has the highest degree of marsh restoration and is most protective of fish habitat. I believe alternative 1 will also provide the most amount of pollution prevention (via re-vegetation and relocation of parking]. It is important that we act to protect and restore habitat at Chuckanut Marsh as it is one of the few areas where the ecosystem is relatively intact and healthy and simple actions can provide great benefit. Chuckanut Marsh contains our best pocket estuary, providing valuable rearing habitat to salmonids and a high functioning wetland. Thanks very much for considering my comments.	Alternative #1 was well supported in the public comments and is the preferred alternative.
76	Jennifer Purcell	**1**	Vehicles should be blocked from waterfront-person gate on Fairhaven Ave. No parking on Chuckanut Ave- no vehicle access (private driveway). Parking on sides of Fairhaven Ave. No parking or vehicle access from Rainier Ave. (person gate on Rainier).	Alternative #1 was well supported in the public comments and is the preferred alternative. Alternatives 2 and3 were not well supported in the public comments and will not be pursued. Driving on the beach is not an option under the Shoreline Master Program (SMP). The SMP discourages creating new streets and parking on beaches if other options are available due to the high ecological impacts.
77	John Goodman		Thank you for the meeting the other night. I think it is great that there is an incentive to improve the sensitive environment at Mud Bay in Chuckanut Village. There are a lot of things to consider of course. I know it was a tough crowd, but hopefully you gained a sense of how important this place is to so many folks and that a careful decision is in order. I have been pondering the various proposals presented and concerns re keeping cars away from the beach and where to put them. I have been wracking my brain to try to come up with a plan that makes the most sense for the environment as well as the residents and public, but is not easy to come up with something that won't have negative effects on the residents of the village, including myself, when parking is removed from the beach. These impacts could be huge. Limiting or changing access concerns a great many folks as you could tell at the meeting. I think the time for public input/comments and discussion REALLY needs to be EXTENDED to be fair. There is a petition circulating right now in the village that requests this, among other things. There is at least one full scale neighborhood meeting planned to discuss concerns villagers have about the proposals presented. I just hope you will allow a bit more time for our collective concerns to be consolidated and presented to you. Since today is supposedly the last day for comments, for the record, here are my "current" personal thoughts on the subject: I can agree to having parking moved off the beach for the sake of an improved beach environment, however if you are going to be taking something away from people who live in the village, you need to give something back I strongly feel. Since villagers are being asked (told?) to absorb parking within neighborhood it appears, I think that there needs to be some kind of private boat launching and dock access retained, at the very least, for the people who own property in Chuckanut Village. Some of the residents who live here are at least 3rd generation "villagers." You can't just shove this no vehicle access/boat launching except to kayakers on the long time villagers without creating a stir. I am ok with parking as shown on several plans, with 4-5 cars close to the drainage culvert to be removed. Period. But NO other parking in the lower village. No parking on the street or cars will be towed. Then have a small 4-5 car lot on the greenway above on the Fairhaven Ave. lot near the gallery, but certainly no more. Put the parking on the flat dry spot. Note: this greenways property should NOT be trashed and turned into a big parking lot as that will affect neighbors up there. My idea here is that when someone headed to the beach looks down at the top of the hill by the Church, they can see if there is room in the parking lot or if it is full. At that point they can alleviate the ongoing problem of people driving all the way down to the bottom to find that there is no parking and then having to drive back out. If the lot is full, then they will have to go to the upper lot. If that lot is full, then perhaps even to the gravel pit/trailhead lot or Woodstock Farm. By the way, the Woodstock Farm should be considered and kept open as an alternative site for parking and beach/kayak access by the way. I DON'T want to see parking relocated in front of personal residences. Parking along the undeveloped Dow/Frost property could be an option, but not one I am that keen on either, unless that property becomes a city greenway someday. Then some parking could be located on the land itself perhaps, if parking pressures build over time. As for property owners of the village, I think it is imperative that some kind of boat access and launching be retained (boats larger than kayaks). I think the best location would be on Rainier, which is off the beaten path for the public, and next to the retaining wall by Buellers. It could simply be a 15 feet wide unimproved section for dropping a skiff off, period. There could even be a locked gate, with villagers having the only access to this private boat launching spot. The rest of the beach zone that is damaged could be restored with cars banished from driving along any of the rest of the beach to the north. 15 feet is not too much to ask for the residents of the village I feel. The remainder of the area can be for the public's use.	Your thoughts are appreciated. There is a lot to consider here. There is an 80ft right-of-way (ROW) along Fairhaven Ave. Street parking is an allowed use in street ROW even in front of private homes. The City is looking for any permits related to the existing dock. The dock is located on public land with little benefit to the public. Creating a "private boat launching and dock access for people who own property in the village" on public land is not an option.

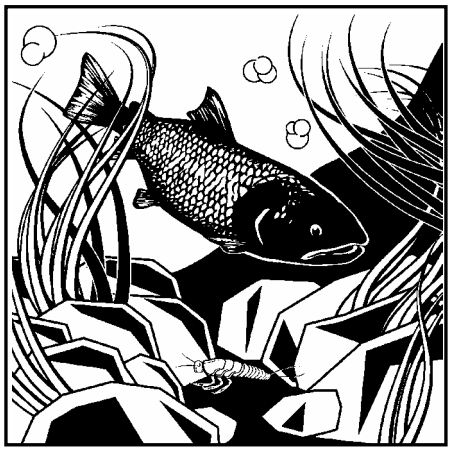
78			I also feel the dock must stay. It doesn't have to be that dock forever, but perhaps replace the dock with one that won't be polluting the bay with creosote. There has been a dock there for almost a hundred years and I believe that dock location and use should be grandfathered in. It is the community dock essentially. The original dock rotted away years ago, but the locals keep replacing it with new floats. There has been a dock there since I arrived in '81. It won't go away without a big fight is my feeling. These are my thoughts at this time, but I hope you will consider extending the time frame for commentary. As stated, there is a lot to consider here.	
79	Morgan Libby		I think any plans for this should examine the impact that the railroad overcrossing has on water flow and fish population. Perhaps there are flaws in the design of the overpass that are contributing to the decline in fish and other hydrologic problems.	City has grant funding to examine this issue. The Whatcom Marine Resources Committee has applied for a grant to study circulation and sedimentation issues related to the railroad trestle. The amount is approximately $10,000, and could supplement the City's grants.
80	Mark J. Herrenkohl,	**1**	I was out late last week and missed the "final" call for public comment on Chuckanut Marsh. If you are still willing to take comments on the project, I am very supportive of the plan and prefer Alternative 1. Alternative 1 meets the project goals outlined during the public meeting but also provides easy access and parking for the Kayakers and other beach goers. I especially like the turnaround so folks can drop off their gear close to the beach access. Thanks again for all the time and energy you and CGS have put into this plan. I think it will be truly beneficial to the marsh and shoreline ecosystems!	Alternative #1 was well supported in the public comments and is the preferred alternative.

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



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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.

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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.

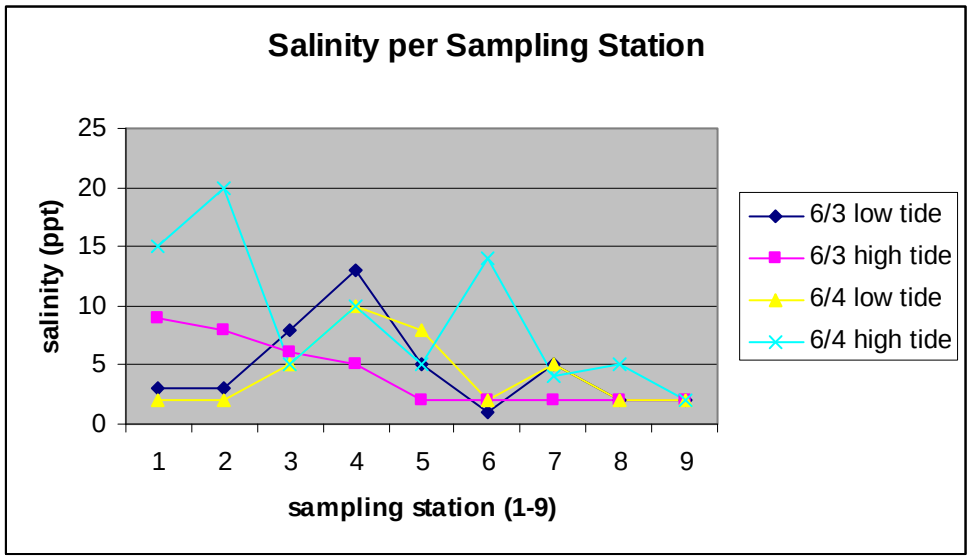
The Natural Resource Conservation Service (NRCS) indicates Fishtrap Muck soils as the dominant soil series at the site with an apparent water table that occurs 1.5 to 2.5 feet from the surface between October through May. Site observations from April and May 2008 indicate that the water table is higher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

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APPENDIX B: FIGURES

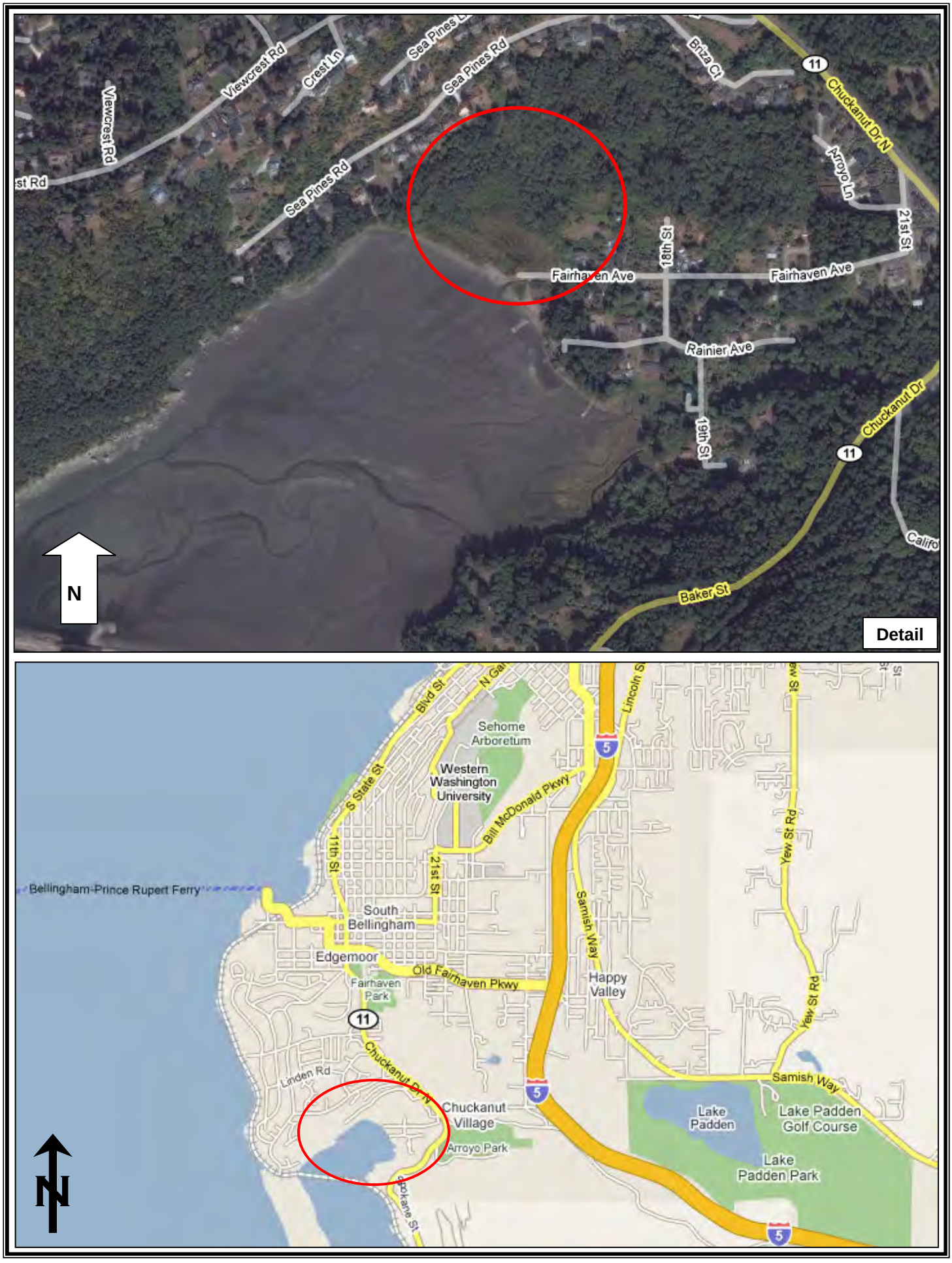

Figure 1. Vicinity Map
(Googlemaps, 2008)

Figure 2. Approximate Review Area Boundary

Pink 1: PSS-Desiduous Shrub Unit

White: PEM-*Typha* Unit

Green: PSS-*Salix* Unit

Pink 2: Upland Shrub

Yellow: PEM-*Distichlis* Unit

Blue: PEM-*Phalaris* Unit

Unlabeled: PEM-*Juncus* Unit

Vegetation sample plot

Salinity sample station

Survey Extent

Green1

White2

White3

White4

Pink1

Pink2

Yellow1

White1

Blue1

Ditch

Fairhaven Avenue

Culvert (invert=+6.6 ft MLLW)

Culvert (outvert=+6.3 ft MLLW)

MHHW

MHW

Figure 6. Vegetation Communities

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"

0 20 40 60 80 ft

N

Ditch
Ditch
Ditch
Ditch
MHHW
MHW
Survey Extent
COB#5213
Culvert
(invert=+6.6 ft MLLW)
Culvert
(outvert=+6.3 ft MLLW)
Fairhaven Avenue

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

Figure 4. Topography

Fairhaven Marsh, Bellingham, WA: Wetland Assessment

Wetland Topography

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

~08-015_SiteSurvey22AP08.dwg

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

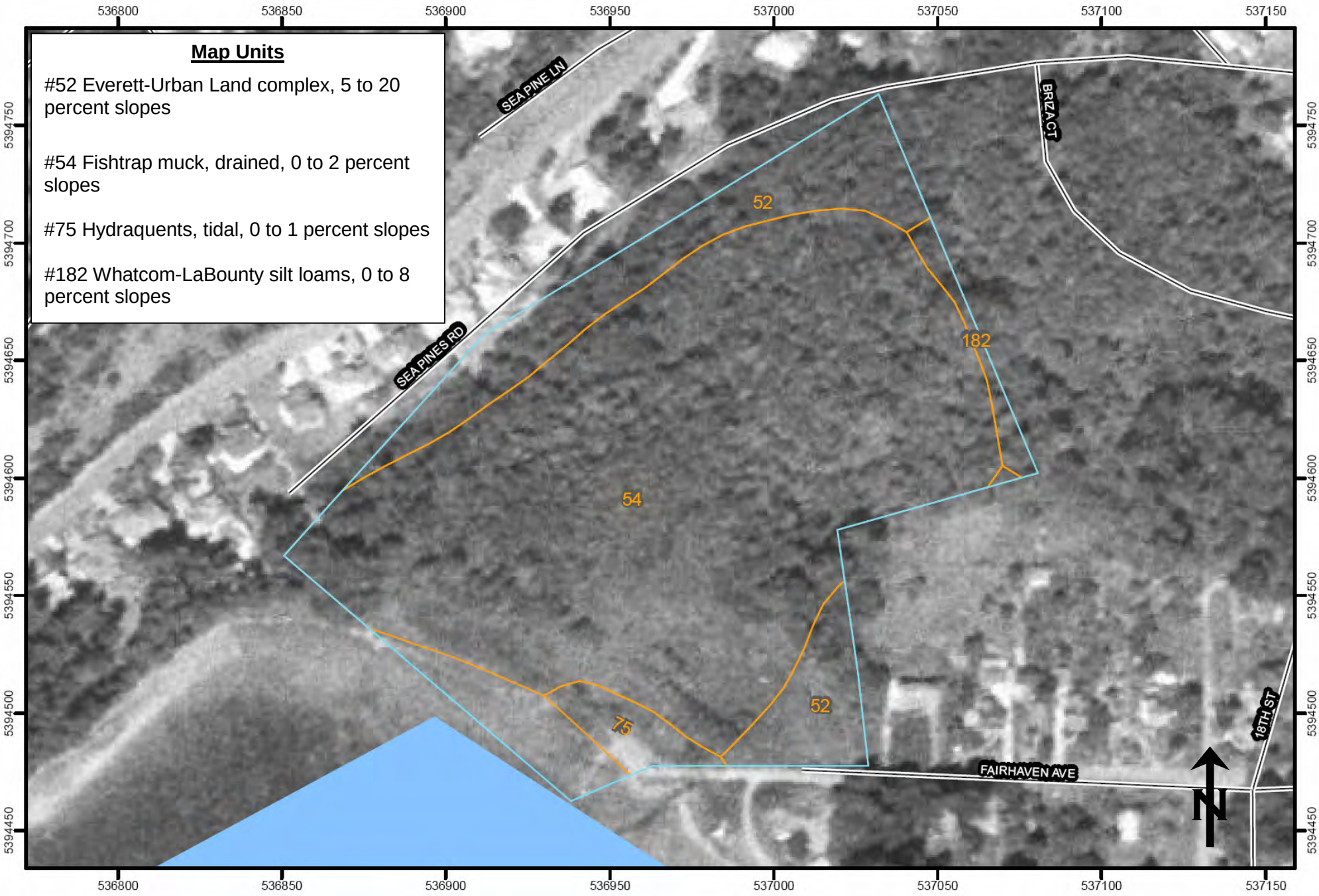

Figure 6. USDA Natural Resources Conservation Service Soil Survey

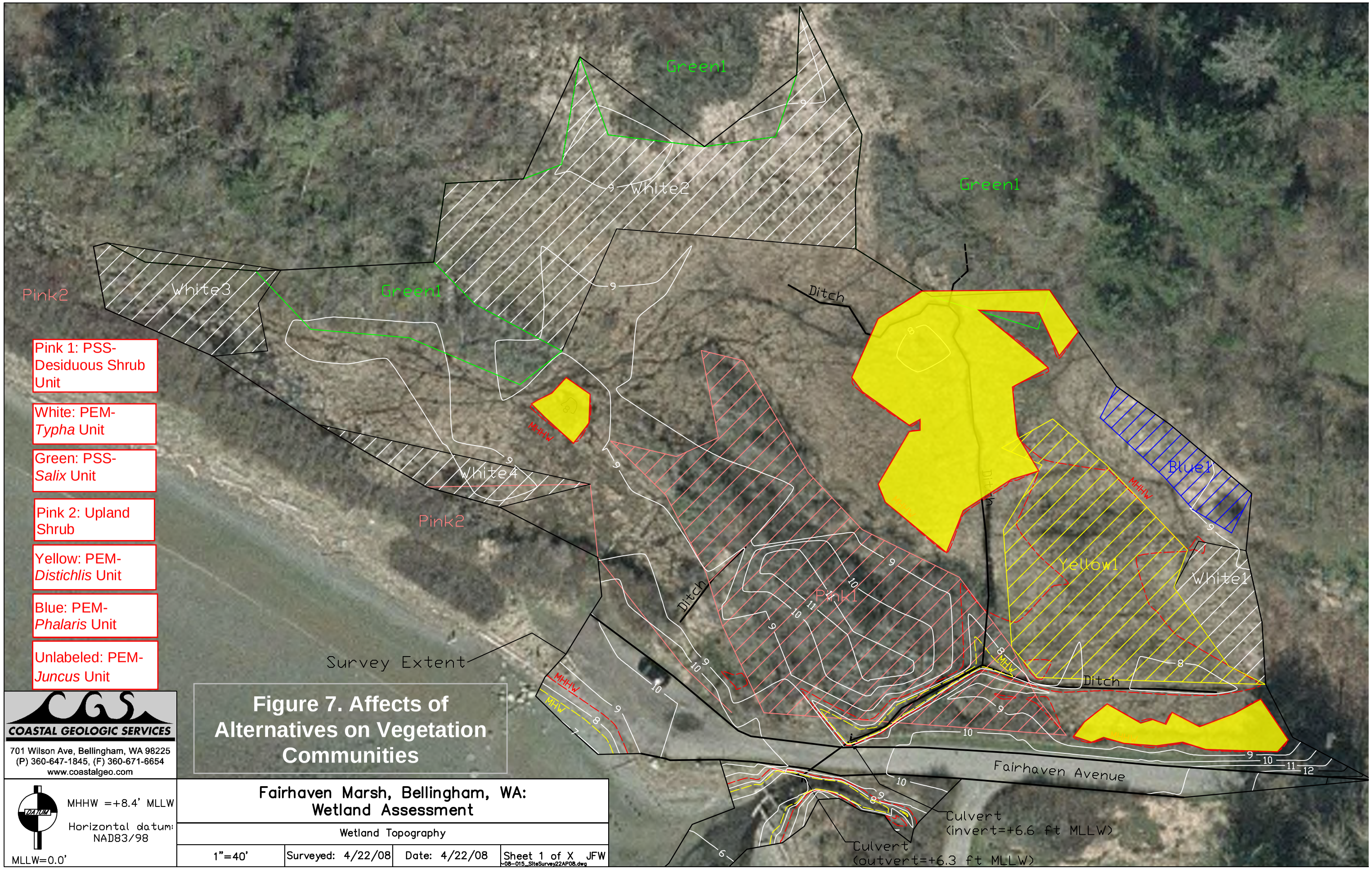

Figure 7. Affects of Alternatives on Vegetation Communities

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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

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.	☒	☐

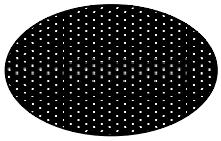
DEPRESSIONAL AND FLATS WETLANDS	Points
Water Quality Functions – Indicators that wetland functions to improve the water quality.	
D1 Does the wetland unit have the <u>potential</u> to improve water quality?	----------
D1.1 Characteristics of surface water which flows out of the wetland: ☐ Unit is a depression 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

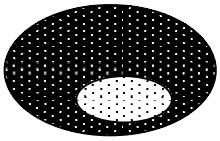
HABITAT FUNCTIONS Indicators that the wetland functions to provide important habitat			Points
H1 Does the wetland unit have the <u>potential</u> to provide habitat for many species?			----------
H1.1 Vegetation structure *Check the types of vegetation classes present (as defined in Cowardin) - Size threshold 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

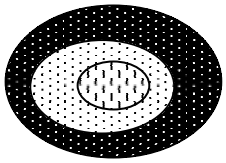
Decide from the diagrams below, whether interspersion between Cowardin vegetation classes (described in H1.1), or the classes and un-vegetated areas (can include open water or mudflats) is high, medium, low, or none.

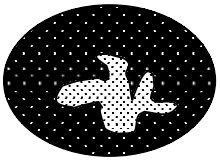


None = 0 points

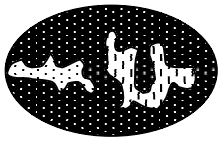


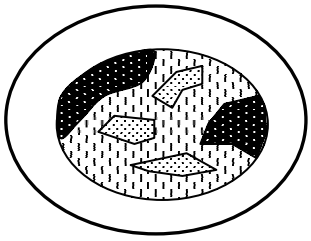
Low = 1 point





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".

3

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

4

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.

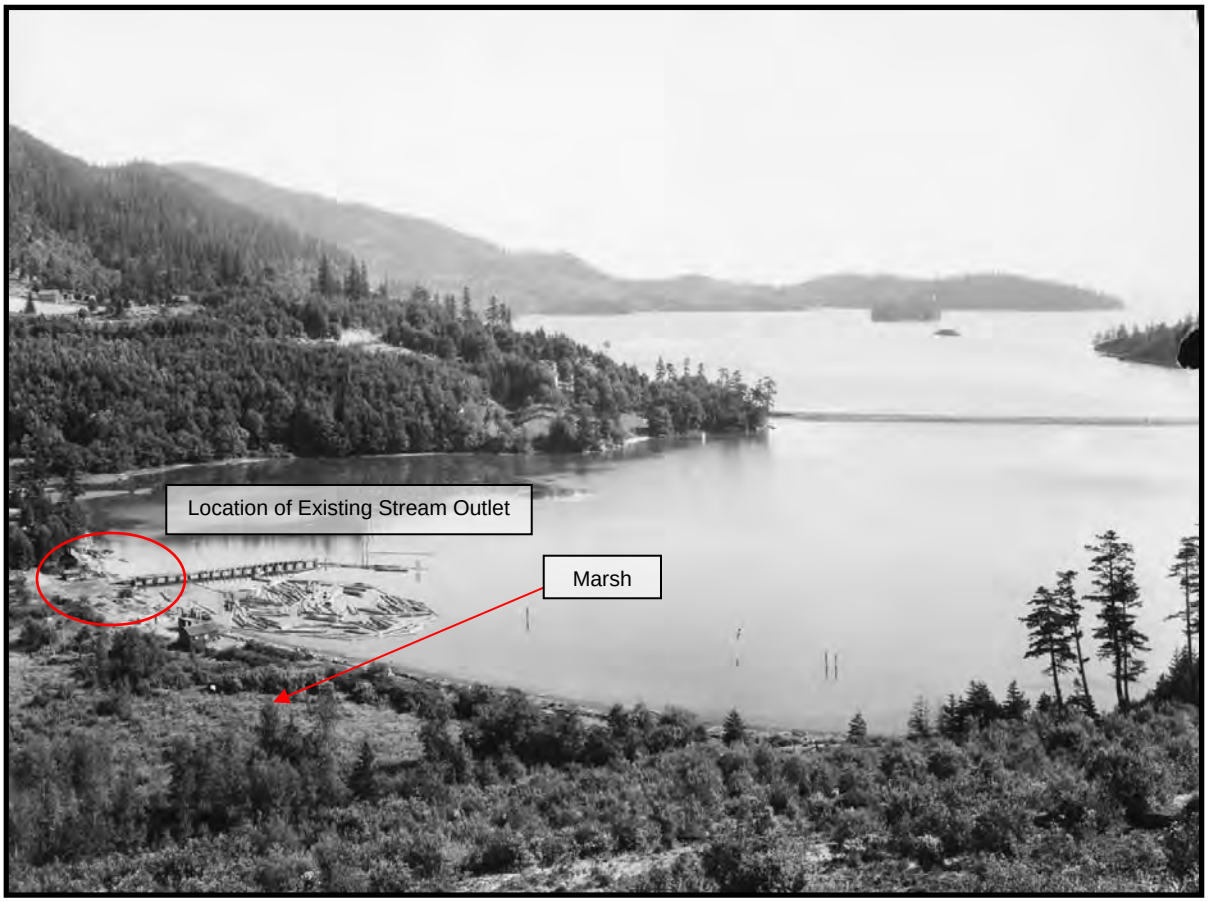
Moderately Tolerant
*Elymus mollis
*Hordeum brachyantherum
*Oenanthe sarmentosa
*Phalaris arunidacea
*Scripus cernuus
Agrostis alba
Aster subspicatus
Eleocharis acicularis
Eleocharis palustris
Eleocharis parvula
Festuca arundinacea
Festuca ruba
Lolium perenne
Lotus corniculatus
Potentilla pacifica
Ranunculus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

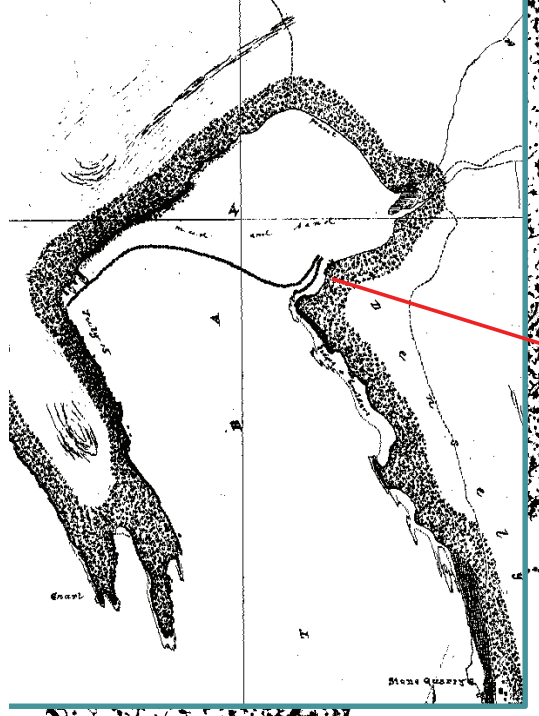
APPENDIX H: HISTORICAL PHOTOGRAPHS



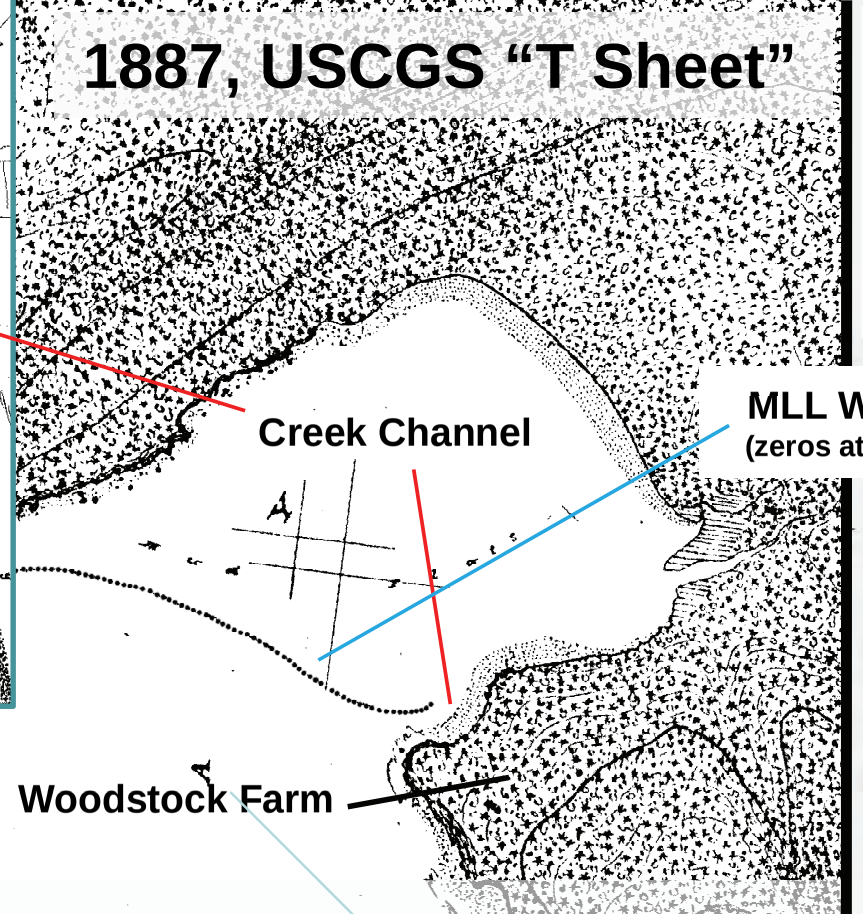
Chuckanut Bay 1930's

Chuckanut Bay 1920's

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



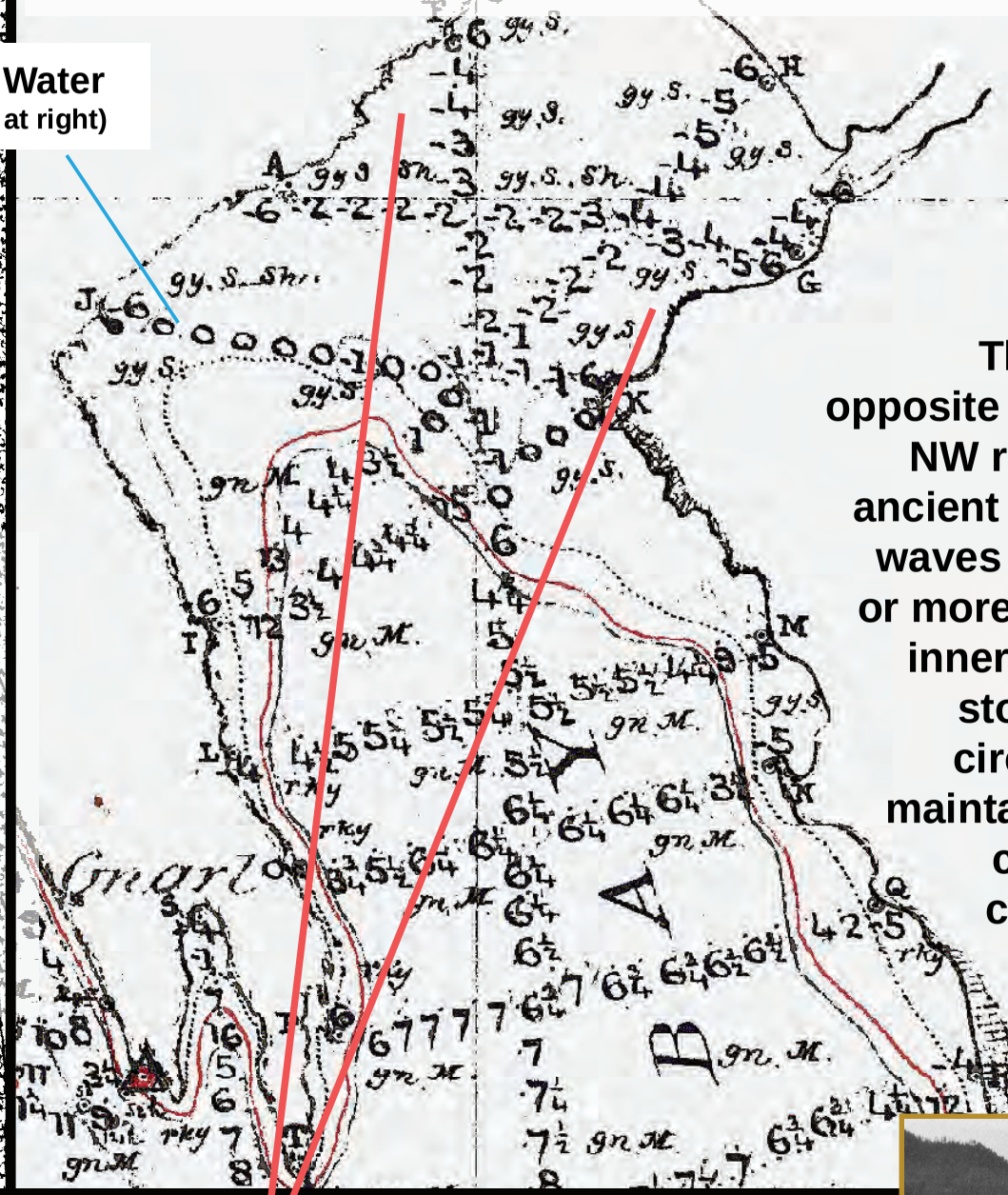
1887, USCGS "T Sheet"



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"

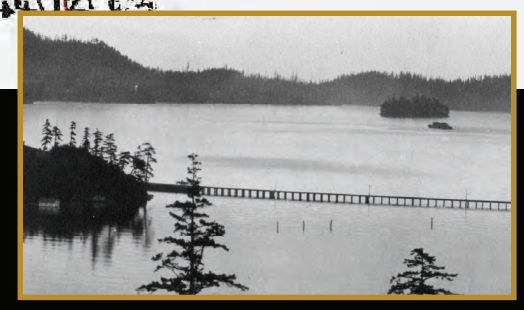
Based on actual bottom sampling, sand, gravel & shell substrates were mapped above Mean Lower Low Water (MLL). Another USCGS dataset (not shown) was created in 1891, capturing hydrography at & below MLL in greater detail.



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".

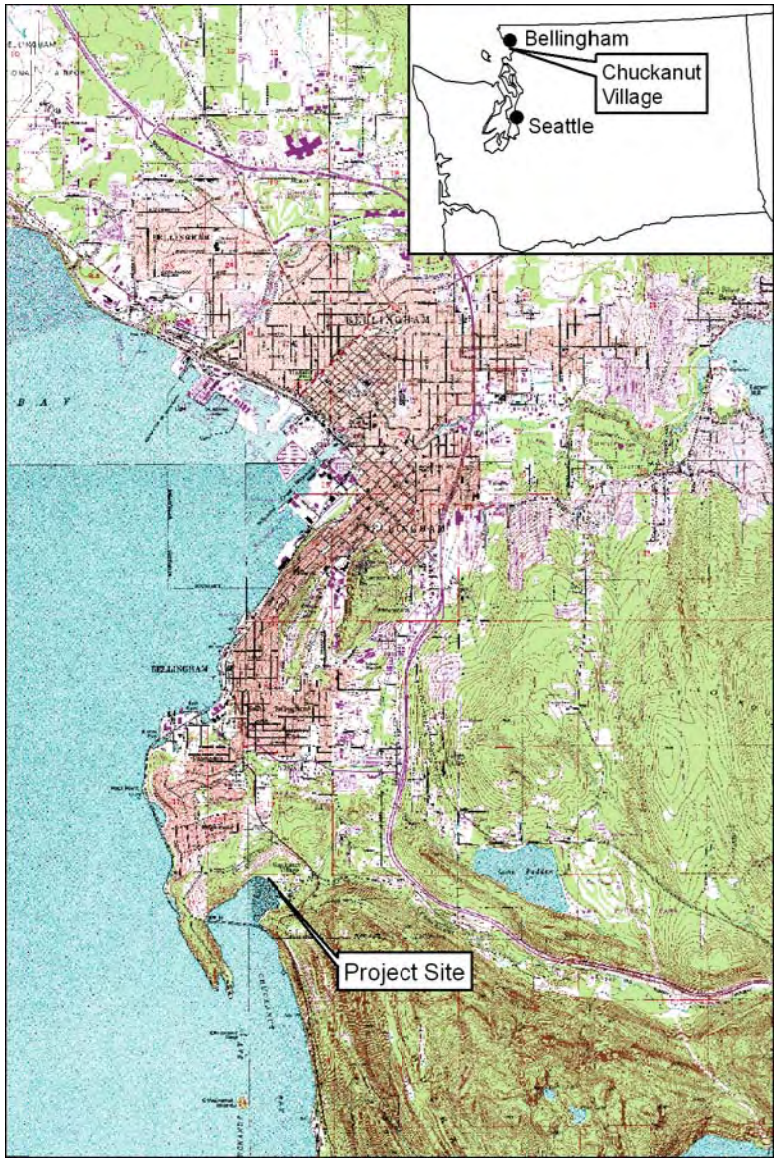


The RR would soon change all this…

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

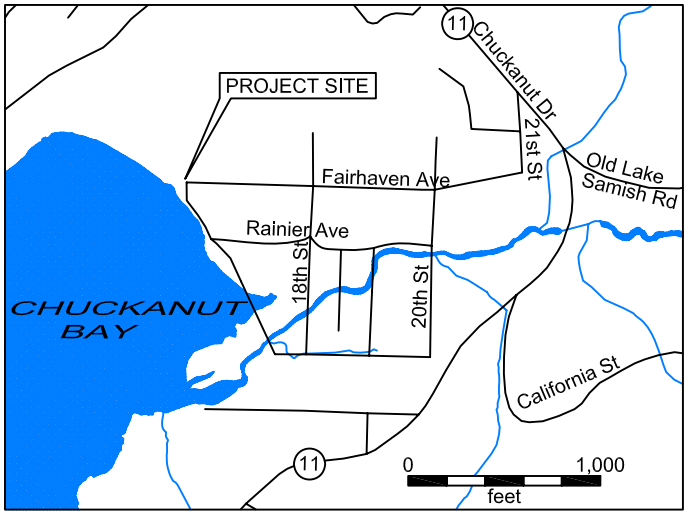
Chuckanut Village Marsh

COB Project #



Drawing Index

Sheet	Sheet Title
1	Cover Sheet
2	Site Plan - Existing Conditions
3	Proposed Conditions - Beach and Inlet
4	Path - Plan + Profile
5	Inlet - Plan + Profile
6	Parking Area - Plan + Profile
7	Details
8	Guardrail detail - COB Parks design manual drawing 2840.03
9	Silt fence detail - COB Public Works Design Guidelines drawing EC-615



THEODORE A. HAMMER
STATE OF WASHINGTON
25870
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 12/27/09

State of Washington
Engineering Geologist
353
Licensed Geologist
James W. Johannessen

Driving Directions

From interstate 5 northbound take exit 250. At the bottom of the ramp turn left onto State Route 11. Follow route 11 for 2.5 miles, then turn right onto 21st St. At sharp right, 21st becomes Fairhaven Ave. Proceed to the end of the road to the project site.

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

PURPOSE: Culvert removal and beach restoration
DATUM: MLLW (MHHW = +8.4' MLLW)
ADJACENT PROPERTY OWNERS:
Burton Baxter
Patrick & Mary Frost
Kevin Engels
Heinrich Family Trust
Stephen & Marnie Hofeditz
John Goodman

CHUCKANUT VILLAGE MARSH
Vicinity Map
OWNER AND ADDRESS
City of Bellingham
210 Lottie Street
Bellingham, WA 98225

PROPOSED: Culvert removal and beach restoration
IN: Chuckanut Bay
COUNTY: Whatcom **STATE:** WA
APPLICATION BY: City of Bellingham

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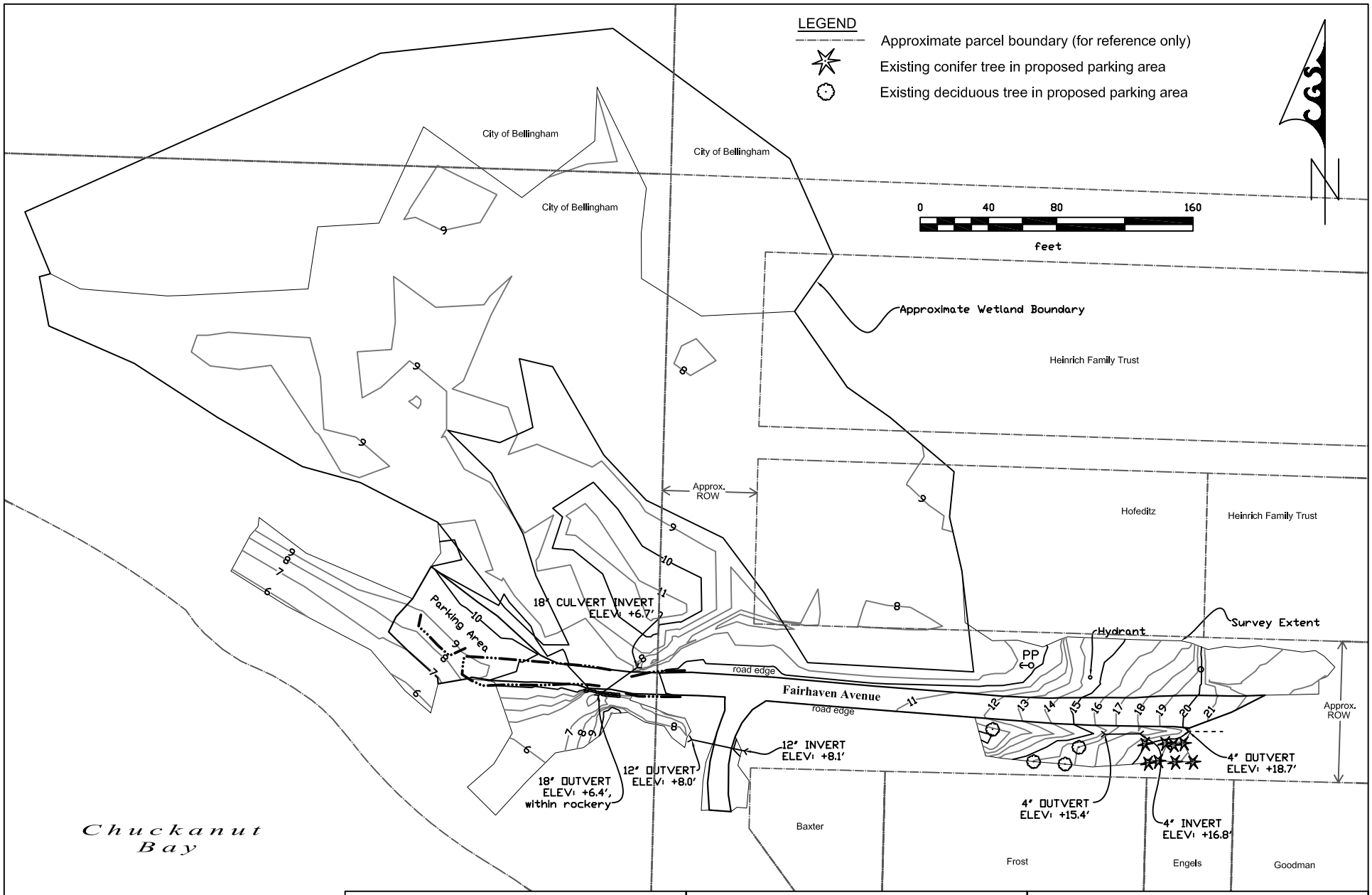

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CHUCKANUT VILLAGE MARSH
Site Plan - Existing Conditions

1"=80'

OWNER AND ADDRESS
City of Bellingham
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Sheet 2 **of** 9 **12AUG09**

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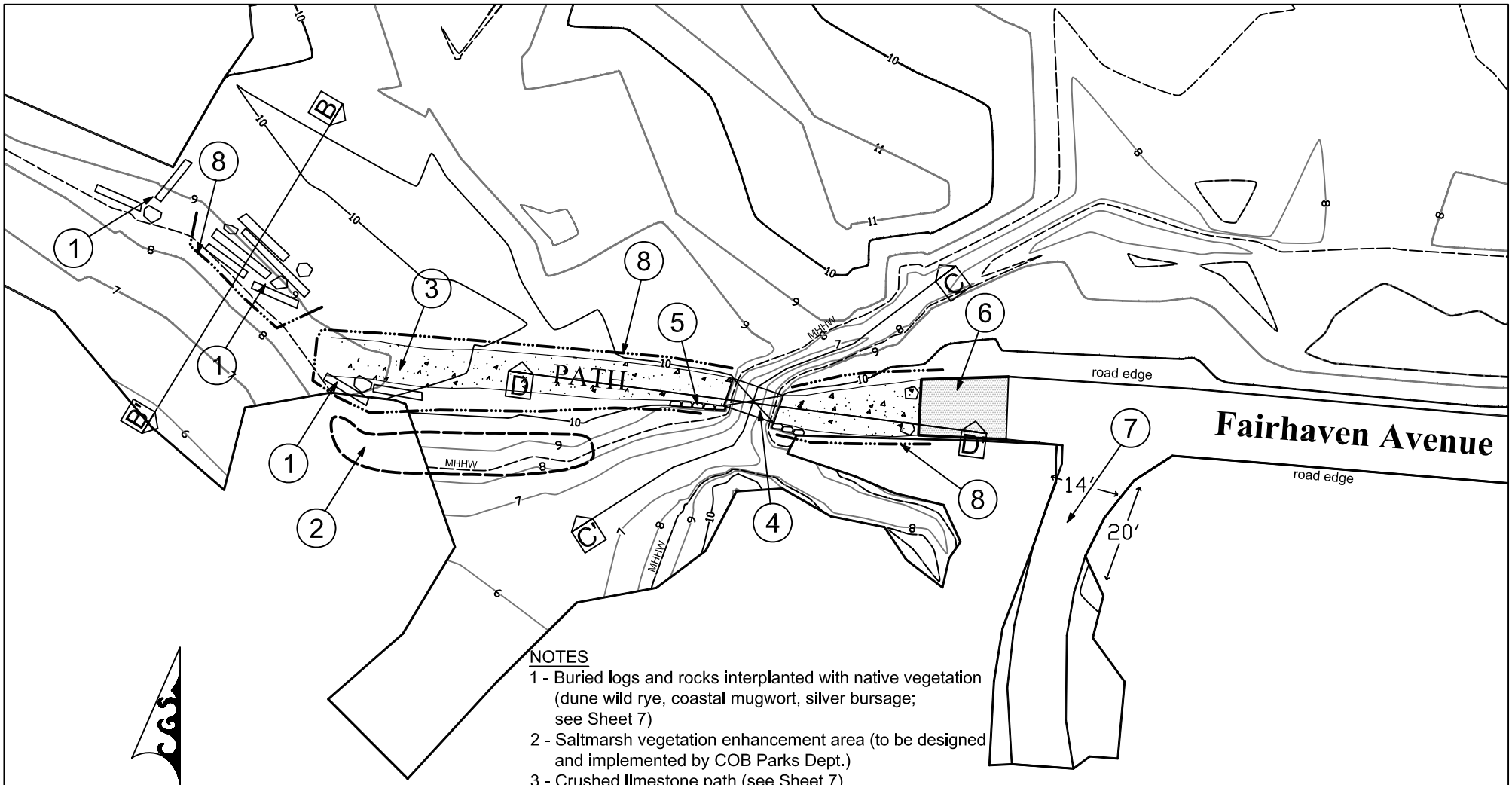

NOTES

1 - Buried logs and rocks interplanted with native vegetation (dune wild rye, coastal mugwort, silver bursage; see Sheet 7)
2 - Saltmarsh vegetation enhancement area (to be designed and implemented by COB Parks Dept.)
3 - Crushed limestone path (see Sheet 7)
4 - 11' long x 6' wide pre-cast concrete box culvert with railings per COB Parks design manual drawing 2840.03 (see Sheets 7 and 8)
5 - Rockery set 2.0 ft below grade at 1:3 (H:V) slope to level of trail on south side of culvert (See detail Sheet 7)
6 - load/unload zone with two 3-4' boulders spaced 5' apart
7 - Turnaround on existing gravel road
8 - Install silt fence (exact location TBD in field; see detail Sheet 9)

0 15 30 60
feet

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CHUCKANUT VILLAGE MARSH
Proposed Conditions - Beach and Inlet
1"=30'
OWNER AND ADDRESS
City of Bellingham
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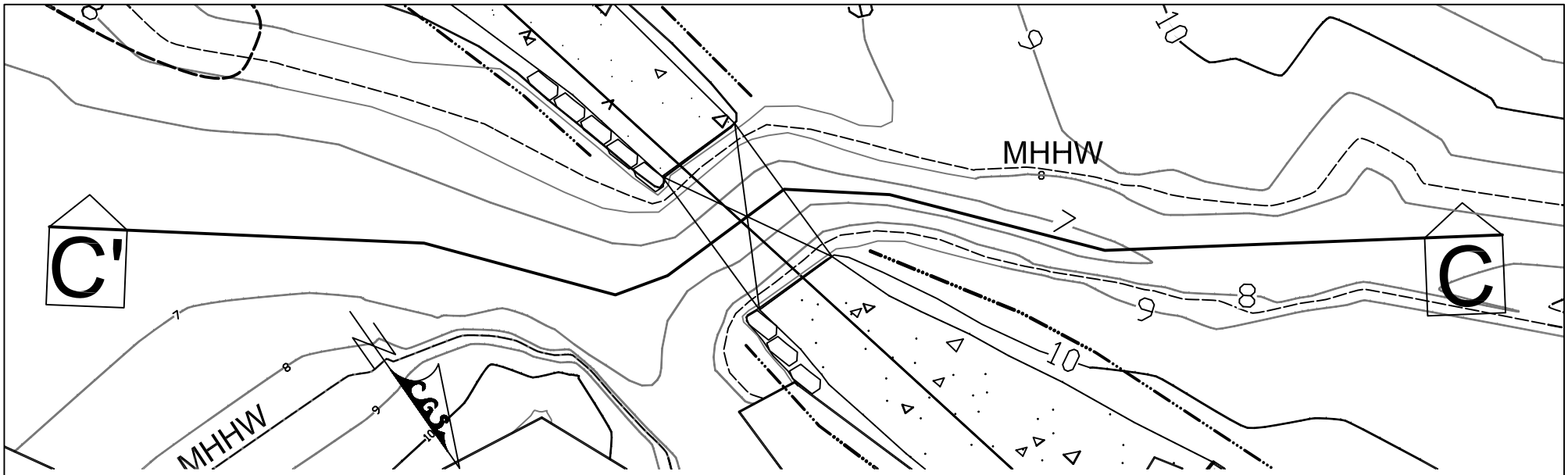
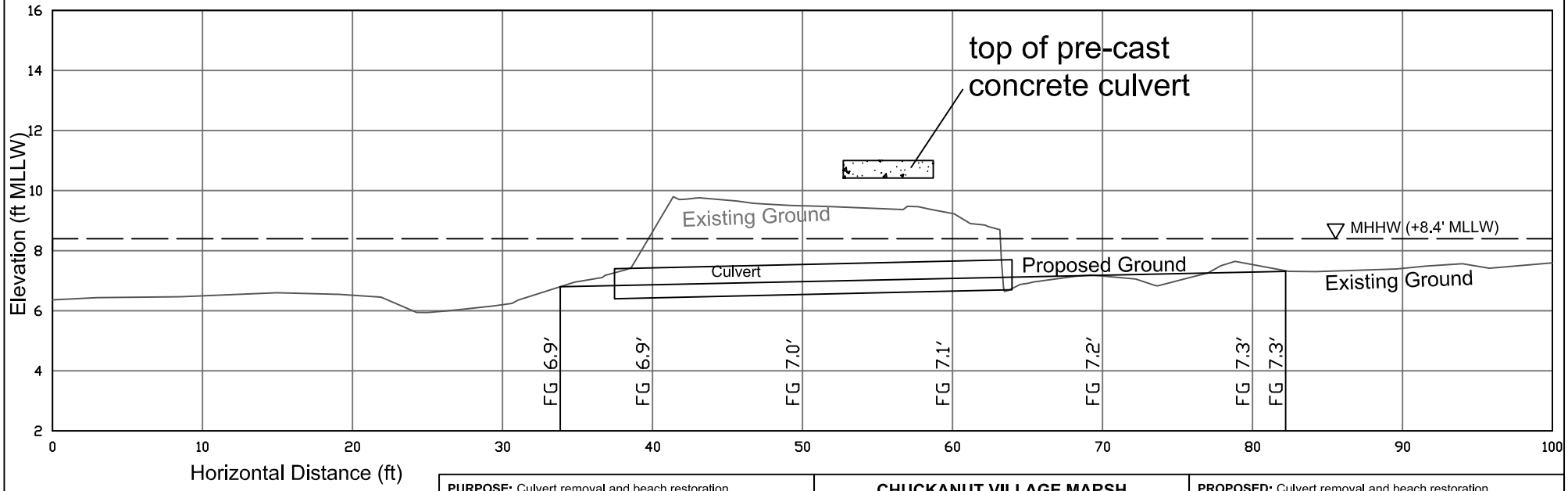


Detail C-C' scale 1"=10' (2x vert. exag.)



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CHUCKANUT VILLAGE MARSH
Path and inlet
1"=20'
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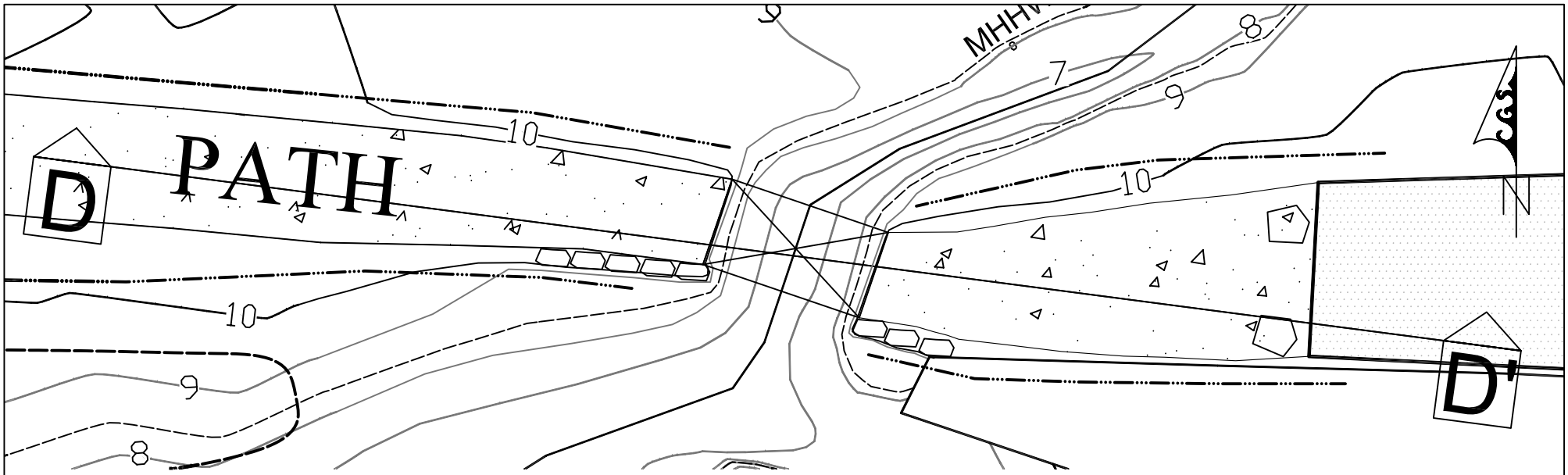
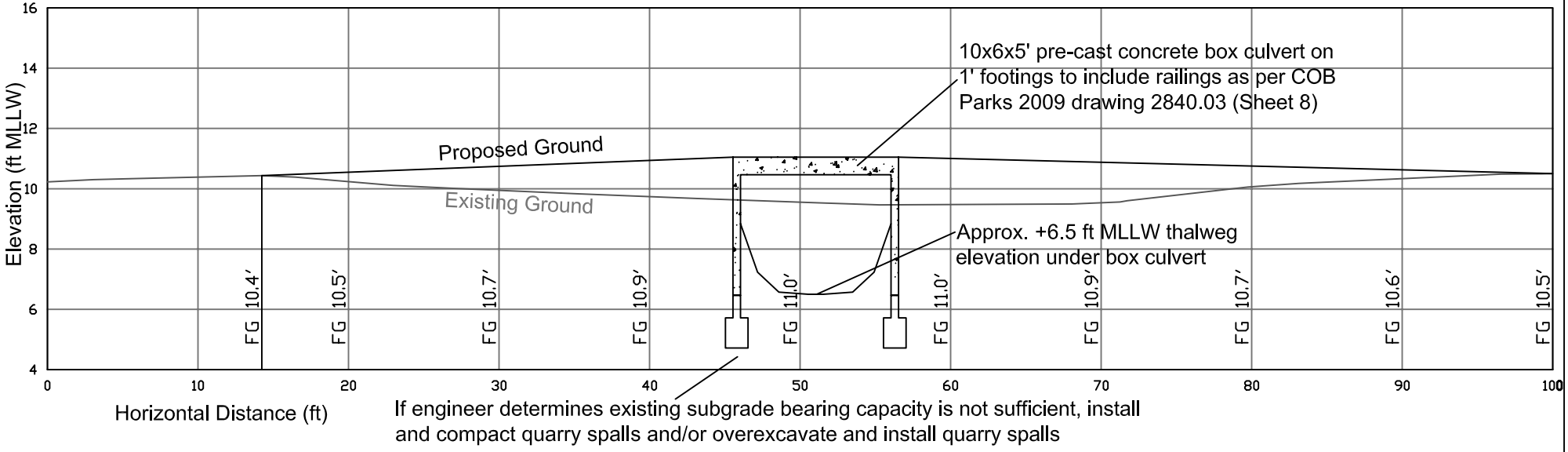


D Detail D-D' scale 1"=10' (2x vert. exag.) D'



If engineer determines existing subgrade bearing capacity is not sufficient, install and compact quarry spalls and/or overexcavate and install quarry spalls

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Path and inlet
1"=20'
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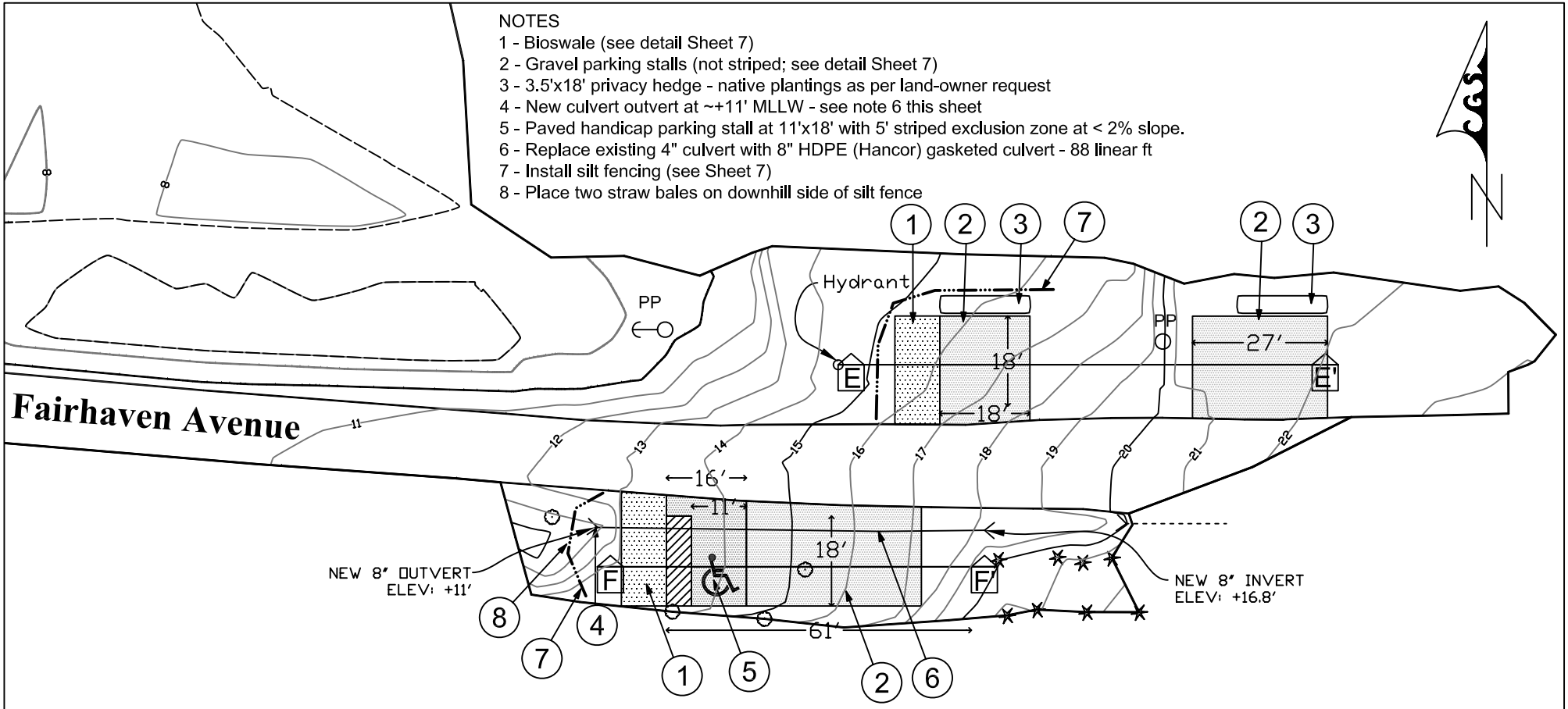
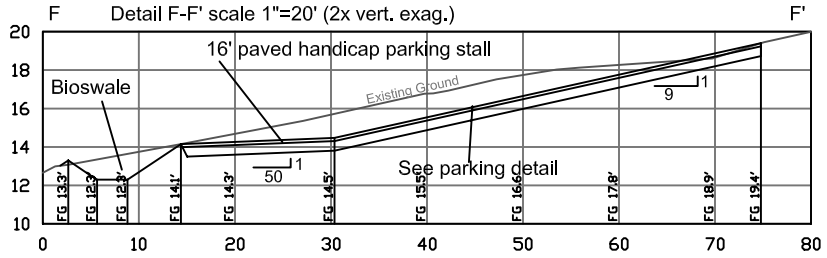
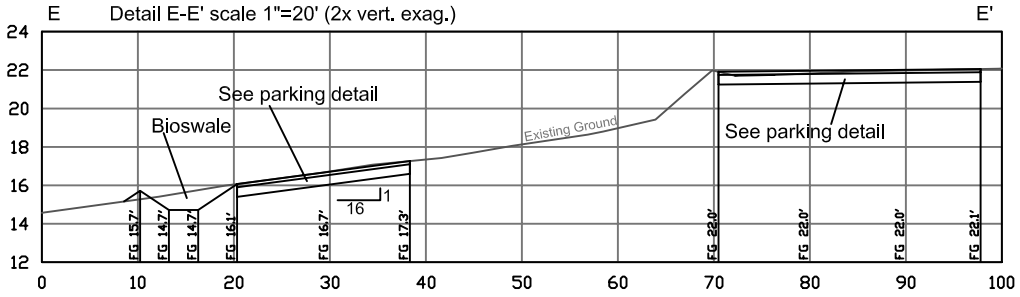
NOTES
1 - Bioswale (see detail Sheet 7)
2 - Gravel parking stalls (not striped; see detail Sheet 7)
3 - 3.5'x18' privacy hedge - native plantings as per land-owner request
4 - New culvert outvert at ~+11' MLLW - see note 6 this sheet
5 - Paved handicap parking stall at 11'x18' with 5' striped exclusion zone at < 2% slope.
6 - Replace existing 4" culvert with 8" HDPE (Hancor) gasketed culvert - 88 linear ft
7 - Install silt fencing (see Sheet 7)
8 - Place two straw bales on downhill side of silt fence







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CHUCKANUT VILLAGE MARSH
Parking Area
1"=30'
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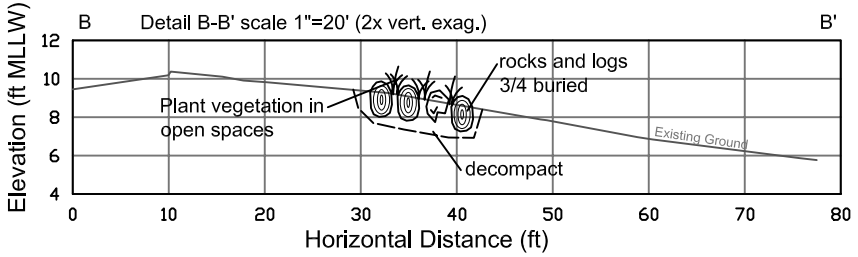
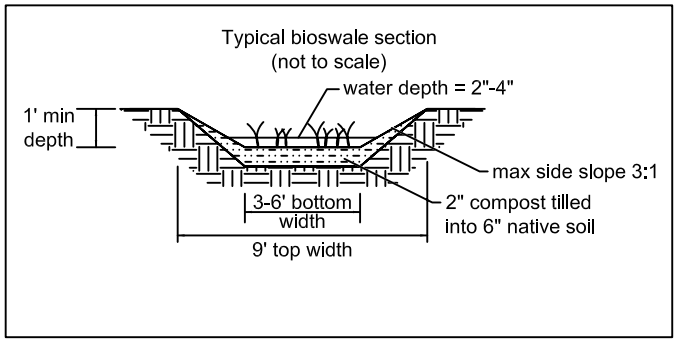
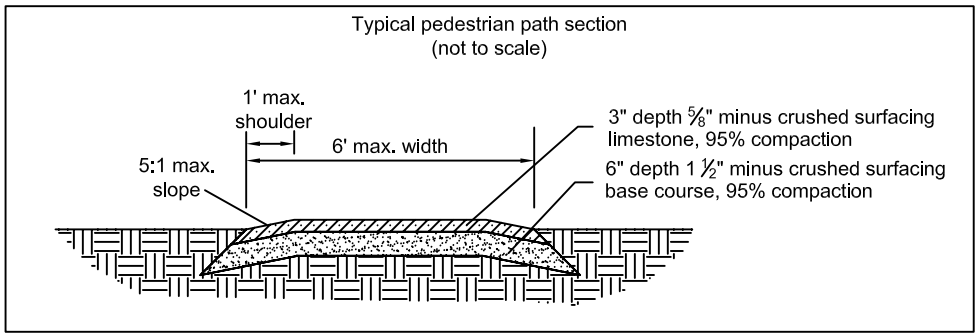
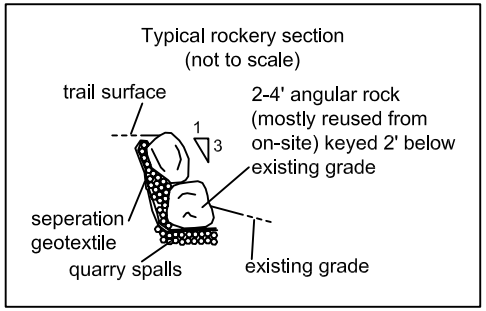


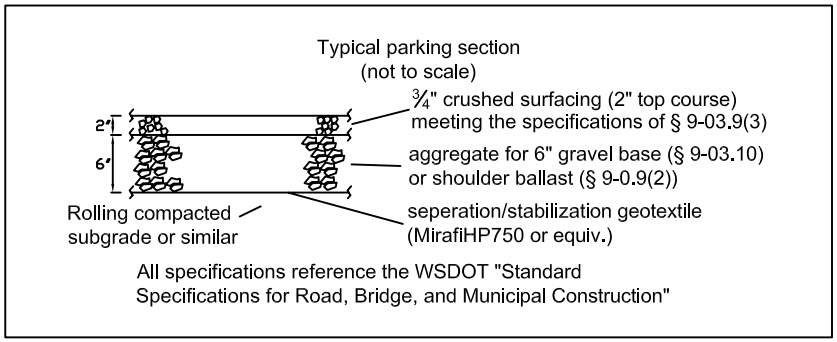
Plant List

Dune wildrye (*Elymus mollis*)
Coastal mugwort (*Artemisia suksdorfii*)
Silver bursage (*Ambrosia chamissonis*)









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CHUCKANUT VILLAGE MARSH
Details
scale as shown
OWNER AND ADDRESS
City of Bellingham
210 Lottie Street
Bellingham, WA 98225

PROPOSED: Culvert removal and beach restoration
IN: Chuckanut Bay
COUNTY: Whatcom **STATE:** WA
APPLICATION BY: City of Bellingham

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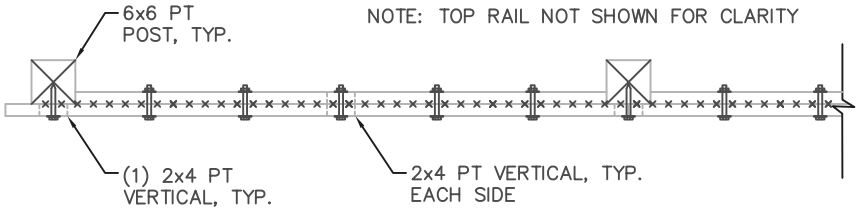
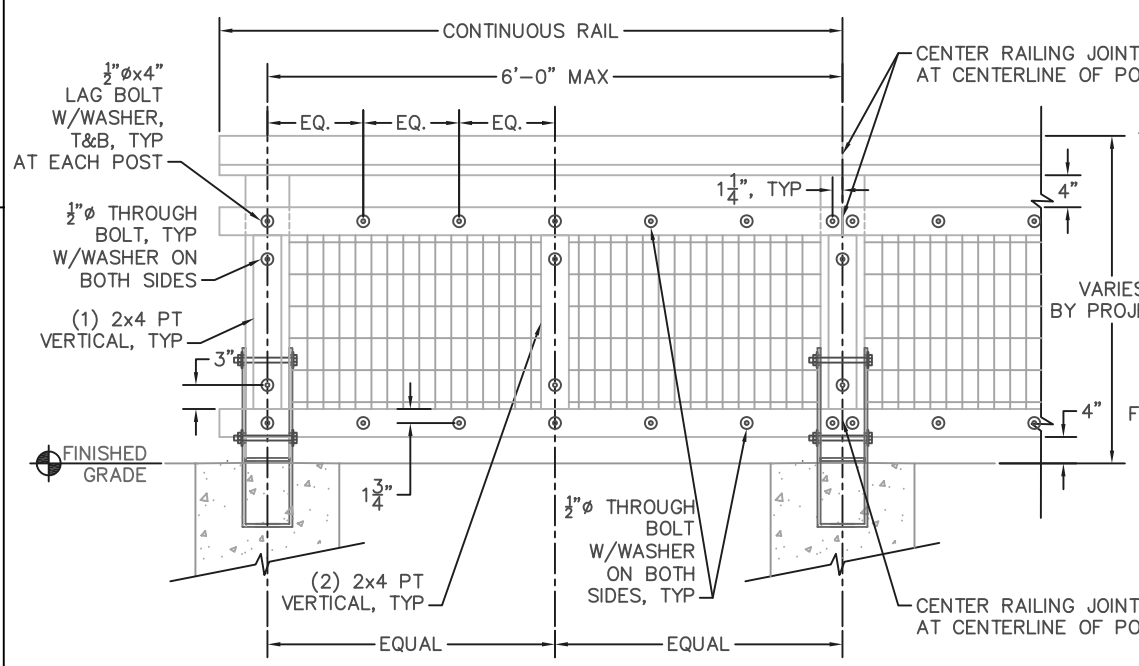
PARKS AND RECREATION
DESIGN AND DEVELOPMENT

CITY OF BELLINGHAM
WOOD GUARDRAIL TYPICAL
ELEVATION & SECTION

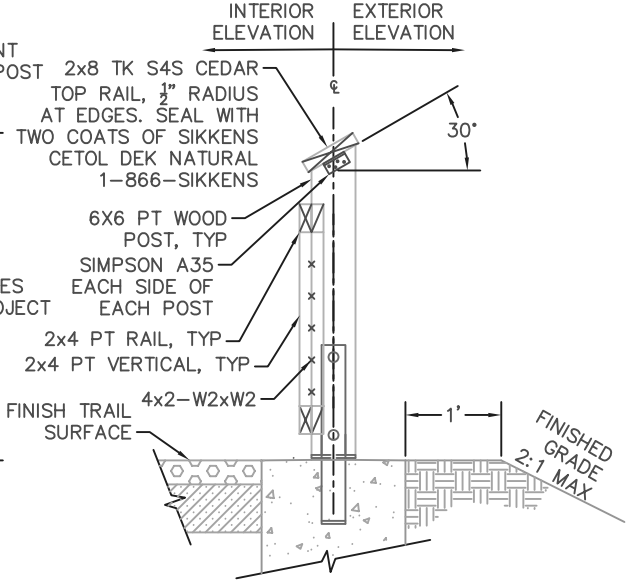
DRAWING
2840.03



GUARDRAIL PLAN VIEW



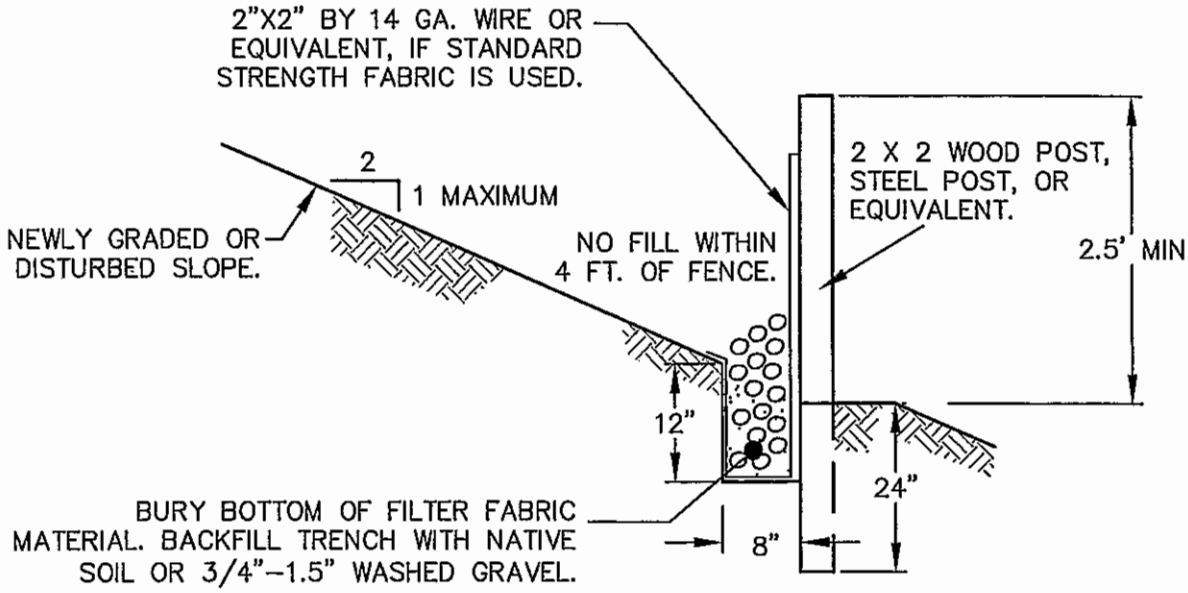
GUARDRAIL INTERIOR ELEVATION



GUARDRAIL SIDE VIEW

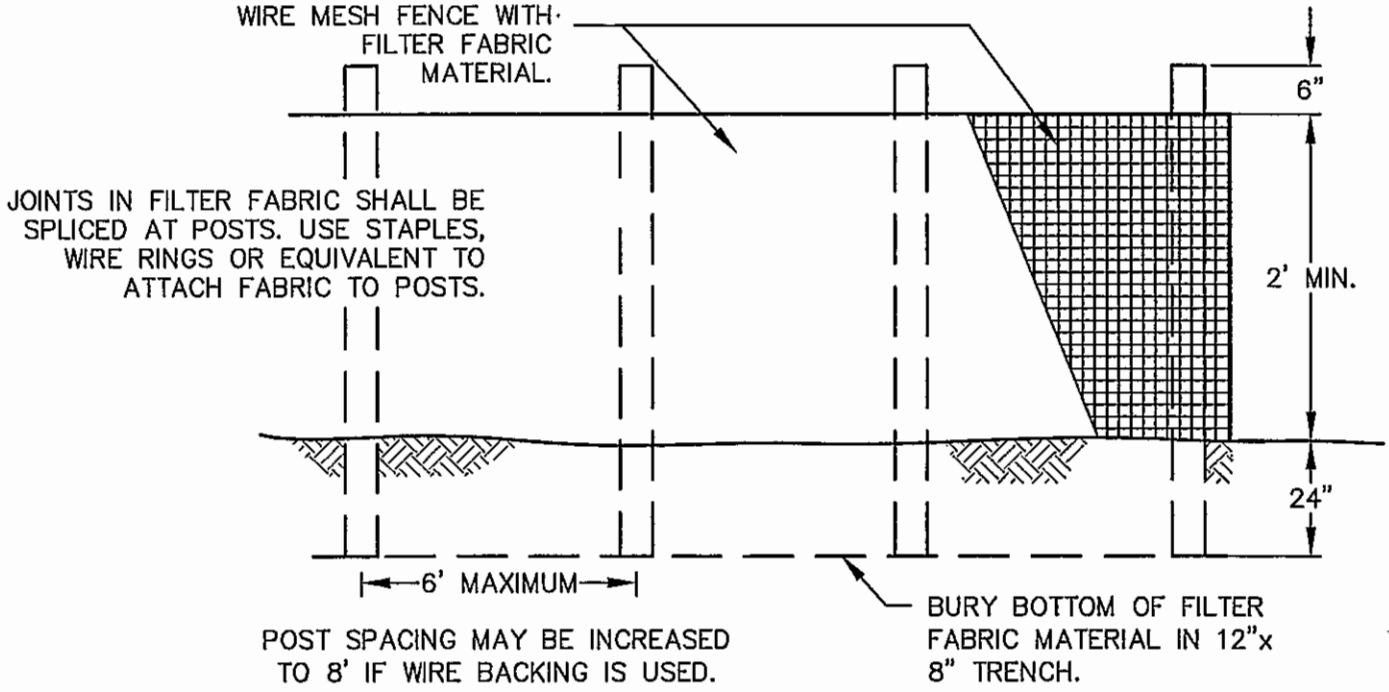
NOTES:

A. DESIGN SHOWN REPRESENTS MINIMUM DESIGN REQUIREMENTS. ACTUAL DESIGN FOR SITE SPECIFIC CONDITIONS WILL NEED TO BE DESIGNED BY A REGISTERED PROFESSIONAL ENGINEER IN THE STATE OF WASHINGTON.
B. ALL STEEL AND WWF SHALL BE A36 STRUCTURAL UNLESS NOTED OTHERWISE.
C. FOOTING DESIGN MAY VARY PER SITE CONDITIONS.
D. REFERENCE DETAIL 2840.06 FOR FOUNDTION AND POST BASE DETAILS.
E. ALL HARDWARE, PLATES, AND FASTENERS SHALL BE HOT DIP GALVANIZED.
F. WHERE TRAIL SLOPES, POSTS AND VERTICAL RAILS SHALL REMAIN PLUMB. HORIZONTAL RAILS SHALL BE SLOPED TO MATCH GRADE OF TRAIL.
G. BROWN PRESSURE TREATMENT SHALL BE USED ON ALL PRESSURE TREATED WOOD.
H. CONTRACTOR SHALL SUBMIT DETAILED SHOP DRAWINGS PRIOR TO CONSTRUCTION. SHOP DRAWINGS SHALL SHOW ALL TRANSITIONS, JOINTS, AND PANEL SECTIONS AT BOTH HORIZONTAL AND VERTICAL CURVES.
I. ALL LUMBER SHALL BE DF-2. REFERENCE WSDOT SPECS FOR GRADE STAMP AND SUBMITTAL REQUIREMENTS.



TYPICAL CROSS SECTION

NTS



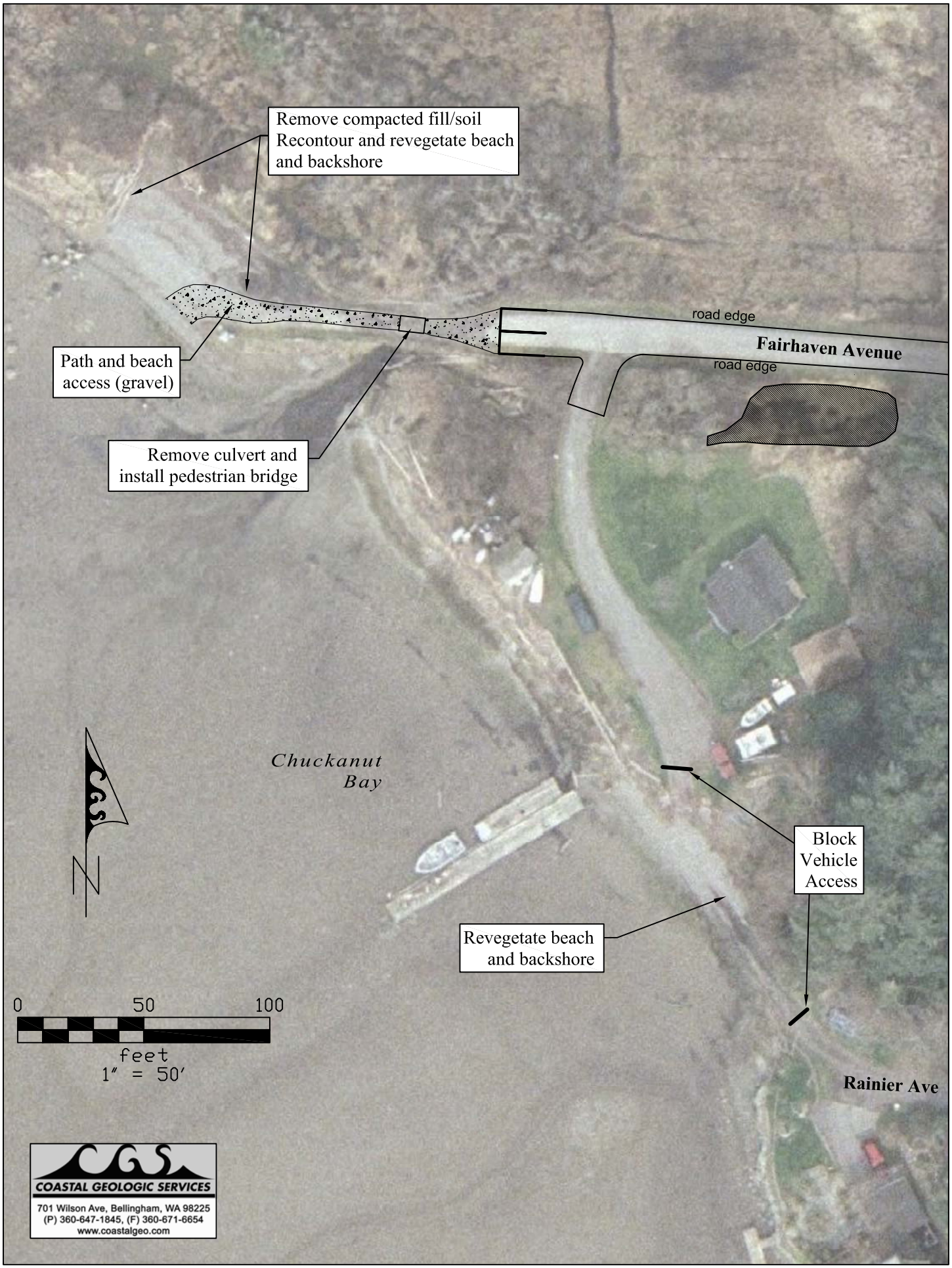
ELEVATION

NTS

NOTES:

1. FENCE SHALL NOT BE INSTALLED ON SLOPES STEEPER THAN 2:1.
2. JOINTS IN FILTER FABRIC SHALL BE OVERLAPPED 6 INCHES AT POST.
3. USE STAPLES, WIRE RINGS, OR EQUIVALENT TO ATTACH FABRIC TO WIRE FENCE.
4. REMOVE SEDIMENT WHEN IT REACHES 1/3 FENCE HEIGHT.

APPROVED Beryl Routh City Engineer	11/29/04 Date	CITY OF BELLINGHAM REINFORCED SILT FENCE	DRAWING EC–615


Remove compacted fill/soil
Recontour and revegetate beach and backshore
road edge
Fairhaven Avenue
road edge
Path and beach access (gravel)
Remove culvert and install pedestrian bridge
Chuckanut Bay
Block Vehicle Access
Revegetate beach and backshore
0
50
100
feet
1″ = 50′
Rainier Ave
COASTAL GEOLOGIC SERVICES
701 Wilson Ave, Bellingham, WA 98225
(P) 360-647-1845, (F) 360-671-6654
www.coastalgeo.com

N

Brackish Region

Survey Extent

0 20 40 60 80 ft

Ditch

MHHW

MHW

Fairhaven Avenue

COB#5213

Culvert
(invert=+6.6 ft MLLW)

Culvert
(outvert=+6.3 ft MLLW)

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

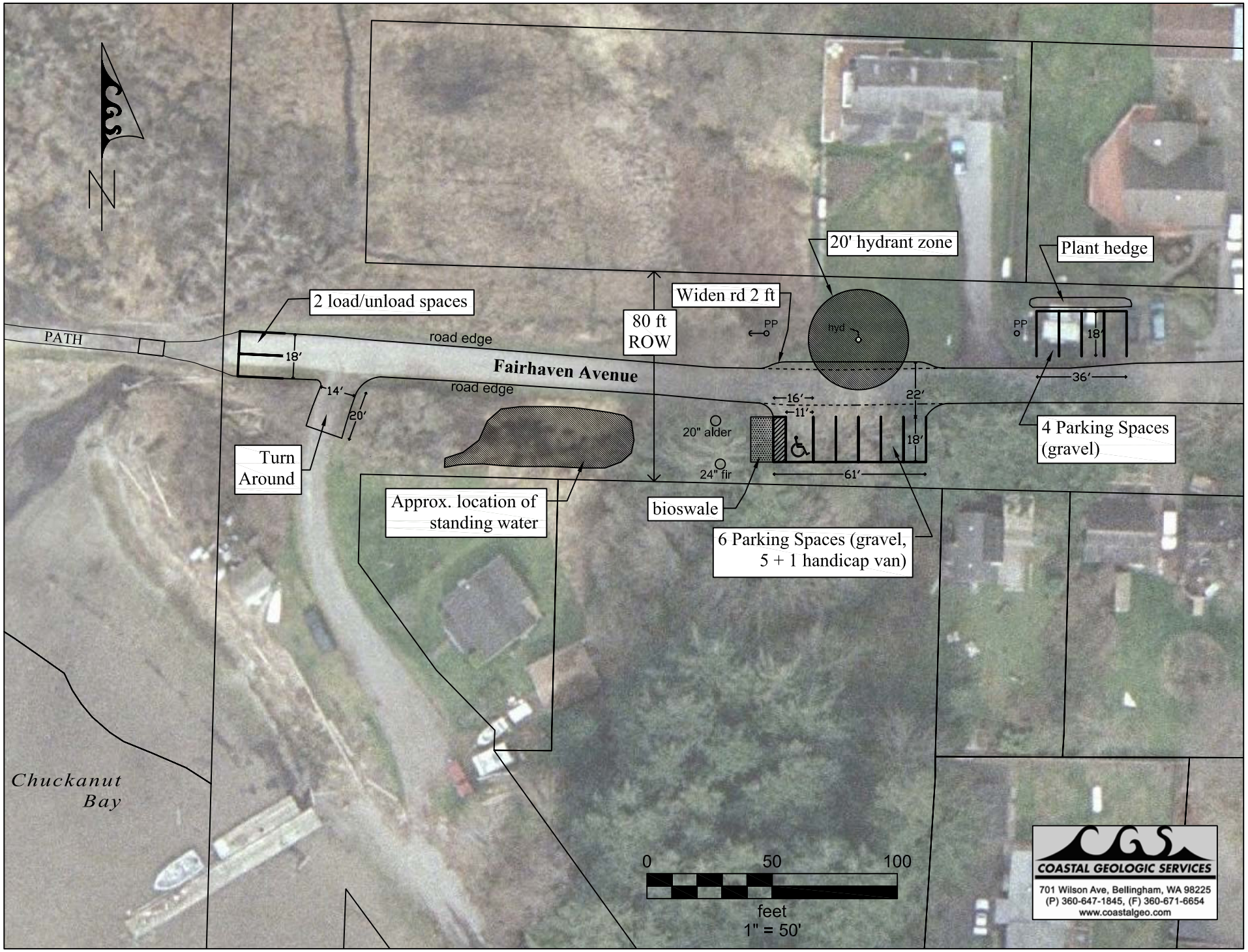
MHHW =+8.4' MLLW
MHW =+7.7' MLLW
Horizontal datum: NAD83/98
MLLW=0.0'

Fairhaven Marsh, Bellingham, WA: Wetland Assessment

Wetland Topography

1"=40'	Surveyed: 4/22/08	Date: 6/23/08	Sheet 2 of 2 JFW

08-015_SiteSurvey22AP08.dwg


N
2 load/unload spaces
PATH
road edge
18′
Fairhaven Avenue
road edge
14′
20′
Turn Around
80 ft ROW
Widen rd 2 ft
PP
20' hydrant zone
hyd
Plant hedge
PP
18′
36′
16′
11′
22′
18′
61′
20" alder
24" fir
4 Parking Spaces (gravel)
Approx. location of standing water
bioswale
6 Parking Spaces (gravel, 5 + 1 handicap van)
Chuckanut Bay
0
50
100
feet
1" = 50'
COASTAL GEOLOGIC SERVICES
701 Wilson Ave, Bellingham, WA 98225
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Chuckanut Village Marsh
Water Quality Improvement

Monitoring Report
CCWF Grant Number G0900085

City of Bellingham
Environmental Resources Division
Public Works Department
2221 Pacific Street
Bellingham, WA 98229

Prepared: July 2013

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Executive Summary

This technical report summarizes water quality monitoring data collected at Chuckanut Village Marsh in Bellingham, Washington. The City of Bellingham Public Works Department, Natural Resources Division conducted the water quality monitoring from April 2010 through June 2013 to document possible hydrologic and water quality changes resulting from the Chuckanut Village Marsh culvert removal project ("the project") completed in March 2011.

The Chuckanut Village Marsh (also known as the Fairhaven Street Marsh, hereafter referred to as "the marsh") is located at the west end of Fairhaven Avenue in Bellingham, Washington (Figure 1). The marsh is a wetland complex adjacent to a marine pocket estuary at the northern end of Chuckanut Bay, north of Chuckanut Creek. One of the goals of the culvert removal project was to remove an undersized culvert and enhance the outlet channel to provide juvenile salmon increased access to rearing habitat in the marsh. The culvert removal was anticipated to have a slight increase in water exchange between the marine and terrestrial environments, potentially resulting in very minor improvements to water quality, increased nutrient exchange and a slight increase in sediment transport. The removal of the road, parking area and culvert were also designed to provide increased intertidal habitat.

The objectives of the water quality monitoring were established to establish a pre-project baseline and assess changes in water quality within the marsh resulting from culvert removal. Four water quality parameters were monitored within the marsh: temperature, dissolved oxygen, specific conductance, and salinity. These parameters were selected to assess changes in tidal influence within the marsh and suitability of the marsh as fish habitat. Water quality monitoring was conducted at nine permanent water quality sampling stations. Seven of the nine water quality stations were located within the delineated wetland (marsh) area (Stations 3, 4, 5, 6, 7, 8, and 9). The remaining two (Stations 1 and 2) were situated on either side of the previous culvert location.

Monthly sampling began in April 2010 and ended in June 2013. Ten monthly data sets were collected from each of the nine stations prior to the removal of the culvert and 28 monthly data sets were collected after removal. If water was not present at a station no data was collected. Data were only collected at a given station when water depth was sufficient to fully submerge the water quality probes. Since the marsh is tidally influenced and freshwater entering the system

is seasonal, water was not present at all stations during all sampling sessions. This resulted in discontinuities in the data, making it difficult to detect data trends in the limited sampling period.

The results presented in this report are based on visual interpretation of the data. No statistical analysis was run as a part of this reporting. All nine permanent water quality stations experienced periods where water was absent during the sampling period. Station 1 was dry more frequently after the culvert replacement; conversely Station 2 was dry less frequently after the replacement. Water was present at Station 6 during all sampling periods except for a single low tide event in August 2010. Data from a few DO, salinity, and specific conductance measurements were omitted due to equipment or measurement errors, still Station 6 had the most consistent record of the nine stations. Overall the culvert removal did not appear to change the frequency of dry events at other stations.

The culvert removal appears to have established a more regular connection between the primary north/south ditch and the marine environment. The ditch is influenced by freshwater inputs entering from the north and the marine tidal influence from the south. Tidal influence changes beyond the primary ditch are not clear from the available data. Prior to the culvert removal, data at the sampling stations were scattered and patterns are difficult to detect due to the limited sampling period and frequent dry periods. The data suggests that Station 3 is primarily influenced by freshwater flowing in the ditch from the east. Stations 4, 5, 7, 8 and 9 interface with marine events, but not on a regular basis. Station 1, 2 and 6 have a more consistent connection with the marine system, but also are influenced by freshwater moving through the system.

Chuckanut Village Marsh appears to continue to provide high functioning estuarine wetland habitat. The data indicates that since the culvert was removed the water quality parameters are functioning in a similar manner as before the culvert was removed. Increased tidal action is present near the outlet of the marsh with evidence of occasional large marine inputs as evidenced by photographs of marine algae drift in the interior of the marsh.

Based on the water quality monitoring and supplemental seining surveys conducted pre and post project by the Whatcom County Marine Resources Committee, the most influential change to fish habitat resulting from the culvert removal project appears to be improved access to rearing habitat for juvenile

salmon. Other project related habitat benefits included the removal of vehicles from the beach, the reestablishment of native vegetation in the previous parking area, and increased community stewardship education.

If sampling continues, we recommend collecting the following additional data to provide a greater understanding of the interaction of the marsh and the marine system:

1. Continue seining surveys in the bay and within the marsh.
2. Monitor vegetation communities within the marsh five years after the culvert removal to detect any change.
3. Monitor beach improvements such as vegetation re-establishment.

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1.0 Introduction

1.1 Report Purpose

This technical report summarizes water quality monitoring data collected at Chuckanut Village Marsh in Bellingham, Washington. The City of Bellingham Public Works Department, Natural Resources Division conducted the water quality monitoring from April 2010 through June 2013 to document possible hydrologic and water quality changes resulting from the Chuckanut Village Marsh culvert removal project ("the project") completed in March 2011. This report was prepared in accordance with the project's Quality Assurance Project Plan (QAPP) (City of Bellingham [COB] 2010).

1.2 Background

The Chuckanut Village Marsh (also known as the Fairhaven Street Marsh, hereafter referred to as "the marsh") is located at the west end of Fairhaven Avenue in Bellingham, Washington (Figure 1). The marsh is a wetland complex adjacent to a marine pocket estuary at the northern end of Chuckanut Bay, north of Chuckanut Creek. The marsh is located on the north side of Fairhaven Avenue and extends from the marine mean high water line eastward to the edge of the developed area and north to the toe of a southeast-facing slope below Sea Pines Road. Surface flow exiting the marsh is directed into a primary channel. The channel enters the marsh in the northeast and exits near the southwest corner. The channel crosses under Fairhaven Avenue before outflowing into Chuckanut Bay (NES 2008). The Chuckanut Creek pocket estuary provides the highest functioning habitat of its type in the City of Bellingham (NES 2006). Furthermore, the marsh provides moderate to high water quality and hydrologic wetland functions as defined by the Western Washington Wetland Rating System (NES 2008).

Figure 1. Overview of the Marsh.

Prior to implementation of the project, an unpaved access road extended from Fairhaven Avenue to a gravel parking area on the beach. Vehicle access to the beach resulted in degradation of natural vegetation and pollutants from cars entering the marine system. The marsh was connected to Chuckanut Bay by an 18-inch diameter culvert which extended for 27 feet under Fairhaven Avenue at a slope of 1.1%. The culvert likely restricted fish passage between the marine system into the marsh based on its size and position (NES 2008, Coastal Geologic Services 2007).

Figure 2. Pre-existing Culvert.

Figure 3. Vehicles parking on beach prior to culvert removal.

The findings from the Chuckanut Village Marsh Characterization indicated that the marsh was influenced by the adjacent marine system, but at only high tides equal to or greater than 9.0+ feet influenced the majority of the marsh (NES 2008). Tides of this height typically occur around 100 times a year and were indicated to be important in maintaining the marsh vegetation communities (NES 2008) (Figure 4). The marsh outlet stream and the marine water were connected at tides of 6.6+ feet, events that typically occur more than 600 times a year. Fish may have had the potential to enter and exit the marsh from the marine system during tides of 6.6+ and above (NES 2008).

Figure 4. Direct observation of marine algae washed into the marsh during a high tide event.

1.3 Project Description

The project involved removing vehicle access to the marine beach; removing the 18-inch culvert and replacing it with an 11 foot long by 6 foot wide bottomless concrete box culvert; removing derelict concrete structures in the nearshore; the addition of a pedestrian footbridge on top of the box culvert; restoring the previous parking area with native vegetation; and providing alternative parking away from the beach and marsh. Educational signage and a pet waste station were also included in the project. The project was completed in March 2011.

Figure 5. New box culvert and pedestrian footbridge.

Figure 6. New pedestrian path between the footbridge and estuary.

Figure 7. New pedestrian path between the footbridge and estuary.

1.4 Project Goals and Objectives

1.4.1 Project Goals

One of the goals of the project was to remove an undersized culvert and enhance the outlet channel to provide juvenile salmon increased access to rearing habitat in the marsh. The culvert removal was anticipated to have a slight increase in water exchange between the marine and terrestrial environments, potentially resulting in very minor improvements to water quality, increased nutrient exchange and a slight increase in sediment transport. The removal of the road, parking area and culvert were also designed to provide increased intertidal habitat (NES 2008).

The following monitoring objectives were established to assess the effects of the removal of the culvert on the water quality within the marsh (COB 2010).

1.4.2 Monitoring Objectives

1. Establish baseline water quality conditions prior to restoration of the marsh (removal of the culvert).
2. Continue water quality monitoring after completion of the restoration (post culvert removal) project in order to document changes in water quality conditions at the marsh.

Four water quality parameters were monitored within the marsh: temperature, dissolved oxygen, specific conductance, and salinity. These parameters were selected to assess changes in tidal influence within the marsh and suitability of the marsh as fish habitat.

Water temperature is an important measure of water quality because all aquatic organisms are dependent upon certain temperature ranges for optimal health and reproduction. Water temperature also has a direct impact on dissolved oxygen levels (COB 2010).

Aquatic organisms require oxygen to survive. Oxygen in water is measured in its dissolved form, dissolved oxygen (DO). Dissolved oxygen varies directly in response to atmospheric pressure and water temperature. Higher atmospheric pressure results in higher oxygen solubility in water and higher DO. Higher temperatures result in lower oxygen solubility and lower DO. Photosynthesis by aquatic plants and the turbulence of running water both increase DO. Dissolved oxygen levels vary seasonally. Dissolved oxygen is also affected by inputs of pollution. Feces from animals and failing septic systems, grass clippings, leaves and woody debris, and urban and agricultural runoff all contain organic matter that is decomposed by microorganisms, which consume oxygen in the decomposition process and can thus reduce DO (COB 2010). Dissolved oxygen varies inversely with salinity. Increasing salinity decreases the ability of water to hold dissolved oxygen.

Specific conductance (SpC) and salinity are dependent on many factors. Natural variation can be due to the type of rocks weathered in the watershed, precipitation levels, the chemical composition of the precipitation (which is largely dependent on distance from the ocean) and the relative contribution of ground water to total flow (Allan 1995). Evaporation can also contribute to increased SpC and salinity levels by concentrating ions in water. In urban settings, pollution from point and non-point sources can contribute to the amount of dissolved ions in water, increasing SpC and salinity. In marine estuaries, SpC and salinity are heavily influenced by tidal action. Salinity and temperature also affect the density of water, which can result in salinity stratification (COB 2010).

2.0 Monitoring Methods

2.1 Study Area

Water quality monitoring stations were located within the five-acre wetland area. Water quality stations were chosen to cover a range of potential tidal influence.

Figure 8. Study Boundaries.

2.2 Field Methodology

Water quality monitoring was conducted at nine permanent water quality sampling stations (Figure 9). Seven of the nine water quality stations were located within the delineated wetland (marsh) area (Stations 3, 4, 5, 6, 7, 8, and 9). The remaining two (Stations 1 and 2) were situated on either side of the previous culvert location (COB 2010). Appendix D includes photographs of the station locations.

Monitoring stations established for preliminary salinity testing in the 2008 wetland characterization study (NES 2008) were adopted for this water quality monitoring program. Station 1 was located at the outlet of the preexisting culvert, on the marine side. Station 2, 3 and 6 were located in internal drainage ditches, which have a direct connection to tidal effects and provide potential fish access. Stations 4, 5 and 7 were located in a lower elevation area, while Stations 8 and 9 were at higher relative elevations (COB 2010).

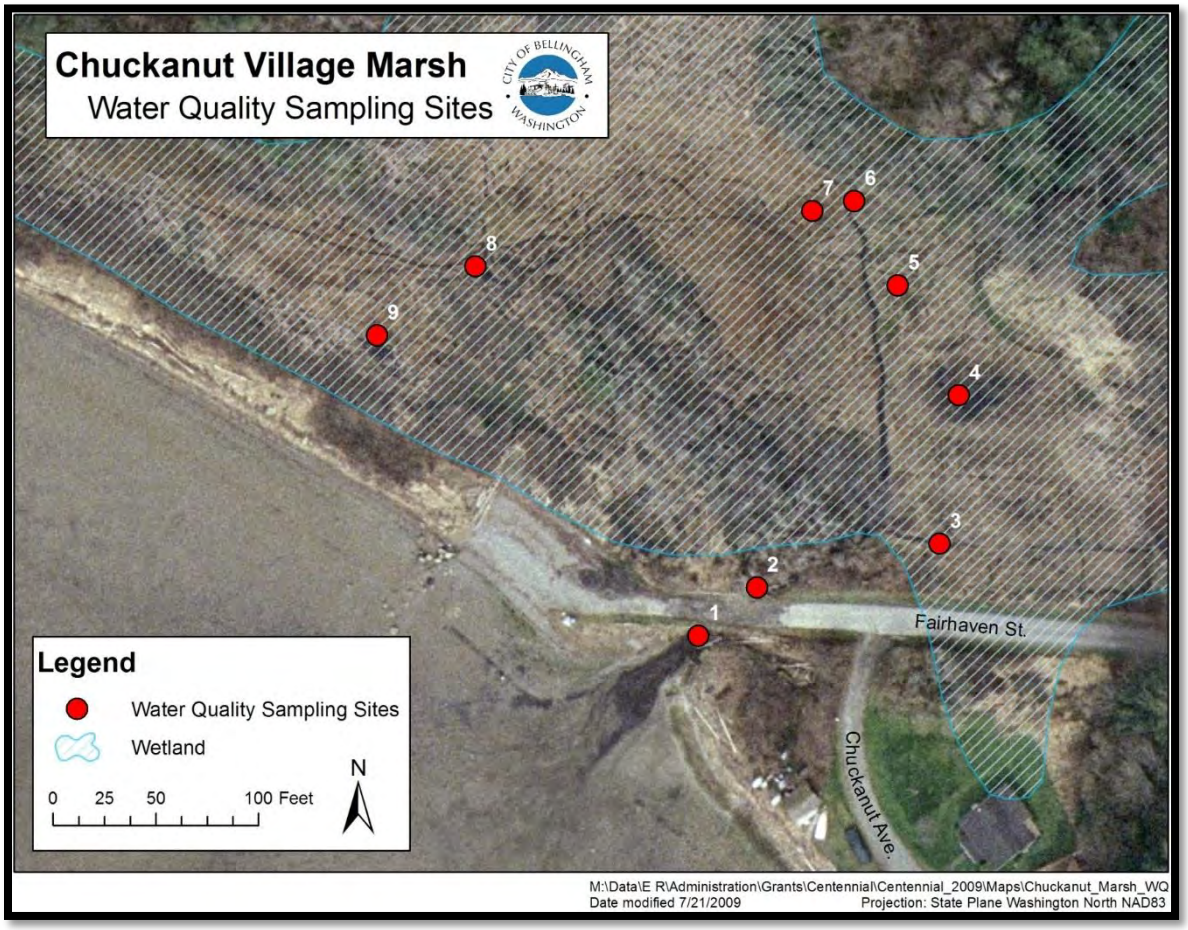

Figure 9. Sampling Stations.

Temperature, DO, specific conductance and salinity were the parameters measured in situ at each of the nine sampling stations. Data were collected once a month on a day which had a high tide exceeding 7.0 feet. Data from the high and low tide conditions were collected at each sampling station during a single sampling day. When sufficient water depth existed, two measurements were taken at each station to detect any stratification: just below the water surface (water quality meter probe submerged) and six inches below the water surface, or the bottom, whichever was first. One set of field duplicate measurements was

also collected per sampling day. This analysis focuses on surface water data (collected in the upper six inches of the water column). Due to insufficient water depths, it was not possible to collect data below six inches (e.g. bottom) at many stations in number of cases. Therefore, this report has focused its discussion on surface sample results (COB 2010).

A Quanta Hydrolab water quality meter was used for data collection. Each day the Hydrolab was calibrated per manufacturer's recommendations and QAPP protocols prior to use, and a post-calibration check was conducted immediately after calibration to ensure an accurate calibration. In the field, a duplicate sample was collected at one station per day. A field duplicate is a second sample from the same station using identical sampling procedures. After the station was sampled (including both stratification measurements) the transmitter was removed from the water for one minute. The station was then sampled a second time using the same procedure. After field data collection, one additional post-sampling check was conducted after use in the field to ensure that instrument drift did not occur during use. Certified standards of known concentration were used to assess the performance of the Hydrolab post-calibration and post-sampling. The calibration checks were used to assess the quality of the data as part of the data validation. All water quality data were evaluated against the project measurement quality objectives (MQOs) defined in the QAPP (COB 2010).

All field monitoring results and observations were recorded on pre-printed data sheets located in a designated project folder. Data sheets were checked for legibility and completeness before leaving the site location (COB 2010).

Field data was entered into spreadsheets monthly and reviewed to ensure that all data was validated before preparing the final project report. Validation involved review of all data for possible transcription errors, missing data, and improbable values when importing data from field sheets to the project spreadsheets (COB 2010).

Problems encountered in the field were recorded in field notes with reasons for missing data or anomalous data points. If alternate sampling equipment was used, these substitutions were documented and the data annotated in the final report. If data were excluded from the data report, documentation will be provided to explain the reason for its absence, including statements concerning equipment malfunction, repair, or substitution (COB 2010).

All water quality data collected in support of these grants has been submitted to the Washington State Department of Ecology's Environmental Information Management System (EIM) Database annually (COB 2010).

Chuckanut Village Marsh is located in an Area of Moderate Concern for aquatic invasive species (Washington State Department of Ecology 2010). Therefore, sampling was conducted using methods and inspectable equipment to minimize contact with potential sources of aquatic invasive species. Only rubber boots and waders were used for sampling; no felt-soled wading boots. All equipment, including boots and water quality probes, were visually inspected for mud, algae, plant parts and other debris and any such debris was cleaned by scrubbing and rinsing until visually clean. Equipment was dried thoroughly after use.

Data verification is a quality assurance review process to determine the completeness and quality of data. Data verification ensures that all quality control samples meet the acceptance criteria as specified in the standard operating procedure for that method. Preliminary data verification occurred in the field before leaving the site. This included reviewing field notes for completeness, errors and consistency. Duplicate measurements and documentation of conditions in field notes support verification of field measurements.

Field personnel ensured that methods and protocols specified in the Quality Assurance Project Plan were followed, including instrument calibrations and quality control checks. Evaluation criteria included the acceptability of instrument calibrations, post-calibration and post-sampling calibration checks, and results from duplicate field samples. Precision was estimated by calculating the relative percent difference for field duplicate results. Analytical bias was assumed to be within acceptable limits if quality control limits are achieved for check standards. Sampling bias was assessed by verifying that the correct sampling and handling procedures were used.

All data were reviewed to determine if results met measurement quality objectives and verify that proper protocols were followed and that data were consistent, correct, and complete. Based on these assessments, the data was either; accepted, accepted with appropriate qualifications, or rejected. Reviewed and validated data were submitted to the EIM database annually.

3.0 Results

This report summarizes both baseline data collected approximately one year prior to the culvert removal and two years post action. The results presented herein are based on visual interpretation of the data. No statistical analysis was run as a part of this reporting.

Monthly sampling began in April 2010 and ended in June 2013. Ten monthly data sets were collected from each of the nine stations prior to the removal of the culvert and 28 monthly data sets were collected after removal. If water was not present at a station no data was collected (Appendix B). Data were only collected at a given station when water depth was sufficient to fully submerge the water quality probes. Since the marsh is tidally influenced and freshwater entering the system is seasonal, water was not present at all stations during all sampling sessions. This resulted in discontinuities in the data, making it difficult to detect data trends in the limited sampling period. Appendix B to this report includes the raw water quality data and Appendix C includes graphs based on the raw data.

Data reported within this analysis include surface water measurements recorded at high and low tides for each of the four water quality parameters described above. For the purpose of this report, bottom water measurements are only included in the discussion regarding stratification (Section 4.0 Discussion, below), as most stations did not have sufficient depth most of the time to provide "bottom" readings.

All nine permanent water quality stations experienced periods where water was absent during the sampling period. Station 1 was dry more frequently after the culvert replacement; conversely Station 2 was dry less frequently after the replacement. Water was present at Station 6 during all sampling periods except for a single low tide event in August 2010. Data from a few DO, salinity, and specific conductance measurements were omitted due to equipment or measurement errors, still Station 6 had the most consistent record of the nine stations. Overall the culvert removal did not appear to change the frequency of dry events at other stations.

The results for each of the four parameters are described in the sections below. The results are grouped according to their location in the marsh:

- **Stations 1, 2 and 6:** these stations are all located along the primary ditch within the marsh. Stations 1 and 2 provide a pathway for fish access and Station 6 provides potential fish rearing and foraging habitat.
- **Stations 3, 4, 5 and 7:** these stations are located off the main ditch and within the interior of the marsh and do not provide direct fish habitat; and
- **Stations 8 and 9:** these stations are located furthest and are most isolated from the ditch and also do not provide direct fish habitat.

For each of the four parameters, data is presented in two table formats. The first table format (Tables 1, 5, and 9) is a summary of high and low tide data and bottom and surface data combined. This summary table format presents mean, median, minimum, maximum and range of each data set and shows general overall trends within a parameter before and after the culvert removal. The second table format (Tables 2, 3, 4, 6, 7, 8, 10, 11, and 12) only includes data from select stations and only include data from high tide and surface measurements. This second table format shows more specific information on how each parameter responds across the sampling period at each station. The data from the low tide and bottom collections were not included as they were not consistently present across all stations for all samplings.

3.1 Temperature

Water temperatures were consistent with seasonal variations at all stations. The seasonal patterns can be seen in Figure 10 below. Many stations had dry periods resulting in data gaps; however, the overall trend was for higher water temperatures to occur during the summer months and cooler temperatures during the winter months. The range was about 30°C across the sampling period.

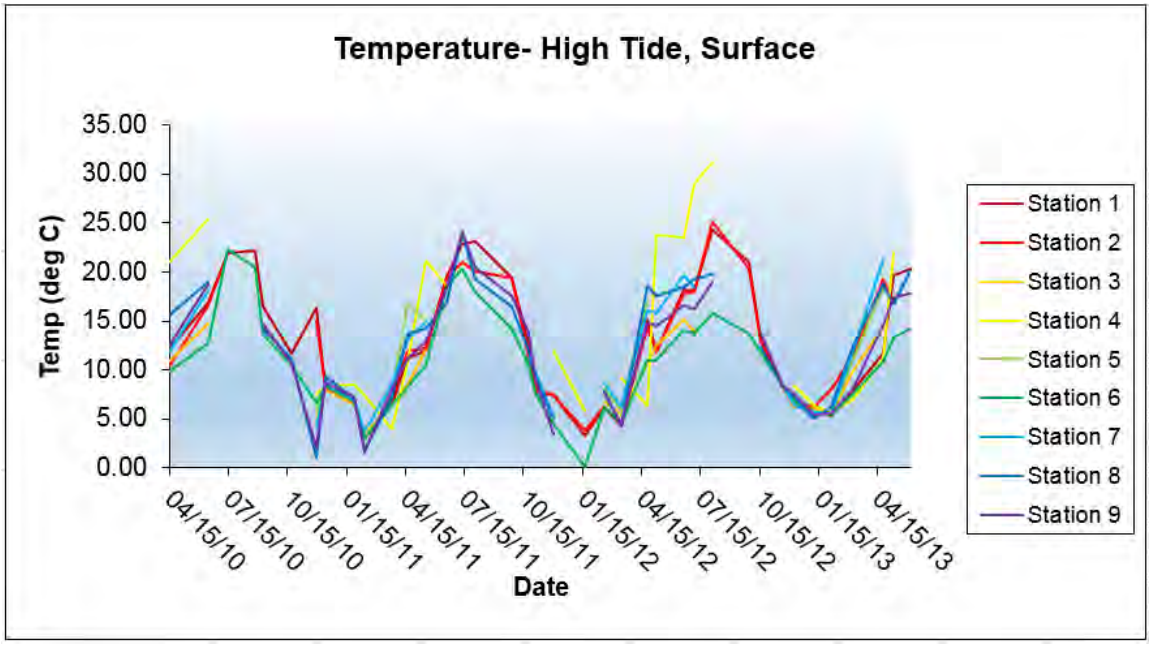

Figure 10. Surface sample temperatures at high tide.

Table 1 presents the combined mean values for all water temperature data for both pre and post culvert conditions. The maximum water temperature encountered was 31°C at Station 4 in July of 2012. The minimum water temperature recorded was 0.15°C at Station 6 in January of 2012. The median and mean water temperatures were slightly lower prior to the culvert removal than after.

*Table 1. Combined Water Temperature data from all Stations pre and post culvert removal**

Project Status	Median Temperature (°C)	Mean Temperature (°C)	Min Temperature (°C)	Max Temperature (°C)	Range (°C)
Pre culvert	10.59	8.67	1.05	28.23	27.18
Post Culvert	11.82	11.11	0.15	31.18	31.03

* high and low tide, surface and bottom samples

Stations 1, 2, and 6

Table 2 presents water temperature values for Stations 1, 2, and 6 pre and post culvert replacement. Stations 1 and 2 displayed very similar patterns and temperature values to each other. The patterns and values were also similar pre and post culvert removal. Although many low tide events resulted in dry conditions at these two stations, where present, there was a trend for low tide conditions to have lower temperatures than high tide conditions.

*Table 2. Water Temperature data from Stations 1, 2, and 6 pre and post culvert removal**

Station	Project Status	Mean Temperature (°C)	Median Temperature (°C)	Min Temperature (°C)	Max Temperature (°C)	Range (°C)
1	Pre culvert	12.56	11.87	3.08	22.25	19.17
1	Post Culvert	11.00	9.00	0.19	24.36	24.17
2	Pre culvert	10.56	9.24	2.89	21.90	19.01
2	Post Culvert	11.30	11.98	0.21	25.13	24.92
6	Pre culvert	10.99	9.75	2.99	22.28	19.29
6	Post Culvert	10.19	10.46	0.15	20.31	20.16

* high tide, surface samples only

Station 6 did not experience drying but showed similar trends as Stations 1 and 2. Station 6 experienced the lowest recorded temperatures during the sampling period. All three stations experienced temperatures near 1°C during a January event, but most often the winter low temperatures were around 3°C and summer high temperatures were between 22°C and 25°C. The range between low and high temperatures was a few degrees higher in the post culvert condition. Other trends and patterns may not have been detectable due to limited data available prior to the culvert removal.

Stations 3, 4, 5 and 7

Table 3 presents water temperature values for Stations 3, 4, 5 and 7 pre and post culvert replacement. Stations 3, 4, 5, and 7 experienced frequent drying events. No other patterns or trends were detected. This may have been due to the limited data available prior to the culvert removal.

*Table 3. Water Temperature data from Stations 3, 4, 5 and 7 pre and post culvert removal**

Station	Project Status	Mean Temperature (°C)	Median Temperature (°C)	Min Temperature (°C)	Max Temperature (°C)	Range (°C)
3	Pre culvert	8.43	6.99	3.44	17.76	14.32
3	Post Culvert	9.89	10.07	4.84	16.31	21.15
4	Pre culvert	12.28	8.52	3.97	21.09	17.12
4	Post Culvert	15.09	11.90	5.72	31.18	25.46
5	Pre culvert	6.37	6.44	2.73	16.50	13.77
5	Pre culvert	11.48	9.10	4.44	23.84	19.40
7	Post Culvert	10.25	8.01	3.71	27.36	23.65
7	Post Culvert	12.59	10.43	4.22	27.79	23.57

*high tide, surface samples only

Stations 8 and 9

Table 4 presents water temperature values for Station 8 and 9 pre and post culvert replacement. Stations 8 and 9 displayed very similar values to each other in both low and high tide conditions. Due to the limited data available prior to the culvert removal, it was not possible to determine changes in patterns or trends.

*Table 4. Water Temperature data from Stations8and 9 pre and post culvert removal**

Station	Project Status	Mean Temperature (°C)	Median Temperature (°C)	Min Temperature (°C)	Max Temperature (°C)	Range (°C)
8	Pre culvert	10.20	9.76	1.05	19.19	18.14
8	Post Culvert	13.26	13.48	4.30	23.96	19.66
9	Pre culvert	9.73	8.79	1.63	19.50	17.87
9	Post Culvert	12.29	13.11	3.40	24.10	20.70

* high tide, surface samples only

3.2 Dissolved Oxygen

Table 5 presents the combined mean values for DO. The maximum DO level recorded during the sampling period was 21.65 mg/L at Station 4 in March of

2012 during a minus low tide; conversely the lowest DO level was 0.09 mg/L recorded at Station 9 in May 2013 which was also a minus low tide. The range between minimum and maximum DO levels was greater after the culvert was removed than when present. The mean and median DO levels were similar to each other and similar in both the pre and post culvert removal conditions. High DO levels often corresponded with low tide events, particularly at Stations 4 and 8. There was a trend for DO levels to be slightly higher in the Stations associated with the ditch (Stations 1, 2 and 6) than the others.

*Table 5. Combined Dissolved Oxygen data from all Stations pre and post culvert removal**

Project Status	Median DO	Mean DO	Min DO	Max DO	Range
Pre culvert	5.57	5.27	0.13	12.52	12.39
Post Culvert	5.80	5.85	0.09	21.65	21.56

* high and low tide, surface and bottom samples

Stations 1, 2, 6

Table 6 presents the DO values for Station 1, 2 and 6 pre and post culvert replacement. The mean values for DO are very similar, but Stations 1 and 2 display slightly higher median DO levels than observed at Station 6. DO means and ranges were similar to each other both pre and post culvert removal where data was present.

*Table 6. DO data from Stations 1, 2, and 6 pre and post culvert removal**

Station	Project Status	Mean DO (mg/L)	Median DO (mg/L)	Min DO (mg/L)	Max DO (mg/L)	Range (mg/L)
1	Pre culvert	6.88	7.56	0.13	11.51	11.38
1	Post Culvert	8.72	8.77	2.33	14.92	12.59
2	Pre culvert	8.08	8.11	5.80	11.48	5.68
2	Post Culvert	8.12	8.52	2.62	14.26	11.64
6	Pre culvert	6.08	5.93	0.80	11.28	10.48
6	Post Culvert	5.34	5.46	0.40	10.57	10.17

* high tide, surface samples only

Stations 3, 4, 5 and 7

Table 7 presents the DO values for Station 3, 4, 5 and 7 pre and post culvert replacement. Station 3 had the lowest mean and median values for DO of all the stations and also had a very narrow range between minimum and maximum

DO. The DO levels were similar in both the pre and post culvert removal conditions.

The mean and median DO levels were similar between Stations 4, 5 and 7, except the post removal mean and median DO for Station 4 which is notably higher. Station 4 had the largest shift in mean and median DO levels between the pre and post culvert replacement (5.6 mg/L). The other stations experienced minimal change (approx. 1 mg/L).

*Table 7. DO data from Stations 3, 4, 5 and 7 pre and post culvert removal**

Station	Project Status	Mean DO (mg/L)	Median DO (mg/L)	Min DO (mg/L)	Max DO (mg/L)	Range (mg/L)
3	Pre culvert	2.06	2.05	0.94	4.67	3.73
3	Post Culvert	2.03	1.47	0.42	9.07	8.65
4	Pre culvert	4.94	4.34	0.33	20.55	20.22
4	Post Culvert	10.55	9.72	1.68	21.65	19.97
5	Pre culvert	4.70	3.35	1.41	10.77	9.37
5	Pre culvert	5.09	4.44	0.49	14.18	13.69
7	Post Culvert	6.65	7.45	0.40	12.52	12.12
7	Post Culvert	7.14	7.11	1.12	13.66	12.54

*high tide, surface samples only

Stations 3 and 7 showed no detectable trends. Stations 3 and 7 experienced many drying events and lacked data associated with low tide events. The data also showed occasional events of higher DO during low tide events at Stations 4 and 5. We would have expected the inverse situation, with low DO during low tide events since incoming marine water would be expected to have higher DO levels. This phenomenon is illustrated in Figure 11 below.

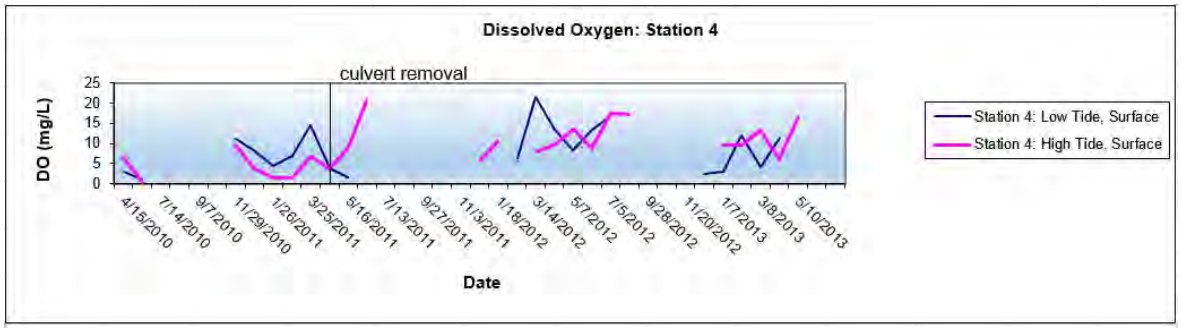

Figure 11. Dissolved oxygen levels at high and low tides at Station 4.

Stations 8 and 9

Table 8 presents the DO values for Station 8 and 9 pre and post culvert replacement. Stations 8 and 9 displayed mixed results. In some cases DO was higher during low tides and with others is higher during high tides (Figure 12). There may be a correlation to tidal cycles, air temperature, and/or photosynthesis, but additional sampling and analysis would be required to discern any such trends. Mean and median DO values did not vary highly between pre and post culvert conditions. Station 9 presented higher minimum DO levels in the pre culvert samplings than after or when compared to Station 8.

*Table 8. DO data from Stations 8 and 9 pre and post culvert removal**

Station	Project Status	Mean DO (mg/L)	Median DO (mg/L)	Min DO (mg/L)	Max DO (mg/L)	Range (mg/L)
8	Pre culvert	3.25	3.03	0.40	8.94	8.54
8	Post Culvert	3.36	2.63	0.13	17.44	17.31
9	Pre culvert	5.91	4.81	1.00	12.03	11.03
9	Post Culvert	4.86	4.21	0.24	11.12	10.88

* high tide, surface samples only

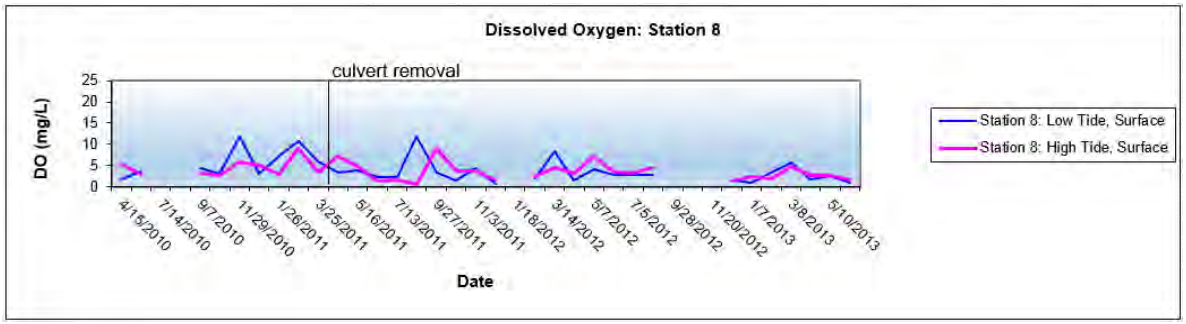

Figure 12. Dissolved oxygen levels at different tidal elevations at Station 8.

3.3 Salinity and Specific Conductance

Salinity and Specific Conductance have been reported together as conductivity is used to measure salinity and results were very similar. Table 9 presents the combined mean values for salinity.

*Table 9. Combined Salinity data from all Stations pre and post culvert removal**

Project Status	Median Salinity (PSS)	Mean Salinity (PSS)	Min Salinity (PSS)	Max Salinity (PSS)	Range (PSS)
Pre culvert	2.68	6.63	0.12	32.87	32.75
Post Culvert	4.15	8.27	0.12	29.24	29.12

* high and low tide, surface and bottom samples

Salinity within the sampling area ranged from a maximum value of 32.87 PSS at Station 6 on a high tide in August 2010 to a low value of 0.12 PSS on May 11, 2010 on a low tide. The median salinity pre culvert replacement was 2.68 PSS verses 4.14 PSS after the replacement. The mean also shifted with the culvert replacement with the pre-replacement mean salinity at 6.63 PSS and after the replacement it was 8.27 PSS. SpC values followed similar trends.

Stations 1, 2, 6

Table 10 presents the salinity values for Station 1, 2 and 6 pre and post culvert replacement. Stations 1 and 2 tended to have the highest salinity readings. Stations 1 and 2 displayed similar wide variations between low and high tide. The range may have increased slightly after removal of the culvert but we could not detect if this is significant. In comparison with Stations 1 and2, Stations 6 displayed more steady values between high and low tide events.

No clear differences were detected, but there may be a slight decrease in salinity at Station 6 after the culvert removal. This may be explained if heavier precipitation occurred during post event monitoring years.

*Table 10. Salinity data from Stations 1, 2, and 6 pre and post culvert removal**

Station	Project Status	Mean Salinity (PSS)	Median Salinity (PSS)	Min Salinity (PSS)	Max Salinity (PSS)	Range (PSS)
1	Pre culvert	7.23	3.21	0.13	11.51	11.38
1	Post Culvert	10.18	4.16	2.33	14.93	12.60
2	Pre culvert	5.54	0.69	0.25	26.86	0.25
2	Post Culvert	10.16	20.19	0.23	29.16	28.93
6	Pre culvert	3.28	0.36	0.12	20.48	20.36
6	Post Culvert	2.47	0.44	0.12	18.99	18.87

* high tide, surface samples only

Stations 3, 4, 5 and 7

Table 11 presents the salinity values for Station 3, 4, 5 and 7 pre and post culvert replacement. Stations 3, 4, 5 and 7 all have inconsistent data and trends were not discernible. Station 7 displayed the lowest salinity values of this guild prior to the culvert removal; this trend continued post culvert removal. However, the range between minimum and maximum salinity values changed substantially post culvert removal. Station 7 had very similar mean and maximum salinity values to Station 6. There may be underlying correlations with tides, but it is difficult to detect.

*Table 11. Salinity data from Stations 3, 4, 5 and 7 pre and post culvert removal**

Station	Project Status	Mean Salinity (PSS)	Median Salinity (PSS)	Min Salinity (PSS)	Max Salinity (PSS)	Range (PSS)
3	Pre culvert	7.14	5.25	3.67	14.24	10.57
3	Post Culvert	8.40	7.61	1.91	21.77	19.86
4	Pre culvert	9.69	9.65	1.11	22.85	21.74
4	Post Culvert	12.55	12.01	2.55	27.82	25.27
5	Pre culvert	5.33	5.4	0.90	14.18	13.83
5	Pre culvert	6.95	4.51	0.35	22.60	22.25
7	Post Culvert	2.18	2.41	0.65	2.91	2.26
7	Post Culvert	4.68	2.93	0.48	18.79	18.31

* high tide, surface samples only

Stations 8 and 9

Table 12 presents the salinity values for Station 8 and 9 pre and post culvert replacement. Stations 8 and 9 also have a number of data gaps. Station 9 has lower mean and median salinity values than Station 8 both pre and post culvert removal. The range of salinity values is greater at Station 8 than observed at 9.

*Table 12. Water DO data from Stations 8 and 9 pre and post culvert removal**

Station	Project Status	Mean Salinity (PSS)	Median Salinity (PSS)	Min Salinity (PSS)	Max Salinity (PSS)	Range (PSS)
8	Pre culvert	5.12	2.60	0.47	17.60	17.13
8	Post Culvert	5.08	2.56	0.23	23.54	23.31
9	Pre culvert	2.20	0.93	0.14	8.67	8.53
9	Post Culvert	2.81	1.47	0.18	12.03	11.85

* high tide, surface samples only

4.0 Discussion

4.1 Water Quality Parameters

Water quality parameters were sampled within the marsh over a three year period, documenting conditions pre and post culvert removal. No obvious effects to the water temperatures, DO, salinity or specific conductivity were observed as the result of the culvert removal. If present, the effects may not be apparent due to the limited sampling period and frequent data gaps. Although the data appear to exhibit minor differences for specific parameters, the differences may be associated with natural variability including air temperature and precipitation.

Nevertheless, the minor changes observed included a slight increase in the range between minimum and maximum DO levels after the culvert was removed. This may be the result of freshwater influence.

Dissolved oxygen levels appear to be correlated with tide cycles, but opposite as might be expected in some cases. The highest DO readings corresponded with low tide events at several stations, as illustrated for Station 4 in Figure 13 below. It was expected that high tide events would result in a flush of additional water inputs and higher DO levels, but this was not always the case. The shift in DO levels could be attributed to differences in temperatures, tide cycles,

photosynthesis, and timing of sampling between different years and would require further analysis and/or sampling.

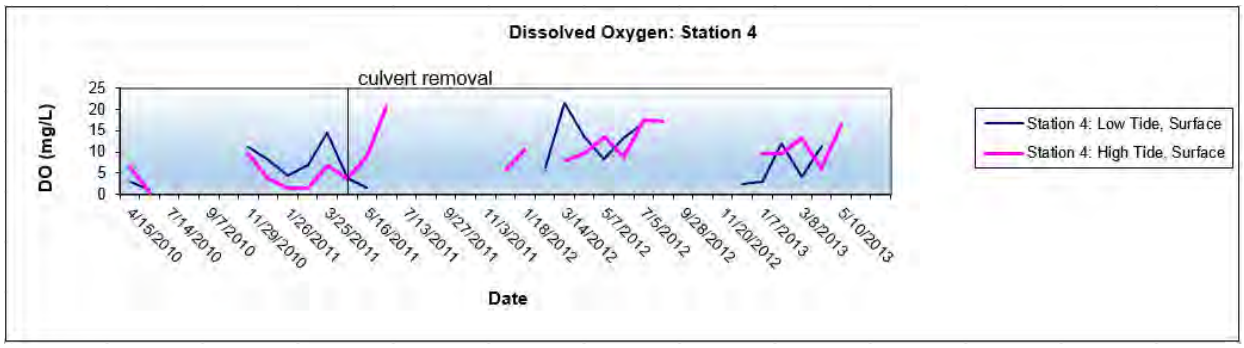

Figure 13. Dissolved oxygen levels at different tidal elevations at Station 4.

The tidal influence within the marsh appears not to have changed significantly. The only notable exception was near Stations 1 and 2. These stations experienced changes in the number of days without water. Both stations had dry periods at high tide prior to the culvert removal and experience none after the removal. Both pre and post culvert replacement, the tidal influence appears to extend throughout the marsh, but the strongest affects were observed within the main drainage ditch at Stations 1, 2, and 6. These stations displayed the closest correlation between water quality parameters and tidal cycles. Figure 14 illustrates how the salinity tends to be higher at high tide than low tide at Station 2. This trend follows at all three stations. Station 2 is nearest to the marine system; whereas Station 6 is farther from the inlet and shows reduced amplitude between high tide and low tide as seen in Figure 15. Also note, Station 2 experiences higher peaks in salinity values compared to Station 6 (Figure 14).

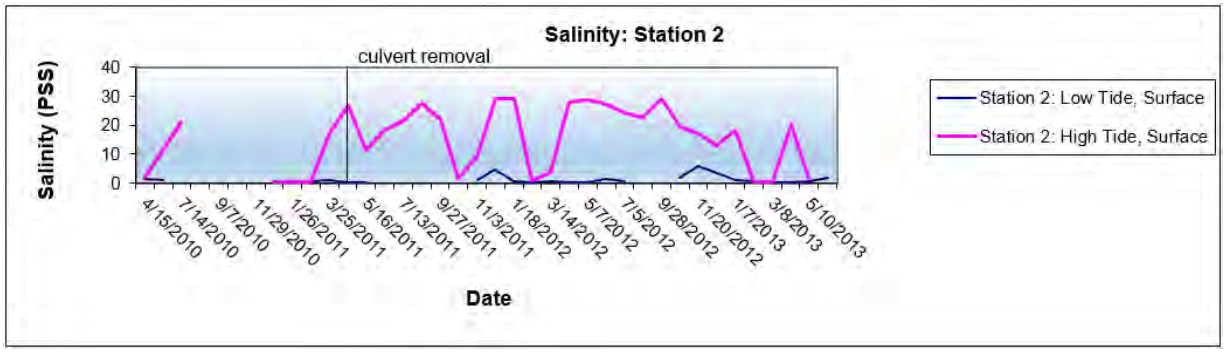

Figure 14. Salinity levels at Station 2.

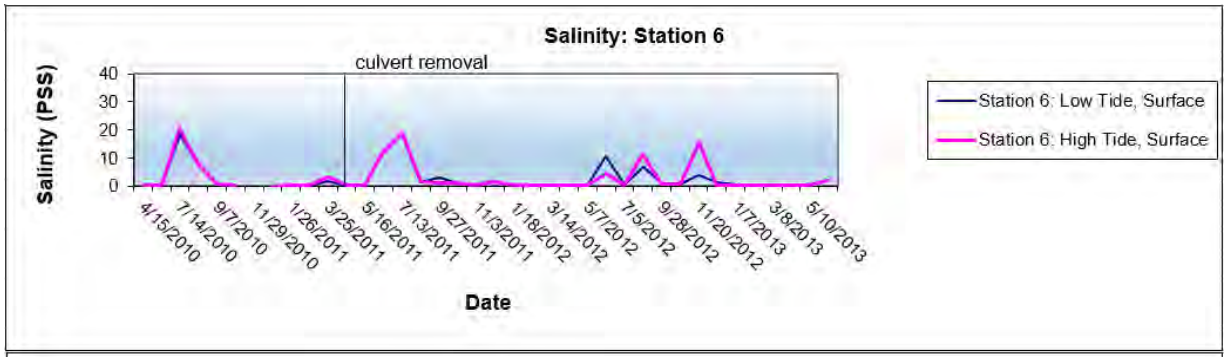

Figure 15. Salinity levels at Station 6.

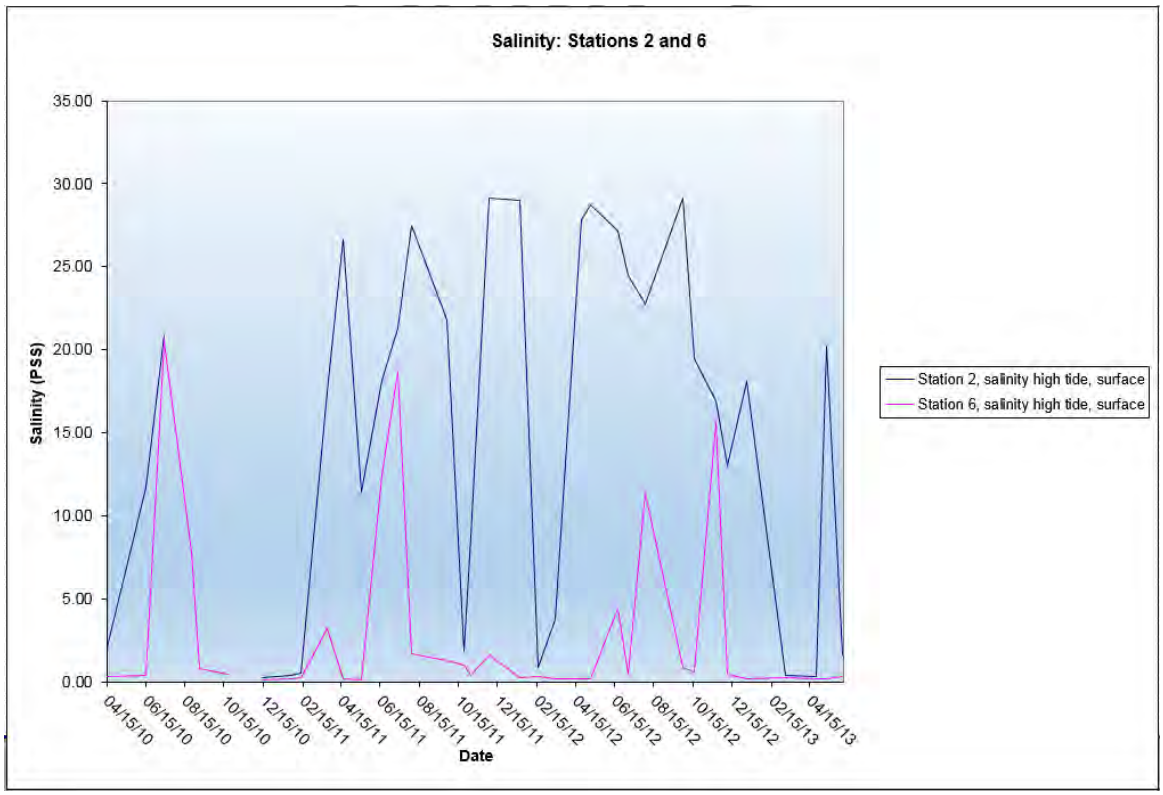

Figure 16. Comparing salinity levels at Stations 2 and 6, high tide surface samples only.

Salinity levels tended to be lower at stations further from the outlet and further from the primary ditch as illustrated in Figure 16. This is consistent with the characterization study conducted in the marsh in 2008 (NES 2008).

Station 6 appears to have the greatest freshwater input through the drainage flowing from the north. During winter months with high precipitation, lower salinity levels were noted at most Stations (except 1 and 2). During winter and early spring months the data indicates good mixing of fresh and salt waters and little stratification in the main ditch. When precipitation rates drop, a layer of

freshwater is observable above the denser salt water at Station 6 as illustrated in Figure 17.

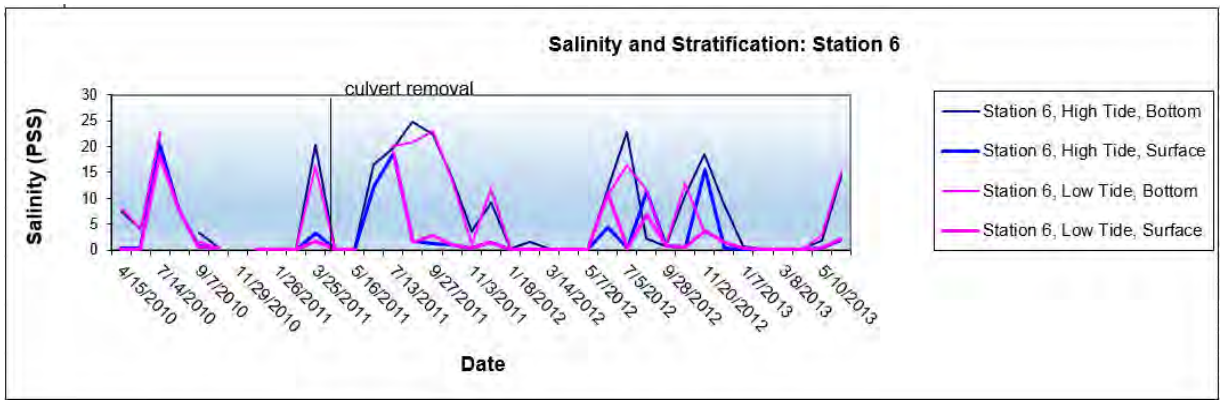

Figure 17. Salinity stratification at Station 6.

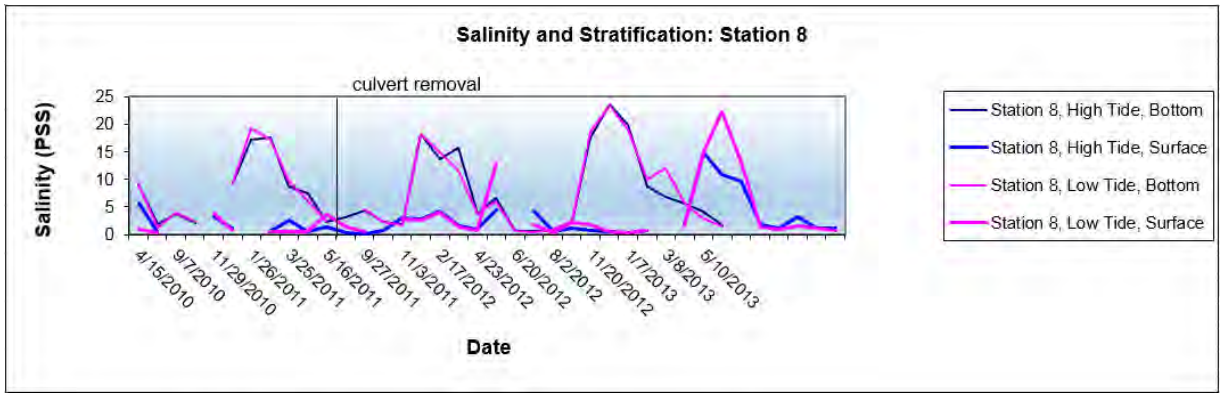

Figure 18. Salinity stratification at Station 8.

Stratification was observed at the three stations where there was sufficient water to allow for this behavior. Both Stations 6 and 8 developed a freshwater layer over a denser salt layer during some conditions (Figures 17 and 18). This is consistent with the observations prior to the culvert removal and likely has important functions within the marsh for some organisms such as pacific chorus frog (*Pseudacris regilla*) (NES 2008). The marsh continues to have a similar salinity gradient post culvert removal as it did prior to the culvert removal.

Note: water sampling was only conducted on days when tides of seven feet or greater occurred and therefore only days when marine water mixed within the marsh are represented. Water quality parameters may differ on days where marine inputs are not present.

4.2 Conclusions

The culvert removal appears to have established a more regular connection between the primary north/south ditch and the marine environment. The ditch is influenced by freshwater inputs entering from the north and the marine tidal influence from the south. Tidal influence changes beyond the primary ditch are not clear from the available data. Prior to the culvert removal, data at the sampling stations were scattered and patterns are difficult to detect due to the limited sampling period and frequent dry periods. The data suggests that Station 3 is primarily influenced by freshwater flowing in the ditch from the east. Stations 4, 5, 7, 8 and 9 interface with marine events, but not on a regular basis. Station 1, 2 and 6 have a more consistent connection with the marine system, but also are influenced by freshwater moving through the system.

Chuckanut Village Marsh appears to continue to provide high functioning estuarine wetland habitat. The data indicates that since the culvert was removed the water quality parameters are functioning in a similar manner as before the culvert was removed. Increased tidal action is present near the outlet of the marsh with evidence of occasional large marine inputs as evidenced by photographs of marine algae drift in the interior of the marsh.

5.0 Fish Presence

Chuckanut Village Marsh is an estuarine wetland and has been considered potential rearing habitat for juvenile salmonids. The 2011 culvert removal project had the potential to change fish access and fish habitat conditions within the marsh.

5.1 Fish Access

Two prior studies documented fish presence within the larger Chuckanut Bay drainage basin and in the vicinity of Chuckanut Village Marsh prior to the 2011 Chuckanut Village Marsh culvert removal project. The City of Bellingham's study consisted of spawner surveys on Chuckanut Creek from 2001 through 2006 (LaCroix personal communication 2013). These surveys documented the presence of adult chum (*Oncorhynchus keta*), coho *(O. kisutch*), Chinook (*O. tshawytscha*), steelhead (*O. mykiss*), and cutthroat trout (*O. clarki clarki*). Of all the species observed, Chinook salmon is the only species not known to spawn in Chuckanut Creek. The adult Chinook salmon sampled in the survey appeared without a mate and did not appear to be associated with a red; therefore, were believed to be strays and not evidence of spawning.

The Lummi Natural Resources Department's study consisted of beach seining surveys in Chuckanut Bay from 2005 through 2007. They captured juvenile Chinook, chum, and coho salmon. Since Chinook are not known to spawn in Chuckanut Creek, they were assumed to be migrating through Chuckanut Bay from their native stream system (MacKay personal communication 2008).

In addition to the two studies mentioned above, the Whatcom County Marine Resource Committee (MRC) collected data on fish presence immediately prior and immediately following culvert removal. The MRC conducted this independent survey from 2010 through 2012. Their data was collected within Chuckanut Bay and also within Chuckanut Village Marsh from March through June of each survey year.

Figure 19. Sorting specimens during seining surveys.

Figure 20. Chinook salmon smolt from beach seine in Chuckanut Bay.

Data results from the MRC seining survey is summarized in Table 13, below.

Table 13. MRC seining survey results

Date	Sample Location	Total fish caught before and after culvert replacement							
		Chinook	Chum	Coho	Staghorn sculpin	Sculpin unid.	3-spine Stickleback	Shiner perch	Starry flounder
2010	Chuckanut Bay	4	210	0	422	363	20	31	4
n=8	Salt Marsh	0	0	1	2	1	111	0	0
2011	Chuckanut Bay	11	488	0	26	460	12	1	2
n=7	Salt Marsh	4	0	150	0	0	300	0	0
2012	Chuckanut Bay*	4	11	15	10	427	13	18	2
n=7	Salt Marsh	0	0	43	0	2	163	0	0

*6 pink salmon were captured in Chuckanut Bay in 2012

In 2010, prior to the culvert project, the MRC only observed one individual salmonid in the marsh. In 2011, the spring and summer following culvert removal, they observed 154 salmonids including four Chinook. In 2012 they observed 43 salmonids. In both years, coho were the most prevalent species. Although of limited duration, these results appear to suggest greater fish access to the marsh after culvert removal.

5.2 Fish Habitat Conditions

The City of Bellingham's Chuckanut Village Marsh water quality monitoring data can be used to assess changes in the quality of fish habitat in the marsh resulting from the 2011 culvert removal project. For this report, Station 6 is the only station evaluated for fish habitat conditions. Station 6 and the immediate vicinity are the only areas that provide the water depth, duration, and connectivity to support prolonged juvenile fish presence and rearing. This report also uses water quality thresholds from the WRIA 1 limiting factors report (Smith 2002). Although the thresholds are used in the context of freshwater streams and may not translate entirely for the estuarine Chuckanut Village Marsh site, they provide some guidance on general fish habitat parameters.

Using the WRIA 1 thresholds, the temperature at Station 6 primarily stayed within the "good" and "fair" ranges (Figure 21). Station 6 occasionally qualified as "poor" and never reached "lethal" temperatures. Although the temperature only reached the "poor" threshold occasionally, the events occurred in early summer both pre and post culvert removal, during the anticipated time when fish might be rearing within the marsh. Based on this limited sampling period, Station 6 does not appear to have experienced an obvious change in temperature conditions after culvert installation.

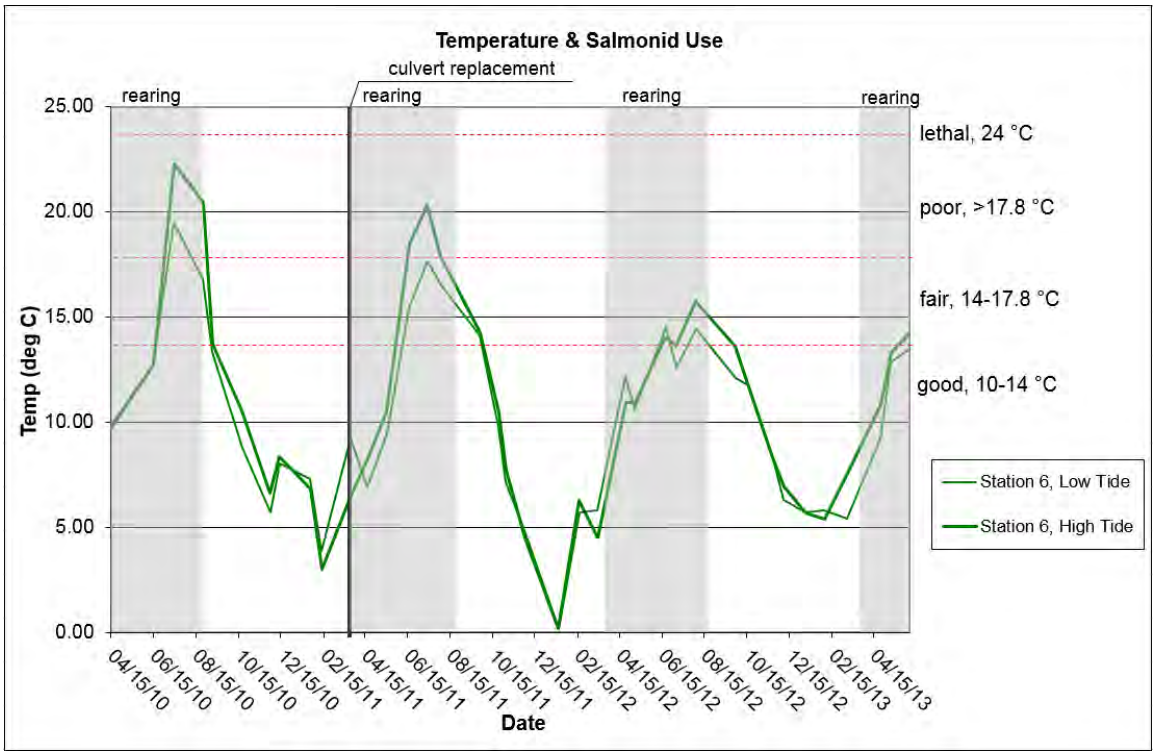

Figure 21. Temperatures and WRIA salmonid thresholds (Smith, 2002).

Station 6 also experienced periods of "poor" DO levels during the anticipated rearing window (Figure 22). Station 6 does not appear to have experienced an obvious change after culvert installation and appears to maintain annual periods of "poor" DO conditions during the anticipated rearing window. However, this observation is based on a limited sampling period.

The culvert removal project had additional benefits for fish habitat. Other project related habitat benefits included the removal of vehicles from the beach, the reestablishment of native vegetation in the previous parking area, and increased community stewardship education.

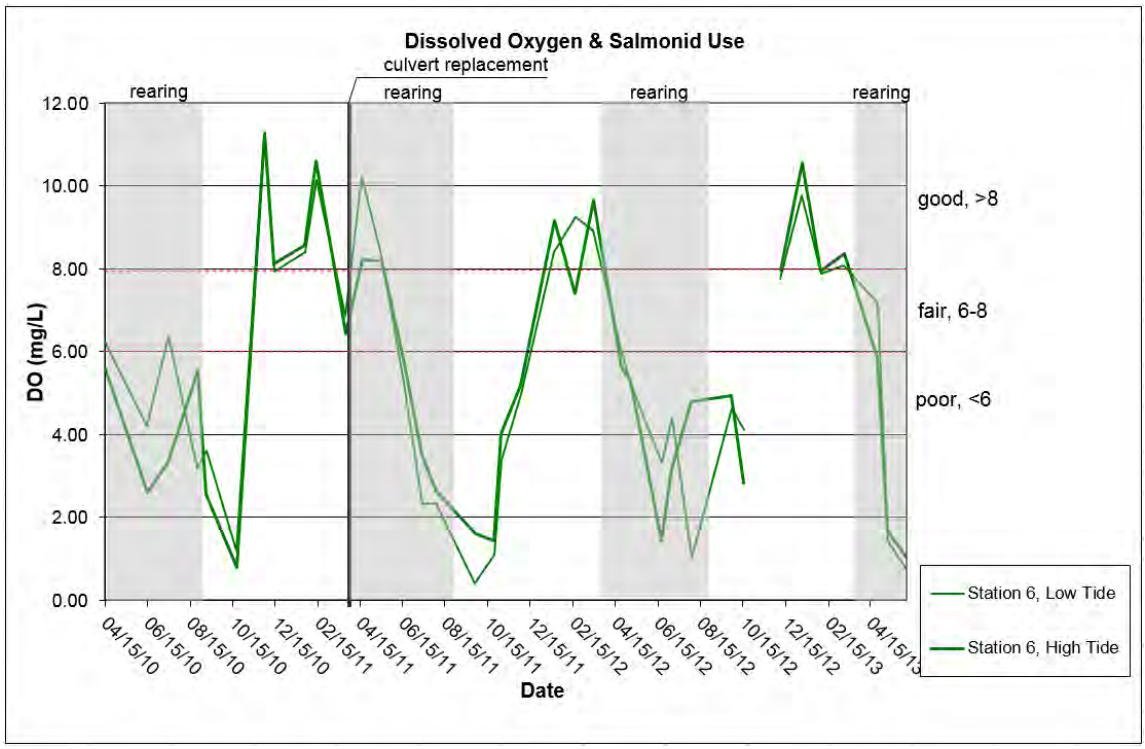

Figure 22. Dissolved oxygen levels and WRIA salmonid thresholds (Smith, 2002)

5.3 Conclusions

Based on the water quality sampling results, the most influential change to fish habitat resulting from the culvert removal project appears to be improved access to rearing habitat for juvenile salmon. Other project related habitat benefits included the removal of vehicles from the beach, the reestablishment of native

vegetation in the previous parking area, and increased community stewardship education.

6.0 Recommendations

The data collected to date provide a representative picture of the pre and post project conditions of standard water quality parameters in the Chuckanut Village Marsh system. If sampling continues, we recommend collecting the following additional data to provide a greater understanding of the interaction of the marsh and the marine system:

1. Continue seining surveys in the bay and within the marsh.
2. Monitor vegetation communities within the marsh five years after the culvert removal to detect any change.
3. Monitor beach improvements such as vegetation re-establishment.

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Appendix A: References

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Appendix B: Water Quality Raw Data

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Chuckanut Village Marsh - Water Quality Sampling Data
Raw Data, April 2010 - June 2013

Legend

circulator broken, therefore all data and checks performed without circulator. All DO data flagged for this data and omitted from EIM.

Omitted readings, pH recorded instead of PSS.

DO fluxuating. Slowly drifting up to 19.0 then down to 15.0 as water mixed.

Improbably low specific conductance and salinity, flagged and omitted.

149% of RPD, flag.

Warmer at surface, double checked in field.

Low DO at bottom in flocculating sediment/algae. Double checked to ensure accurate reading.

Raw Data

Date	Tide	Height (ft)	Site	Depth	Temp (^{o}C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
04/15/10	Low	-0.94	1	Surface	10.68	3.18	7.72	1.64
04/15/10	Low	-0.94	1	Bottom	10.64	3.30	7.36	1.68
04/15/10	Low	-0.94	2	Surface	10.51	2.90	7.58	1.48
04/15/10	Low	-0.94	3	Surface	12.88	23.60	2.20	14.24
04/15/10	Low	-0.94	4	Surface	19.13	17.90	2.88	10.74
04/15/10	Low	-0.94	6	Surface	9.66	0.53	6.26	0.25
04/15/10	Low	-0.94	6	Bottom	10.68	14.50	1.42	8.19
04/15/10	Low	-0.94	7	Surface	15.74	5.44	1.27	2.68
04/15/10	Low	-0.94	8	Surface	14.06	3.29	1.85	0.96
04/15/10	Low	-0.94	8	Bottom	17.10	16.30	1.11	9.08
04/15/10	Low	-0.94	9	Surface	13.13	2.46	6.13	1.31
04/15/10	High	7.76	1	Surface	12.10	41.90	9.28	26.38
04/15/10	High	7.76	1	Bottom	12.05	43.00	9.14	27.07
04/15/10	High	7.76	2	Surface	10.35	4.05	8.31	2.07
04/15/10	High	7.76	3	Surface	10.85	22.90	2.14	13.23
04/15/10	High	7.76	4	Surface	20.97	23.50	6.63	14.01
04/15/10	High	7.76	6	Surface	9.83	0.67	5.60	0.33
04/15/10	High	7.76	6	Bottom	10.43	12.99	1.45	7.36
04/15/10	High	7.76	7	Surface	11.84	5.10	2.35	2.91
04/15/10	High	7.76	8	Surface	15.53	10.32	5.24	5.64
04/15/10	High	7.76	8	Bottom	16.79	16.10	1.50	9.19
04/15/10	High	7.76	9	Surface	12.42	3.08	4.03	1.52
06/14/10	Low	-3.23	1	Surface	16.46	1.81	7.40	0.92
06/14/10	Low	-3.23	1	Bottom	16.36	2.32	6.74	1.12
06/14/10	Low	-3.23	2	Surface	16.20	1.65	7.25	0.83
06/14/10	Low	-3.23	3	Surface	17.76	7.32	1.96	3.67
06/14/10	Low	-3.23	4	Surface	28.23	11.62	0.92	6.68
06/14/10	Low	-3.23	6	Surface	12.66	0.49	4.20	0.22
06/14/10	Low	-3.23	6	Bottom	13.59	7.63	0.53	3.98
06/14/10	Low	-3.23	7	Surface	27.36	4.49	7.48	2.41
06/14/10	Low	-3.23	8	Surface	20.04	0.86	3.55	0.42
06/14/10	Low	-3.23	8	Bottom	16.33	2.57	1.42	1.31
06/14/10	Low	-3.23	9	Surface	19.50	1.28	7.95	0.64
06/14/10	High	9.10	1	Surface	16.87	23.20	6.59	14.72
06/14/10	High	9.10	1	Bottom	17.96	37.90	5.99	23.85
06/14/10	High	9.10	2	Surface	16.64	18.40	5.80	11.73
06/14/10	High	9.10	2	Bottom	17.47	24.20	5.78	14.53
06/14/10	High	9.10	3	Surface	14.77	9.49	1.13	5.22
06/14/10	High	9.10	4	Surface	25.41	17.60	0.33	10.37
06/14/10	High	9.10	6	Surface	12.73	0.80	2.60	0.39
06/14/10	High	9.10	6	Bottom	13.50	7.66	1.04	4.18
06/14/10	High	9.10	7	Surface	18.07	5.13	0.40	2.73
06/14/10	High	9.10	8	Surface	18.98	1.26	2.98	0.60
06/14/10	High	9.10	8	Bottom	19.19	3.45	1.28	1.79
06/14/10	High	9.10	9	Surface	18.68	1.84	3.96	0.93
07/14/10	Low	-1.94	1	Surface	18.51	13.53	6.26	7.73

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
07/14/10	Low	-1.94	6	Surface	19.47	34.70	6.37	18.23
07/14/10	Low	-1.94	6	Bottom	19.54	36.40	6.61	22.74
07/14/10	High	9.16	1	Surface	21.96	33.30	6.46	20.74
07/14/10	High	9.16	1	Bottom	21.66	33.60	6.41	20.94
07/14/10	High	9.16	2	Surface	21.90	33.50	6.61	20.88
07/14/10	High	9.16	2	Bottom	21.87	33.60	6.49	20.88
07/14/10	High	9.16	6	Surface	22.28	32.60	3.34	20.48
07/14/10	High	9.16	6	Bottom	20.24	36.30	4.13	22.83
08/25/10	Low	0.80	1	Surface	20.26	42.30	0.13	26.96
08/25/10	Low	0.80	6	Surface	16.80	13.61	3.20	7.78
08/25/10	High	7.90	1	Surface	22.25	49.90	0.31	32.51
08/25/10	High	7.90	1	Bottom	22.23	50.40	0.22	32.87
08/25/10	High	7.90	6	Surface	20.45	13.54	5.55	7.76
09/07/10	Low	-0.60	1	Surface	13.71	2.69	4.71	1.38
09/07/10	Low	-0.60	1	Bottom	14.55	27.80	0.37	16.84
09/07/10	Low	-0.60	6	Surface	13.34	1.30	3.61	0.64
09/07/10	Low	-0.60	6	Bottom	13.47	3.26	2.23	1.69
09/07/10	Low	-0.60	8	Surface	14.10	7.14	4.46	3.88
09/07/10	Low	-0.60	8	Bottom	14.13	7.15	3.97	3.88
09/07/10	Low	-0.60	9	Surface	14.15	15.10	2.90	8.67
09/07/10	Low	-0.60	9	Bottom	15.19	19.20	4.90	11.26
09/07/10	High	8.30	1	Surface	16.40	42.90	5.10	27.21
09/07/10	High	8.30	1	Bottom	16.33	43.00	4.69	27.28
09/07/10	High	8.30	2	Surface	16.34	42.40	6.00	26.86
09/07/10	High	8.30	6	Surface	13.72	1.58	2.57	0.79
09/07/10	High	8.30	6	Bottom	13.97	6.23	1.49	3.35
09/07/10	High	8.30	8	Surface	14.17	6.06	3.27	3.26
09/07/10	High	8.30	8	Bottom	14.47	6.77	5.59	3.67
09/07/10	High	8.30	9	Surface	14.75	11.11	3.23	6.23
09/07/10	High	8.30	9	Bottom	15.42	17.70	6.20	10.31
10/20/10	Low	3.50	1	Surface	8.20	2.71	4.29	1.38
10/20/10	Low	3.50	1	Bottom	8.96	4.40	1.04	2.31
10/20/10	Low	3.50	6	Surface	8.78	0.87	1.21	0.42
10/20/10	Low	3.50	6	Bottom	8.79	1.18	0.93	0.58
10/20/10	Low	3.50	8	Surface	8.00	1.68	3.17	0.84
10/20/10	Low	3.50	8	Bottom	8.48	4.28	0.99	2.24
10/20/10	Low	3.50	9	Surface	8.90	4.92	1.00	2.59
10/20/10	Low	3.50	9	Bottom	11.16	15.40	0.22	8.82
10/20/10	High	7.80	1	Surface	11.64	2.68	3.88	1.37
10/20/10	High	7.80	1	Bottom	11.64	6.08	2.41	3.26
10/20/10	High	7.80	6	Surface	10.52	0.93	0.80	0.45
10/20/10	High	7.80	6	Bottom	10.49	0.98	0.56	0.48
10/20/10	High	7.80	8	Surface	11.15	2.12	2.73	1.07
10/20/10	High	7.80	8	Bottom	10.19	4.03	0.62	2.10
10/20/10	High	7.80	9	Surface	10.65	2.58	2.22	1.31
10/20/10	High	7.80	9	Bottom	11.17	15.10	0.21	8.64
11/29/10	Low	2.90	1	Surface	8.40	0.00	10.37	0.00
11/29/10	Low	2.90	2	Surface	3.82	1.16	8.94	0.56
11/29/10	Low	2.90	3	Surface	4.50	0.30	3.27	0.14
11/29/10	Low	2.90	4	Surface	5.20	0.00	11.17	0.00
11/29/10	Low	2.90	5	Surface	5.39	0.00	4.20	0.00
11/29/10	Low	2.90	6	Surface	5.70	0.00	11.18	0.00
11/29/10	Low	2.90	6	Bottom	5.49	0.00	8.14	0.00
11/29/10	Low	2.90	7	Surface	5.34	0.00	10.89	0.00
11/29/10	Low	2.90	8	Surface	5.08	0.00	11.93	0.00
11/29/10	Low	2.90	8	Bottom	3.81	4.66	2.00	2.44
11/29/10	Low	2.90	9	Surface	4.54	0.00	11.02	0.00
11/29/10	Low	2.90	9	Bottom	4.43	0.00	5.05	0.00
11/29/10	High	9.10	1	Surface	16.36	0.00	8.77	0.01
11/29/10	High	9.10	1	Bottom	15.87	0.00	7.18	0.01
11/29/10	High	9.10	2	Surface	14.97	0.00	6.30	0.01
11/29/10	High	9.10	2	Bottom	12.92	0.00	7.06	0.01
11/29/10	High	9.10	3	Surface	4.98	21.10	2.33	12.28
11/29/10	High	9.10	4	Surface	7.58	0.00	9.73	0.00
11/29/10	High	9.10	5	Surface	6.01	0.00	8.11	0.00

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
11/29/10	High	9.10	6	Surface	6.61	0.00	11.28	0.00
11/29/10	High	9.10	6	Bottom	3.44	0.38	8.46	0.18
11/29/10	High	9.10	7	Surface	4.21	0.01	12.52	0.01
11/29/10	High	9.10	8	Surface	1.05	0.00	5.93	0.00
11/29/10	High	9.10	8	Bottom	2.73	3.47	3.84	1.78
11/29/10	High	9.10	9	Surface	2.07	0.00	12.03	0.00
12/13/10	Low	3.20	1	Surface	8.03	1.11	8.32	0.54
12/13/10	Low	3.20	1	Bottom	8.02	1.11	8.11	0.53
12/13/10	Low	3.20	2	Surface	8.01	1.06	8.09	0.52
12/13/10	Low	3.20	3	Surface	7.43	46.30	2.19	9.33
12/13/10	Low	3.20	4	Surface	9.12	26.50	8.04	15.84
12/13/10	Low	3.20	5	Surface	8.15	17.10	2.33	9.84
12/13/10	Low	3.20	6	Surface	8.02	0.40	7.94	0.19
12/13/10	Low	3.20	6	Bottom	8.02	0.46	7.95	0.21
12/13/10	Low	3.20	7	Surface	8.02	2.08	8.98	1.05
12/13/10	Low	3.20	8	Surface	8.37	1.14	3.11	0.56
12/13/10	Low	3.20	8	Bottom	8.36	16.10	0.32	9.22
12/13/10	Low	3.20	9	Surface	8.43	0.37	4.23	0.17
12/13/10	Low	3.20	9	Bottom	8.45	1.11	2.32	0.54
12/13/10	High	8.70	1	Surface	8.04	0.51	8.46	0.24
12/13/10	High	8.70	1	Bottom	8.21	30.50	5.82	18.43
12/13/10	High	8.70	2	Surface	8.12	0.53	8.12	0.25
12/13/10	High	8.70	2	Bottom	8.14	0.53	7.82	0.25
12/13/10	High	8.70	3	Surface	7.91	9.58	4.67	5.27
12/13/10	High	8.70	4	Surface	8.37	2.21	3.57	1.11
12/13/10	High	8.70	4	Bottom	8.52	37.10	1.42	22.85
12/13/10	High	8.70	5	Surface	8.61	1.80	6.43	0.90
12/13/10	High	8.70	6	Surface	8.36	0.25	8.12	0.12
12/13/10	High	8.70	6	Bottom	8.37	0.32	8.02	0.15
12/13/10	High	8.70	7	Surface	8.73	1.33	7.42	0.65
12/13/10	High	8.70	7	Bottom	8.84	1.10	5.82	0.54
12/13/10	High	8.70	8	Surface	9.33	0.97	4.97	0.47
12/13/10	High	8.70	8	Bottom	8.31	16.20	0.40	9.28
12/13/10	High	8.70	9	Surface	8.79	0.30	6.11	0.14
12/13/10	High	8.70	9	Bottom	8.45	4.52	0.62	2.37
01/26/11	Low	0.70	1	Surface	7.50	0.95	8.59	0.46
01/26/11	Low	0.70	1	Bottom	7.48	0.95	8.67	0.46
01/26/11	Low	0.70	2	Surface	7.43	0.90	8.59	0.44
01/26/11	Low	0.70	3	Surface	6.47	9.49	1.09	5.21
01/26/11	Low	0.70	4	Surface	9.86	10.33	4.34	5.73
01/26/11	Low	0.70	5	Surface	8.37	6.04	10.77	3.22
01/26/11	Low	0.70	6	Surface	7.27	0.60	8.42	0.28
01/26/11	Low	0.70	6	Bottom	7.27	0.43	8.51	0.20
01/26/11	Low	0.70	7	Surface	7.99	4.08	9.93	2.13
01/26/11	Low	0.70	8	Surface	8.39	1.11	7.39	0.54
01/26/11	Low	0.70	8	Bottom	7.87	31.70	1.86	19.21
01/26/11	Low	0.70	9	Surface	7.65	0.59	7.20	6.28
01/26/11	Low	0.70	9	Bottom	8.37	36.70	1.02	22.58
01/26/11	High	9.40	1	Surface	6.75	0.88	8.81	0.42
01/26/11	High	9.40	1	Bottom	7.38	43.40	7.52	27.09
01/26/11	High	9.40	2	Surface	6.74	0.77	8.69	0.37
01/26/11	High	9.40	2	Bottom	6.73	0.81	8.64	0.38
01/26/11	High	9.40	3	Surface	6.54	8.92	1.39	4.88
01/26/11	High	9.40	4	Surface	7.43	16.80	1.59	9.65
01/26/11	High	9.40	5	Surface	6.87	7.88	1.88	4.27
01/26/11	High	9.40	6	Surface	6.81	0.37	8.58	0.17
01/26/11	High	9.40	6	Bottom	6.78	0.54	8.57	0.26
01/26/11	High	9.40	7	Surface	6.88	3.80	4.94	1.97
01/26/11	High	9.40	8	Surface	7.18	4.93	3.08	2.60
01/26/11	High	9.40	8	Bottom	7.24	28.60	0.74	17.15
01/26/11	High	9.40	9	Surface	7.10	0.52	4.81	0.25
01/26/11	High	9.40	9	Bottom	7.64	34.40	0.53	21.00
02/11/11	Low	1.00	1	Surface	3.93	1.14	11.51	0.56
02/11/11	Low	1.00	2	Surface	3.91	1.13	11.34	0.55
02/11/11	Low	1.00	3	Surface	3.65	9.82	0.94	5.38
02/11/11	Low	1.00	4	Surface	5.89	10.53	6.90	5.82
02/11/11	Low	1.00	5	Surface	4.83	12.84	2.50	7.19

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
02/11/11	Low	1.00	6	Surface	3.89	0.55	10.16	0.26
02/11/11	Low	1.00	6	Bottom	3.87	0.60	10.09	0.28
02/11/11	Low	1.00	7	Surface	5.10	4.59	5.96	2.40
02/11/11	Low	1.00	8	Surface	3.94	1.21	10.72	0.59
02/11/11	Low	1.00	8	Bottom	5.01	28.80	1.03	17.21
02/11/11	Low	1.00	9	Surface	3.26	0.90	10.65	0.43
02/11/11	Low	1.00	9	Bottom	5.53	30.20	6.31	18.14
02/11/11	High	8.20	1	Surface	3.08	8.77	10.70	4.77
02/11/11	High	8.20	1	Bottom	3.12	10.65	10.20	5.87
02/11/11	High	8.20	2	Surface	2.89	1.11	11.48	0.54
02/11/11	High	8.20	3	Surface	3.44	9.14	1.44	4.98
02/11/11	High	8.20	4	Surface	3.97	6.97	6.66	3.74
02/11/11	High	8.20	5	Surface	2.73	11.78	1.41	6.53
02/11/11	High	8.20	6	Surface	2.99	0.55	10.62	0.26
02/11/11	High	8.20	6	Bottom	2.98	0.60	10.63	0.28
02/11/11	High	8.20	7	Surface	3.71	5.40	7.71	2.85
02/11/11	High	8.20	8	Surface	1.84	1.14	8.94	0.55
02/11/11	High	8.20	8	Bottom	5.06	29.40	0.96	17.60
02/11/11	High	8.20	9	Surface	1.63	0.71	7.04	0.34
02/11/11	High	8.20	9	Bottom	5.23	28.20	8.15	16.83
PROJECT CONSTRUCTED, NEW BOX CULVERT INSTALLED								
03/25/11	Low	-0.40	2	Surface	9.26	1.85	9.24	0.93
03/25/11	Low	-0.40	3	Surface	10.84	20.10	3.41	11.76
03/25/11	Low	-0.40	4	Surface	18.06	20.30	14.60	12.01
03/25/11	Low	-0.40	5	Surface	16.50	23.70	7.44	14.18
03/25/11	Low	-0.40	6	Surface	9.24	3.18	6.86	1.63
03/25/11	Low	-0.40	6	Bottom	9.94	27.00	6.28	16.19
03/25/11	Low	-0.40	7	Surface	16.52	7.22	6.71	3.93
03/25/11	Low	-0.40	8	Surface	12.02	6.87	6.02	3.71
03/25/11	Low	-0.40	8	Bottom	12.13	16.90	2.28	9.77
03/25/11	Low	-0.40	9	Surface	10.86	2.14	3.10	1.08
03/25/11	Low	-0.40	9	Bottom	12.06	13.64	0.25	7.75
03/25/11	High	8.00	1	Surface	6.46	10.23	8.86	5.65
03/25/11	High	8.00	1	Bottom	7.21	43.60	9.12	27.22
03/25/11	High	8.00	2	Surface	7.17	43.30	8.86	17.47
03/25/11	High	8.00	2	Bottom	7.18	43.40	8.84	27.08
03/25/11	High	8.00	3	Surface	6.52	20.00	0.98	11.62
03/25/11	High	8.00	4	Surface	10.79	20.20	3.71	11.83
03/25/11	High	8.00	5	Surface	7.26	23.40	0.49	13.79
03/25/11	High	8.00	6	Surface	6.54	5.99	6.44	3.19
03/25/11	High	8.00	6	Bottom	7.22	33.30	3.40	20.25
03/25/11	High	8.00	7	Surface	8.50	6.26	2.37	3.35
03/25/11	High	8.00	8	Surface	7.14	2.71	3.64	1.38
03/25/11	High	8.00	8	Bottom	9.62	15.20	0.51	8.68
03/25/11	High	8.00	9	Surface	8.09	3.21	3.43	1.65
03/25/11	High	8.00	9	Bottom	10.38	16.40	0.15	9.43
04/18/11	Low	-1.60	1	Surface	7.15	0.68	11.60	0.32
04/18/11	Low	-1.60	2	Surface	7.06	0.65	11.60	0.31
04/18/11	Low	-1.60	3	Surface	10.15	8.97	2.12	4.93
04/18/11	Low	-1.60	4	Surface	13.30	4.82	3.80	2.55
04/18/11	Low	-1.60	5	Surface	12.42	4.43	2.85	2.33
04/18/11	Low	-1.60	6	Surface	6.90	0.38	10.22	0.18
04/18/11	Low	-1.60	6	Bottom	7.05	0.45	9.84	0.21
04/18/11	Low	-1.60	7	Surface	12.36	1.23	8.01	0.60
04/18/11	Low	-1.60	8	Surface	9.57	2.60	3.25	1.32
04/18/11	Low	-1.60	8	Bottom	10.96	10.64	1.46	5.92
04/18/11	Low	-1.60	9	Surface	7.88	0.69	9.43	0.33
04/18/11	Low	-1.60	9	Bottom	13.04	20.70	17.39	12.18
04/18/11	High	8.60	1	Surface	11.17	10.99	14.19	6.14
04/18/11	High	8.60	1	Bottom	11.96	43.70	13.20	27.55
04/18/11	High	8.60	2	Surface	11.98	42.40	12.87	26.65
04/18/11	High	8.60	2	Bottom	11.67	43.00	13.11	27.05
04/18/11	High	8.60	3	Surface	8.48	8.58	2.54	4.69
04/18/11	High	8.60	4	Surface	21.09	9.67	8.94	5.41
04/18/11	High	8.60	5	Surface	16.84	5.26	11.05	2.81
04/18/11	High	8.60	6	Surface	8.23	0.38	8.23	0.18
04/18/11	High	8.60	6	Bottom	8.25	0.43	7.72	0.20
04/18/11	High	8.60	7	Surface	13.14	1.12	8.06	0.55

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
04/18/11	High	8.60	8	Surface	13.72	0.72	7.25	0.35
04/18/11	High	8.60	8	Bottom	13.24	13.11	1.57	7.44
04/18/11	High	8.60	9	Surface	11.10	0.93	10.53	0.45
04/18/11	High	8.60	9	Bottom	13.74	22.30	9.69	13.22
05/16/11	Low	-2.20	1	Surface	9.80	0.49	9.76	0.23
05/16/11	Low	-2.20	2	Surface	9.82	0.49	8.66	0.23
05/16/11	Low	-2.20	3	Surface	11.36	3.68	0.42	1.91
05/16/11	Low	-2.20	4	Surface	13.80	8.07	1.68	4.42
05/16/11	Low	-2.20	5	Surface	10.93	0.76	5.25	0.37
05/16/11	Low	-2.20	6	Surface	9.45	0.27	8.34	0.12
05/16/11	Low	-2.20	6	Bottom	9.44	0.26	8.34	0.12
05/16/11	Low	-2.20	7	Surface	11.23	1.14	6.70	0.56
05/16/11	Low	-2.20	8	Surface	10.92	0.93	3.82	0.45
05/16/11	Low	-2.20	8	Bottom	11.88	4.67	0.65	2.46
05/16/11	Low	-2.20	9	Surface	10.43	0.43	2.58	0.20
05/16/11	Low	-2.20	9	Bottom	11.86	4.39	0.60	2.31
05/16/11	High	8.40	1	Surface	11.97	9.30	10.76	5.13
05/16/11	High	8.40	1	Bottom	12.36	21.30	11.14	12.56
05/16/11	High	8.40	2	Surface	12.22	19.50	11.10	11.43
05/16/11	High	8.40	2	Bottom	12.30	21.30	10.98	12.55
05/16/11	High	8.40	3	Surface	12.05	3.69	1.48	1.92
05/16/11	High	8.40	4	Surface	18.62	4.82	20.55	2.56
05/16/11	High	8.40	5	Surface	14.89	0.73	11.39	0.35
05/16/11	High	8.40	6	Surface	10.46	0.28	8.19	0.13
05/16/11	High	8.40	6	Bottom	10.44	0.28	8.00	0.13
05/16/11	High	8.40	7	Surface	14.83	0.99	10.28	0.48
05/16/11	High	8.40	8	Surface	14.22	0.48	4.93	0.23
05/16/11	High	8.40	8	Bottom	14.98	4.45	3.74	2.35
05/16/11	High	8.40	9	Surface	12.81	0.81	7.02	0.39
05/16/11	High	8.40	9	Bottom	13.06	8.57	2.39	4.71
06/17/11	Low	-2.60	6	Surface	15.43	4.54	5.25	
06/17/11	Low	-2.60	6	Bottom	16.94	29.00	3.39	
06/17/11	Low	-2.60	8	Surface	17.61	1.67	2.26	
06/17/11	Low	-2.60	8	Bottom	15.57	9.78	0.38	
06/17/11	Low	-2.60	9	Surface	17.77	2.92	11.11	
06/17/11	Low	-2.60	9	Bottom	16.85	6.42	1.33	
06/17/11	High	9.10	1	Surface	19.47	29.70	7.79	18.56
06/17/11	High	9.10	1	Bottom	17.97	35.50	8.58	22.13
06/17/11	High	9.10	2	Surface	19.33	29.60	7.58	18.16
06/17/11	High	9.10	2	Bottom	17.87	35.60	7.97	22.19
06/17/11	High	9.10	6	Surface	18.48	21.00	5.71	12.47
06/17/11	High	9.10	6	Bottom	18.93	27.30	4.77	16.61
06/17/11	High	9.10	8	Surface	16.85	1.66	1.28	0.83
06/17/11	High	9.10	8	Bottom	16.24	5.68	0.13	3.05
06/17/11	High	9.10	9	Surface	18.39	2.33	2.46	1.19
06/17/11	High	9.10	9	Bottom	17.96	4.71	0.14	2.50
07/13/11	Low	-2.07	6	Surface	17.64	30.90	2.32	18.99
07/13/11	Low	-2.07	6	Bottom	18.13	32.40	1.47	20.02
07/13/11	Low	-2.07	8	Surface	16.32	5.36	2.35	2.86
07/13/11	Low	-2.07	9	Surface	17.30	11.51	0.42	6.49
07/13/11	High	8.70	1	Surface	22.83	33.70	6.94	21.04
07/13/11	High	8.70	1	Bottom	20.53	34.20	7.24	21.32
07/13/11	High	8.70	2	Surface	21.02	34.20	7.04	21.33
07/13/11	High	8.70	2	Bottom	20.63	34.30	7.02	21.39
07/13/11	High	8.70	6	Surface	20.31	30.40	3.51	18.72
07/13/11	High	8.70	6	Bottom	19.56	31.70	4.24	19.58
07/13/11	High	8.70	8	Surface	23.96	5.51	1.56	2.97
07/13/11	High	8.70	9	Surface	24.10	9.65	1.11	5.41
08/02/11	Low	-0.40	6	Surface	16.50	17.90	2.35	1.42
08/02/11	Low	-0.40	6	Bottom	17.61	33.10	4.76	20.75
08/02/11	Low	-0.40	8	Surface	25.17	4.85	11.80	2.59
08/02/11	Low	-0.40	9	Surface	23.29	9.74	4.03	5.46
08/02/11	High	8.80	1	Surface	23.07	41.70	8.85	26.64
08/02/11	High	8.80	1	Bottom	20.54	42.20	8.81	26.90
08/02/11	High	8.80	2	Surface	20.02	43.10	8.79	27.51
08/02/11	High	8.80	2	Bottom	22.41	41.10	7.53	26.19
08/02/11	High	8.80	6	Surface	17.88	3.28	2.64	1.70

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
08/02/11	High	8.80	6	Bottom	20.89	39.10	3.60	24.73
08/02/11	High	8.80	8	Surface	19.30	5.19	0.69	2.77
08/02/11	High	8.80	9	Surface	20.40	9.73	1.33	5.44
09/27/11	Low	2.00	2	Surface	14.13	4.72	4.69	2.50
09/27/11	Low	2.00	6	Surface	14.13	5.49	0.40	2.93
09/27/11	Low	2.00	6	Bottom	14.50	37.00	0.27	23.03
09/27/11	Low	2.00	8	Surface	14.82	7.35	3.51	4.00
09/27/11	Low	2.00	8	Bottom	15.22	8.37	5.04	4.60
09/27/11	Low	2.00	9	Surface	15.95	19.60	5.41	11.53
09/27/11	Low	2.00	9	Bottom	16.18	20.10	6.72	11.85
09/27/11	High	8.60	1	Surface	19.37	43.80	14.93	27.98
09/27/11	High	8.60	1	Bottom	19.22	45.40	15.77	29.11
09/27/11	High	8.60	2	Surface	19.40	34.90	9.44	21.76
09/27/11	High	8.60	2	Bottom	19.66	44.90	9.90	28.78
09/27/11	High	8.60	6	Surface	14.24	2.49	1.61	1.27
09/27/11	High	8.60	6	Bottom	15.53	36.00	1.01	22.39
09/27/11	High	8.60	8	Surface	16.48	7.66	9.10	4.19
09/27/11	High	8.60	8	Bottom	16.19	7.70	12.94	4.28
09/27/11	High	8.60	9	Surface	17.55	10.60	11.12	5.94
09/27/11	High	8.60	9	Bottom	17.17	19.40	11.35	11.42
10/24/11	Low	2.70	1	Surface	8.99	3.51	2.59	1.83
10/24/11	Low	2.70	1	Bottom	8.99	3.53	2.69	1.83
10/24/11	Low	2.70	6	Surface	9.76	2.29	1.11	1.16
10/24/11	Low	2.70	6	Bottom	10.54	22.50	0.10	13.35
10/24/11	Low	2.70	7	Surface	8.53	7.84	2.24	4.26
10/24/11	Low	2.70	8	Surface	9.88	2.55	1.62	1.30
10/24/11	Low	2.70	8	Bottom	11.26	4.23	3.16	2.21
10/24/11	Low	2.70	9	Surface	11.07	7.97	4.30	4.35
10/24/11	Low	2.70	9	Bottom	13.49	14.29	7.33	8.13
10/24/11	High	8.60	1	Surface	12.62	3.59	2.33	1.87
10/24/11	High	8.60	2	Surface	11.32	3.53	2.62	1.84
10/24/11	High	8.60	6	Surface	10.43	1.96	1.44	0.98
10/24/11	High	8.60	6	Bottom	11.04	23.10	1.03	13.94
10/24/11	High	8.60	7	Surface	11.08	7.14	8.94	3.87
10/24/11	High	8.60	8	Surface	11.91	3.16	3.82	1.63
10/24/11	High	8.60	8	Bottom	12.53	4.21	6.02	2.21
10/24/11	High	8.60	9	Surface	13.87	9.28	7.79	5.13
10/24/11	High	8.60	9	Bottom	14.04	13.65	13.44	7.39
11/03/11	Low	4.20	2	Surface	6.86	2.14	3.71	1.08
11/03/11	Low	4.20	6	Surface	7.13	0.82	3.38	0.39
11/03/11	Low	4.20	6	Bottom	7.17	2.42	2.10	1.22
11/03/11	Low	4.20	7	Surface	8.06	6.17	5.90	3.30
11/03/11	Low	4.20	8	Surface	6.66	1.47	4.36	0.72
11/03/11	Low	4.20	8	Bottom	9.33	3.39	3.40	1.75
11/03/11	Low	4.20	9	Surface	7.53	4.61	6.83	2.41
11/03/11	Low	4.20	9	Bottom	10.18	12.44	1.10	7.00
11/03/11	High	8.60	1	Surface	7.85	3.82	5.72	1.98
11/03/11	High	8.60	1	Bottom	8.07	35.10	5.10	21.49
11/03/11	High	8.60	2	Surface	7.95	15.40	3.74	8.78
11/03/11	High	8.60	2	Bottom	8.15	33.80	4.33	20.62
11/03/11	High	8.60	4	Surface	11.90	37.90	5.78	23.55
11/03/11	High	8.60	6	Surface	7.73	0.75	4.03	0.36
11/03/11	High	8.60	6	Bottom	7.97	6.73	1.01	3.62
11/03/11	High	8.60	7	Surface	9.77	6.72	6.11	3.62
11/03/11	High	8.60	8	Surface	9.31	1.80	3.86	0.90
11/03/11	High	8.60	8	Bottom	9.65	3.57	5.08	1.83
11/03/11	High	8.60	9	Surface	9.10	1.10	6.56	0.54
11/03/11	High	8.60	9	Bottom	11.13	12.20	6.20	6.86
12/01/11	Low	4.50	1	Surface	4.76	8.57	6.40	4.66
12/01/11	Low	4.50	2	Surface	4.77	8.52	6.01	4.63
12/01/11	Low	4.50	3	Surface	5.29	35.70	0.60	21.77
12/01/11	Low	4.50	4	Surface	6.76	44.10	18.86	27.54
12/01/11	Low	4.50	5	Surface	4.66	37.00	5.84	22.60
12/01/11	Low	4.50	6	Surface	4.69	3.12	4.97	1.60
12/01/11	Low	4.50	6	Bottom	5.28	2.06	1.23	11.97
12/01/11	Low	4.50	7	Surface	5.26	27.80	7.09	16.57
12/01/11	Low	4.50	8	Surface	6.23	22.00	0.66	12.88
12/01/11	Low	4.50	8	Bottom	7.74	30.10	2.29	18.15

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
12/01/11	Low	4.50	9	Surface	6.78	18.00	1.88	10.37
12/01/11	Low	4.50	9	Bottom	8.22	30.40	1.26	18.37
12/01/11	High	9.10	1	Surface	7.41	46.40	6.67	29.17
12/01/11	High	9.10	1	Bottom	7.41	46.60	6.79	29.24
12/01/11	High	9.10	2	Surface	7.37	46.40	6.81	29.16
12/01/11	High	9.10	2	Bottom	7.38	46.50	6.73	29.16
12/01/11	High	9.10	3	Surface	5.35	35.70	0.68	21.77
12/01/11	High	9.10	4	Surface	5.85	44.60	10.49	27.82
12/01/11	High	9.10	5	Surface	4.44	36.70	4.44	22.39
12/01/11	High	9.10	6	Surface	4.51	3.14	5.18	1.61
12/01/11	High	9.10	6	Bottom	4.97	16.30	1.90	9.29
12/01/11	High	9.10	7	Surface	5.15	28.70	4.49	17.15
12/01/11	High	9.10	8	Surface	5.06	8.28	1.54	4.49
12/01/11	High	9.10	8	Bottom	7.45	30.20	1.08	18.21
12/01/11	High	9.10	9	Surface	3.40	4.90	3.75	2.57
12/01/11	High	9.10	9	Bottom	8.18	30.40	1.18	18.37
01/18/12	Low	-0.80	1	Surface	0.19	1.66	9.18	0.82
01/18/12	Low	-0.80	2	Surface	0.21	1.65	8.99	0.82
01/18/12	Low	-0.80	6	Surface	0.16	0.51	8.41	0.24
01/18/12	Low	-0.80	6	Bottom	0.17	0.61	8.02	0.29
01/18/12	High	9.20	1	Surface	3.35	40.90	8.74	25.15
01/18/12	High	9.20	1	Bottom	3.89	46.30	8.49	28.85
01/18/12	High	9.20	2	Surface	3.83	46.50	8.22	28.99
01/18/12	High	9.20	2	Bottom	3.89	46.40	8.21	28.92
01/18/12	High	9.20	6	Surface	0.15	0.45	9.17	0.21
01/18/12	High	9.20	6	Bottom	0.18	0.48	8.99	0.22
02/17/12	Low	-0.60	1	Surface	5.63	0.78	9.49	0.35
02/17/12	Low	-0.60	2	Surface	5.67	0.74	9.29	0.35
02/17/12	Low	-0.60	3	Surface	5.47	13.75	2.59	7.74
02/17/12	Low	-0.60	4	Surface	8.40	13.45	6.38	7.67
02/17/12	Low	-0.60	5	Surface	6.54	8.01	3.60	4.35
02/17/12	Low	-0.60	6	Surface	5.70	0.33	9.26	0.15
02/17/12	Low	-0.60	6	Bottom	5.69	0.34	9.32	0.15
02/17/12	Low	-0.60	7	Surface	6.07	6.95	10.30	3.59
02/17/12	Low	-0.60	8	Surface	6.26	3.53	2.13	1.82
02/17/12	Low	-0.60	8	Bottom	7.29	25.00	0.37	14.82
02/17/12	Low	-0.60	9	Surface	5.80	0.56	5.24	0.26
02/17/12	Low	-0.60	9	Bottom	7.77	12.63	7.90	7.09
02/17/12	High	8.20	1	Surface	6.23	1.78	8.80	0.89
02/17/12	High	8.20	2	Surface	6.26	1.79	8.37	0.89
02/17/12	High	8.20	3	Surface	6.72	14.32	2.30	8.04
02/17/12	High	8.20	4	Surface	9.15	12.44	7.82	6.99
02/17/12	High	8.20	5	Surface	8.15	9.34	6.42	5.74
02/17/12	High	8.20	6	Surface	6.25	0.60	7.41	0.28
02/17/12	High	8.20	6	Bottom	6.35	2.92	6.01	1.57
02/17/12	High	8.20	7	Surface	8.56	13.49	9.80	7.49
02/17/12	High	8.20	8	Surface	7.86	7.78	2.54	4.23
02/17/12	High	8.20	8	Bottom	7.24	23.50	2.88	13.73
02/17/12	High	8.20	9	Surface	7.73	2.75	5.86	1.47
02/17/12	High	8.20	9	Bottom	8.72	27.50	4.10	16.61
03/14/12	Low	-0.40	1	Surface	6.00	0.88	9.74	0.43
03/14/12	Low	-0.40	2	Surface	6.00	0.88	9.57	0.43
03/14/12	Low	-0.40	3	Surface	5.80	22.42	1.62	13.40
03/14/12	Low	-0.40	4	Surface	11.00	24.88	21.65	15.20
03/14/12	Low	-0.40	5	Surface	9.90	13.67	14.14	7.91
03/14/12	Low	-0.40	6	Surface	5.80	0.36	8.92	0.17
03/14/12	Low	-0.40	6	Bottom	5.80	0.36	8.85	0.17
03/14/12	Low	-0.40	7	Surface	8.60	17.10	13.66	10.42
03/14/12	Low	-0.40	8	Surface	7.20	0.68	8.33	0.35
03/14/12	Low	-0.40	8	Bottom	7.80	19.58	6.10	11.66
03/14/12	Low	-0.40	9	Surface	6.50	0.58	8.03	0.26
03/14/12	Low	-0.40	9	Bottom	7.90	6.68	8.13	3.56
03/14/12	High	8.40	1	Surface	4.20	16.55	10.65	9.46
03/14/12	High	8.40	1	Bottom	4.20	19.70	10.74	11.55
03/14/12	High	8.40	2	Surface	4.30	7.47	10.20	3.73
03/14/12	High	8.40	2	Bottom	4.20	19.31	10.78	11.20
03/14/12	High	8.40	3	Surface	5.40	22.80	0.45	13.59
03/14/12	High	8.40	4	Surface	6.30	17.37	9.59	10.17

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
03/14/12	High	8.40	5	Surface	5.90	14.50	5.33	8.40
03/14/12	High	8.40	6	Surface	4.50	0.40	9.67	0.19
03/14/12	High	8.40	6	Bottom	4.50	0.37	9.20	0.18
03/14/12	High	8.40	7	Surface	6.20	22.17	7.27	13.18
03/14/12	High	8.40	8	Surface	4.30	1.02	4.68	0.48
03/14/12	High	8.40	8	Bottom	7.20	26.07	0.61	15.71
03/14/12	High	8.40	9	Surface	4.30	0.39	6.13	0.18
03/14/12	High	8.40	9	Bottom	6.10	4.68	5.35	2.53
04/23/12	Low	-0.60	2	Surface	13.00	0.80	8.44	0.39
04/23/12	Low	-0.60	3	Surface	14.80	7.16	1.92	3.88
04/23/12	Low	-0.60	4	Surface	22.85	6.46	13.38	3.29
04/23/12	Low	-0.60	5	Surface	22.60	7.55	2.13	4.16
04/23/12	Low	-0.60	6	Surface	12.13	0.33	6.07	0.16
04/23/12	Low	-0.60	6	Bottom	12.23	0.34	6.02	0.16
04/23/12	Low	-0.60	7	Surface	21.98	1.22	9.53	0.60
04/23/12	Low	-0.60	8	Surface	17.82	4.18	1.49	2.20
04/23/12	Low	-0.60	8	Bottom	17.92	6.83	0.24	3.70
04/23/12	Low	-0.60	9	Surface	14.98	1.04	2.30	0.51
04/23/12	Low	-0.60	9	Bottom	15.62	3.56	0.74	1.89
04/23/12	High	8.30	1	Surface	15.08	43.90	11.32	27.85
04/23/12	High	8.30	1	Bottom	14.19	44.00	13.20	27.87
04/23/12	High	8.30	2	Surface	14.38	43.90	12.90	27.81
04/23/12	High	8.30	2	Bottom	14.24	43.90	13.27	27.81
04/23/12	High	8.30	3	Surface	10.70	7.28	1.03	3.89
04/23/12	High	8.30	4	Surface	23.79	5.50	13.61	2.96
04/23/12	High	8.30	5	Surface	17.06	8.45	1.64	4.66
04/23/12	High	8.30	6	Surface	10.95	0.31	5.63	0.14
04/23/12	High	8.30	6	Bottom	10.92	0.33	5.44	0.15
04/23/12	High	8.30	7	Surface	16.10	1.31	6.91	0.65
04/23/12	High	8.30	8	Surface	18.54	2.46	3.21	1.26
04/23/12	High	8.30	8	Bottom	19.29	6.97	0.73	3.80
04/23/12	High	8.30	9	Surface	14.88	1.34	3.95	0.66
04/23/12	High	8.30	9	Bottom	15.70	3.15	0.67	1.61
05/07/12	Low	-3.00	2	Surface	12.44	0.88	8.86	0.42
05/07/12	Low	-3.00	3	Surface	16.31	8.30	2.82	4.52
05/07/12	Low	-3.00	4	Surface	23.03	8.59	8.25	4.75
05/07/12	Low	-3.00	6	Surface	10.59	0.40	5.21	0.19
05/07/12	Low	-3.00	6	Bottom	10.67	0.39	5.18	0.19
05/07/12	Low	-3.00	7	Surface	24.53	2.16	7.04	1.10
05/07/12	Low	-3.00	8	Surface	14.97	3.56	4.26	1.85
05/07/12	Low	-3.00	8	Bottom	15.56	10.64	9.48	5.96
05/07/12	Low	-3.00	9	Surface	13.50	1.23	9.41	0.61
05/07/12	Low	-3.00	9	Bottom	14.28	3.27	8.30	1.63
05/07/12	High	9.10	1	Surface	11.90	45.20	14.36	28.60
05/07/12	High	9.10	1	Bottom	12.02	45.40	14.58	28.68
05/07/12	High	9.10	2	Surface	11.84	45.40	14.26	28.74
05/07/12	High	9.10	2	Bottom	11.86	45.30	14.36	28.67
05/07/12	High	9.10	3	Surface	12.44	8.43	1.89	4.34
05/07/12	High	9.10	4	Surface	23.50	11.26	8.79	6.38
05/07/12	High	9.10	6	Surface	10.95	0.38	5.28	0.18
05/07/12	High	9.10	6	Bottom	11.04	0.65	4.82	0.31
05/07/12	High	9.10	7	Surface	15.83	2.31	7.13	1.18
05/07/12	High	9.10	8	Surface	17.59	1.49	7.20	0.74
05/07/12	High	9.10	8	Bottom	17.48	11.76	17.44	6.65
05/07/12	High	9.10	9	Surface	14.52	0.93	7.61	0.45
05/07/12	High	9.10	9	Bottom	15.19	2.63	10.48	1.35
06/20/12	Low	-1.70	2	Surface	16.86	2.73	6.45	1.41
06/20/12	Low	-1.70	3	Surface	15.97	19.00	1.18	11.15
06/20/12	Low	-1.70	4	Surface	26.35	27.60	13.31	16.97
06/20/12	Low	-1.70	6	Surface	14.51	18.50	3.31	10.81
06/20/12	Low	-1.70	6	Bottom	14.42	18.30	3.42	10.62
06/20/12	Low	-1.70	7	Surface	27.79	4.75	7.82	2.54
06/20/12	Low	-1.70	8	Surface	16.51	1.14	2.90	0.56
06/20/12	Low	-1.70	8	Bottom	16.48	1.24	2.83	0.61
06/20/12	Low	-1.70	9	Surface	15.80	2.57	1.15	1.31
06/20/12	Low	-1.70	9	Bottom	15.31	3.01	1.16	1.55
06/20/12	High	8.60	1	Surface	18.20	42.70	8.74	27.15
06/20/12	High	8.60	1	Bottom	17.81	42.70	8.61	27.14

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
06/20/12	High	8.60	2	Surface	17.86	42.70	8.70	27.14
06/20/12	High	8.60	2	Bottom	17.88	42.80	8.48	27.21
06/20/12	High	8.60	3	Surface	15.17	20.00	1.00	11.77
06/20/12	High	8.60	4	Surface	28.93	32.10	17.56	20.10
06/20/12	High	8.60	6	Surface	14.06	8.07	1.43	4.42
06/20/12	High	8.60	6	Bottom	16.58	19.80	8.46	11.66
06/20/12	High	8.60	7	Surface	19.61	4.81	5.33	2.56
06/20/12	High	8.60	8	Surface	18.47	1.16	3.52	0.57
06/20/12	High	8.60	8	Bottom	17.51	1.41	1.52	0.70
06/20/12	High	8.60	9	Surface	16.55	2.29	2.59	1.16
06/20/12	High	8.60	9	Bottom	15.80	3.02	0.90	1.56
07/05/12	Low	-2.40	2	Surface	15.32	1.59	6.56	0.79
07/05/12	Low	-2.40	3	Surface	14.76	5.70	0.58	3.00
07/05/12	Low	-2.40	4	Surface	26.56	22.00	16.79	13.24
07/05/12	Low	-2.40	5	Surface	23.84	13.39	7.12	7.70
07/05/12	Low	-2.40	6	Surface	12.58	0.92	4.42	0.50
07/05/12	Low	-2.40	6	Bottom	14.16	27.30	2.04	16.23
07/05/12	Low	-2.40	7	Surface	22.16	1.70	10.11	0.86
07/05/12	Low	-2.40	8	Surface	21.14	0.70	2.72	0.34
07/05/12	Low	-2.40	8	Bottom	16.10	0.88	1.45	0.43
07/05/12	Low	-2.40	9	Surface	15.93	1.08	2.45	0.53
07/05/12	Low	-2.40	9	Bottom	16.00	1.97	2.31	1.00
07/05/12	High	9.00	1	Surface	18.00	39.20	8.66	24.69
07/05/12	High	9.00	1	Bottom	17.05	39.40	9.10	24.99
07/05/12	High	9.00	2	Surface	17.97	38.90	8.52	24.48
07/05/12	High	9.00	2	Bottom	17.20	39.40	8.99	24.80
07/05/12	High	9.00	3	Surface	13.92	6.55	0.80	3.53
07/05/12	High	9.00	4	Surface	31.18	27.90	17.20	17.13
07/05/12	High	9.00	5	Surface	18.34	13.37	2.94	7.65
07/05/12	High	9.00	6	Surface	13.62	0.85	3.19	0.44
07/05/12	High	9.00	6	Bottom	18.10	36.50	6.48	22.89
07/05/12	High	9.00	7	Surface	18.41	1.92	4.95	0.96
07/05/12	High	9.00	8	Surface	19.30	0.81	3.36	0.39
07/05/12	High	9.00	8	Bottom	17.73	1.14	0.47	0.56
07/05/12	High	9.00	9	Surface	16.14	0.69	1.99	0.33
07/05/12	High	9.00	9	Bottom	15.39	2.32	0.30	1.18
08/02/12	Low	-1.70	6	Surface	14.41	11.74	1.04	6.88
08/02/12	Low	-1.70	6	Bottom	14.85	20.20	0.97	11.57
08/02/12	Low	-1.70	8	Surface	17.62	1.57	2.97	0.78
08/02/12	Low	-1.70	8	Bottom	16.61	1.62	1.49	0.81
08/02/12	Low	-1.70	9	Surface	17.37	2.68	4.13	1.38
08/02/12	Low	-1.70	9	Bottom	16.11	3.61	1.02	1.88
08/02/12	High	8.60	1	Surface	24.36	38.10	5.99	24.15
08/02/12	High	8.60	1	Bottom	22.43	39.40	6.34	24.93
08/02/12	High	8.60	2	Surface	25.13	34.80	5.88	22.77
08/02/12	High	8.60	2	Bottom	23.90	37.70	4.53	23.85
08/02/12	High	8.60	6	Surface	15.74	19.40	4.80	11.33
08/02/12	High	8.60	6	Bottom	16.58	4.35	2.00	2.29
08/02/12	High	8.60	8	Surface	19.81	1.61	4.44	0.81
08/02/12	High	8.60	8	Bottom	19.21	1.65	2.44	0.83
08/02/12	High	8.60	9	Surface	18.95	2.69	5.27	1.38
08/02/12	High	8.60	9	Bottom	17.82	3.17	2.06	1.64
09/28/12	Low	1.90	6	Surface	12.11	1.63	4.64	0.81
09/28/12	Low	1.90	6	Bottom	12.16	1.60	3.67	0.80
09/28/12	High	8.20	1	Surface	20.94	45.20	7.45	29.05
09/28/12	High	8.20	2	Surface	20.29	45.50	6.37	29.16
09/28/12	High	8.20	6	Surface	13.62	1.68	4.95	0.84
09/28/12	High	8.20	6	Bottom	13.80	1.43	3.61	0.71
10/16/12	Low	4.50	1	Surface	11.42	2.97	7.00	1.53
10/16/12	Low	4.50	2	Surface	11.42	3.54	5.90	1.86
10/16/12	Low	4.50	6	Surface	11.77	1.24	4.10	0.61
10/16/12	Low	4.50	6	Bottom	11.71	21.70	2.96	12.74
10/16/12	Low	4.50	8	Surface	11.98	2.97	4.50	1.53
10/16/12	Low	4.50	8	Bottom	12.67	4.84	4.27	2.56
10/16/12	Low	4.50	9	Surface	13.41	13.52	7.07	7.52
10/16/12	High	8.70	1	Surface	12.96	17.40	7.02	17.06
10/16/12	High	8.70	1	Bottom	13.07	32.30	7.16	19.79
10/16/12	High	8.70	2	Surface	12.97	31.80	7.10	19.46

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
10/16/12	High	8.70	2	Bottom	13.02	32.40	7.01	19.86
10/16/12	High	8.70	6	Surface	11.84	1.14	2.83	0.56
10/16/12	High	8.70	6	Bottom	11.87	18.00	2.70	10.64
10/16/12	High	8.70	8	Surface	12.33	3.60	2.95	1.87
10/16/12	High	8.70	8	Bottom	12.67	4.33	3.30	2.31
10/16/12	High	8.70	9	Surface	13.85	14.90	7.50	8.42
10/16/12	High	8.70	9	Bottom	12.14	9.08	6.45	5.01
11/20/12	Low	4.20	1	Surface	8.31	10.94	6.60	6.08
11/20/12	Low	4.20	2	Surface	8.31	10.90	6.41	6.05
11/20/12	Low	4.20	4	Surface	8.25	28.00	2.43	16.79
11/20/12	Low	4.20	6	Surface	8.41	6.96	5.94	3.75
11/20/12	Low	4.20	6	Bottom	8.41	6.85	6.07	3.69
11/20/12	Low	4.20	7	Surface	8.16	10.97	9.12	6.10
11/20/12	Low	4.20	8	Surface	8.50	25.30	0.84	15.05
11/20/12	Low	4.20	8	Bottom	8.76	30.60	0.43	18.52
11/20/12	Low	4.20	9	Surface	8.50	18.40	1.34	10.65
11/20/12	Low	4.20	9	Bottom	8.75	26.80	2.43	16.03
11/20/12	High	9.10	1	Surface	8.28	23.60	8.59	13.94
11/20/12	High	9.10	1	Bottom	8.45	40.50	7.51	25.16
11/20/12	High	9.10	2	Surface	8.28	28.20	9.06	16.93
11/20/12	High	9.10	2	Bottom	8.30	31.00	9.04	18.77
11/20/12	High	9.10	3	Surface	8.20	25.30	8.50	15.04
11/20/12	High	9.10	3	Bottom	8.33	31.50	8.05	19.10
11/20/12	High	9.10	4	Surface	8.31	28.30	8.54	16.99
11/20/12	High	9.10	4	Bottom	8.33	31.50	6.75	19.10
11/20/12	High	9.10	5	Surface	8.30	28.40	8.59	17.06
11/20/12	High	9.10	5	Bottom	8.34	31.50	7.15	19.10
11/20/12	High	9.10	6	Surface	8.30	26.20	8.45	15.62
11/20/12	High	9.10	6	Bottom	8.30	30.60	7.70	18.50
11/20/12	High	9.10	7	Surface	8.37	27.90	8.05	16.73
11/20/12	High	9.10	7	Bottom	8.29	29.50	7.19	17.78
11/20/12	High	9.10	8	Surface	8.41	25.00	7.29	14.85
11/20/12	High	9.10	8	Bottom	8.42	29.10	5.90	17.52
11/20/12	High	9.10	9	Surface	8.34	20.60	5.67	12.03
11/20/12	High	9.10	9	Bottom	8.42	26.90	3.55	16.08
12/07/12	Low	2.30	1	Surface	6.17	6.78	8.14	3.65
12/07/12	Low	2.30	2	Surface	6.16	6.68	7.91	3.57
12/07/12	Low	2.30	4	Surface	7.66	37.40	2.47	23.02
12/07/12	Low	2.30	6	Surface	6.28	3.06	7.77	1.57
12/07/12	Low	2.30	6	Bottom	6.27	3.08	7.55	1.58
12/07/12	Low	2.30	7	Surface	7.04	31.10	7.91	18.79
12/07/12	Low	2.30	8	Surface	7.44	36.30	1.47	22.27
12/07/12	Low	2.30	8	Bottom	8.48	38.00	2.56	23.46
12/07/12	Low	2.30	9	Surface	5.99	3.55	3.45	1.83
12/07/12	Low	2.30	9	Bottom	8.92	39.10	4.69	24.23
12/07/12	High	9.00	1	Surface	6.21	22.20	10.04	13.00
12/07/12	High	9.00	1	Bottom	6.20	22.80	9.80	13.38
12/07/12	High	9.00	2	Surface	6.20	22.50	9.62	13.00
12/07/12	High	9.00	2	Bottom	6.20	22.70	9.42	13.32
12/07/12	High	9.00	3	Surface	6.26	23.10	8.94	13.58
12/07/12	High	9.00	4	Surface	6.38	23.20	9.72	13.64
12/07/12	High	9.00	4	Bottom	7.06	32.80	5.01	19.65
12/07/12	High	9.00	5	Surface	6.44	19.00	7.95	10.93
12/07/12	High	9.00	6	Surface	6.91	0.89	7.97	0.43
12/07/12	High	9.00	6	Bottom	6.52	15.80	7.78	9.01
12/07/12	High	9.00	7	Surface	6.41	13.00	8.04	7.30
12/07/12	High	9.00	7	Bottom	7.07	31.60	6.55	19.05
12/07/12	High	9.00	8	Surface	7.18	18.90	1.41	10.94
12/07/12	High	9.00	8	Bottom	8.61	38.10	1.59	23.54
12/07/12	High	9.00	9	Surface	7.53	5.01	1.66	2.64
12/07/12	High	9.00	9	Bottom	8.74	39.10	4.96	24.22
01/07/13	Low	-0.70	1	Surface	5.71	1.80	10.11	0.90
01/07/13	Low	-0.70	2	Surface	5.70	1.79	10.09	0.89

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
01/07/13	Low	-0.70	3	Surface	5.27	13.27	4.20	7.48
01/07/13	Low	-0.70	4	Surface	5.94	37.80	3.02	23.20
01/07/13	Low	-0.70	4	Bottom	5.89	37.10	3.41	22.60
01/07/13	Low	-0.70	5	Surface	5.82	6.79	4.08	3.77
01/07/13	Low	-0.70	6	Surface	5.70	0.75	9.78	0.36
01/07/13	Low	-0.70	6	Bottom	5.70	0.74	9.77	0.35
01/07/13	Low	-0.70	7	Surface	5.45	11.53	6.75	6.41
01/07/13	Low	-0.70	8	Surface	5.37	22.30	1.05	13.05
01/07/13	Low	-0.70	8	Bottom	5.27	31.70	1.52	19.12
01/07/13	Low	-0.70	9	Surface	5.79	3.53	3.17	1.82
01/07/13	Low	-0.70	9	Bottom	5.78	31.80	6.49	19.20
01/07/13	High	9.20	1	Surface	6.35	30.60	9.59	18.43
01/07/13	High	9.20	1	Bottom	6.22	37.80	8.63	23.22
01/07/13	High	9.20	2	Surface	6.22	31.00	9.57	18.10
01/07/13	High	9.20	2	Bottom	6.15	37.60	9.27	23.08
01/07/13	High	9.20	3	Surface	6.09	33.70	9.07	20.47
01/07/13	High	9.20	4	Surface	5.72	4.90	9.49	2.57
01/07/13	High	9.20	4	Bottom	5.44	38.10	2.08	23.38
01/07/13	High	9.20	5	Surface	5.62	9.41	9.09	5.23
01/07/13	High	9.20	6	Surface	5.69	0.43	10.57	0.20
01/07/13	High	9.20	6	Bottom	5.66	1.41	10.17	0.78
01/07/13	High	9.20	7	Surface	5.66	1.33	9.39	0.65
01/07/13	High	9.20	7	Bottom	5.09	8.77	3.93	4.80
01/07/13	High	9.20	8	Surface	5.02	16.80	2.35	9.59
01/07/13	High	9.20	8	Bottom	5.07	32.70	0.88	19.77
01/07/13	High	9.20	9	Surface	5.40	0.99	6.51	0.48
01/07/13	High	9.20	9	Bottom	5.44	31.90	3.01	19.25
02/03/13	Low	0.60	2	Surface	5.80	1.09	8.42	0.52
02/03/13	Low	0.60	3	Surface	6.04	12.67	1.05	7.16
02/03/13	Low	0.60	4	Surface	7.43	33.40	11.94	20.33
02/03/13	Low	0.60	5	Surface	6.23	6.91	1.76	3.71
02/03/13	Low	0.60	6	Surface	5.79	0.51	7.88	0.24
02/03/13	Low	0.60	6	Bottom	5.79	0.55	7.71	0.26
02/03/13	Low	0.60	7	Surface	6.19	2.71	6.33	1.35
02/03/13	Low	0.60	8	Surface	6.53	2.64	3.36	1.34
02/03/13	Low	0.60	8	Bottom	6.59	17.20	0.36	9.87
02/03/13	Low	0.60	9	Surface	6.11	3.43	3.83	1.77
02/03/13	Low	0.60	9	Bottom	7.19	26.70	11.85	16.05
02/03/13	High	9.00	1	Surface	5.32	1.38	8.56	0.67
02/03/13	High	9.00	2	Bottom	5.32	1.09	7.96	0.53
02/03/13	High	9.00	3	Surface	5.43	13.96	0.57	8.07
02/03/13	High	9.00	4	Surface	7.04	32.10	13.20	19.45
02/03/13	High	9.00	5	Surface	5.58	7.98	1.47	4.32
02/03/13	High	9.00	6	Surface	5.40	0.50	7.95	0.24
02/03/13	High	9.00	6	Bottom	5.40	0.54	7.84	0.26
02/03/13	High	9.00	7	Surface	5.58	3.23	6.42	1.66
02/03/13	High	9.00	8	Surface	6.20	3.35	1.94	1.72
02/03/13	High	9.00	8	Bottom	6.61	15.50	0.28	8.76
02/03/13	High	9.00	9	Surface	5.53	2.48	4.29	1.25
02/03/13	High	9.00	9	Bottom	6.94	26.70	9.85	15.91
03/08/13	Low	-0.10	1	Surface	5.58	0.76	8.42	0.36
03/08/13	Low	-0.10	2	Surface	5.58	0.76	8.09	0.37
03/08/13	Low	-0.10	3	Surface	4.84	5.47	2.00	2.90
03/08/13	Low	-0.10	4	Surface	10.80	9.71	4.12	5.37
03/08/13	Low	-0.10	5	Surface	6.50	2.07	1.40	1.05
03/08/13	Low	-0.10	6	Surface	5.41	0.40	8.09	0.19
03/08/13	Low	-0.10	6	Bottom	5.44	0.41	8.01	0.19
03/08/13	Low	-0.10	7	Surface	4.22	1.28	6.45	0.63
03/08/13	Low	-0.10	8	Surface	7.77	1.80	5.85	0.90
03/08/13	Low	-0.10	8	Bottom	9.74	20.20	11.25	11.93
03/08/13	Low	-0.10	9	Surface	5.05	0.60	7.04	0.28
03/08/13	Low	-0.10	9	Bottom	9.61	19.30	16.01	11.24
03/08/13	High	7.60	1	Surface	7.91	0.75	9.50	0.36
03/08/13	High	7.60	2	Surface	7.94	0.76	9.20	0.36
03/08/13	High	7.60	3	Surface	9.99	6.20	2.13	3.35
03/08/13	High	7.60	4	Surface	11.11	14.80	6.33	8.45
03/08/13	High	7.60	5	Surface	11.20	3.19	5.20	1.63
03/08/13	High	7.60	6	Surface	7.55	0.38	8.36	0.18

Date	Tide	Height (ft)	Site	Depth	Temp (°C)	SpC (mS)	DO (mg/L)	Salinity (PSS)
03/08/13	High	7.60	6	Bottom	7.54	0.41	8.27	0.19
03/08/13	High	7.60	7	Surface	11.98	1.64	9.28	0.82
03/08/13	High	7.60	8	Surface	12.48	2.43	4.74	1.24
03/08/13	High	7.60	8	Bottom	9.91	12.22	2.56	6.80
03/08/13	High	7.60	9	Surface	8.04	0.84	7.34	0.41
03/08/13	High	7.60	9	Bottom	10.35	19.40	11.71	11.38
04/25/13	Low	-0.09	1	Surface	10.09	0.61	10.17	0.29
04/25/13	Low	-0.09	2	Surface	10.15	0.61	9.68	0.29
04/25/13	Low	-0.09	3	Surface	11.99	4.89	1.02	2.59
04/25/13	Low	-0.09	4	Surface	16.42	7.84	11.52	4.28
04/25/13	Low	-0.09	5	Surface	16.28	3.55	2.20	1.85
04/25/13	Low	-0.09	6	Surface	9.23	0.34	7.16	0.16
04/25/13	Low	-0.09	6	Bottom	9.36	0.36	7.21	0.17
04/25/13	Low	-0.09	7	Surface	18.76	1.30	9.17	0.64
04/25/13	Low	-0.09	8	Surface	14.10	3.01	1.83	1.55
04/25/13	Low	-0.09	8	Bottom	15.06	10.82	1.17	5.60
04/25/13	Low	-0.09	9	Surface	11.57	4.12	8.95	2.16
04/25/13	Low	-0.09	9	Bottom	13.50	10.82	12.06	6.07
04/25/13	High	8.20	1	Surface	11.65	0.66	7.59	0.31
04/25/13	High	8.20	2	Surface	11.54	0.65	7.21	0.31
04/25/13	High	8.20	3	Surface	14.40	3.74	1.29	1.95
04/25/13	High	8.20	4	Surface	21.98	11.54	16.57	6.54
04/25/13	High	8.20	5	Surface	18.35	3.55	1.94	1.86
04/25/13	High	8.20	6	Surface	10.83	0.37	5.86	0.18
04/25/13	High	8.20	6	Bottom	10.78	0.38	5.71	0.18
04/25/13	High	8.20	7	Surface	21.29	1.48	7.58	0.74
04/25/13	High	8.20	8	Surface	18.72	6.06	2.83	3.27
04/25/13	High	8.20	8	Bottom	18.14	10.06	2.84	5.55
04/25/13	High	8.20	9	Surface	14.64	2.67	9.54	1.37
04/25/13	High	8.20	9	Bottom	17.01	16.90	4.40	9.20
05/10/13	Low	-1.00	2	Surface	15.63	1.36	6.62	0.68
05/10/13	Low	-1.00	6	Surface	12.84	0.97	1.42	0.46
05/10/13	Low	-1.00	6	Bottom	13.41	5.66	1.07	3.03
05/10/13	Low	-1.00	8	Surface	18.44	2.34	2.64	1.19
05/10/13	Low	-1.00	8	Bottom	16.78	5.39	1.77	2.89
05/10/13	Low	-1.00	9	Surface	17.95	5.98	0.24	3.22
05/10/13	Low	-1.00	9	Bottom	17.02	9.37	0.09	5.25
05/10/13	High	8.40	1	Surface	19.71	35.90	7.22	22.46
05/10/13	High	8.40	1	Bottom	19.48	38.40	7.35	24.26
05/10/13	High	8.40	2	Surface	19.31	32.60	7.31	20.19
05/10/13	High	8.40	2	Bottom	19.32	36.30	6.91	22.73
05/10/13	High	8.40	6	Surface	13.29	0.69	1.69	0.33
05/10/13	High	8.40	6	Bottom	13.74	5.33	2.43	1.84
05/10/13	High	8.40	8	Surface	16.67	2.32	2.63	1.18
05/10/13	High	8.40	8	Bottom	17.07	7.57	2.34	4.14
05/10/13	High	8.40	9	Surface	17.36	5.97	0.53	2.29
05/10/13	High	8.40	9	Bottom	17.11	11.95	0.38	6.52
06/05/13	Low	-0.50	2	Surface	14.38	3.28	6.09	1.70
06/05/13	Low	-0.50	3	Surface	14.70	14.34	1.47	8.21
06/05/13	Low	-0.50	4	Surface	22.10	29.00	5.47	17.82
06/05/13	Low	-0.50	6	Surface	13.46	5.64	0.77	2.07
06/05/13	Low	-0.50	6	Bottom	14.35	25.10	1.71	15.12
06/05/13	Low	-0.50	7	Surface	23.98	9.41	1.73	5.25
06/05/13	Low	-0.50	8	Surface	15.98	1.48	1.06	0.74
06/05/13	Low	-0.50	8	Bottom	16.05	2.92	0.24	1.48
06/05/13	Low	-0.50	9	Surface	15.37	4.11	0.53	2.16
06/05/13	Low	-0.50	9	Bottom	15.95	6.38	0.47	3.43
06/05/13	High	7.60	1	Surface	20.38	13.45	5.81	6.34
06/05/13	High	7.60	2	Surface	16.97	3.09	4.42	1.61
06/05/13	High	7.60	3	Surface	15.66	15.10	0.87	8.63
06/05/13	High	7.60	4	Surface	27.66	29.40	11.68	18.22
06/05/13	High	7.60	6	Surface	14.21	4.56	1.04	2.00
06/05/13	High	7.60	6	Bottom	15.72	23.80	4.69	14.23
06/05/13	High	7.60	7	Surface	25.09	13.03	1.12	7.50
06/05/13	High	7.60	8	Surface	20.15	2.37	1.61	1.21
06/05/13	High	7.60	8	Bottom	19.87	3.26	0.47	1.71
06/05/13	High	7.60	9	Surface	17.77	2.90	1.03	1.50
06/05/13	High	7.60	9	Bottom	17.31	6.78	5.10	3.67

Appendix C: Graphs

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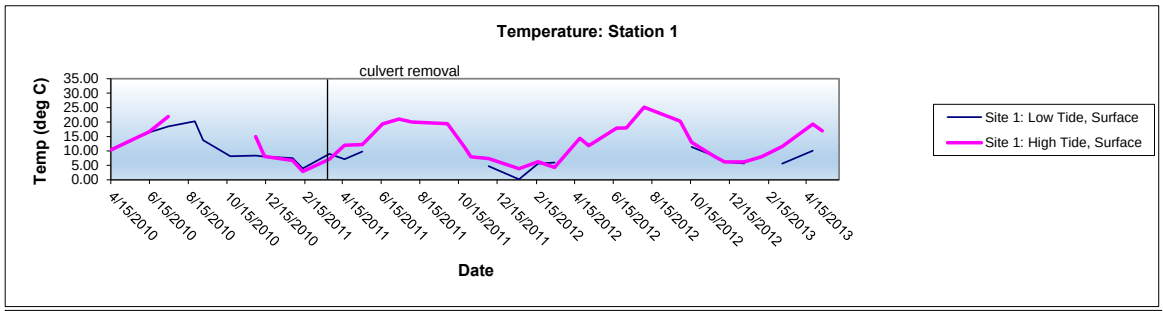
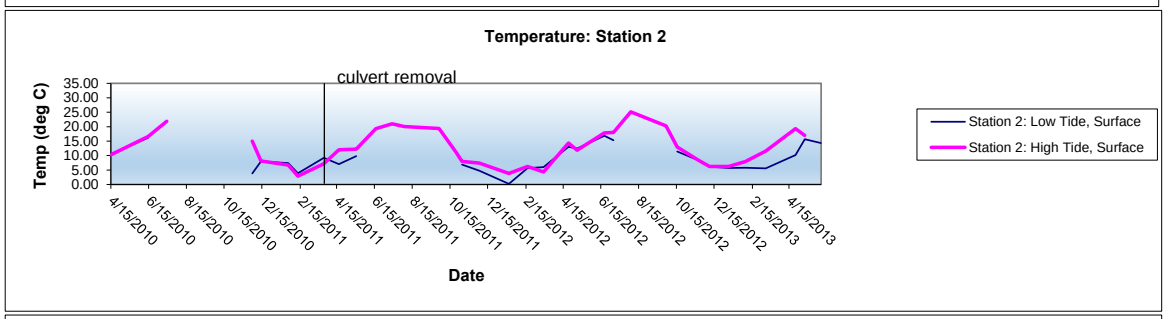
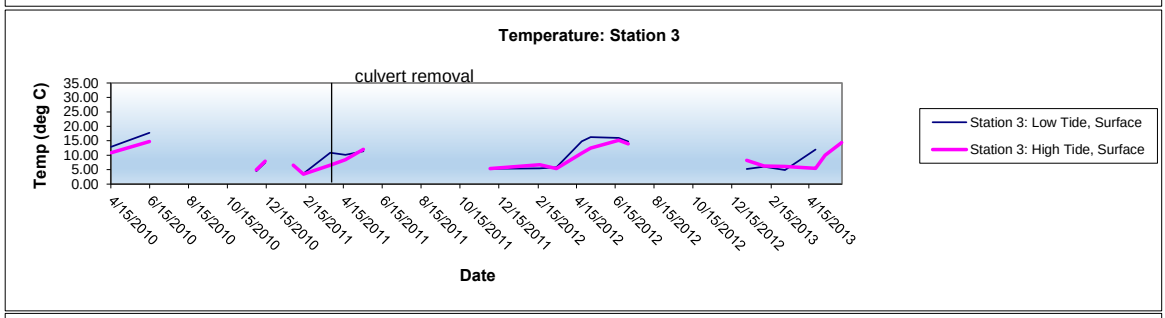
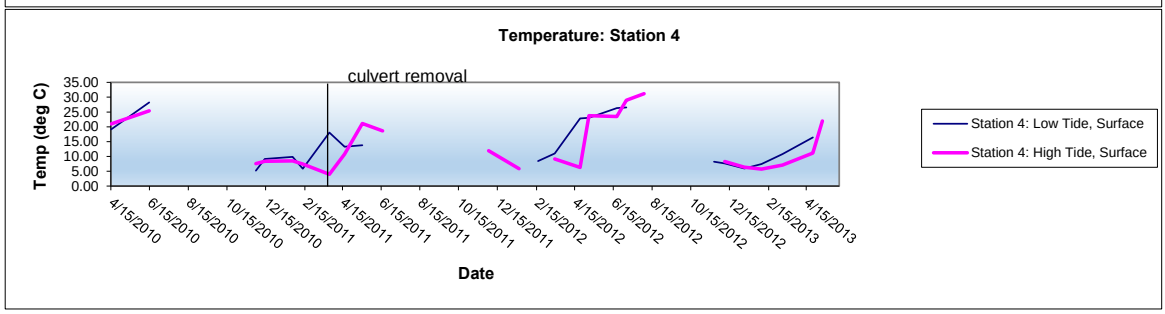
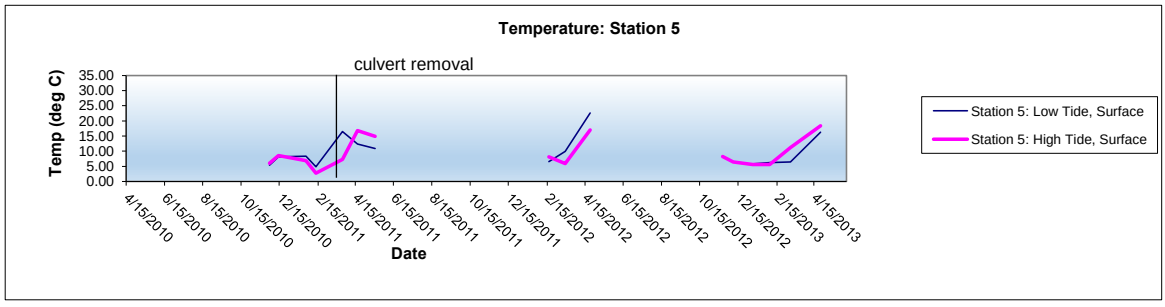
Temperature Graphs (pg 1 of 2)



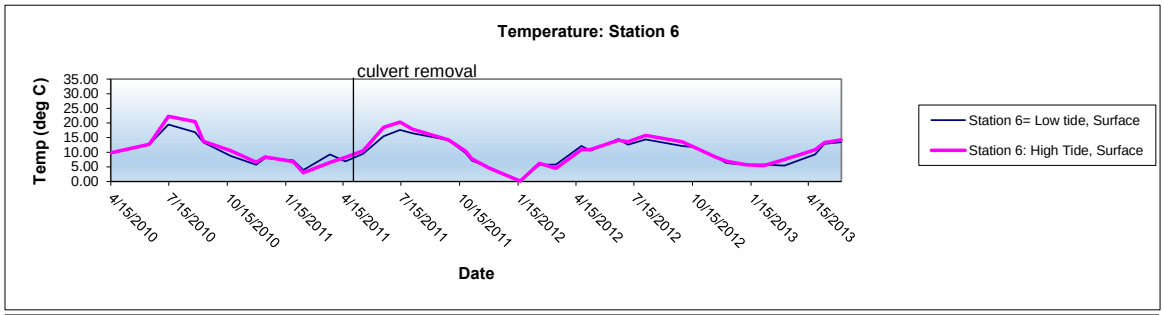


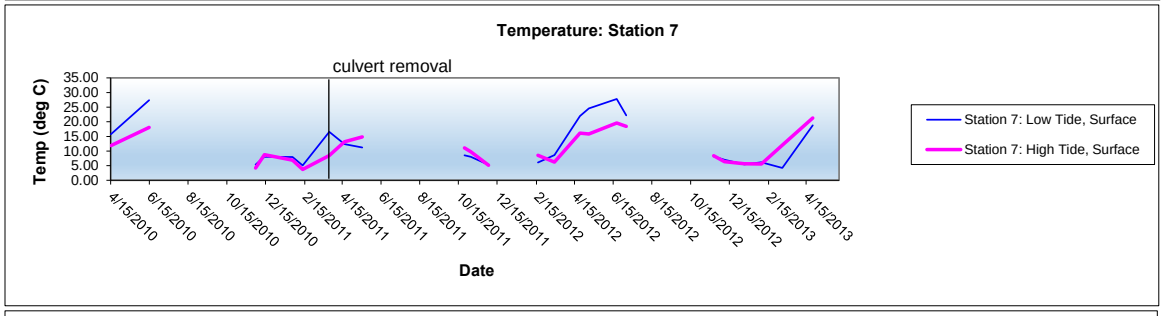


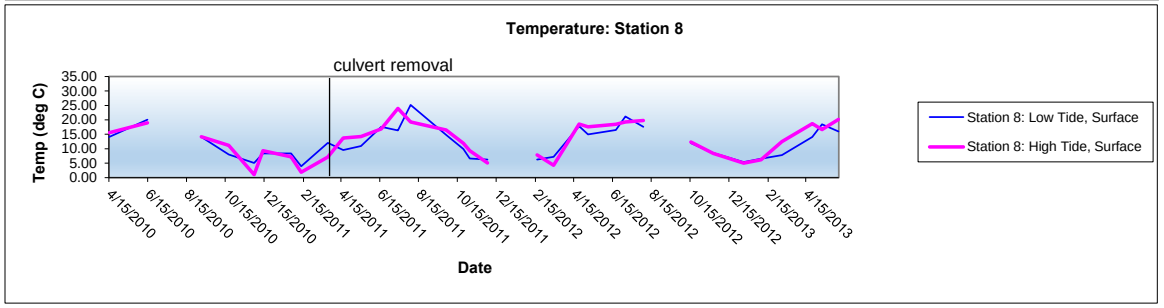


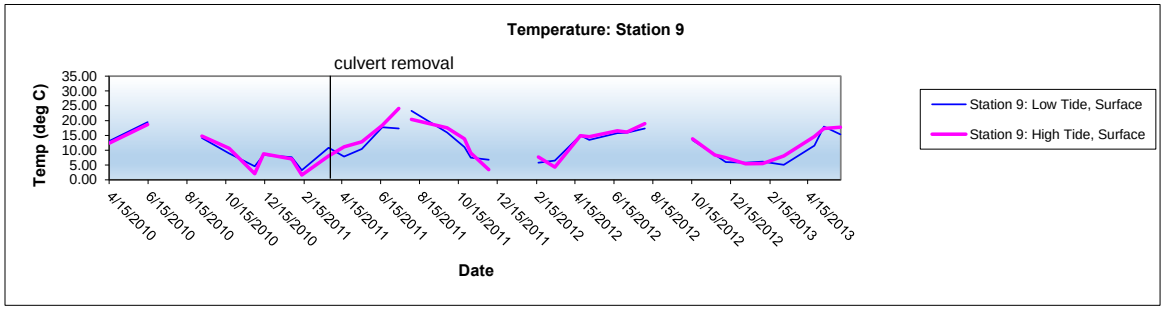


Temperature Graphs (pg 2 of 2)

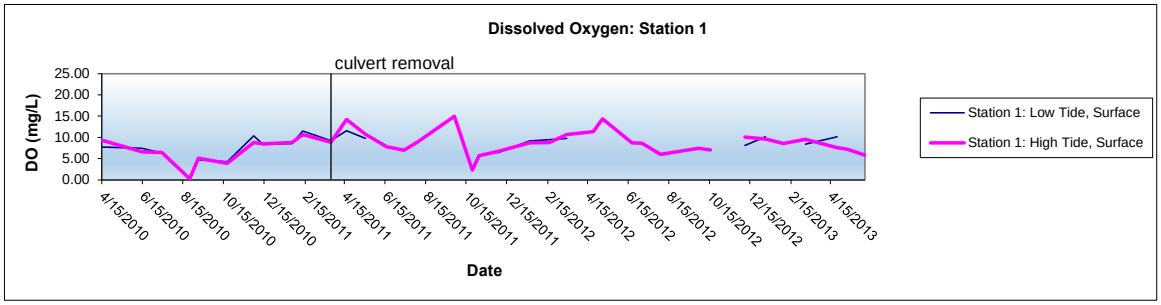


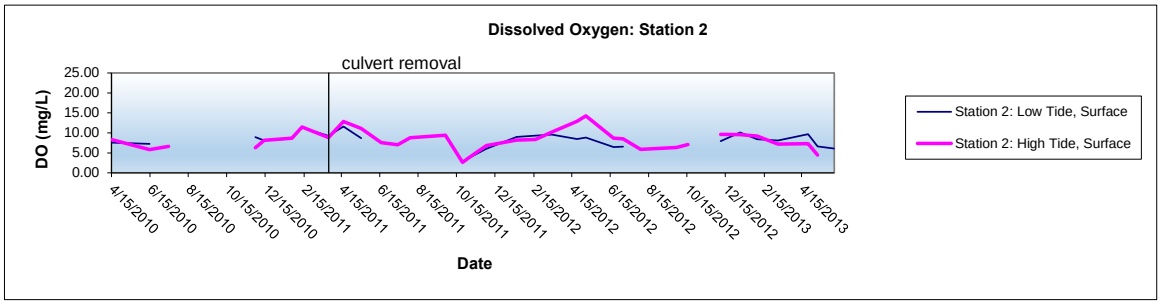


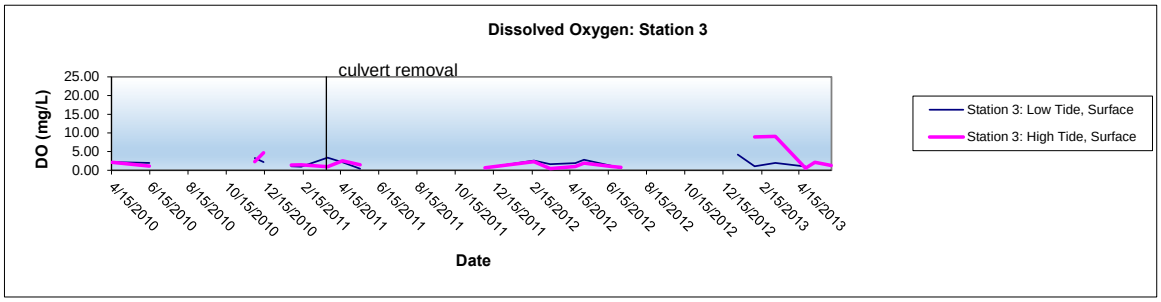


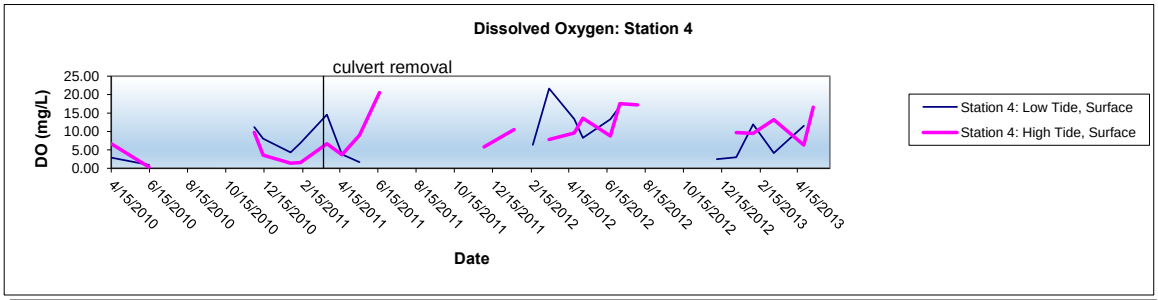


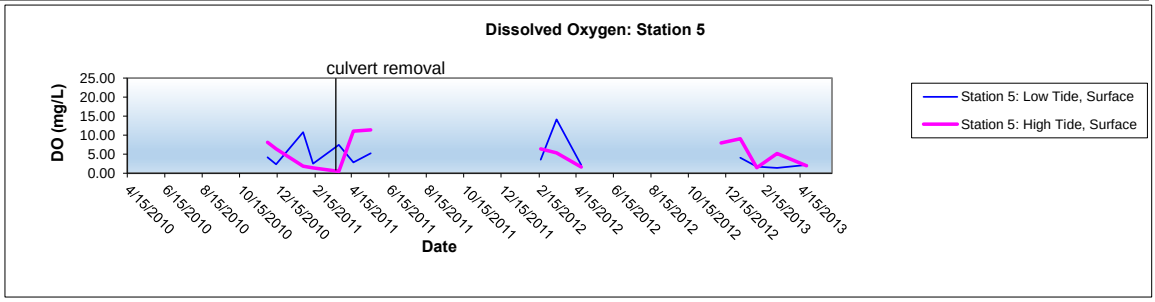
Dissolved Oxygen Graphs (pg 1 of 2)



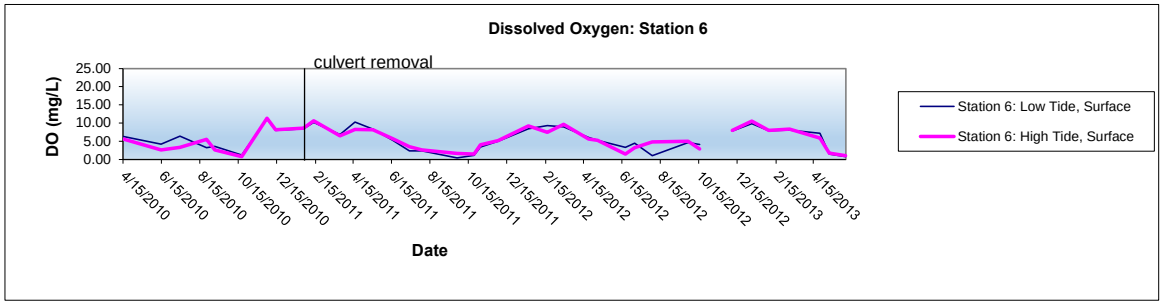


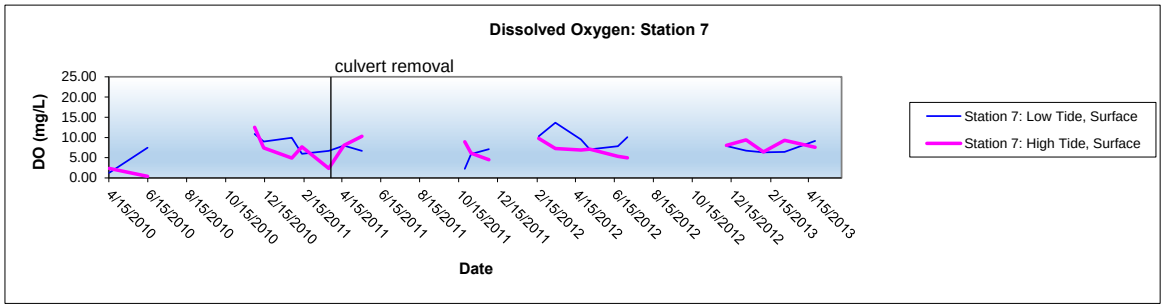


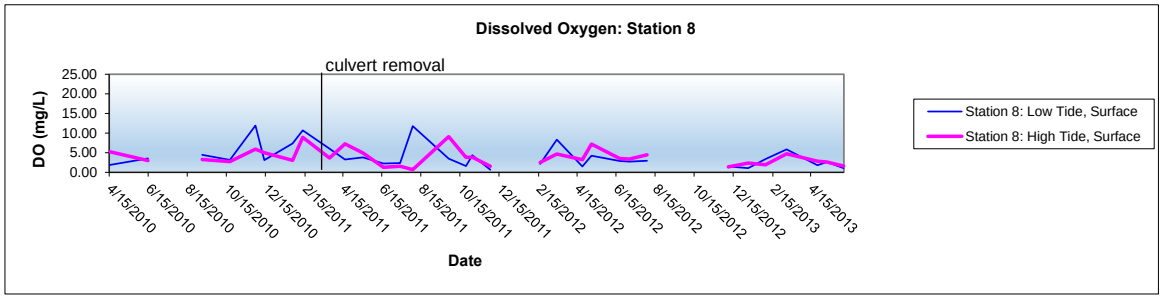


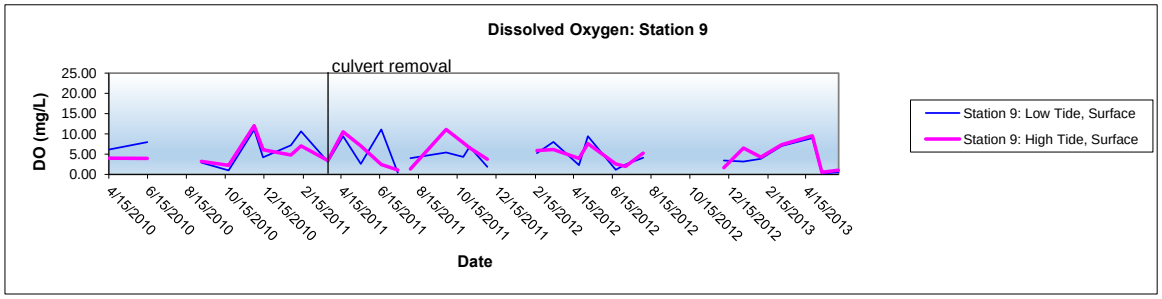


Dissolved Oxygen Graphs (pg 2 of 2)

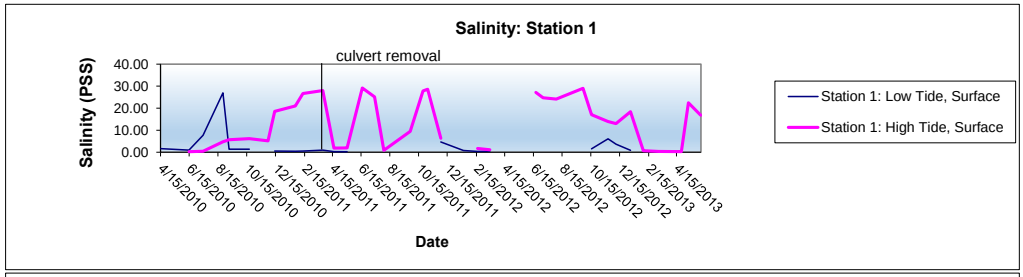


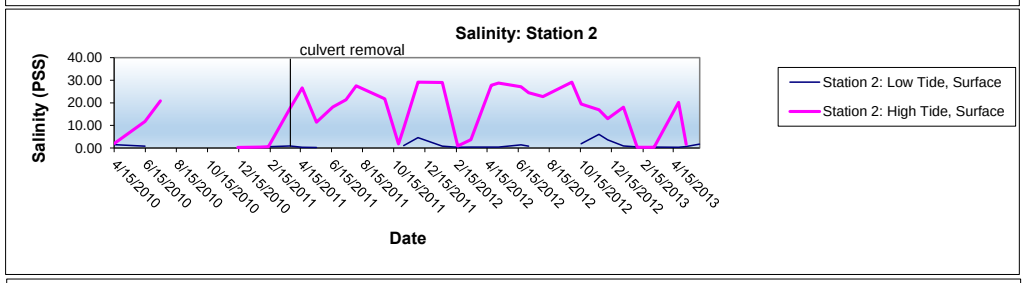


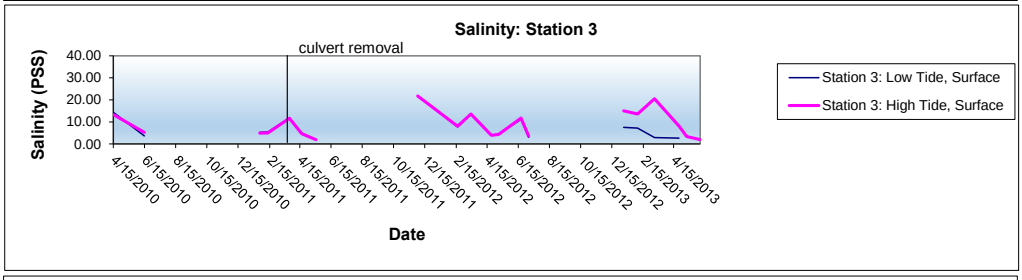


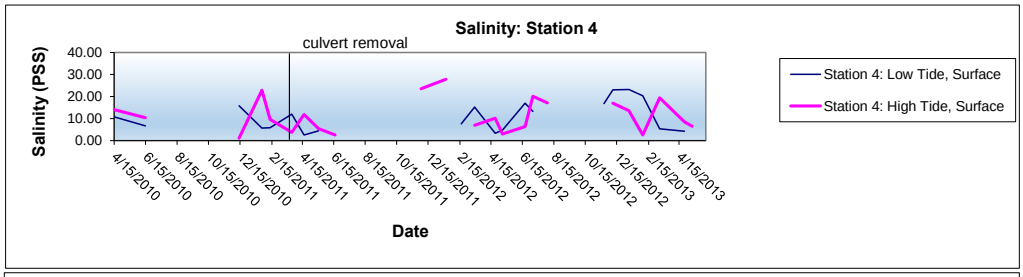


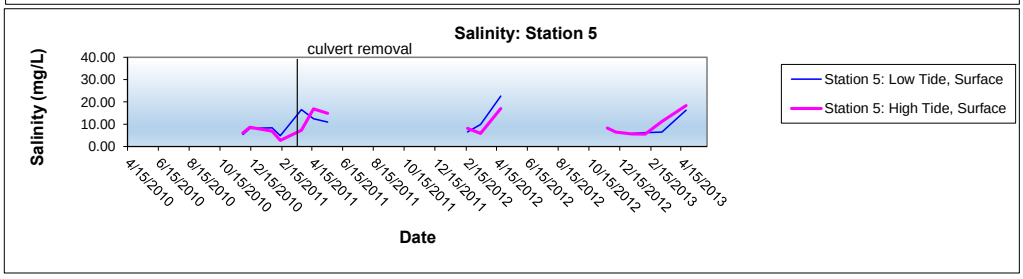
Salinity Graphs (pg 1 of 2)



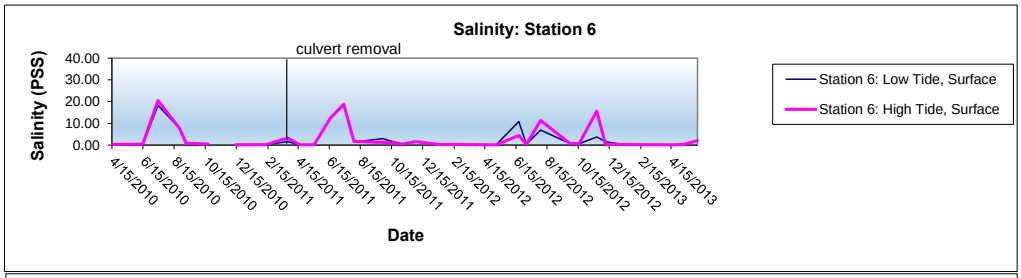


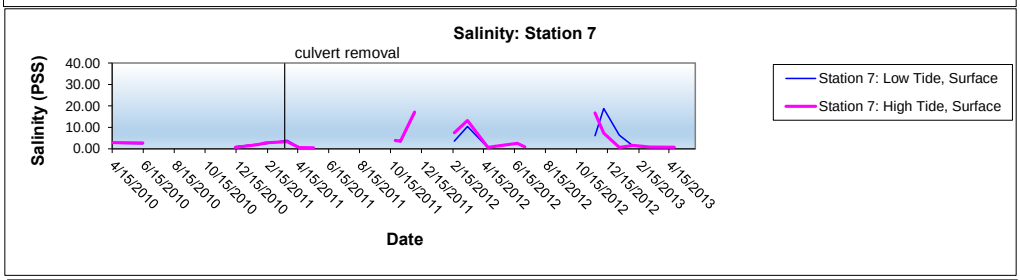


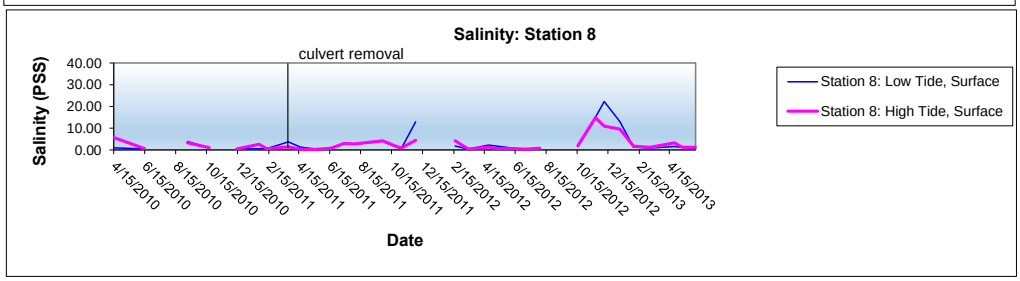


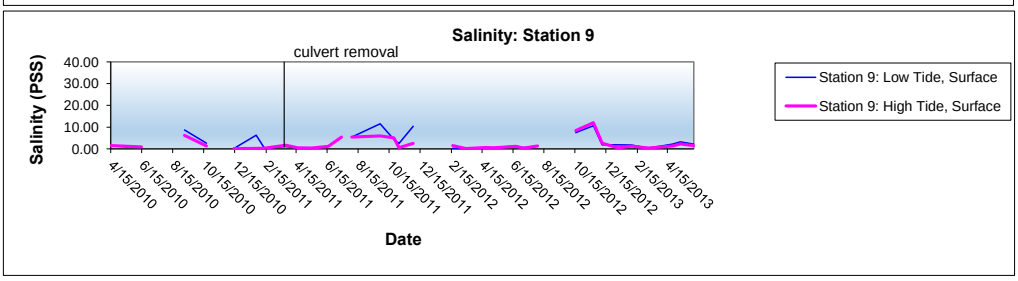


Salinity Graphs (pg 2 of 2)

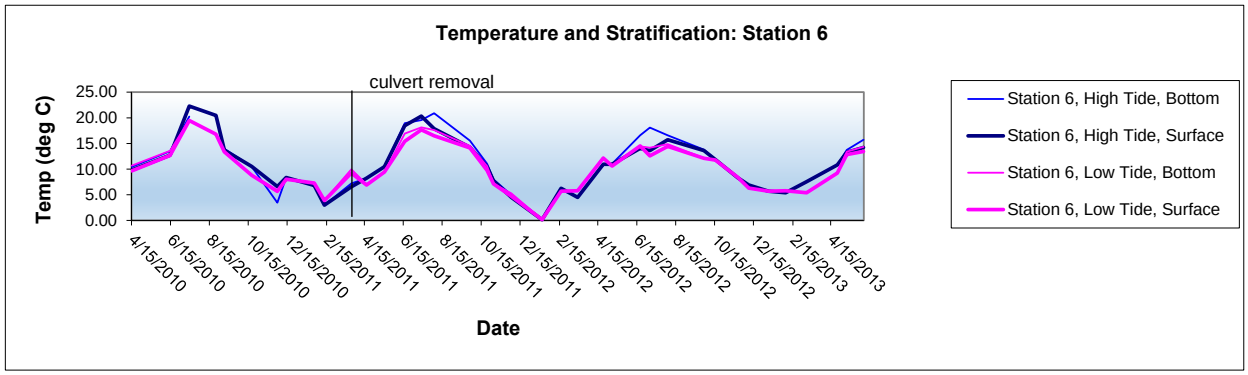


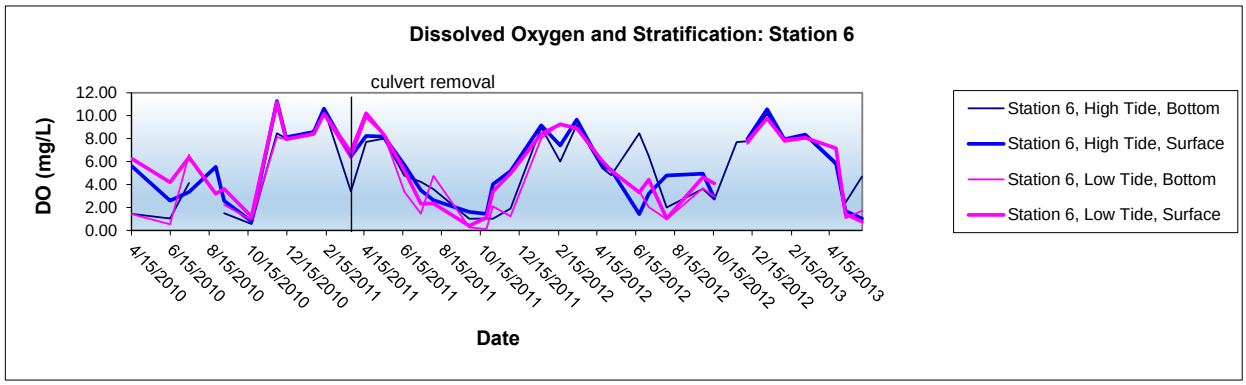


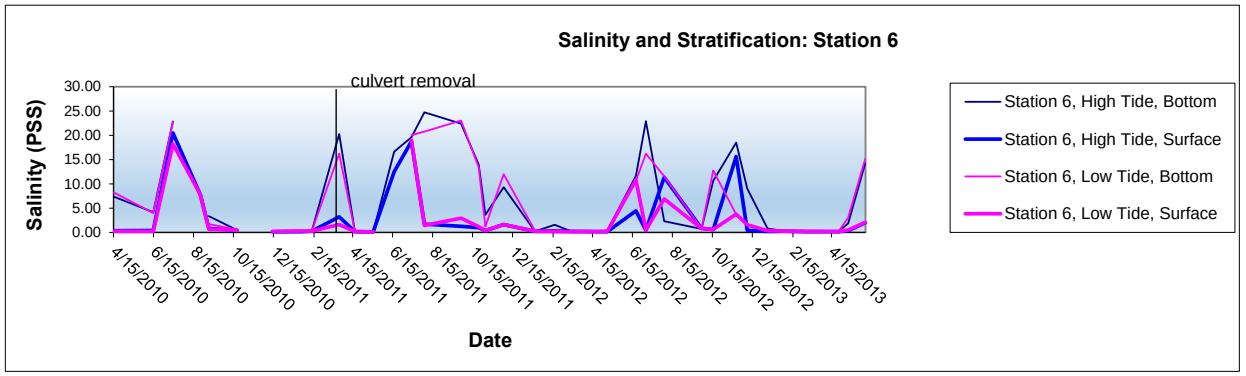




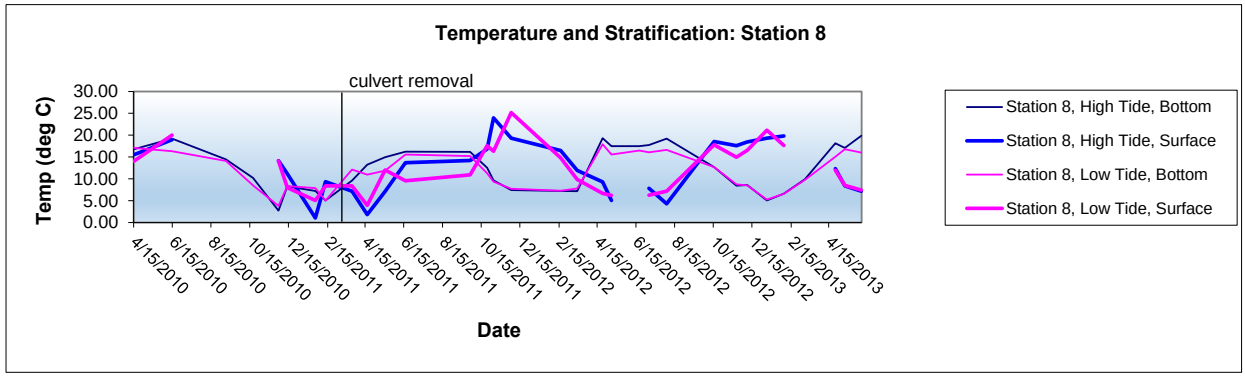
Stratification Graphs: Site 6 (pg 1 of 2)

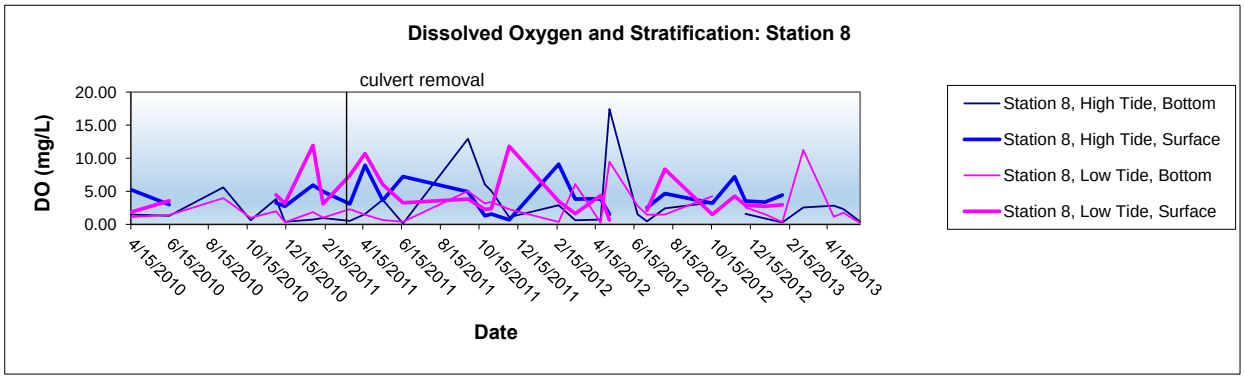


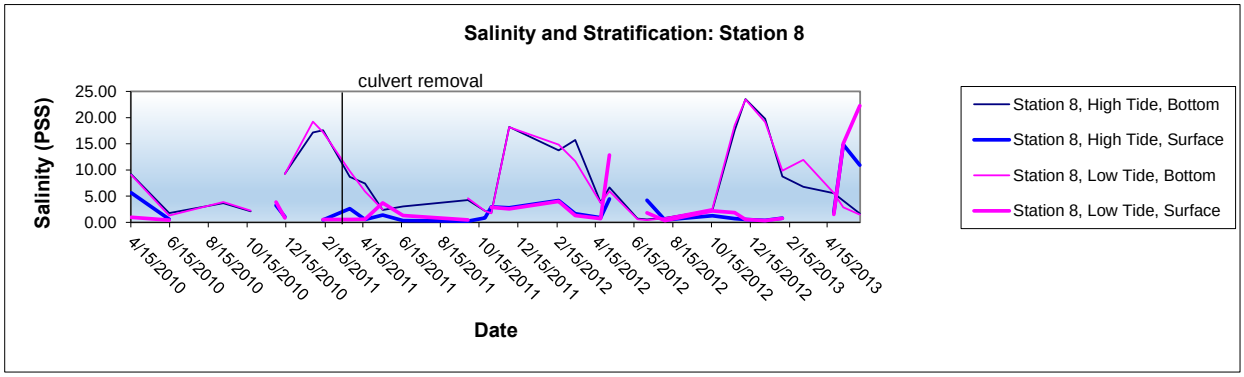




Stratification Graphs: Site 8 (pg 1 of 2)







Appendix D: Photographs of Sampling Stations

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WQ Station 1

WQ Station 2

WQ Station 3

WQ Station 4

WQ Station 5

WQ Station 6

WQ Station 7

WQ Station 8

WQ Station 9