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HABITAT RESTORATION FEASIBILITY ASSESSMENT

Cornet Bay/Hoypus Point Improvement Project

2006 oblique aerial photographs of Cornet Bay (courtesy of WA Department of Ecology)

Prepared for

Washington State Parks and Recreation and
Island County Marine Resources Committee

November 2009

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

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Cornet Bay/Hoypus Point Improvement Project

Prepared for

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Contents

Tables

Figures

Introduction

The Washington State Parks and Recreation Commission, in collaboration with the Island County Marine Resources Committee (MRC), proposes to upgrade the Cornet Bay – Hoypus Point area within Deception Pass State Park. The proposed upgrade includes improvements to upland facilities, marine facilities, and nearshore habitat. The Washington State Parks and Recreation Commission retained Herrera Environmental Consultants (Herrera) to assist with the design of this project. This document provides the results of the feasibility assessment associated with the nearshore habitat improvement element of the project.

Project Area

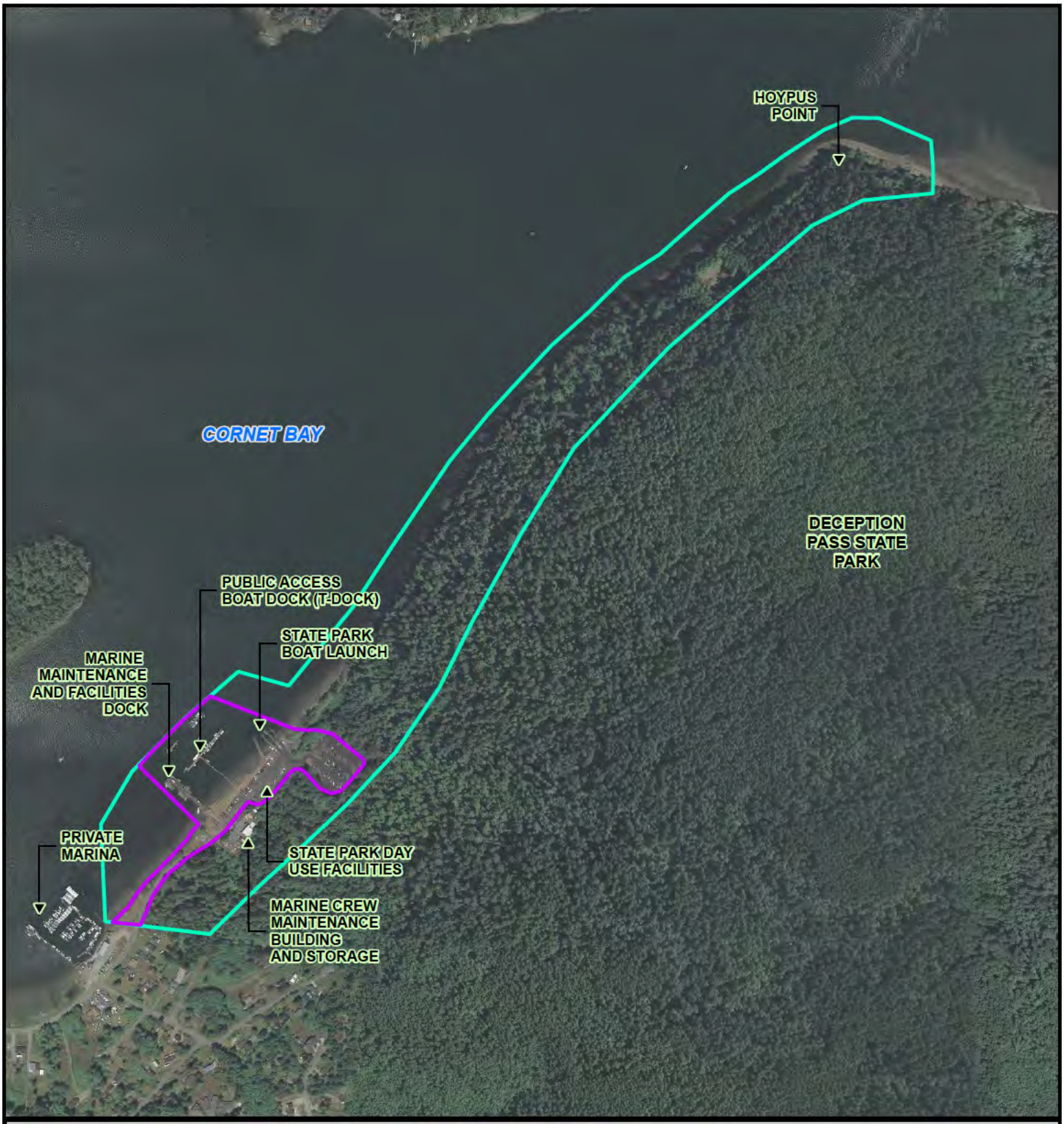
Deception Pass State Park is a 4,250-acre marine and camping park, with 77,000 feet of saltwater shoreline and 33,900 feet of freshwater shoreline on three lakes. Rugged cliffs drop to meet the turbulent waters of Deception Pass. The park is outstanding for breathtaking views, old-growth forests, and abundant wildlife.

The Cornet Bay area within the park includes a six-lane boat launch for motorized craft, a day use area, and a narrow road to Hoypus Point where a trail and stockpile/borrow pit currently exist. This report defines the *project area* as the area extending from the park entrance on Cornet Bay Road to Hoypus Point (Figure 1). It includes the nearshore aquatic and riparian environments (zones) and all marine and upland facilities associated with the park. The aquatic environment extends from the deepest axis of Cornet Bay (offshore) to the mean higher high water (MHHW) elevation. The riparian zone associated with the project area extends 200 feet from the MHHW elevation.

This report defines the *project site* as the area from the park entrance on Cornet Bay Road to the access gate at the head of the road segment leading to Hoypus Point, where work in the riparian and nearshore zones is likely to occur (Figure 2). The project site includes:

- **Marine facilities**: The Public Access Boat Dock (T-dock), offshore moorage floats, Marine Maintenance and Facilities Dock, debris deflector boom, and boat launch ramps and pier floats
- **Day-use facilities**: Grassy picnic area, comfort station, and parking areas
- Marine Crew Maintenance buildings and storage areas

The Cornet Bay area is unique among Puget Sound coastal habitats because the majority of its landscape is characterized by intact forest, due to its inclusion in the protected area of Deception Pass State Park. This facilitates the maintenance of a relatively natural nearshore environment (Island County 2008a).



Legend

- Project site
- Project area

Figure 1. Project area and project site map for the Cornet Bay/Hoypus Point Improvement Project.

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0 400 800 1,600 Feet

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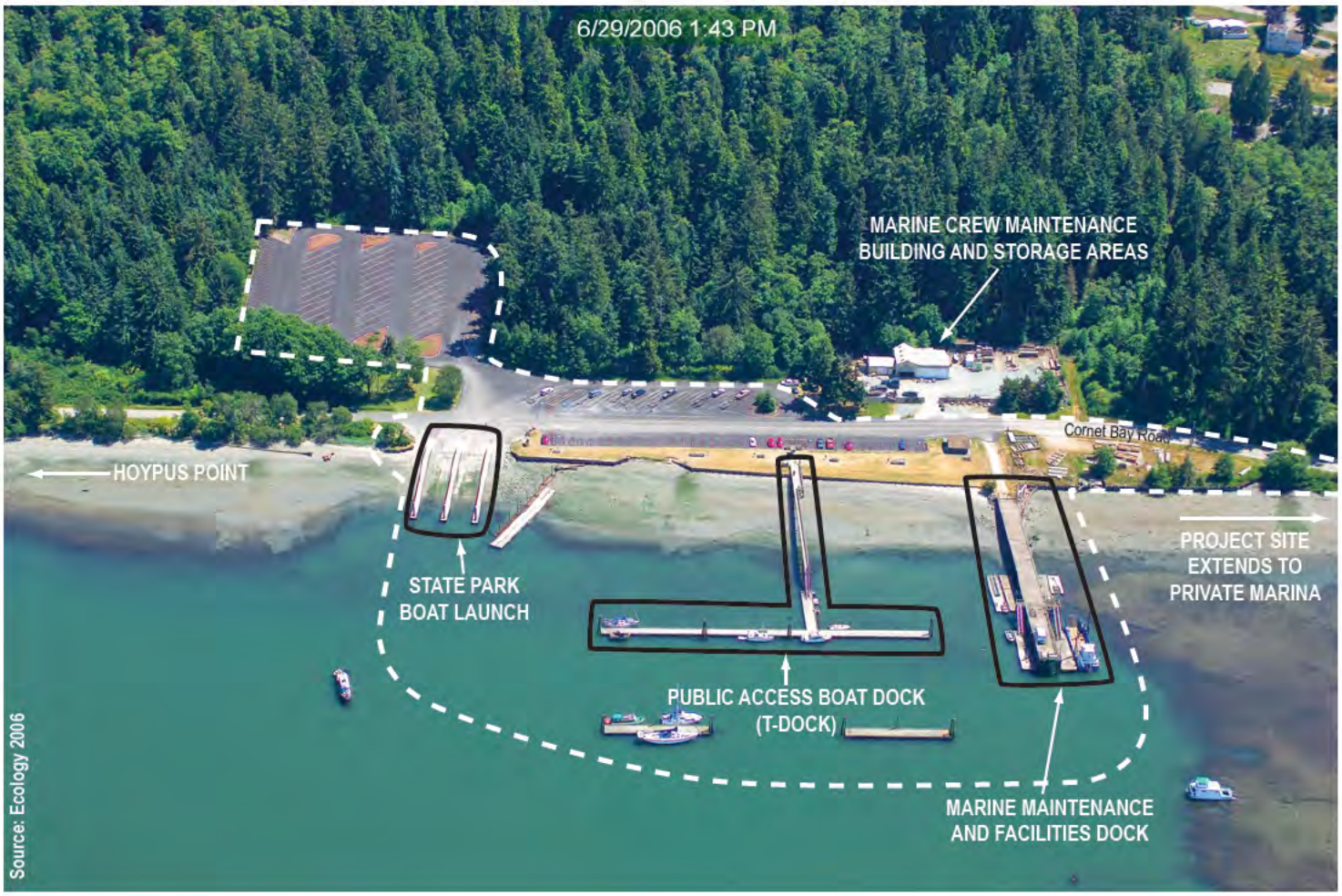

Legend

- - - - Project Site

Figure 2.
Oblique photographic view of Cornet Bay/Hoypus Point Improvement Project project site, Whidbey Island, Washington.

0 50 100 200
Approximate scale in feet

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The vegetation community and shoreline cover conditions within the project area are influenced by several elements including geology, climate, topography, and disturbance. The interaction of these elements facilitates significant diversity both in structure and species composition. The Cornet Bay watershed is characterized by the presence of mature and old-growth coniferous forests, forested wetlands, and diverse shoreline vegetation.

The Cornet Bay shoreline provides important nearshore marine habitat for a range of species, including Endangered Species Act (ESA)-protected salmonids, marine fishes, several species of forage fish, and a number of marine invertebrates.

Project Goals and Objectives

The overall project goal is to perform upgrade and expansion and nearshore restoration of the Cornet Bay Marine Area (day use and marine facilities). The chief goals of the nearshore restoration are to:

- Achieve maximum ecological lift through the restoration of the nearshore aquatic and riparian habitat areas critical for forage fish, juvenile salmon, and other marine species
- Maintain or enhance the park's commercial and recreational values, uses, and present and future opportunities

Using these chief goals as guiding principles, the nearshore restoration strategy for this project specifically targets these objectives:

- Enhance nearshore habitat (aquatic and terrestrial [riparian]) while maintaining necessary protection measures for park infrastructure (i.e., remove as much bulkhead as possible without compromising the integrity of park infrastructure)
- Remove creosote-treated bulkhead (pollution source) and associated fill
- Avoid areas containing cultural resources
- Improve habitat functions along shoreline
- Provide access points for kayaks and park users to beach at targeted locations
- Maintain or expand number of existing picnic benches and facilities
- Maintain or expand existing park use of shoreline and improve visitor access

Report Objectives

The main objective of this report is to present the methodology and results associated with the habitat restoration feasibility assessment component of this project, which serves to inform the basis of design for park improvements. This includes a description of historic and existing conditions and a summary of findings within the context of the conceptual restoration design.

Another objective of this report is to present the information considered during the alternatives analysis. The preferred alternative was selected during workshop exercises on the basis of information uncovered during research to support the feasibility assessment and the collective desire to achieve optimum balance among the chief goals mentioned above.

In addition, a brief overview of a larger suite of Nearshore Restoration Opportunities within the project area is included at the end of the report. Although the scope of this assessment and alternatives analysis was limited to certain activities within the project site, this discussion of restoration opportunities was added to provide context for the preferred alternative and to initiate dialog about additional potential future efforts to improve habitat within Cornet Bay.

Methodology

This feasibility assessment includes two main components:

- An assessment of the ecologic, geomorphic, and physiographic environment in Cornet Bay, examining both historic and existing conditions

- An analysis of alternative strategies and opportunities to restore Cornet Bay within the boundaries of Deception Pass State Park

The assessment of the ecologic, geomorphic, and physiographic environment in Cornet Bay was collaboratively developed by fisheries and plant ecologists, geomorphologists, landscape architects, and engineers. The assessment included a characterization of the following:

- Geomorphic shoreline change
- Oceanographic conditions
- Sediment transport
- Watershed conditions
- Riparian vegetation community conditions
- Aquatic habitat conditions and fish habitat utilization

The following sections describe the methodology used to assess, analyze, and evaluate the project area's history and conditions, possible restoration alternatives, and conceptual restoration design.

Geomorphic Shoreline Change Assessment

The history of a site is important to the potential success of any restoration activity. Understanding the impacts of previous development not only provides information about restoration alternatives, but also additional data on the geomorphic response of the landscape to disturbance. While some activities can have harmful consequences, not all human actions negatively impact habitat or recreational functions. This assessment attempts to catalog these human impacts and exhaustively account for their effects on the nearshore environment.

Geomorphic change on the project area was placed in context with the following existing resources describing environmental conditions:

- A recent PhD thesis describing the dynamics of Puget Sound beaches (Finlayson 2006)

- An analysis of feeder bluffs in Island County (CGS 2006)

- Two historic nautical charts (sometimes called H-sheets) produced in 1890 and 1939 (US Coast and Geodetic Survey 1890; US Coast and Geodetic Survey 1939)

- Two T-sheets, a series of maps of shoreline conditions obtained during initial European settlement (US Coast Survey 1871; US Coast Survey 1908)

- Survey notes associated with the T-sheets and H-sheets above (Jordan 1891; Knox 1940)

- Washington Coastal Atlas (Ecology 2009), which includes a series of oblique aerial photographs taken in the 1970s and a number of disparate data sets on the physical and ecological conditions of the shoreline in Washington State

- Historic aerial photographs taken in 1944, 1956, 1965, 1971, 1980, 1995, 2001, 2006 and 2007

- 1:100,000 maps of the surficial and bedrock geology in the Port Townsend Quadrangle (Pessl et al. 1989; Whetten et al. 1988), which covers the western portion of the project area

- 7.5-minute geologic map (1:24,000) of the Anacortes South and La Conner quadrangle (Dragovich et al. 2000), which covers the eastern portion of the project area

- An article describing (ancient) relict shorelines on northern Whidbey Island (Kovanen and Slaymaker 2004)

Site visits conducted on March 22, March 27, and April 17, 2009 provided additional information about existing geomorphic conditions. On March 27, 15 transects were measured for elevation, substrate composition, presence of large woody debris and wrack, and human modifications. Also, at each transect, at least four photographs were taken at the upper end of the foreshore, near the ordinary high water mark. These photographs included:

- One looking toward the water (over the transect alignment/measurement tape) from the upper beach area

- One looking toward the upper beach area (over the transect alignment/measurement tape) from the water

- One looking to the left from the upper beach area

- One looking to the right from the upper beach area

Oceanographic Characterization

To assess the impacts of past actions and predict the potential effects of proposed nearshore restoration activities, the currents and waves that transport water and sediment around the project area must be understood. For the purpose of this project, this characterization is important to avoid negatively affecting the habitat quality or the recreational value of the park. Considerable information has been collected about the circulation (i.e., currents) in the greater Deception Pass area. Probably the most significant of these studies is Collias (1973). Collias and other recent studies (Babson et al. 2006) were used to interpret the current collected measurements. The method for taking the measurements is described below.

Wave height estimates were made using the methodology recommended by the US Army Corps of Engineers Coastal Engineering Manual (US Army Corps of Engineers 2008). The model used was developed for deep-water waves. It has been demonstrated that no swell penetrates into Puget Sound (Finlayson 2006), so all onsite wave energy comes from locally generated winds and marine vessels. And while most of the project area is relatively shallow (less than 100 feet), the size of the waves is extremely small, meaning that they are deep water waves (i.e., not influenced by the seabed). Wave energy from vessels was determined from a comparison of the wave observations (described below) with wave predictions using the US Army Corps of Engineers methodology.

An RDI Acoustic Doppler Current Profiler (ADCP) was deployed north of the Cornet Bay boat launch between March 22 and April 17, 2009. This device sampled current speed and direction in 14-inch intervals or "bins" from 34 inches above the bed to the water surface. It also collected wave height, wave direction, and water level data. To economize data production and maximize the benefit of the data acquired, data was collected continuously at 2 Hz (two samples per second) for 1 minute in each hour. Based on these sampling characteristics, the device was capable of resolving waves with periods between 1.5 and 60 seconds.

Finally, observations made on site during site visits and deployment of the ADCP established the spatial variability of the observed currents.

Sediment Transport Assessment

Sediment transport is a complex, non-linear physical process that is difficult describe with simple analytical models. Often, the most effective way to understand sediment transport is through sediment budget estimation. A sediment budget usually consists of the definition of sediment sources, transport mechanisms and deposition locations, and a rough estimation of the amount of sediment removed, transported, and delivered to given areas. While this budget could be qualitative, it is possible to provide numerical constraints on restoration design alternatives once the general dynamics of the system are understood.

The sediment transport assessment was performed primarily by using information collected during the site visit. Sediment sources, accumulations and barriers were cataloged previously by

CGS (2006). While Cornet Bay was identified by this study as a target for restoration, the degree of site alteration and the resolution required for design was not covered in sufficient detail by CGS.

The information collected on site on March 27, 2009, was used to identify areas of sediment accumulation, erosion, barriers, and sources. Accumulation was identified by trends in grain size and accumulations of loose sediment. Sediment sources were identified by the presence of bank/bluff erosion (slumps, downed wood, etc.) or, in the case of small channels, the preferential accumulation of sand and gravel adjacent to these outlets. Erosion was generally identified by areas where substrate was armored, in the sense that the sediment particles were tightly locked together to form a kind of pavement. Direction of transport was primarily interpreted by the interlinking of the sediment sources and accumulation zones, often associated with obstructions (natural or otherwise) in the foreshore. The low tide terrace was not sufficiently exposed or altered to determine the direction of transport in this zone.

Watershed Characterization

In 2008, Island County conducted a watershed characterization of the drainage areas contributing to Cornet Bay and the surrounding nearshore environment (Island County 2008a). This characterization focused on the physical, hydrologic, and habitat features of the watershed, with emphasis on zoning, land use, and surface water quality conditions. The intent of this characterization was to identify land use and hydrologic parameters that could potentially affect habitat conditions in the Cornet Bay nearshore environment (Island County 2008a). Since it is important to understand the processes and conditions in the watershed that may influence the Cornet Bay nearshore during development of a restoration feasibility assessment, this report was reviewed and a summary was prepared to provide context for observed conditions within the project area.

Riparian Vegetation Community Characterization

Characterization of the riparian vegetation community in the Cornet Bay project area was based on a review of existing information and observations during a site visit conducted on April 17, 2009. This characterization included an assessment of the terrestrial vegetation types within the project area. Several available data sources, assessment inventories, studies, and management plans provided relevant information. Sources used this characterization included:

- The Cornet Bay Watershed Characterization (Island County 2008a)
- Oblique aerial photographs from Washington State Department of Ecology (Ecology 2009a)
- High resolution aerial photographic interpretation (Google Maps 2009)

- USFWS National Wetland Inventory (NWI) and Island County Wetland Inventory wetland data (Island County 2008b)
- NRCS soil survey data (NRCS 2006)

Aerial and oblique photographs were reviewed prior to field work to assist in determining the extent of habitat types and potential features of interest. Field investigations of the project area allowed for verification of plant community species composition, identification of specific features that may pose environmental constraints to project activities (e.g., wetlands), and documentation of habitat conditions within the project area to help inform restoration design.

Field observations were documented through a combination of notes, sketch maps, photos, and collection of GPS data. Because field work was limited to one day, observations were made primarily from areas easily accessed by the shoreline trail. Results from the site visit were integrated with interpretation of remotely sensed data (i.e., aerial photographs) to develop a characterization for the entire project area.

Aquatic Habitat Characterization and Fish Habitat Utilization Assessment

Nearshore aquatic habitat conditions were characterized based on a review of existing information and observations during the site visit. This characterization included an assessment of marine habitats and associated fish utilization within the project area. Several available data sources, assessment inventories, studies, and management plans provided relevant information. Sources relied upon for this characterization included:

- The Cornet Bay Watershed Characterization (Island County 2008a)
- Skagit Chinook Recovery Plan (Beamer et al. 2005)
- High resolution aerial photographic interpretation (Google Maps 2009)
- WRIA 6 Multi-Species Salmon Recovery Plan (Island County 2005)
- Puget Sound Intertidal Habitat Inventory 1996 for Skagit County and Northern Whidbey Island of Washington State (WA DNR 1997)
- Documented spawning areas for forage fish (Bargmann 1998; Island County et al. 2003; WDFW 2009)
- Biological Evaluation for the Cornet Bay Marine Area Improvements (CH2M Hill 2003)

Restoration Alternative Analysis

Three conceptual design alternatives were developed for restoration of the nearshore ecosystem. These design alternatives were developed in coordination with the Washington State Parks and Recreation Commission and Island County MRC. The alternative analysis criteria included:

- An evaluation of the historic and current geomorphic, physical processes, and aquatic and riparian habitat conditions
- Wave and boat wake energy at the site
- Currents and tides
- Presence of cultural resources
- Park uses

After development of the three conceptual nearshore restoration alternatives, an analysis was performed to determine their feasibility and select a preferred alternative.

Results

The following sections present and discuss the results of the feasibility assessment, including characterizations of general site conditions, geomorphic shoreline changes, oceanographic conditions, sediment transport, watershed conditions, riparian vegetation community, aquatic habitat, and fish habitat utilization. A summary of findings within the context of the conceptual restoration also provided.

Site Characteristics

Cornet Bay is an embayment in Deception Pass that connects Skagit Bay (a part of the greater Puget Sound) to the Strait of Juan de Fuca. The bay extends out to Hoypus Point on the south and east and is bounded to the north by Ben Ure Island and Goose Rock. The south shore is composed of glacial sediments from the last (Vashon) glaciation, while the north side of the bay is composed of bedrock that was formed on the ocean floor, which is called an ophiolite. Both sides of the bay are forested with a typical assemblage of vegetation for coastal Washington, characterized by a mix of Sitka spruce, hemlock and Douglas fir, with an understory of salal, salmon berry, and Oregon grape. Cornet Bay is used by a number of marine species, including salmon and forage fish species.

Cornet Bay is in the rain shadow of the Olympics. It receives between 25 and 30 inches of rain a year, mostly in the winter (Ecology 2003). Groundwater seeps are common at the base of the upland slope throughout the entire project area. Much of this water enters the bay through a series of culverts underneath Cornet Bay Road. The bay is also inundated by tides which are slightly less (10 percent or less) in magnitude than those in Seattle, and they also lag Seattle's tides by as much as half an hour (NOAA 2009). There is a large gradient in tidal currents across the project area. The nearshore portion of the head of the bay has virtually no tidal flow, while the northwestern tip of Hoypus Point has currents of greater than 1 foot per second in less than 3 feet of water during spring (large) tides.

The bay has been filling with sediments derived from bluffs and from the Skagit River since sea level stabilized. This has created extensive mud flats at the head of Cornet Bay, which extend to form broad, low tide terraces in the project area. The project area, along Cornet Bay Road toward Hoypus Point, also has several terraces above modern sea level indicative of relict shorelines common on the north end of Whidbey Island.

Since European settlement, much of the project area has been logged. Shrub vegetation has been and continues to be mowed between Cornet Bay Road and the shoreline at the entrance to the park. Numerous nearshore structures have also been constructed that disrupt sediment transport processes, including a creosote-treated timber bulkhead. Most of the infrastructure has been placed within the last 50 to 75 years.

Geomorphic Shoreline Change Assessment

Predevelopment conditions at Cornet Bay are well documented in notes accompanying the 1890 H-sheet (US Coast and Geodetic Survey 1890). These notes describe a forested shoreline with the head of the bay being "low and swampy" (Jordan 1891). This is consistent with the Port Townsend Quadrangle geologic map (Pessl et al. 1989), which describes the surficial geology of the head of the bay as consisting of "marsh, bog or swamp deposits." Given the low-lying elevation of these areas and the mild slope of the shoreline, it is likely that some limited marshlands existed between the forested uplands and the mudflats as far east as the existing parking area. These early documents also describe the presence of large boulders in the nearshore leading toward Hoypus Point (Jordan 1891), indicating that boulders present today on the beach are of natural origin.

The project area has been altered in several ways since the arrival of European settlers. A series of orthorectified aerial photographs are shown in Appendix A to illustrate these alterations. The T-sheet is overlain on these photographs to provide a common marker and to demonstrate the lack of change in the project area since development occurred, particularly when viewed in light of the accuracy of the T-sheet (e.g., Ben Ure Island, a bedrock outcropping that has not moved since development, is displaced by 150 to 200 feet in the T-sheet). The shoreline, at least what can be gleaned from the 1944 aerial photograph, prior to the construction of marine or upland infrastructure (with the exception of the Hoypus Point ferry terminal and Cornet Bay Road), was typical of other undisturbed shorelines in Puget Sound. It was thickly forested to the shoreline without any clear or concentrated source of freshwater, at least in the area covered by the aerial photograph.

Development of the project site occurred primarily from 1944 onwards. The Marine Maintenance and Facilities Dock was constructed sometime before 1956, but after 1944, with a small area cleared for access. The Public Access Dock was constructed after 1956, but before 1965. During this period, further upland development associated with the marine facilities also took place. The current parking area was cleared, filled and paved in 1974. As can be seen in a comparison of recent aerial photographs with the T-sheet and aerial photographs taken before the filling, the modifications associated with the fill did not change the horizontal position of the shoreline. Rather, only vertical height of the land surface was increased. Finally, only in the most recent photographs (those from the last 20 years) is the accumulation of sediment updrift (northeast) of the Marine Maintenance and Facilities Dock visible, indicating that the blockage of littoral transport associated with it is an ongoing process, at least over this time frame.

The human alterations observed from the aerial photographs and conditions observed on-site and their geomorphic consequences are summarized as follows:

- Deforestation – Prior to 1908, the entire project area and the adjacent uplands were forested (US Coast Survey 1908). Deforestation, even for limited areas such as those adjacent to the parking lots, increases runoff from rain and causes erosion, which can be exacerbated when runoff is concentrated by other infrastructure.

- Filling and paving of the project site – Filling of the former backshore area occurred by the park entrance and in the vicinity of the park's marine facilities. The filling of the former backshore area required the construction of a bulkhead to protect the fill (see next item and Figure 3). In addition to filling the area, parking areas (over 3 acres total) were constructed on top of the fill. This further increased runoff flow rates over deforestation alone. Paving also forced stormwater through a single outlet next to (east of) the Public Access Boat Dock.

- Bulkhead construction – Aside from the chemical contamination, the creosote-timber bulkhead has increased the wave energy over pre-development conditions and fixed the shoreline in place.

Figure 3. Historical photograph of fill prior to the construction of the bulkhead. Looking to the northeast. September 16, 1974.

- Construction of the Boat Launch – The boat launch has taken many forms over the years. It was last modified in 2006, when it was fitted with infrastructure that passes sediment beneath the floats. Because of the recent modifications, the primary geomorphic effect of the boat launch is an increase in human disturbance in its immediate vicinity from wakes and vehicle and pedestrian traffic associated with the loading and unloading of boats. There also have been some quarry spalls dropped in this area. Despite the fact that the concrete ramps do extend well above grade, it appears that sediment is bypassing underneath the floats and above the ramps. Evidence of the lack of disruption of alongshore transport comes from anecdotal accounts by park staff that indicate that the ramps are covered with sediment following large storms (Hartt 2009). In addition, abundant sand volumes were observed on the ramps during the site visits conducted on March 22, March 27, and April 17, 2009. Indirect evidence of the intact littoral transport across the boat launch comes from the deep loose material accumulated on the northeast side of the Marine Maintenance and Facilities Dock. However, it may be too recent to detect an obvious geomorphic impact from the boat launch elements installed in 2006.

- Road fill associated with Cornet Bay Road – In addition to the fill placed to support parking areas, fill was also placed to both raise the Cornet Bay Road segment entering the park and for a small picnic area at the southwest end of the project area. Like the fill for the park picnic areas, the road prism necessitated the placement of stormwater drainage system (open ditches, pipes, catch basins, and culverts). This stormwater drainage system captured what was likely diffuse flow (runoff) prior to development. The concentration of stormwater runoff discharge and the conveyance of water and sediment from upland areas have caused the formation of small deltas at the culvert outlets, which are most evident at both ends of the day-use facilities area. In areas at the southwest end of the project area, the fill is unprotected and is being slowly eroded away (Figure 4). The extremely slow rate of erosion of unprotected placed fill is indicative of relatively quiescent conditions in the area.

- Construction of The Public Access T-Dock – The Public Access T-Dock was constructed sometime after 1964. This structure includes 300 feet of gangway 4 feet wide and a 300-foot-long and 12-foot-wide float for a total overwater coverage of 5,800 square feet, with 31 creosote-treated timber piles. In addition, the Public Access T-Dock includes two floats (island structure) accessible by boat. The overall float island structure includes 2,300 square feet and six creosote-treated timber piles. The decking of the structures does not allow light penetration. Eelgrass beds are located adjacent to the Public Access T-Dock, but the degree to which this structure has affected the eelgrass beds is unknown.

Figure 4. Photograph of unprotected fill at the southeast end of the project area.

- Construction of the Marine Maintenance and Facilities Dock – The Marine Maintenance and Facilities Dock was constructed sometime after 1944. The dock is 300 feet long and 20 feet wide for a total overwater coverage of 6,300 square feet (not including removable floats). The dock has approximately 145 creosote-treated timber piles. The decking of the structure does not allow light penetration. Eelgrass beds are located adjacent to the Marine Maintenance and Facilities Dock, but the degree to which this structure has affected the eelgrass beds is unknown. The Marine Maintenance and Facilities Dock has a substantial amount of fill associated with the approach to the dock (Figure 5). The fill, and debris associated with it, extends down to approximately 3 to 5 feet above mean lower low water. As a result, this fill has impounded a large amount of sand on the northeast side of the filled area at elevations above extent of the fill. This is the single largest geomorphic impact to nearshore physical processes (i.e., impairment of longshore sediment transport) in the project area.

- Construction of the Hoypus Ferry Terminal – The remaining features associated with the historic ferry terminal consist primarily of three elements: (1) a large concrete pier set at an elevation of approximately mean lower-low water, (2) a rock wall surrounding the old terminal

parking area (approximately 80 feet long), and (3) a riprap and construction debris revetment northwest of the rock wall, extending approximately 180 feet toward the northernmost point of Hoypus Point. Except for a single concrete block associated with a demolished overwater structure, very little of this structure extends below the upper foreshore. Therefore, none of the remaining structures significantly disrupt longshore transport of sediment and most of the geomorphic impact of the structures is associated with the loss of upper beach over the footprint of the wall (a few feet near mean higher-high water line), disconnection of the beach from adjacent uplands, and relative loss of overhanging riparian vegetation.

Figure 5. Accumulation of sediment on the northeast side of the Marine Maintenance and Facilities Dock. Fill associated with the dock approach protrudes into the intertidal area. March 27, 2009.

- Dredging of navigation channels – The bed of Cornet Bay has been substantially altered by dredging associated with the boat launch and a private marina (also located in Cornet Bay). Because some of these efforts took place when sediment control was not mandated by law, adjacent areas experienced heightened sediment accumulation during dredging operations.

Sediment Contamination

Although not confirmed by testing, some marine sediment contamination is likely to exist adjacent to the creosote-treated timber bulkhead within the project site. For the purpose of this report, contaminated marine sediments are defined as those that exceed Sediment Quality Standards (SQS) chemical or biological criteria under the Sediment Management Standards (Chapter 173-204 WAC). For surface sediment, the criteria apply to the top 10 centimeters (the biologically active zone) unless a site-specific biologically active zone is determined later by testing. For subsurface sediment, the criteria will apply to sediments below the biologically active zone, with an exceedance being defined at each 1-foot horizon using 1-foot interval composite samples.

Consequently, before implementing any project action involving the removal of the existing creosote-treated timber bulkhead, sediment testing should be performed and contaminated sediments and creosote-treated timber removed following applicable guidance from the Washington State Department of Resources (WA DNR) *Standard Practice for the Use and Removal of Treated Wood and Pilings on and from State-Owned Aquatic Lands* (WA DNR 2005). Any removed contaminated marine sediments and/or and creosote-treated timber should be disposed of at a permitted location.

Oceanographic Characterization

Oceanographic conditions regulate the physical environment of the nearshore, particularly in a place like Deception Pass State Park, renowned for its strong tidal currents. In the case of Cornet Bay, an explanation was sought to describe the nature of the geomorphic changes (or lack thereof) associated with these underlying physical processes. However, limited information exists on currents within Cornet Bay. Most existing information is found in a series of publications from the National Oceanic and Atmospheric Administration (NOAA) on the general circulation in Puget Sound (Babson et al. 2006; Cokelet et al. 1990; Collias et al. 1973). There are no known previous studies of wave dynamics within Cornet Bay.

Currents

Collias et al. (1973) found that exchange through Deception Pass is strongly influenced by the Skagit River. Other work has described the pass as an area of intense water-column mixing (Babson et al. 2006; Cokelet et al. 1990). However, none of these studies discussed the detailed dynamics of Cornet Bay.

Therefore, ADCP measurements were used to determine the strength and direction of currents in the bay. The site of placement at the northern end of the Cornet Bay boat launch was selected because it was anticipated to be the area where currents were stronger than anywhere in the project site (i.e., away from Hoypus Point). The observations lead to the three conclusions:

1. Currents are relatively uniform most of the time throughout the water column and penetrate close to the bed.

2. Currents on the flood tide are roughly parallel to the shoreline (southwesterly), while ebb currents are nearly always due northward.

3. Currents on both the flood and ebb are sufficient to move sediment up to sand size.

With maximum currents averaging 1 knot over the sample interval (1 minute), observations indicate that fine sediment (i.e., sand, silt, and clay) from the main channel associated with Deception Pass is capable of being transported into the project area. The misalignment of the flood and ebb currents means that sediment is preferentially transported into the bay. This may explain the extensive mudflats that fill most of the head of Cornet Bay. The net direction of the current-driven sediment transport is in the same direction as the wave-driven sediment transport discussed in detail in the Sediment Transport Assessment section of this report.

Waves

Finlayson (2006) showed that for areas within the protection of Puget Sound, the wave energy that reaches the nearshore comes exclusively from locally generated waves. In Cornet Bay, these waves generally come from local winds and boats (wakes). Large marine vessels (e.g., container ships) can generate wakes in excess of 1 foot in height. However, even in heavy traffic areas, waves generated by winds generally overwhelm wake effects because they occur continually for an extended period of time, rather than being a series of discrete waves (Finlayson 2006).

There are two general types of wind events in the greater Puget Sound region. One occurs as a result of low pressure (rain) events that produce southerly winds, while the other is a northeasterly wind that occurs during high pressure (clear sky) events. These northeasterly wind events are generally strongest in the north, near the Fraser Valley where the winds originate. The closest wind gage is at Bellingham Airport, approximately 27 miles away, and a wind rose from the wind records at this location clearly shows the two basic types of wind events there (Figure 6).

Wave data collected from the ADCP indicate that the wakes of boats that use the harbor are small and infrequent enough to be below the detection limit of the ADCP. The detection limit of the ADCP is frequency-specific, but for the most common waves (between 1- and 2-second-period waves) the detection limit is approximately 2 inches. The ADCP averaged wave motions over the sample interval (1 minute), therefore it is possible that a single wave train larger than this could have occurred during the sampling interval, but it could not be significantly larger than that size and not be detected. On 10 occasions (out of more than 500 samples), waves were identified during the deployment period with heights greater than the detection limit. These were identified as boats, primarily because of their isolation in time from other periods of identifiable wave activity. In no instance did the measured wave height exceed 6 inches when averaged over the sampling interval.

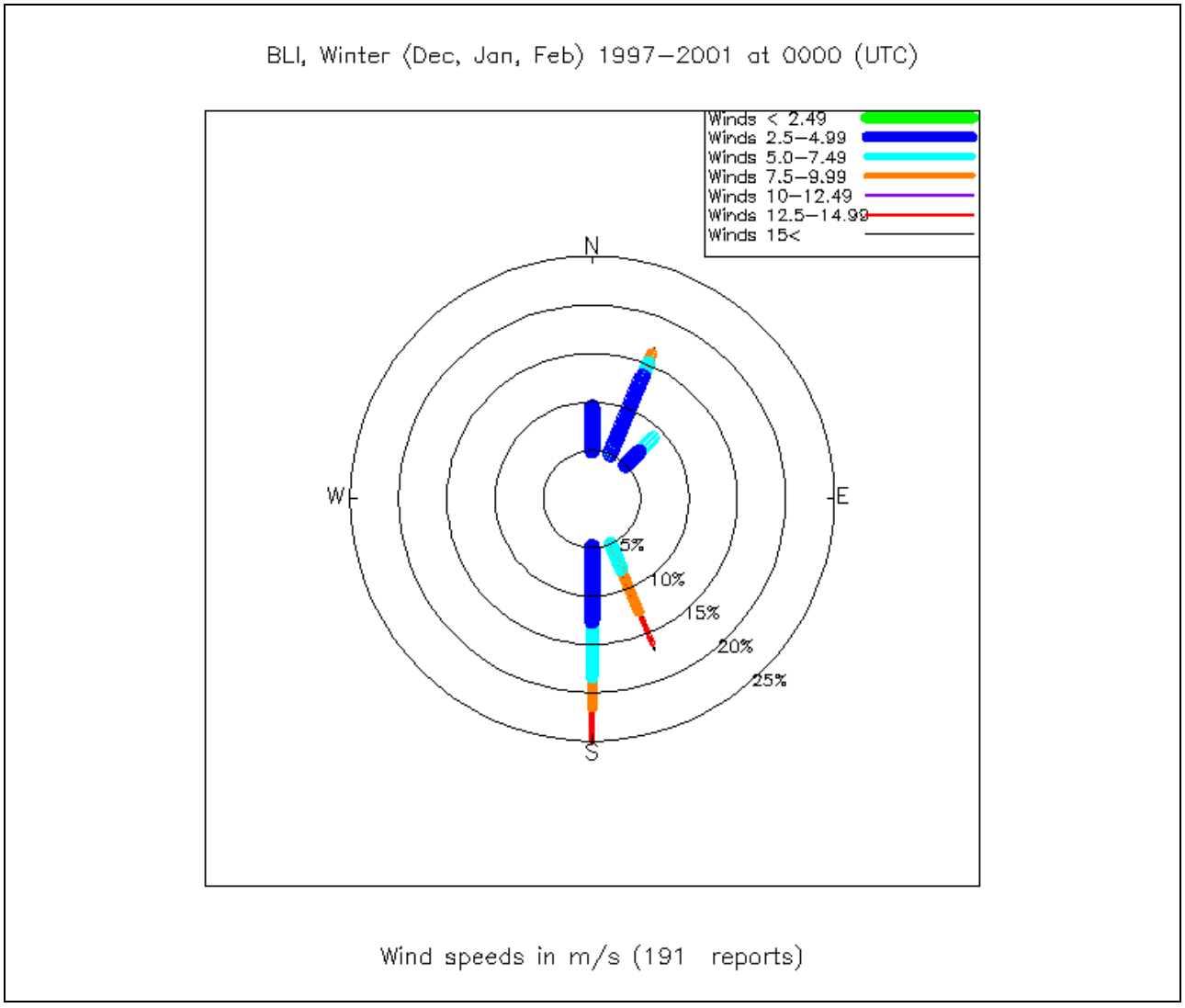

Figure 6. Wind rose from Bellingham Airport during winter storms (Stewart 2009).

Winds at Bellingham were generally light during the deployment, with the only significant winds (greater than 10 knots) coming from the south. The strongest wind observed was a southerly wind of 19 knots. No wind events above 10 knots occurred from the northeast during the deployment. Anecdotal evidence from local park staff indicates that the occurrence of rare northeasterly events that can produce significant waves in the project site. The largest of these in the last five years was reported to have produced waves approximately 2 feet in height, the same size as the largest wakes produced by the Victoria Clipper (Hartt 2009). However, the Clipper rarely routes through Deception Pass and only during times of large waves.

Analysis of the time series of winds from Bellingham indicates that the strongest northeasterly to occur in Bellingham in the last 12 years was a 33-knot wind that occurred on December 20, 1998. Based on a common analytical model of wave generation, this wind blowing from the east-northeast would produce waves of 1.7 feet (US Army Corps of Engineers 2008), consistent with the anecdotal evidence of parking area flooding during extreme high water events (Hartt

2009). From these same wind records, it appears that there are at least one or two events each year that produce waves of 1 foot in height. It is important to mention that these events occur only during lower tides, because of the "inverse barometer effect" associated with the high-pressure-nature of the event. Therefore, they are unlikely to erode material from above mean higher high water. In sum, this indicates that the project site is in an extremely low energy environment and explains the relative stability of the shoreline position through time.

Sediment Transport Assessment

A process-based approach was adopted to describe sediment transport throughout the project area (Figure 7). Sediment transport on Puget Sound beaches (i.e., in intertidal areas) occurs differently on the upper beach as compared to the lower beach. On the upper beach, also known as the foreshore, swash—the action of water that washes up on shore after an incoming wave has broken—actively transports coarser sediments (i.e., sand and gravel). Lower in the beach profile at elevations that are nearly always submerged, the seabed and sediment transport is more influenced by currents, which can be complemented by wave-induced suspension.

To describe sediment transport at the project area, it is first important to identify the sources of sediment to the nearshore. There are two primary sources of sediment to project area:

- Bluff erosion – Bluffs have long been identified as an important sediment source to nearshore areas in Puget Sound (Finlayson 2006). CGS (2006) details a drift cell, a unit used by coastal geomorphologists, which begins immediately east of Hoypus Point and extends to the head of Cornet Bay. Prior to site development, it is likely that most of the sediment that supplied to the foreshore (upper beach) came from the bluffs around Hoypus Point and the shoreline between the point and the project area. The mode of erosion of these bluffs is primarily through bank erosion at the bluff toe (Figure 8). Erosion of the bank subsequently causes the slope above to become unstable, initiating slope failures (e.g., the slumps that have compromised Cornet Bay Road). This process is extremely slow owing to the mature vegetation on the bluffs. It is likely sediment south and east of the Hoypus Point ferry terminal contributes sediment to the area as seen in uni-directional bedforms from tidal flow on the foreshore at Hoypus Point (Figure 9).

- Skagit River – Although the Skagit River is 12 miles from the project area, the large sediment load of the river is an important source of fine sediment (silt and clay), particularly to inner Cornet Bay. It deposits primarily on the low-tide terrace and likely does not contribute a significant source of sediment to the Cornet Bay foreshore.

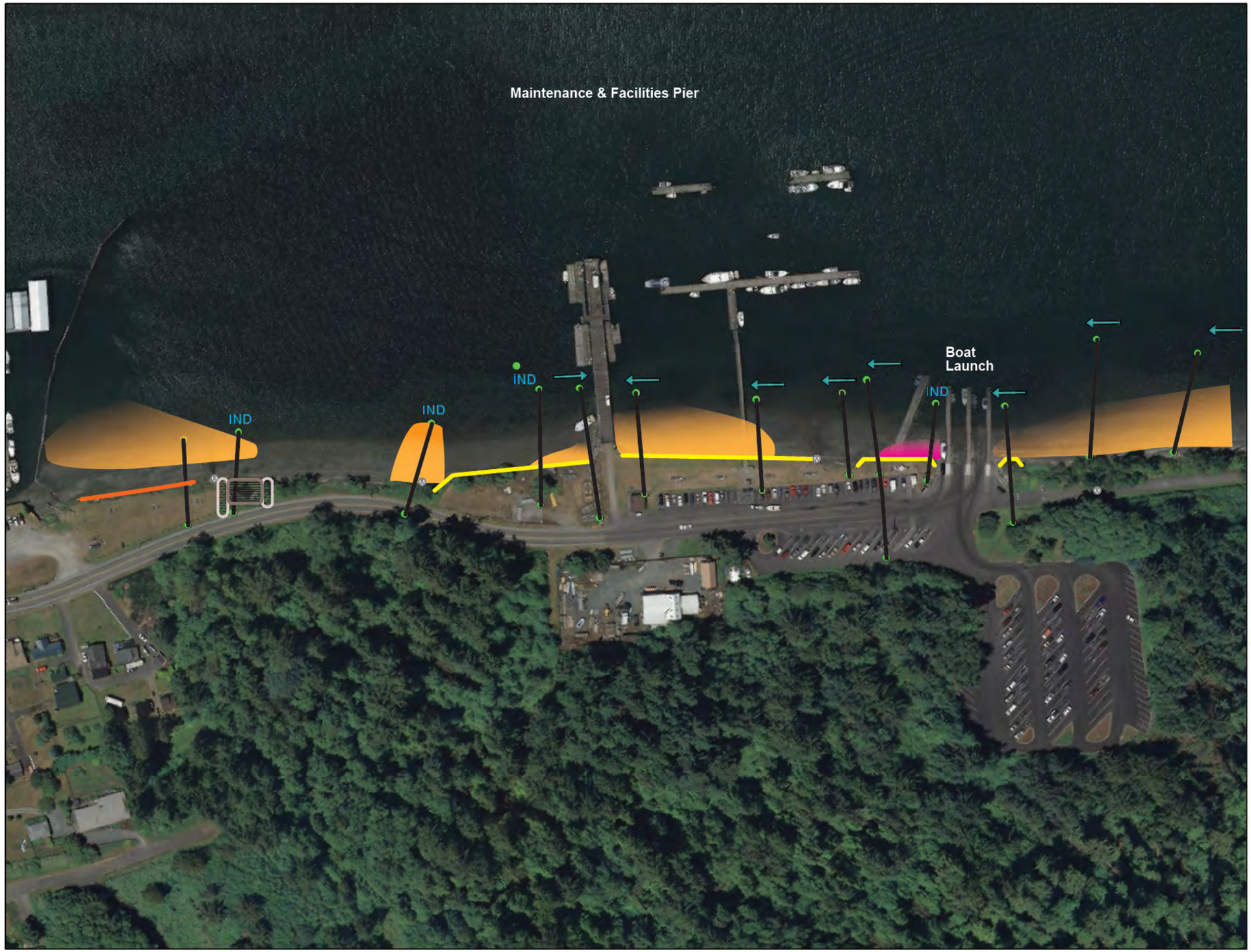

Figure 7.
Results of the sediment transport assessment

Legend

- Culvert
- GPS point
- Bulkhead
- Zone of intense tidal flow
- Cross section
- Eroding bank fill
- Excavation
- Fill
- Accretion
- IND Indeterminate
- Erosion

N

0 80 160 320 Feet

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Figure 8. Photograph of an eroding bank near Hoypus Point.

Figure 9. Bedform in the lee of a large rock on the foreshore of Hoypus Point. Bedform indicates transport toward the west and the project site.

The results of this assessment, summarized in Figure 7, are broadly consistent with earlier work (CGS 2006; Finlayson 2006) on foreshore transport, the primary difference being the identification of fluvial processes as a source of nearshore sediment.

The dominant southwesterly oriented drift near park development is seen most clearly in the deposit updrift (northeast) of the Marine Maintenance and Facilities Dock (Figure 5). The beach is elevated and comprised of sand much finer than adjacent shorelines, particularly those downdrift (southwest) of the dock. This indicates that the fill and the debris associated with it are preventing transport alongshore, causing a lack of sediment further southwest that results in beach erosion and compromised nearshore habitat. However, the lack of foreshore transport to the southwest does not impact fine-grained (silt and clay) natural accumulation in the inner bay (discussed below). No park element is related to this sediment accumulation.

The slope of the beach foreshore is variable throughout the project area, partly because of the disturbance to longshore transport from constructed works and marine traffic. However, the shoreline northeast of the boat launch provides an excellent reference site to investigate historical beach foreshore slope. Figure 10 illustrates a beach profile taken approximately 150 feet northeast of the small stream that enters the beach just northeast of the boat launch. As the figure shows, the beach foreshore has a slope of between 7:1 and 8:1. This slope is very typical for Puget Sound shorelines (Finlayson 2006) and should be used to estimate the approximate beach slope prior to development, particularly in areas that have been filled. A map of all of the profiles taken, as well as their descriptions, is contained with Appendix B.

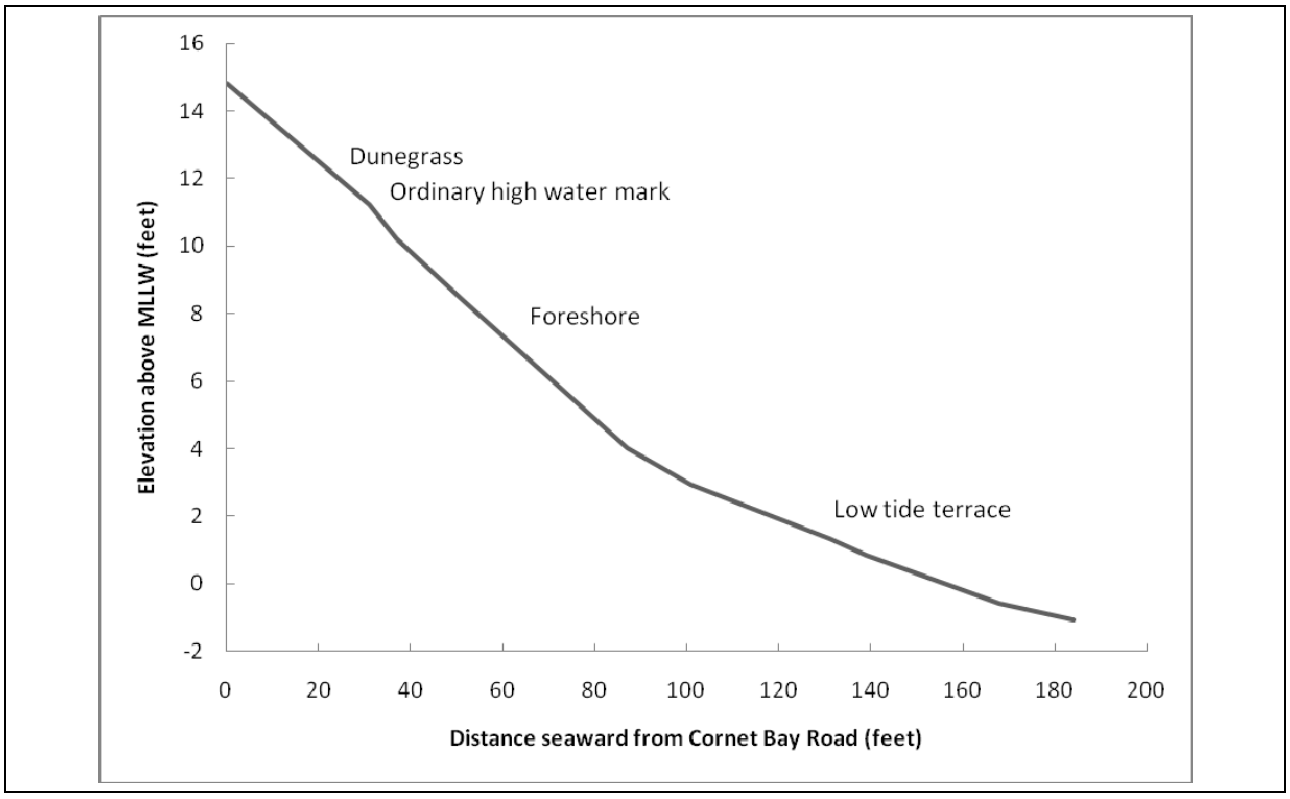

Figure 10. Beach profile from a relatively undisturbed area between the project site and Hoypus Point (Profile #3, Appendix B).

The lower beach (i.e., the low tide-terrace, elevations at approximately mean lower low water and below) at the project area exhibits a broad trend from the northeast (Hoypus Point) to the southwest (towards the head of Cornet Bay). Near Hoypus Point, the low tide terrace is either well below mean lower low water or nonexistent. Unidirectional bedforms composed of sand and pebbles found on the lower foreshore indicate that geomorphically significant tidal currents likely prevent or significantly alter wave processes that typically form the low tide terrace (Figure 9). However, the low tide terrace becomes higher and broader to the southwest. The one disturbance in this trend is where the low tide terrace is missing because of dredging associated with the boat launch facility. At the southwestern end of the project area, there is ample evidence of recent sediment accumulation (i.e., event deposits comprised of unconsolidated silt and clay), particularly at shallow subtidal depths. This has caused the need for maintenance dredging of the private marina southwest of the project area. None of the restoration strategies discussed later in this document (Nearshore Restoration Opportunities section) will have an effect on this natural sediment accumulation. The aggradation of the low tide terrace over recent geologic time has also provided the basis for a stable shoreline, as seen in the historic aerial photographs in Appendix A.

Watershed Characterization

There are seven watersheds[1] associated with Cornet Bay identified in the Cornet Bay Watershed Characterization report prepared by Island County (Island County 2008a). The Cornet Bay/ Hoypus Point Improvement Project area comprises portions of watersheds 3, 4, and 5, which constitute largely intact, first- and second-growth coniferous forested areas associated with the State Park (Figure 11). Given the lack for potential of development in this area, it received little attention in the report (Island County 2008a).

The Cornet Bay watersheds are rare within the context of Puget Sound coastal habitats, because the majority of the landscape is characterized by intact forest (mainly coniferous, first- or second-growth), due to its inclusion in the protected area of Deception Pass State Park. This facilitates the maintenance of a relatively natural nearshore environment (Island County 2008a). County-regulated critical areas, including wetlands, highly erodible soils, steep slopes, and fish and wildlife conservation areas are common, especially in the vicinity of the State Park.

In the bay, shoreline development is common and includes a private marina, State Park day use facilities, public docks, and bulkheads. The native riparian vegetation has been highly altered here, giving way to lawns and landscaping. Some low to moderate density residential development has occurred in the vicinity of the private marina, with associated clearing of forested vegetation and increase in impervious surface. The majority of the Cornet Bay area is zoned as Park, with some rural development zoning in the areas mentioned above.

Although Cornet Bay does not have any identified streams, there are many small, short surface water channels that empty into the bay at identified “pour points” (Island County 2008a). Four

[1] There are no identified streams contributing to the marine waters of Cornet Bay, thus there are no true watersheds. However, the term “watershed” is used by this report to denote drainage basins within the study area.

pour points are located within the project area, with two (near the boat launch and near the private marina) serving as sampling locations for ongoing water quality testing by the Island County Surface Water Monitoring Program (Island County 2008a).

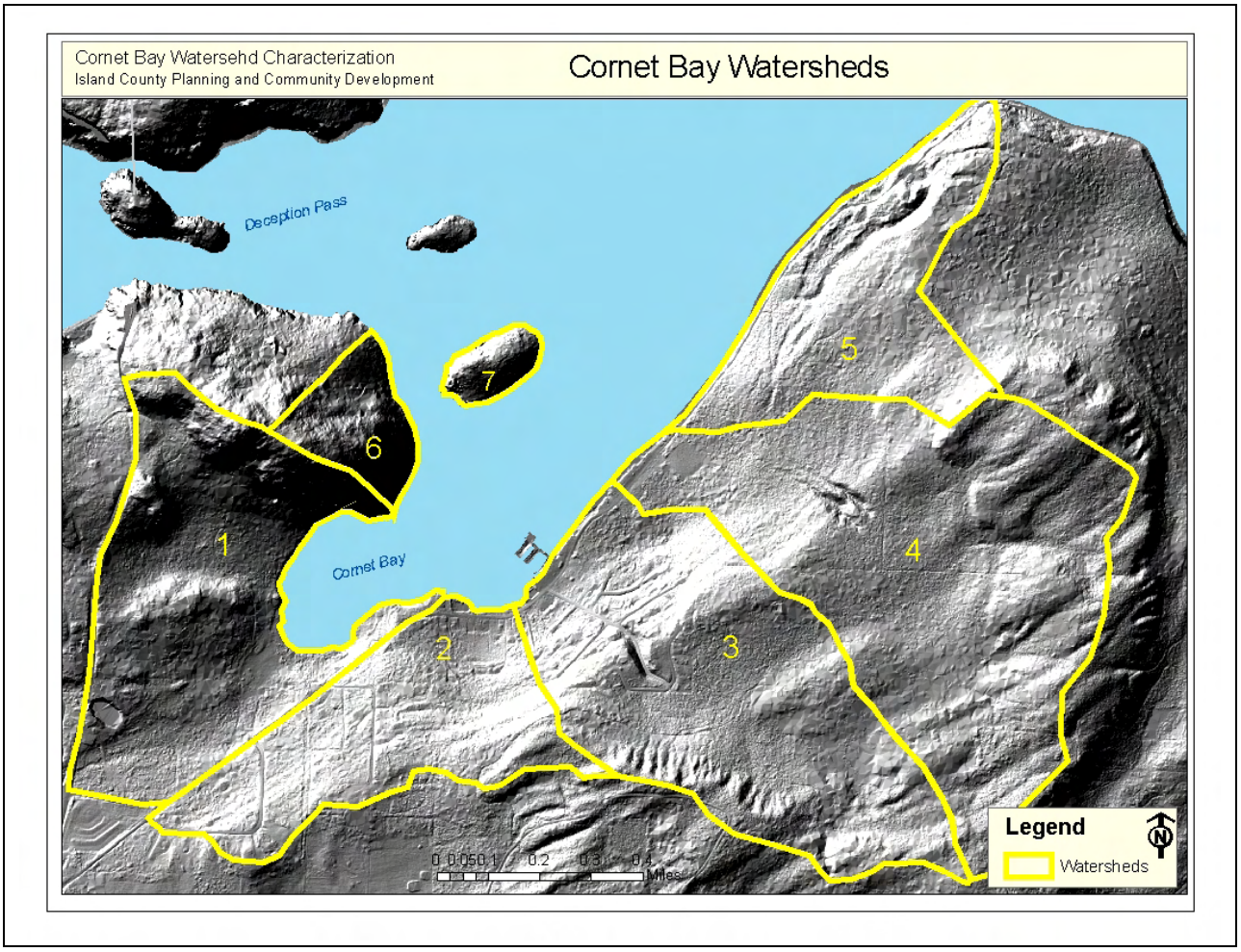

Figure 11. Watershed map from the Cornet Bay Watershed Characterization report (Island County 2008a).

The short residence time of surface water on the Cornet Bay landscape facilitates rapid transport of non-point pollutants and sediment into the bay and consequent accumulation at these pour points. From 2008 data, all sampling locations exhibited high concentrations of fecal coliform, whereas concentration of other pollutants, including copper, nutrients, and pesticides were below a level warranting concern (Island County 2008a).

Riparian Vegetation Community Characterization

Background

Shoreline vegetation is an essential component of the nearshore environment. Vegetation community characteristics, including composition and structure, have a significant influence on nearshore habitat function. Shoreline vegetation moderates the quality of aquatic habitats by

increasing slope stability, providing erosion protection (Myers 1993; Manashe 1993; Broadhurst 1998), and buffering against pollution and sediment runoff (Federal Interagency Stream Restoration Working Group 1998; Brennen 2007). Overhanging shoreline vegetation provides shade that regulates microclimates important to surf smelt spawning (Penttila 2001; Rice 2006). The abatement of solar radiation (and its desiccation-causing effects) influences the distribution of intertidal invertebrates in the upper beach area (Foster et al. 1986). Large woody debris sourced from these shoreline areas can stabilize beaches and help build berms and backshore areas (Brennan and Culverwell 2004). Intact, diverse shoreline vegetation provides high-quality habitat for birds[2], mammals, amphibians, and invertebrates. Given the critical role of trees and shrubs in providing these functions, structurally and compositionally complex land cover types in the upland shoreline environment (e.g., coniferous forest, mixed forest) likely provide greater functions for the nearshore than structurally homogeneous land cover types (e.g., lawn, shrub). The functions provided by upland shoreline forested habitats support higher nearshore invertebrate abundance and diversity, greater habitat diversity, recruitment of large woody debris, and increased shade.

The vegetation community and shoreline cover conditions within the Cornet Bay – Hoypus Point project area are influenced by multiple elements, including geology, climate, topography and disturbance. The interaction of these elements facilitates significant diversity both in structure and species composition. The Cornet Bay watershed in general is characterized by the presence of mature and old-growth coniferous forests, forested wetlands, and diverse shoreline vegetation.

The most striking differences in vegetation types are the product of high variability in land development and land use activities. Some portions of the project area in areas between the State Park boat launch and Hoypus Point exemplify intact native shoreline vegetation conditions, while other areas exhibit varying degrees of modification to facilitate shoreline access and recreational activities. Throughout much of the project area, large tracts of intact, mature, native forested communities are fragmented from the shoreline by the existing road. In the southwestern portion of the project area, the native plant community has been largely replaced by the State Park day use and maintenance facilities. Although not fully captured by USFWS NWI or Island County data sources, wetland habitats were observed within the project area (Island County 2008b). These areas also correspond with areas of hydric soils identified by NRCS (NRCS 2006). Environmental features that will need to be considered during project planning and design and associated regulatory requirements are presented in Appendix C.

Location-specific Vegetation Community Characterizations

Because riparian vegetation community characteristics vary significantly across the project area, the following geographically-oriented summary descriptions (from northeast to southwest) of habitat conditions were developed to facilitate easy relation with specific restoration opportunity elements or phases of the project.

[2] A number of protected bird species, including great blue heron, osprey, and bald eagle, are present either within or in close proximity to the project area. Project planning and design will need to consider the regulatory requirements associated with these species that are provided in Appendix A.

Hoypus Point to State Park Boat Launch

In this largely undeveloped nearshore section of the project area, the riparian vegetation community in many places reflects essentially unaltered, diverse, mixed and mature to old-growth coniferous forest with well-developed understory and shrub layers (Figure 12). These habitats occupy the top of the low bluffs found here, sometimes extend down to the shoreline, and extend beyond nearshore areas to the rest of the State Park. Downed wood (along with driftwood) and overhanging trees are extremely common along the shoreline in this area.

Figure 12. Riparian vegetation along a representative section of the shoreline between Hoypus Point and the State Park boat launch.

Mature to old-growth coniferous forest vegetation (many trees aged 200+ years) is characterized by Sitka spruce, Douglas fir, Western hemlock, and Western red cedar, with an understory of sword fern, Oregon grape, and Indian plum; Pacific madrone, salal, salmonberry, and oceanspray become more common closer to the shoreline. Historically, it is likely that the majority of the shoreline within the park area not occupied by brackish wetland was characterized by this habitat type.

Some areas of anthropogenic disturbance were observed, including in the direct vicinity of the access road/trail to Hoypus Point and the maintenance pit area located approximately 0.25 miles from the end of the road. Invasive plant species, including Himalayan blackberry and English ivy, were observed in these disturbed areas.

Wetlands characterized by old-growth to mature coniferous forest vegetation observed in the project area have slightly different plant community composition (hydrophytic species typical of wetlands) than the site's upland mature and old-growth forested areas, and they occur to the greatest extent in the southern portion of the project area. The forested area to the south and west of the State Park maintenance building would likely be classified as a jurisdictional wetland. The mature conifers dominating these areas include Sitka spruce and Western red cedar, with Western hemlock and Douglas fir also being present. Mature red alder (>100 years) is also common in these wetland areas. These areas are described in detail in *Mature Forested Wetlands* below.

Immediately northeast of the boat launch, the vegetation community has been altered and is now in a state of regeneration. This scrub-shrub area is located on a low shoreline bank and is dominated by young trees and shrub species (Figure 13). Dominant species observed here include red alder, Pacific crabapple, a variety of willow species (Hookers willow being the most common), snowberry, oceanspray, salal, Oregon grape, Nootka rose, salmonberry, and red elderberry. This area may serve an appropriate reference site for project plant community restoration target conditions. All planting prescriptions will need to consider specific species requirements and tolerance ranges in conjunction with on-site conditions to determine the most ecologically appropriate plant types for specific project areas.

Figure 13. Scrub-shrub areas immediately northeast of the State Park boat launch (looking southwest).

Some of these areas exhibit wetland environmental indicators (hydric soils, wetland hydrology, and hydrophytic vegetation) that would warrant classification as wetland habitats under Island County's Critical Areas regulations (see Appendix C). Wetlands characterized by this vegetation type occur in areas of lower topography along the generally low-bluff, conifer-dominated shoreline to the northeast. These wetlands are often associated with slumps or failures in the existing roadbed. Their hydrology is likely driven by groundwater expression facilitated by the marked elevation drop to the shoreline from the steep hillslope above.

State Park Boat Launch to Private Marina

In the southwest extent of the project area near the majority of park development and infrastructure, the historic native plant community has been largely replaced by State Park day use and maintenance facilities (Figure 14). The vegetation along the shoreline is dominated by lawn areas and weedy perennial and annual grass species, with intermittent patches of scrub-shrub habitats (species composition discussed above), and largely lacks the functions attributed to intact riparian communities discussed previously.

Figure 14. Riparian vegetation conditions southwest of the State Park boat launch.

Mature Forested Wetlands

Due to its unique characteristics, both locally and regionally and potential implications for restoration feasibility, the mature forested wetland habitat type found within the Cornet Bay –

Hoypus Point project area is described here in detail. These wetlands are characterized by an extremely diverse plant community, dominated by mature to old coniferous tree species, with many resident individuals appearing to exceed 200 years in age, and many trees >4 feet diameter breast height (DBH) (Figure 15). The most common tree species observed in portions of the wetland near the project area are Sitka spruce, Western red cedar, Western hemlock, and mature (>100 years) red alder (especially in gaps created by downed conifers). Other common species include Douglas fir, grand fir, and big leaf maple.

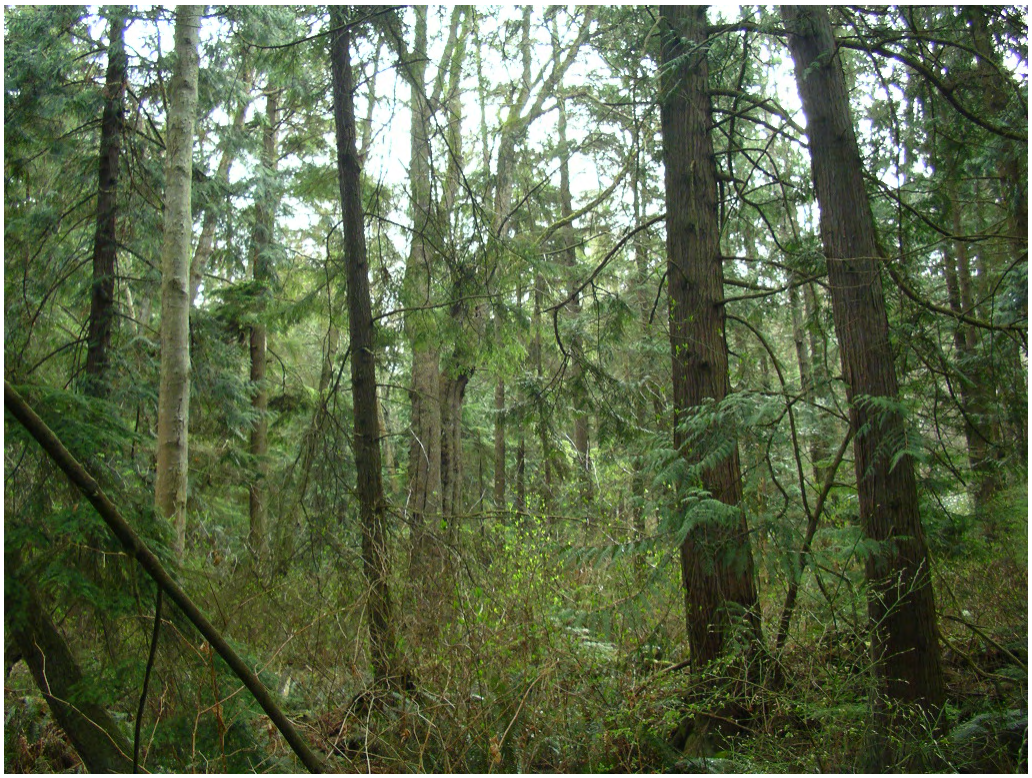

Figure 15. Mature forested wetland area near southwest portion of project area (looking east).

The understory of this habitat type is dominated by salmonberry, Pacific crabapple, gooseberry, red elderberry, sword fern (on hummocks), slough sedge, and skunk cabbage. Large stands of mature red alder and high densities of shrub species were observed in canopy gaps in the forested wetland at Cornet Bay. Forested wetland areas may occur as mosaics with patches of upland vegetation interspersed among wetland areas, especially in areas near the day use parking lot (see Appendix C).

Although the mature forested wetlands in the southwest portion of the project area are not subject to tidal inundation, saturation and high water table conditions and small drainage channels conveying surface water were observed throughout the wetlands. As mentioned, the high water table is likely from groundwater expression (seepage) and runoff from the hillslopes located east of the project area.

The extent of saturation in this area appears to have been amplified by the installation of the Cornet Bay road prism and the lack of sufficient culverts, thereby restricting outflow and potentially expanding the size of the wetland complex. This hypothesis is supported by the presence of a number of standing dead large big leaf maple trees along the southwest margin of the wetland area adjacent to the housing development (Figure 16). The fact that big leaf maple is not a flood-tolerant species and the large size (and corresponding age) of these particular trees suggests that they likely developed under drier conditions. Rapid expansion of wetland hydrologic conditions to these areas following road construction could explain the unusual tree mortality, as the majority of the trees appear to have died near the same time.

Before installation of the road, it is likely that this forested wetland to the east of Cornet Bay Road was once a swamp, subject to tidal and salt water influence. This hydrologic connection could have been via surface water or percolation through a backbeach berm. The General Land Office survey plat for this area depicts the presence of forested vegetation extending to the shoreline, and the U.S. Coast and Geodetic Survey hydrography survey field notes describe the area as "swampy" (U.S. Coast Survey 1871; U.S. Coast and Geodetic Survey 1890). In addition, results from the survey performed by Herrera for this feasibility assessment indicate that the elevation of these wetland areas is almost 2 feet below the MHHW in some places (MHHW = 10.2 feet above MLLW, surveyed wetland elevation = 8.5 feet above MLLW), indicating that before the road, this area was likely tidally influenced.

Road construction and clearing and artificially filling in the area currently occupied by the Park day use facilities and maintenance yard likely disconnected the conifer-dominated swamp from tidal inundation, thereby altering the wetland's hydrology and hydrochemistry. The potential transition to lower salinity in the forested wetland at this Cornet Bay wetland following road installation is substantiated by the presence of a significantly higher proportion of young individual trees occupying the subcanopy (<30 years old) belonging to species less tolerant of salinity such as Western red cedar and Western hemlock than Sitka spruce.

Historically found in greater abundance in the coastal region of the Pacific Northwest, Sitka spruce-dominated swamps and estuarine sloughs have been identified as important habitat for salmonid species (Simenstad et al. 1992). The extent of this habitat type in Puget Sound has been significantly reduced through development of coastal areas, diking, and timber harvesting (Jefferson 1975; Franklin and Dyrness 1973). These plant community types were likely relatively rare in the Puget Sound Area forest zone as described by Franklin and Dyrness (1973), which is acknowledged as a highly diverse zone given the large variation in environmental conditions. The forested wetlands in the Cornet Bay portion of Deception Pass State Park, although now largely disconnected from tidal influence due to road construction, may to a certain extent represent relatively intact relics of this rare mature ecosystem type in Puget Sound.

Sitka spruce tends to be exceptionally shallowly rooted, making them highly susceptible to blow-down in coastal areas characterized by extreme weather and high winds from the Pacific Ocean (Peterson 1997). Downed and decaying trees (and accumulated driftwood) in portions of the high marsh permit establishment of Sitka spruce and other conifers by serving as nurse logs, which provide elevated refuge from inundation and salt stress, in addition to providing nutrients

Figure 16. Standing dead big leaf maple in the forested wetland area in southwestern portion of project area.

(Peterson 1997; Jefferson 1975). Providing a source of downed large wood to the shoreline is a significant function of coastal shoreline forests, and Sitka spruce trees are an important constituent species of these plant communities. In the portion of Cornet Bay where the forested wetland has been severed from the shoreline, this function is virtually lost. Additional information on Sitka spruce wetlands and their implications for Cornet Bay nearshore restoration is provided in Appendix D.

Reintroduction of tidal influence and salinity to this forested wetland at Cornet Bay – Hoypus Point would have significant consequences on hydrologic regime and plant community composition and structure. Since species with low salt tolerance have become established over the last 30+ years, abrupt exposure to water of significantly higher salinity will likely result in significant plant stress and subsequent mortality. In addition, tidal inundation will greatly alter the degree, duration, and nature of flooding in this area, given that ground elevations are almost 2 feet lower than MHHW. In addition to affecting the plant community on-site, reintroduction of tidal influence may also affect neighboring properties. Therefore, a detailed hydrologic/hydraulic analysis and feasibility assessment will be required to determine the extent of potential effects from reconnecting with Cornet Bay prior to re-establish a tidal connection.

Great Blue Heron Habitat within Forested Wetlands

A great blue heron[3] rookery is situated within the forested wetland habitat located at the southwestern extent of the project area and less than 300 feet to the east of Cornet Bay Road (Figure 2 in Appendix C). This well-established rookery is close to proposed construction activities, and all regulations described in Appendix C should be followed closely to ensure that impacts to this species are minimized.

Great blue herons move seasonally between upland and lowland habitats, but concentrate in large numbers (colonies) to breed in coastal forests in large groups of nests comprising rookeries (Ecology 2009b; Eissinger 2007). They prefer to roost in large, red alder trees (<75 feet tall), but also build nests in Douglas fir, spruce, cottonwood, and hawthorn trees (Ecology 2009b). Great blue herons tend to build their nests close to marine intertidal habitats, particularly eelgrass meadows and estuaries, in order to maximize foraging opportunities during nesting (Eissinger 2007). Following, the presence of a rookery in this close proximity to Cornet Bay is not surprising given the abundant eelgrass population here that supports important prey species for the herons.

Great blue herons tend to nest in the same areas year after year, and colonies tend to be established in areas that are not heavily affected by human noise impacts (Ecology 2009b; Eissinger 2007). These birds are extremely sensitive to disturbance during the breeding season, which commences in January-March and concludes with the fledgling of young in July-September (Eissinger 2007). If a rookery is affected by human disturbance during the breeding period, the reproductive rate of the colony can drop or adult herons may move the entire colony (Ecology 2009b).

[3] Great blue heron are a Species of Local Importance designated by the County pursuant to Chapter 36.70A RCW (ICC 17.02A.030) are also regulated under ICC 17.02.050.C.

Aquatic Habitat Characterization and Fish Habitat Utilization Assessment

Aquatic Habitat Characterization

The Cornet Bay shoreline provides important nearshore marine habitat for a range of species, including ESA-protected salmonid populations, marine fish species, several species of forage fish, and a number of marine invertebrates.

Within the nearshore portion of the project area, fish habitat includes the upper beach, intertidal areas, and shallow subtidal areas. Primary habitat features include macroalgae (e.g., *Ulva* sp., *Enteromorpha* sp., and *Fucus* sp.), eelgrass beds, beach areas, and limited dune and salt marsh vegetation. Although not directly utilized by fish, overhanging riparian vegetation provides several essential functions that benefit the nearshore environment (discussed in detail in the *Riparian Vegetation Characterization* section) including maintenance of high quality rearing habitat for forage fish and transitional habitat for migrating anadromous juvenile salmonids, Large Woody Debris (LWD) sourcing, habitat for invertebrate prey, and natural stormwater and erosion control. LWD also plays an extremely important role in maintaining healthy nearshore aquatic habitat, including providing invertebrate habitat and fish refuge, facilitating sediment accumulation, and wave attenuation (Brennan and Culverwell 2004).

Extensive eelgrass meadows are present throughout the bay, providing foraging opportunities and shelter for a host of fish and invertebrates. This area has been documented as one of the most productive growth areas for Dungeness crab in the Puget Sound, which depend on healthy eelgrass beds for continued productivity (Island County 2008a; CH2M Hill 2003; WA DNR 1997). Kelp beds, which also provide important habitat for fish and marine mammals, are also present here (Nearshore Habitat Program 2001). During field work for this feasibility assessment, a kelp bed was observed 75 feet offshore to the north of Hoypus Point.

Substrate characteristics and the geomorphic processes that drive them play a significant role in shaping the biological components of the nearshore environment which, in combination with anthropogenic influences, have created current habitat conditions in Cornet Bay. Because intertidal, backbeach, and riparian habitat conditions vary significantly across the project area, the following geographically-oriented (from northeast to southwest, within the portions of the project area slated for potential construction activities) summary descriptions of habitat conditions were developed to facilitate easy relation with specific restoration opportunities discussed later in this report.

Hoypus Point to State Park Boat Launch

From Hoypus Point to the boat launch, in the largely undeveloped portion of the State Park shoreline, nearshore processes and conditions remain in a relatively natural state (Figure 17). Substrate composition is diverse, driven by sourcing and sorting facilitated by largely unimpaired geomorphic and oceanic processes.

Figure 17. Representative nearshore conditions along the segment of shoreline between Hoypus Point and the State Park boat launch (looking southwest).

The foreshore sediment consists of well-sorted gravelly sand, consistent with close proximity to bluffs that are the source of sediment in this area. Beginning at the northernmost point of Hoypus Point, a number of isolated large boulders are present throughout the beach profile. Historical documents show that these are natural features of the landscape (Jordan 1891). These boulders are not present southwest of the boat launch. The low tide terrace is quite deep for much of this area (if it exists) and so was not observed on the site visits. Macroalgae are found sporadically across the intertidal gradient throughout this segment of shoreline.

LWD is plentiful along this shoreline, often spanning 20 feet near the ordinary high water mark. It is less abundant in front of the wall at the old ferry terminal. The plentiful amount of LWD here is largely attributable to (1) abundance of overhanging riparian vegetation provides a rich source of wood input, and (2) the absence of shoreline armoring facilitates the accumulation of LWD above MHHW. Backbeach areas are found in some instances here, and their formation is partially facilitated by abundant LWD and its associated "beach-forming" functions. In some cases, backbeach areas support small patches, or strands, of dune vegetation, namely American dunegrass. Interestingly, this species was also observed extending up onto the low bluff face in some areas, which likely corroborates the observation that bluff composition appears to be characterized by considerable sand substrate, which provides suitable habitat for this species. This composition likely contributes to the highly erodible nature of soils in this area. Following, this species is likely providing soil binding and bluff stabilizing functions in instances where it has rooted on the toe of the bluff.

State Park Boat Launch to Private Marina

Park development in the southwestern portion of the project area has resulted in significant alteration to nearshore aquatic habitat between the park boat launch and the private marina (Figure 18). Installation of overwater structures associated with park infrastructure has imposed a variety of impacts, including loss of eelgrass habitat due to shading and disruption of longshore sediment transport in some instances (as discussed in the *Geomorphic Change Assessment* section), altering and eliminating forage fish spawning habitat in affected areas. Much of the area previously occupied by riparian vegetation has been converted to lawn and walkways to accommodate park use. In these situations, the provision of benefits by overhanging vegetation described previously is lost – for example, Pentilla (2001) and Rice (2006) have linked a lack of shade in intertidal beach areas to mortality of surf smelt eggs due to desiccation.

Figure 18. Representative nearshore conditions along the armored segment of shoreline between the State Park boat launch and the private marina.

Shoreline armoring throughout this area causes significant impacts to nearshore aquatic habitat, including coarsening and homogenizing of intertidal substrate and steepening of beach grades, which negatively affects forage fish spawning. In addition, shoreline armoring precludes the accumulation of LWD and development of backbeach habitats. Since nearshore conditions among various sections of the shoreline in this area exhibit differences with regard to degree of modification and substrate characteristics, they are described individually below.

Vicinity of Boat Launch

The foreshore in this area is heavily armored, in some places with large (cobble sized), placed rock. The low tide terrace does not exist because it was dredged for the boat launch. LWD is absent from this area, partially because it is removed to maintain use of the boat launch. Riparian vegetation has been cleared and replaced with lawn or pavement to facilitate boat launch access. Forage fish (sand lance and surf smelt) spawning habitat in this area has been lost. *Fucus* sp., *Enteromorpha* sp., and *Ulva* sp. exhibited a patchy distribution across the intertidal gradient in this area.

Boat Launch to Marine Facilities and Maintenance Dock

This is an area of accretion in the foreshore. The material here is sandy, with a small amount of gravel near the foreshore/low tide terrace transition. The foreshore in this area is heavily armored with a bulkhead composed of creosote-treated wood, and the low tide terrace is comprised of silty sand. *Fucus* sp. is found in the mid- to lower elevations of the intertidal zone, with *Enteromorpha* sp. being present in some areas, mainly occupying the lower portion of the intertidal gradient. LWD is virtually absent from this area with the exception of the portion of the shoreline that is not armored, and even in those areas only a few pieces of LWD are present. There is a large accumulation of LWD underneath the maintenance dock (some logs 50 feet in length with attached root wads), mostly oriented perpendicular to the beach. Riparian vegetation has been largely removed to permit lawn installation and the construction of picnic tables and other day use facilities. Due to the accreted sand, this area provides spawning habitat for forage fish.

Marine Facilities and Maintenance Dock to Private Marina

The foreshore in this shoreline segment (composed primarily of large gravel) has somewhat coarsened because it has been largely cut-off from nearshore sediment transport. Sand is present in patches, mainly near the park boundary, and these patches are narrow and sparse. Moving toward the southwest boundary of the park, the low tide terrace broadens and the substrate becomes finer and shows of signs of active accumulation. *Fucus* sp. is found across the intertidal gradient to varying extents throughout this segment of shoreline, while *Enteromorpha* sp. is primarily found in the lower portions of the intertidal zone.

LWD is uncommon to southwest of the large accumulation under the maintenance dock, but increases in prevalence near the park boundary and the private marina. In this portion of the project area, where the protected bay has created a lower-energy environment, the finer substrate characteristics have facilitated the development of narrow bands of salt marsh vegetation (usually <10 feet wide), including saltgrass and pickleweed (Figure 19). Saltgrass tends to occupy the upper portion of the salinity and tidal inundation gradients, and pickleweed often extends through the lower end of this gradient (Ewing 1986).

One area of particular interest was a small lagoon feature (approximately 1,500 square feet) located approximately 300 feet northeast of the private marina (Figure 20). Although likely artificial (field observations suggest that it was likely created by fill placement), this feature supports some salt marsh vegetation, which in other locations has been shown to be important habitat for anadromous fish. The presence of salt marsh vegetation does not provide indication

of the origin of this feature, however, because of the relatively rapid colonization rate of constituent species (Ewing 1986).

Figure 19. Representative nearshore conditions along the unarmored segment of shoreline near the park boundary and the private marina.

Figure 20. Small lagoon feature (approximately 1,500 square feet) located approximately 300 feet northeast of the private marina; looking toward the northeast. Note scrub-shrub vegetation on the background.

Similar to the other areas, riparian vegetation has been removed throughout this section, but some reestablishment has occurred in the area to the northeast of the lagoon feature. Although composed primarily of scrub-shrub vegetation (i.e., less than 20 feet in height), this area will likely continue to mature and provide increasingly greater benefits to the nearshore environment (Figure 20).

As mentioned in the *Watershed Characterization* section, there are no identified streams that discharge into Cornet Bay within the vicinity of the project area. However, a number of "pour points" have been located by Island County (2008a), which convey groundwater and surface water originating from inland seeps and drainages to Cornet Bay. There are five culvert outfalls within the project area – one culvert northeast of the boat launch was not documented by the Island County Watershed Characterization in 2008 (see Figure 1 in Appendix C). This hydrologic input influences the nearshore environment in a number of ways, including influencing salinity in the bay via freshwater mixing, sediment contribution, and addition of allochthonous nutrients (i.e., external in origin) and pollutants. These drainages are ephemeral, lacking flows for extended periods during the summer dry season and generally providing limited discharge during wet periods. Their low-flow and sporadic characteristics, and the fact that the culverts at the shoreline providing conveyance of these drainages likely pose as fish passage barriers, means that these drainages provide no existing or potential habitat for anadromous fish species.

Fish Habitat Utilization

The *Water Resources Inventory Area 6 Multi-species Salmon Recovery Plan* identifies Cornet Bay as a "very high" Nearshore Habitat Restoration Priority, and reports that this area is an important refuge along a major migratory corridor for 6 of the 22 Puget Sound Chinook Evolutionary Significant Units (ESUs), whose shoreline-rearing period can last from days to months (Beamer et al. 2005; Island County 2005).

Also, the *Priority Marine Sites for Conservation in the Puget Sound* report identifies Cornet Bay and the Deception Pass area as the top-rated site for conservation in the Whidbey Basin (Palazzi and Bloch 2006). In addition to providing habitat for salmonids, Cornet Bay's sand, mud, and eelgrass meadows also provide an important foraging, refugia, and spawning area for a variety of invertebrates and forage fish species, including sand lance, surf smelt, and herring, which all serve as the major prey resource for Chinook and other salmonids (Island County 2008a). Cornet Bay is also documented as boasting one of the most productive Dungeness crab habitats in Puget Sound (Island County 2005).

Forage Fish

Healthy forage fish populations, including surf smelt, Pacific herring, and sand lance, are critical to the continued survival of Puget Sound salmonids (Island County 2005). These species feed on phytoplankton and zooplankton, converting this biomass into a preferred prey resource for many predatory species, including marine mammals, seabirds, juvenile and adult salmonids, and many

other fish species. The nearshore of Whidbey Island, including the Cornet Bay area, provides significant existing and potential spawning habitat for forage fish (Island County 2005, 2003).

A single sand lance spawning site is documented in the project area, just northeast of the Public Access Boat Dock (Penttila 2009). For this reason, restoration alternatives should include provision for the upper intertidal zone to consist of sandy substrate to provide sand lance spawning habitat. Although surf smelt is commonly caught off the State Park dock, evidence has not been found that surf smelt are using the beaches around the dock or launch for spawning. The closest known surf smelt spawning beach is at the northeastern end of the project area at Hoypus Point. This marks the northwestern-most extremity of a large surf smelt spawning area that stretches south along Whidbey Island, down Skagit Bay, and to Saratoga Passage (Penttila 2009).

Both surf smelt and sand lance use similar sandy and gravelly substrate high in the intertidal zone. Accordingly, the recruitment and transport of substrate along this shoreline habitat strongly influence the quality and quantity of available spawning habitat.

Salmonids

The central location of Whidbey Island in the Salish Sea, at the junction of Puget Sound, the Strait of Juan de Fuca and Georgia Strait, places it on the migration corridors used by most Puget Sound juvenile and adult salmon and trout populations (Island County 2005). As the fish move to and from their parent river systems, Whidbey Island's nearshore provides essential habitat for refuge and forage (Beamer et al. 2005). Since Cornet Bay and the Hoypus Point area lie on the most direct salmon migration pathway between the Skagit River system and the Pacific Ocean through Deception Pass, it is presumed that most juvenile salmon exit Skagit Bay via this route (Beamer et al. 2005; Island County 2005).

The following species of salmonids are known to be present in the vicinity of the project area and may use the entire shoreline in various life stages: Puget Sound Chinook salmon (spring, summer, and fall stocks), coho salmon, chum salmon, pink salmon, sockeye salmon, summer and winter run steelhead, sea-run cutthroat trout, Dolly Varden char, and bull trout (CH2M Hill 2003). The majority of the salmonids using the project area originate in the Skagit River system (Beamer et al. 2005; Island County 2005).

Island County Beach Watchers, Island County Marine Resources Committee, and Washington State Parks worked collaboratively to collect data on juvenile salmonid utilization of the nearshore environment at Cornet Bay in the spring of 2009 (Keystone Ecological LLC 2009). Intertidal beach seining was employed as the primary fish abundance sampling method, and designated sites within the bay were sampled twice a month from March to June. Seined areas were typically less than 4 feet deep, and the marine organisms in each catch were tallied by species.

Over 6,580 fish were caught and at least 22 species were identified during this study. Juvenile salmon accounted for nearly 74 percent of the total catch (Table 1). Most of the salmon caught

during the survey were subyearling chum, and only two were identified as subyearling Chinook salmon. The juvenile Chinook salmon were present in Cornet Bay from late May to early June. Juvenile chum salmon were found in Cornet Bay throughout the study, with peak abundance in April and May.

Table 1. Summary of fish species caught during 2009 fish sampling, as presented in Keystone Ecological LLC (2009).

Species	Percentage
Juvenile Salmon	74%
Sculpins	17%
Flatfish	5%
Gunnels (mainly Crescent and Saddleback)	2%
Other (threespine stickleback, snake prickleback, arrow goby, pipefish, sand sole, English sole, snailfish, greenling, herring, and surf smelt)	2%

The peak fish density in Cornet Bay was during the month of April, with juvenile salmon accounting for the majority of the total catches. From March to May, the fish population was dominated by juvenile salmonids, while in June the fish community was dominated by other species, mainly sculpin, flatfish, and gunnels.

Implication of Findings for Restoration Options

Following is a summary of findings which were considered during the alternative analysis. When applicable, these findings should also be considered during any future design developments and during project implementation.

Geomorphic Shoreline Configuration

The slope of the beach foreshore is variable throughout the project area. The shoreline immediately northeast of the boat launch provides an excellent reference site to investigate historical beach foreshore slope. The beach foreshore in this area has a slope of between 7:1 and 8:1 (Figure 10). This slope is very typical for Puget Sound shorelines (Finlayson 2006) and should be used in the design where feasible to replicate the approximate historical beach slope.

The Marine Maintenance and Facilities Dock is characterized by a substantial amount of fill associated with the approach to the dock. This is the single largest geomorphic impact to nearshore physical processes (i.e., impairment of longshore sediment transport) in the project area.

Physical Processes

There are several characteristics of the physical processes occurring in the project area that are relevant for the assessment of habitat conditions, alternative selection, and future restoration actions. They are:

- *Disruption of longshore transport by fill associated with the Marine Maintenance and Facilities Dock* – Within the project area, the most significant disruption to natural physical shoreline processes is the placement of fill associated with the Marine Maintenance and Facilities Dock. This fill blocks the longshore transport of sediment on the beach foreshore from source areas around Hoypus Point and beyond. This blockage has caused an accumulation of sediment updrift (northeast) of the dock. Downdrift (southwest) of the dock the beach foreshore is starved of sediment, resulting in a course armored surface. Consequently, removing this fill will restore longshore sediment transport to the southwest portion of the project area. It would also cause the accumulation of previously impounded sediment to be eroded away, but it is unlikely for it to cause wholesale migration of the shoreline since the shoreline position has been stable in the recent geologic past.

- *Low-energy wave environment* – The wave gage deployment revealed that very little wave energy makes its way into Cornet Bay. Marine traffic in the open water (i.e., away from the boat launch) produces relatively small waves in discrete, short periods of time. The largest wind-generated waves are caused by rare, strong winds originating in the Fraser River valley in winter. None of the waves exceed 2 feet in height in the open bay. As such, shore protection away from areas of intense human disturbance (see next item) is generally not necessary.

- *Extreme high water events* – Extreme high water events within the confines of Puget Sound are associated with low-pressure storm events that occur predominantly during the winter. They occur as a result of the "inverse barometer effect" that is associated with low atmospheric pressure raising marine water levels. In Puget Sound, these events are associated with southerly wind storm events. Because Cornet Bay is sheltered from all winds with a southerly orientation, there are effectively no waves during these times of highest marine levels. Anecdotal observations of past high water levels and associated flooding of parking area are consistent with this conclusion (see Figure 21). From NOAA adjustments to more than one hundred years of observations at Seattle, the highest marine water level expected at Cornet Bay is 12.7 feet MLLW.

- *Extreme high wave events* – The largest storm waves at the project site are generated by local winds (Finalyson 2006). These largest waves are associated with northeasterly winds originating in the Fraser Valley with a relatively long fetch across Cornet Bay to Yokeko Point. These "gap wind" events occur when high pressure in southern British Columbia causes flow of air down the Fraser Valley and out the Strait of Juan de Fuca (Overland and Walter 1981). Because these events occur when high atmospheric pressure is dominant, they do not coincide with high marine

water levels. The largest wave event in the last five years postdicted using a Corps-approved wind-wave model from winds observed at Bellingham was found to be 1.7 feet, which is consistent with observations at the project site of waves approximately 2 feet in height (Hartt 2009).

Figure 21. Flooding during an extreme high water event at Deception Pass State Park, looking to the southwest.

- *Sea level Rise* – It is understood by the scientific community that an unconstrained natural beach system is more adaptable than one that is constrained by human structures. Therefore, by restoring areas of the beach to their natural conditions one can improve the beaches adaptability to sea level rise. For areas and design elements that may not being restored to their natural conditions the design high water elevation for the project should be increased by 6 inches over the 100-year extreme high water. Sea level rise is highly geographically variable in the Pacific Northwest because tectonics plays an important role in the vertical migration of the land surface; however, according to the nearest NOAA gage that measures sea level rise (in Port Townsend), 6 inches is the sea level rise that would occur in 75 years.

- *Extremely local impact from human disturbance* – Geomorphic observations and the sediment transport assessment reveal that the boat launch does have an indirect, local effect on the beach, but only within a

few hundred feet of the launch. This is related to not only to wakes from boats and vehicles entering the water, but also vehicle and pedestrian traffic. As a result, the shoreline at the southwest site of the boat launch may require structural protection against this disturbance.

- *Spatially complex currents that sequester fine sediment in inner bay* – Strong currents in the main channel of Deception Pass do penetrate somewhat into the confines of Cornet Bay. These currents are not symmetric, but are directed in such a way as to direct the flow of water into the flood tide and release the water more slowly through constricted outlets at the north end of the bay. The net effect of these motions is that fine (suspended) material is deposited in the head of the bay. Consequently, the lower beach in the project area and the head of the bay will aggrade (fill in) with time, ultimately causing the shoreline to progress seaward.

Watershed

The following summarizes the implications that the findings presented in the *Watershed Characterization* section of this assessment have for project future planning and design:

- A number of Island County-regulated critical areas, including wetlands, steep slopes, and highly erodible soils, are found within the project area. The project will need to consider these environmental features and their associated regulations (see Appendix C).

- The project will need to consider drainage, sedimentation, and fecal coliform issues associated with the culvert outfalls ("pour points") within the project area.

Riparian Vegetation

The following summarizes the implications of the findings discussed in the *Riparian Vegetation Community Characterization* section of this assessment:

- The lack of intact native riparian vegetation and associated beneficial functions throughout the southwest extent of the project area (near the majority of park development and infrastructure) provides an opportunity to significantly improve nearshore conditions via revegetation activities in this area.

- The scrub-shrub plant community occupying the low bank shoreline in the area immediately northeast of the boat launch serves as an appropriate reference site for project plant community restoration target conditions.

Dominant plant species observed here that can be incorporated into restoration planting plans include Pacific crabapple, red alder, a variety of willow species (Hookers willow being the most common), snowberry, oceanspray, Nootka rose, salal, Oregon grape, salmonberry, and red elderberry.

- The observed presence of wetlands within the project area suggests the need for more extensive critical areas review and documentation, including wetland delineations, prior to project implementation, in order to avoid and minimize any impacts to on-site aquatic resources (see Appendix C).

- Reintroduction of tidal influence and salinity to the forested wetland areas at Cornet Bay – Hoypus Point as part of restoration activities will have significant consequences on hydrologic regime and plant community composition and structure. Therefore, a detailed hydrologic/hydraulic analysis and feasibility assessment will be required to determine the extent of potential effects from any project activities involving reconnection with Cornet Bay.

- Activities associated with maintenance and/or retrofit of the road to Hoypus Point in proximity to wetland areas or seeps will require careful on-site assessment and appropriate documentation to ensure that impacts to aquatic resources are minimized and that road integrity is not compromised, which is a problem currently requiring attention in some locations.

- Although invasive species (e.g., Himalayan blackberry, English ivy) currently exhibit minimal presence at Cornet Bay, adaptive management of existing and future populations through development and implementation of an Integrated Pest Management (IPM) program is recommended in order to prevent any spread following disturbance caused by construction and prevent establishment and infestation by additional invasive species in the future.

- Project areas slated for construction activities lie within close proximity (<300 feet) to a well-established great blue heron rookery and other protected bird species, and therefore project planning will need to accommodate applicable regulatory requirements (see Appendix C).

Aquatic Habitat and Fish Habitat Utilization

The following summarizes the implications of findings discussed in the *Aquatic Habitat Characterization and Fish Habitat Utilization Assessment* section of this report for future project planning and design:

- Avoiding or minimizing impacts to existing important habitat features within the nearshore aquatic environment (including eelgrass beds, beach areas providing exceptional forage fish spawning habitat, and dune and salt marsh vegetation) will be an important element of project planning and regulatory compliance (see Appendix C).

- Documented use of this site by protected fish species warrants careful consideration of project impacts and appropriate regulatory compliance (see Appendix C), and provides a basis for restoration activities.

- Many opportunities for restoration and enhancement of the aquatic nearshore environment are present within the project area. For example, replacement of the existing bulkhead with soft bank stabilization structures (structural LWD) will improve forage fish spawning habitat by removing the current intertidal beach steepening and substrate coarsening trend. Structural LWD protection consists of a series of intertwined structural logs with and without root wads that form a stable matrix, secured by partial burial. LWD augmentation in nearshore areas would also greatly improve habitat conditions.

Alternative Analysis Results – Preferred Alternative

Three conceptual design alternatives were developed for restoration of the nearshore ecosystem. These designs alternatives were developed in coordination with the Washington State Parks and Recreation Commission and Island County MRC. These alternatives were analyzed during Workshop #1 on May 7, 2009 using the information compiled as part of the feasibility assessment and the collective desire to achieve maximum balance among the chief goals mentioned in the Introduction. The alternative analysis criteria included

- An evaluation of the historic and current geomorphic, physical processes, and aquatic and riparian habitat conditions
- Wave and boat wake energy at the site
- Currents and tides
- Presence of cultural resources
- Park uses

The three restoration alternatives that were analyzed are described below.

- **Alternative 1**: Remove the existing bulkhead and fill material along the entire shoreline segment within the park boundaries, and regrade to match historical or adjacent beach.
- **Alternative 2**: Remove the existing bulkhead and provide new shoreline armoring where needed (using nontoxic materials such as creosote-treated wood) to address infrastructure protection on areas with high wave energy. Remove fill material along the shoreline segment where the existing bulkhead is removed to match historical or adjacent beach.
- **Alternative 3**: Replace the existing bulkhead using nontoxic materials (wood, riprap, and or concrete) without regrading or removing fill material.

After development of the three conceptual nearshore restoration alternatives, an analysis was performed to determine their feasibility and select a preferred alternative. Selection criteria for the preferred alternative included:

- Achieving maximum ecological lift through the restoration of the nearshore aquatic and riparian habitat areas critical for forage fish, juvenile salmon, and other marine species
- Improving/restoring shoreline processes

- Avoiding disturbance to cultural resources
- Maintaining or enhancing the park's commercial and recreational values, uses, and present and future opportunities

Of the three alternatives, Alternative 2 was selected by Washington State Parks and Recreation Commission and Island County MRC as the preferred alternative. Plan view and cross-sections of the preferred alternative are provided in Appendix E.

Conclusions

Nearshore restoration opportunities exist in Cornet Bay within the project area. A significant portion of the shoreline has been armored (and fill material placed) within the park boundary, resulting in nearshore habitat loss and degradation. Removing the bulkhead and associated fill material would restore the area.

The shoreline northeast of the boat launch provides an excellent reference site for replicating the predevelopment beach foreshore slope. The beach foreshore in this area has a slope of between 7:1 and 8:1, which is very typical for undisturbed Puget Sound shorelines (Finlayson 2006) and feasible for replicating the approximate predevelopment beach slope.

The following sections discuss specific nearshore restoration opportunities and a conceptual restoration design for one of these opportunities.

Nearshore Restoration Opportunities

The scope of Alternative 2 (the selected preferred alternative) consists of removing the existing bulkhead but providing new shoreline armoring where needed (not using toxic materials such as creosote-treated wood) to help protect infrastructure in areas with high wave energy. This alternative also includes the removal of fill material along the shoreline segment where the existing bulkhead is removed to match historical or adjacent beach conditions.

Given the scope of the preferred alternative (shoreline removal of bulkhead and fill), and to facilitate project implementation if only partial funds become available, the project area associated with the preferred alternative was segregated into eight discrete restoration target areas. Where additional nearshore restoration opportunities existed within each of the eight target areas, such opportunities were added to the nearest target area according to their relative geographic location. Each of these eight target areas represents an opportunity to restore the nearshore environment. These eight areas are presented in Table 2 and their physical location is shown in Figures 22 and 23.

Future design and implementation of any of these restoration opportunities should consider the environmental constraints discussed in Appendix C.

Conceptual Design – Restoration Opportunity Number 5

As previously stated, the most significant disruption of natural physical shoreline processes within the project area is the presence of fill associated with the Marine Maintenance and Facilities Dock (Restoration Opportunity Number 5 in Table 2 and Figures 22 and 23).

Table 2. Nearshore restoration opportunities associated with the Cornet Bay/Hoypus Point Improvement Project.

Opportunity Number	Target Area Location	Description	Cost	Impairments	Expected Benefits
1	Shoreline area immediately northeast of private marina (south end of project area)	Removal of fill and restoration of upper beach and back beach areas Grade back and recontour shoreline to create pocket beach area Feasibility study to determine the potential for restoration/creation of pocket estuary habitat or tidal marsh habitat [Note: All actions contingent on results of cultural resources documentation/approval]	Construction: $172,600 PS&E: $35,000 Permitting: * Feasibility Study: $20,000	Upper and back beach areas loss Lack of riparian vegetation	Expanded upper beach habitat Forage fish spawning habitat improvements Create pocket beach area for juvenile salmon
2	Forested wetland complex (south end and middle project area)	Feasibility study to explore the potential for reconnection of tidal influence (extensive research and assessment would be required; need to determine if this connection was historically a surface water connection; consideration will need to be given to existing drainage system characteristics)	Construction: $532,800 PS&E: $107,000 Permitting: * Feasibility Study: $75,000	Forested wetland complex may have loss historic tidal influence	Restore natural hydrology of the wetland
3	Shrub-scrub portion of day use area (arch site)	Nourishment along edge of road prism (impacts to sediment transport have resulted in sediment depletion in this area) Removal of construction debris and other placed fill Feasibility study to determine the potential for restoration/creation of pocket estuary habitat or tidal marsh habitat [Note: All actions contingent on results of cultural resources documentation/approval]	Construction: $56,000 PS&E: $12,000 Permitting: * Feasibility Study: $20,000	Impaired natural geomorphic processes Upper and back beach areas loss Lack of riparian vegetation	Resumption of natural geomorphic processes Forage fish spawning habitat improvements Create pocket beach area for juvenile salmon
4	Shoreline area immediately southwest of the Marine Maintenance Facility Dock	Removal of fill and bulkhead Grade back and recontour shoreline to create pocket beach area	Construction: $169,700 PS&E: $33,000 Permitting: *	Upper and back beach areas loss Lack of riparian vegetation Source of pollutants (creosote)	Expanded upper beach habitat Removal of creosote contamination Forage fish spawning habitat improvements Nearshore juvenile salmon habitat improvements

Table 2 (continued). Nearshore restoration opportunities associated with the Cornet Bay/Hoypus Point Improvement Project.

Opportunity Number	Target Area Location	Description	Cost	Impairments	Expected Benefits
5	Marine Maintenance Facility Dock approach area	Pier approach setback; replace decking; restore natural beach slope; restore longshore sediment transport	Construction: $318,000 PS&E: $64,000 Permitting: *	Impaired natural geomorphic processes Upper and back beach areas loss Lack of riparian vegetation Source of pollutants (creosote)	Expanded upper beach habitat in footprint of pier approach Elimination of longshore blockage and resumption of sand supply to areas downdrift (southwest) Forage fish spawning habitat restoration Nearshore juvenile salmon habitat improvements
6	Shoreline area extending from the Marine Maintenance Facility Dock to boat launch	Removal of fill and bulkhead and beach set-back. Corner immediately southwest of boat launch will require a short concrete bulkhead	Construction: $248,200 PS&E: $50,000 Permitting: *	Upper and back beach areas loss Lack of riparian vegetation Source of pollutants (creosote)	Expanded upper beach habitat Removal of creosote contamination Forage fish spawning habitat improvements Nearshore juvenile salmon habitat improvements
7	Shoreline area immediately northeast of boat launch	Removal of fill and bulkhead and beach set-back	Construction: $30,710 PS&E: $7,000 Permitting: *	Upper and back beach areas loss Source of pollutants (creosote)	Expanded upper beach habitat Removal of creosote contamination Forage fish spawning habitat improvements Nearshore juvenile salmon habitat improvements
8	Hoypus Point	Removal of loose riprap and concrete debris not required to support road infrastructure	Construction: $25,300 PS&E: $6,000 Permitting: *	Upper and back beach areas loss	Expanded upper beach habitat Forage fish spawning habitat improvements

* Note: Overall permitting cost estimate is $46,000, assuming the following:

- There would only be one permitting process.
- Compensatory mitigation is not required.
- Eelgrass surveys are not required.
- Wetland delineation is not included.
- Bald eagle management plan development is not included, as it requires pre-application coordination with WDFW to define the scope.
- Cultural resources are not present within the area of construction disturbance.
- Hazardous materials (other than creosote) are not present within the project area and environmental assessment is not required.

Figure 22. Potential locations and extents of nearshore restoration target areas along Cornet Bay.

Figure 23. Potential locations and extents of nearshore restoration target areas along Hoypus Point.

Since removing such fill material would create considerable habitat benefits, this restoration option was selected by Washington State Parks and Recreation Commission and Island County MRC for further consideration. This restoration opportunity includes:

- Dock approach setback
- Fill removal
- A portion of decking replacement
- Natural beach slope restoration
- Longshore sediment transport restoration

Also included is the addition of native vegetation and wood to enhance existing habitat conditions. Conceptual design drawings for restoration opportunity number 5 (in addition to other adjacent nearshore and upland project elements) are included in Appendix F. This conceptual design was prepared to support grant applications for the full design development and construction of this restoration opportunity.

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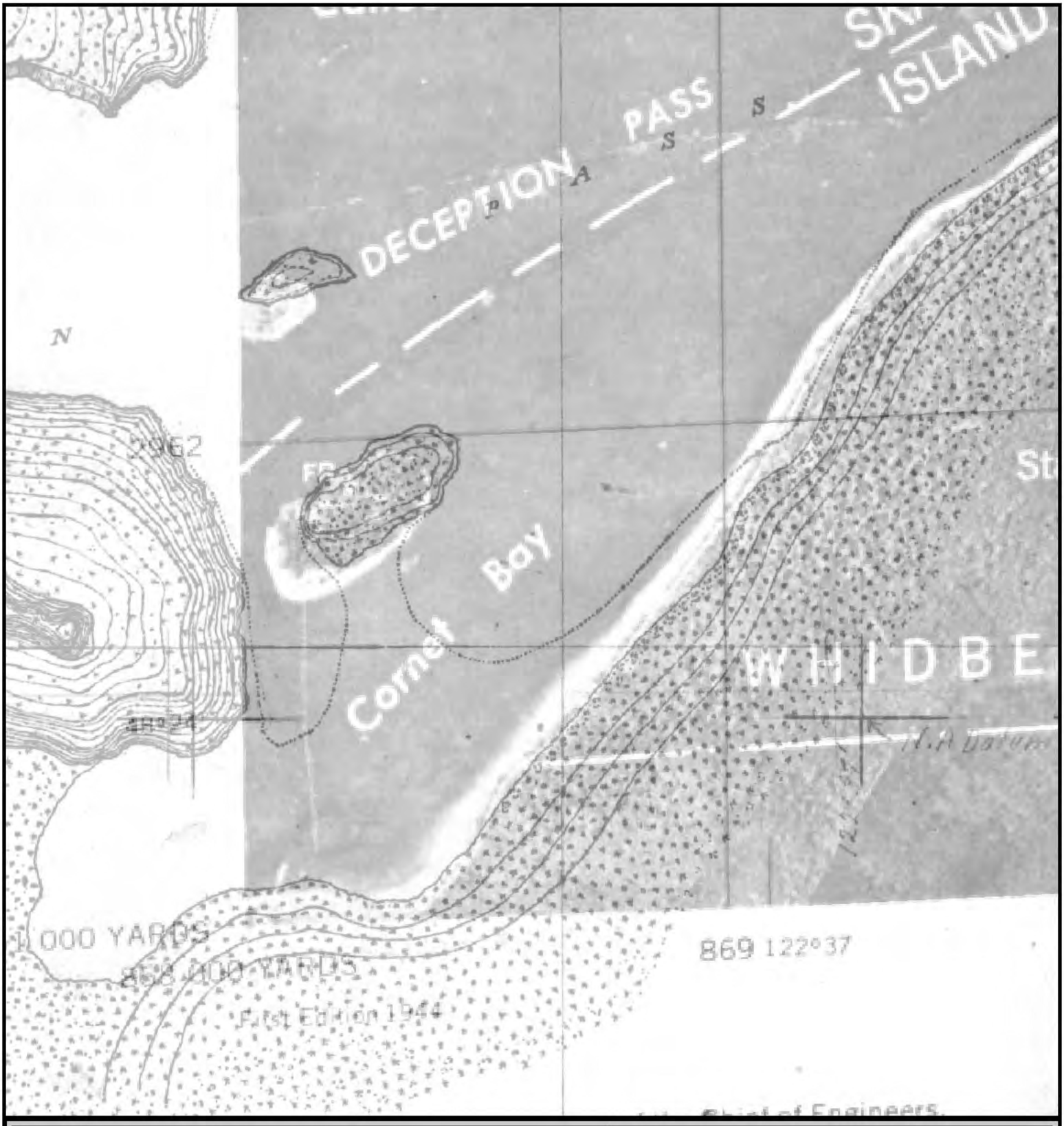
APPENDIX A

Historic Aerial Photographs



Legend

Figure A-1. 1944 aerial overlain on the 1890 T-sheet

N

0 400 800 1,600 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photography: Army Corps of Engineers, 1944

K:\Projects\08-03620-000\Project\t-sheet_overlay.mxd

Legend

Figure A-2. 1956 aerial overlain on the 1890 T-sheet

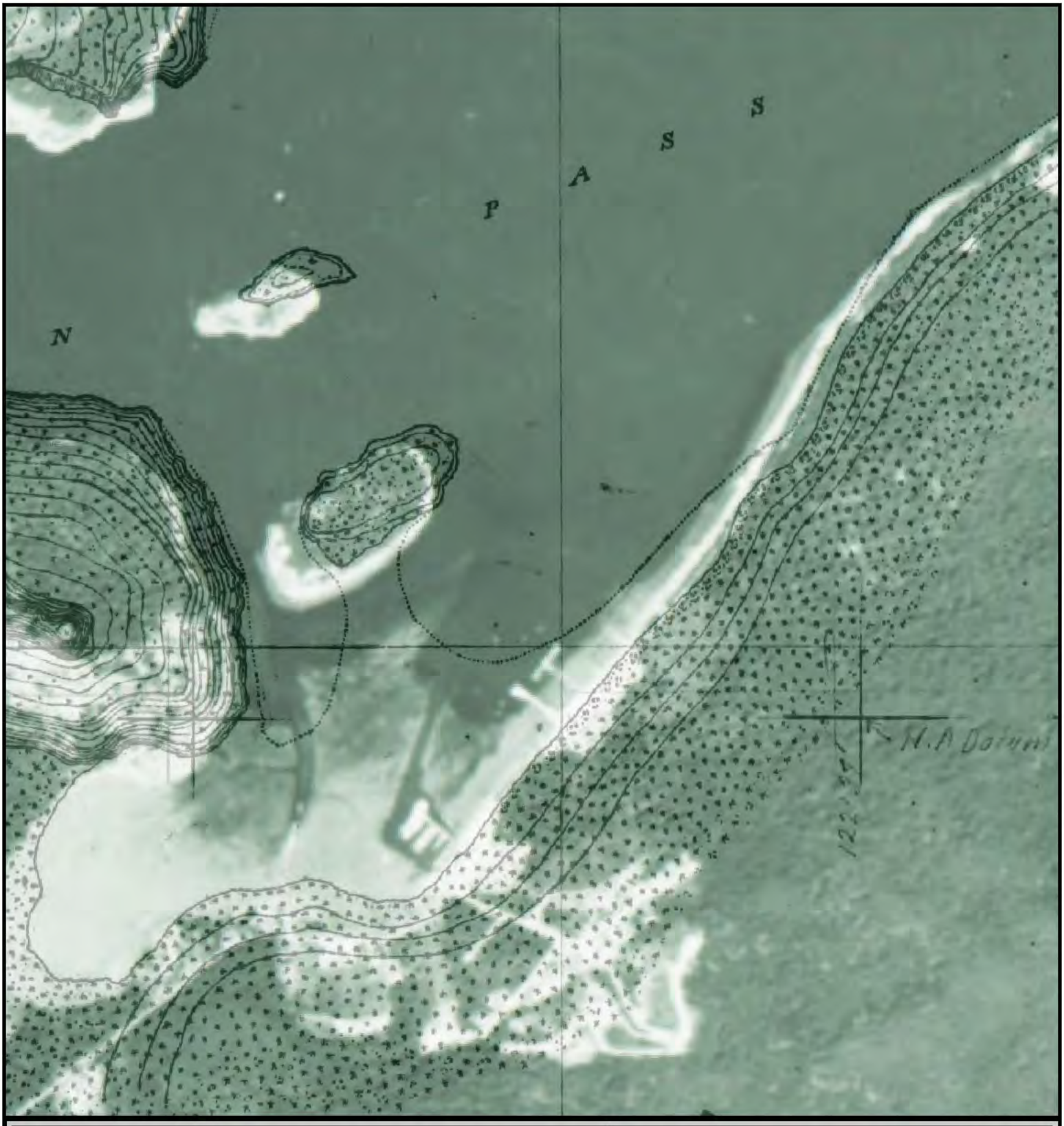
N

0 400 800 1,600 Feet

HERRERA
ENVIRONMENTAL CONSULTANTS

Aerial photography: USDA, 1956

K:\Projects\08-03620-000\Project\t-sheet_overlay.mxd



Legend

Figure A-3. 1965 aerial overlain on the 1890 T-sheet

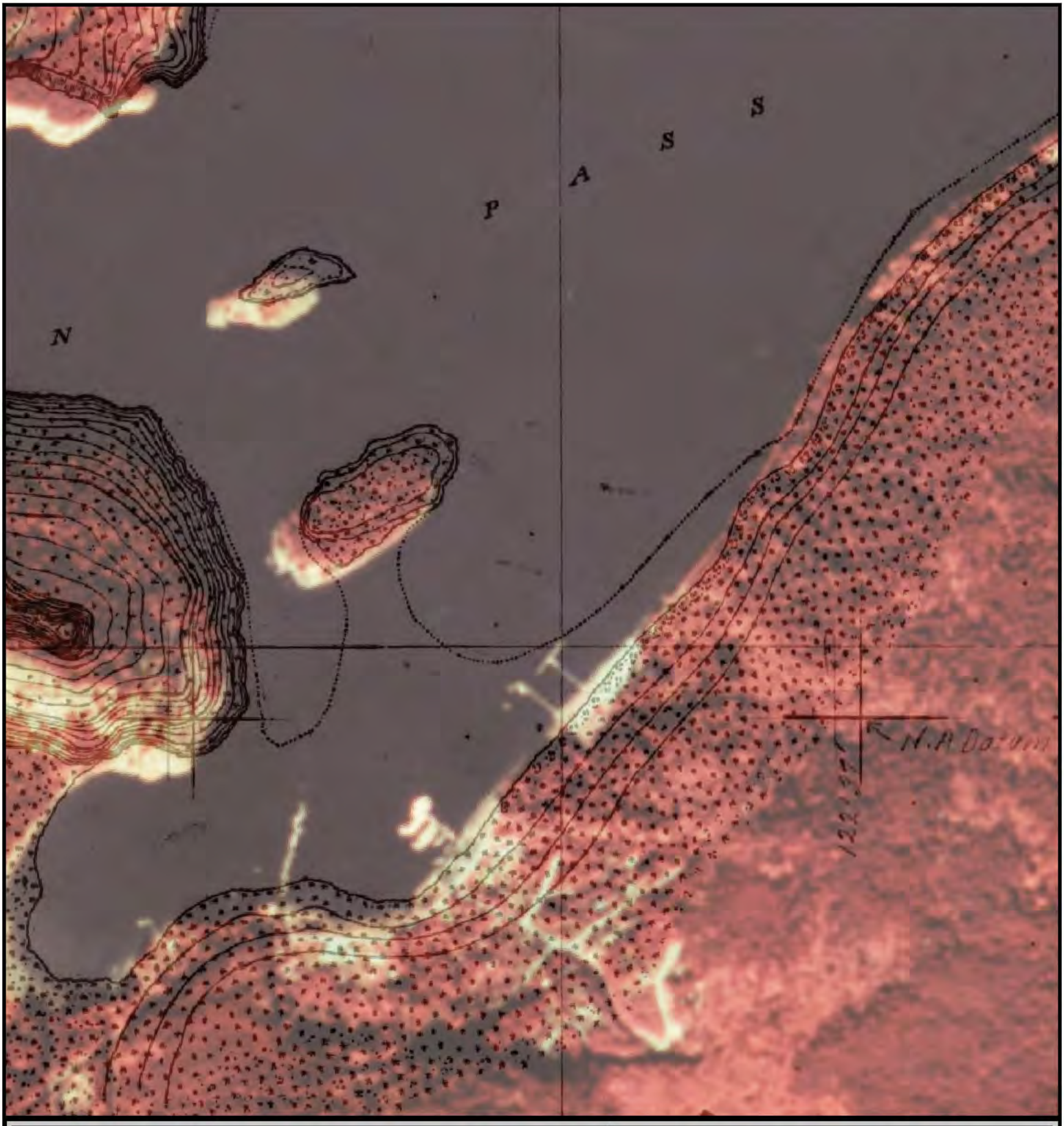
N

0 400 800 1,600 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photography: Pacific Aerial Surveys, 1965

K:\Projects\08-03620-000\Project\t-sheet_overlay.mxd



Legend

Figure A-4. 1971 aerial overlain on the 1890 T-sheet

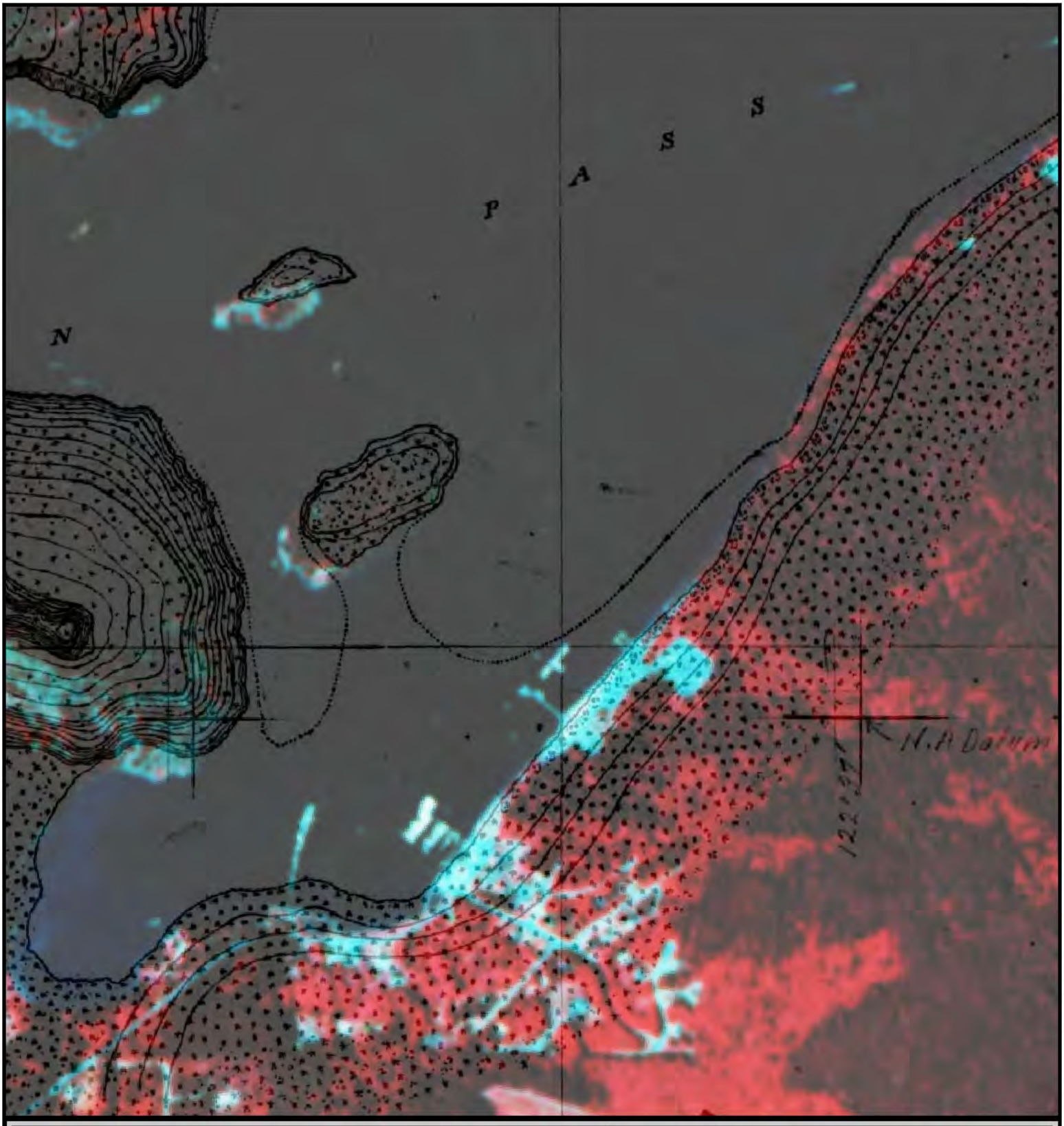
N

0 400 800 1,600 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photography: NASA, 1971

K:\Projects\08-03620-000\Project\t-sheet_overlay.mxd



Legend

Figure A-5. 1980 aerial overlain on the 1890 T-sheet

N

0 400 800 1,600 Feet

HERRERA
ENVIRONMENTAL CONSULTANTS

Aerial photography: USDA, 1980

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Legend

Figure A-6. 1995 aerial overlain on the 1890 T-sheet

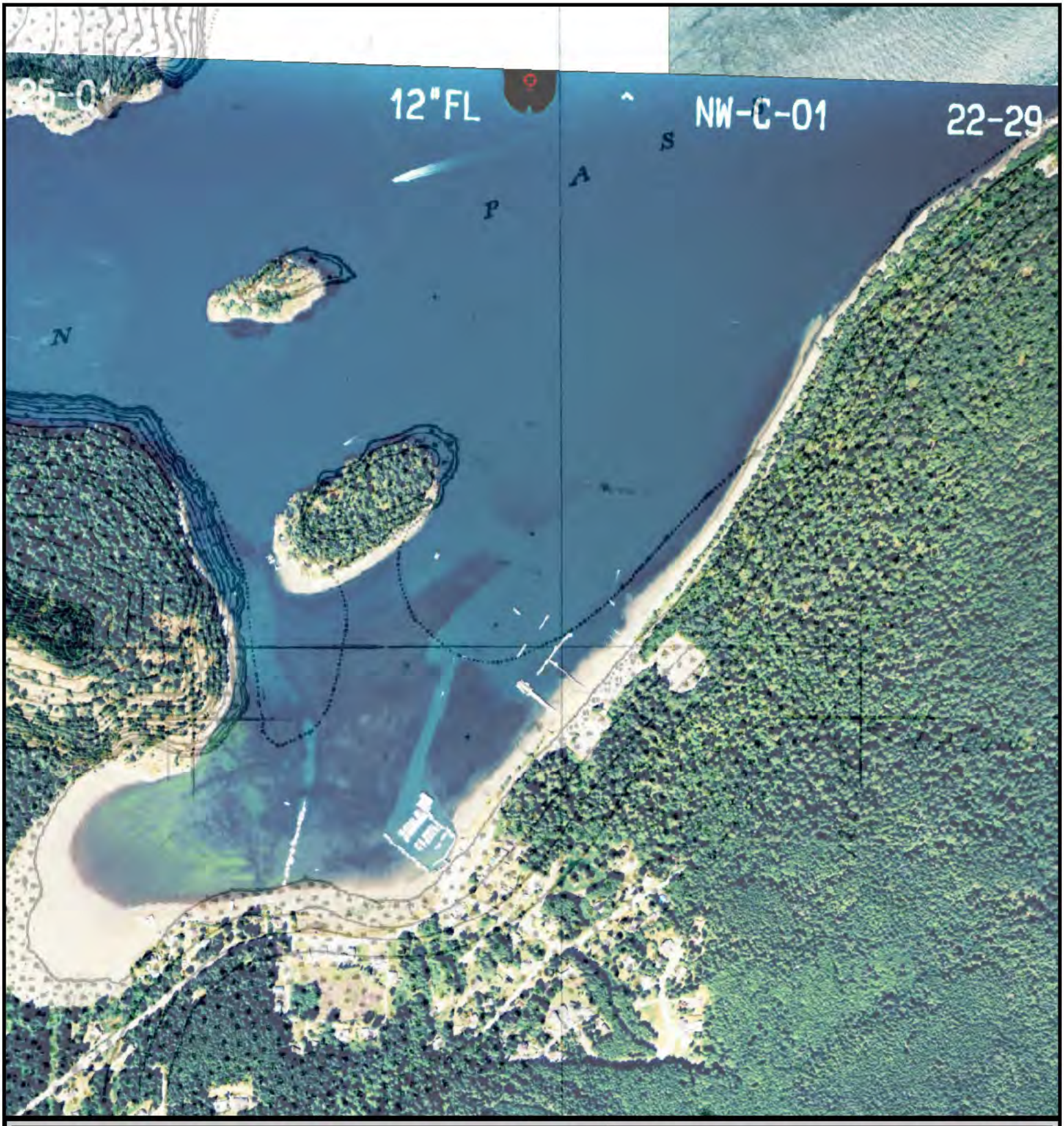
N

0 400 800 1,600 Feet

HERRERA
ENVIRONMENTAL CONSULTANTS

Aerial photography: Washington State DNR, 1995

K:\Projects\08-03620-000\Project\t-sheet_overlay.mxd



Legend

Figure A-7. 2001 aerial overlain on the 1890 T-sheet

N

0 400 800 1,600 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photography: Washington State DNR, 2001

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Legend

Figure A-8. 2006 aerial overlain on the 1890 T-sheet

N

0 400 800 1,600 Feet

HERRERA ENVIRONMENTAL CONSULTANTS

Aerial photography: USDA, 2006

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Legend

Figure A-9. 2007 aerial overlain on the 1890 T-sheet

N

0 400 800 1,600 Feet

HERRERA
ENVIRONMENTAL CONSULTANTS

Aerial photography: Island County, 2007

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APPENDIX B

Location of Beach Profiles with Field Notes

Legend

Transect

Figure B-1. Beach profiles in Cornet Bay Hoypus Improvement Project

N

0 400 800 1,600

Feet

HERRERA ENVIRONMENTAL CONSULTANTS

K:\Projects\08-03620-000\Project\transects.mxd

TP 8.88

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 29.673/122 36.942

GPS Landward: 48 29.663/122 36.949

Surveyor(s): Dan & Jeff

Cross Section Id: 2

Form Completed by: JP

Time: 9:28

Photos

East	7577
West	7574
North	7575
South	7576

upper foreshore substrate 7573

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	0.5	duff
4	3	
8	3.1	edge pavement
32	2.7	
38	3.4	edge of pavement
43	4.4	top of wall
48	8.9	base of wall / gravel w/ sand
69	11.9	gravel
84	14.2	wsgl
101	16.9	gravel
-16		survey marker near road

Upper Beach Modifications

Description: wall (concrete)

Foreshore

Erosion

Accretion Neutral

Low-tide terrace

Erosion

Accretion 16t not exposed

Exposed Bedrock:

YES (NO)

Type:

Drift Direction:

South to north

Driftwood/Wrack

Cross-shore extent of LWD: minimal (1)

Average DBH of 10 nearest logs: 1'

Average Orientation of 10 nearest logs: parallel

Length of Extent of 10 nearest logs: 10'

Barnacles present: YES (NO)

Alongshore consistency: minimal LWD

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 24.688/122 36.521

GPS Landward: 4824.669/122 36.534

Surveyor(s): Gus & Jeff

Cross Section Id: 2

Form Completed by: JDP

Photos

East	7584
West	7582
North	7582
South	~~7585~~
	7586 upper foreshore substrate

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

survey marker b.s.
8.3 to new level
2.5 to old level

X-section

Distance Seaward	Elevation wrt datum	Substate
—	[redacted] 20.8	gravel
0	0	bluff
11	4.4	fill (exposed)
27	12.1	base of bluff/slope
34	13.1	sand
42	14.2	sand
59	16.2	gravel
9[redacted]4	20.4	
[redacted]99	21.1	wsel
112	23.5	
-16	-2.9	marker HDYP 1939 - Photo 7587, 7588

10:07 [redacted] 20.4 [redacted]

Back site
14.7 (old level)
[redacted] (new level)

wrack

lots of shell hash w/ sparse riprap

Upper Beach Modifications

Description: possible fill @ road

Foreshore

Erosion — of bluff

(Accretion) on foreshore

Low-tide terrace

Erosion

Accretion not exposed

Exposed Bedrock:

YES (NO)

Type:

Drift Direction:

east to west

Driftwood/Wrack

Cross-shore extent of LWD:	15'
Average DBH of 10 nearest logs:	10"
Average Orientation of 10 nearest logs:	parallel
Length of Extent of 10 nearest logs:	10'
Barnacles present:	YES (NO)
Alongshore consistency:	100+'

General Notes/Comments:

Cornet Bay Restoration

Project Number: 08-03620-000

Herrera Environmental Consultants

GPS Seaward: 48 24 113 / 122 37 294

Surveyor(s): Gus & Jeff

GPS Landward: 48 24 136 / 122 37 316

Cross Section Id: 3

Form Completed by: JP

Photos

East	7592
West	7591
North	7593
South	7590
Substrate	7589

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	7.6	dune grass/ sand
6	8.6	sand
-31		edge of pavement
20	10.4	to gravel
50	14.8	to Sand
70	15.9	BK sand
100	17.5	sand
108	18.0	wisel muddy sand 11:10
132	19.4	edge of eelgrass
153	19.9	muddy sand eelgrass

Upper Beach Modifications

Description: road fill beyond upper beach

Foreshore

Erosion

(Accretion)

Low-tide terrace

Erosion

(Accretion)

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD: 3-5' (minimal)

Average DBH of 10 nearest logs: 1'

Average Orientation of 10 nearest logs: 45° (mixed)

Length of Extent of 10 nearest logs: <16'

Barnacles present: YES (NO)

Alongshore consistency: increasing to east

Drift Direction:

east to west

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 24 119/12237 348

GPS Landward: 48.24 086/12237 316

Surveyor(s): GSJ

Cross Section Id: 4 (@ stream

Form Completed by: JDP

Photos

East	7592
West	7595
North	7598
South	7597
Substrate	7594

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	7.5	sand overhanging veg/soil line
10	8.5	sand/shell hash
29	10.2	gravel transition
68	14.8	transition back to sand
91	16.7	BKL sand
100	17.3	sand
141	18.1	wsel 11:33
178	19.8	eelgrass
200	20.2	eelgrass

Upper Beach Modifications

Description: none (road 811 beyond end of cross-section)

Foreshore

Erosion

(Accretion)

Low-tide terrace

Erosion

(Accretion)

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD: limited/0 overhanging veg

Average DBH of 10 nearest logs: → 6" (DBH)

Average Orientation of 10 nearest logs: 90°

Length of Extent of 10 nearest logs: ~20'

Barnacles present: YES (NO)

Alongshore consistency: 100'

Drift Direction:

East to west

General Notes/Comments:

Stream flowing 0.1 - 0.5 cfs

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 24 089 / 122 37 354

GPS Landward: 48 24 069 / 122 37 318

Surveyor(s): GSJ

Cross Section Id: 5

Form Completed by: JDP

Photos

East	7602
West	7600
North	7601
South	7603
substrate	7599

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
3	-1	top of bank
5	0	
19	2.3	sign
47	4.0	edge of pavement
[illegible]	[illegible]	edge of pavement
72	5.2	hydrophic sign
100	5.3	small conifer on fill
117	5.3	fill
125	5.4	bulkhead pile @ angle (3rd pile west of 90° corner)
125	9.5	sand bulkhead toe
132	10.2	gravel transition
188	18.1	← begin mix of mud w/ gravel
200	19.4	
208	21.1	

Upper Beach Modifications

Description: wooden bulkhead

Foreshore

Erosion

Accretion Neutral

Low-tide terrace

Erosion

Accretion

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD: None

Average DBH of 10 nearest logs:

Average Orientation of 10 nearest logs:

Length of Extent of 10 nearest logs:

Barnacles present: YES NO

Alongshore consistency: SD

Drift Direction:

east to west

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 4824 076/122 37 373 74

GPS Landward: 4824 060/122 37 354

Surveyor(s): GJ

Cross Section Id: 6

Form Completed by: JPP

Photos

East	7605
West	7607
North	7606
South	7608
up foreshore sub shots	7604

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	5.3	edge of pavement
7	5.3	ER
49	15.6	fill behind bulkhead near 1st pile to west
49	10.6	Sand/shell wash
65	12.5	broken rip rap w/ sand
100	16.7	mix sed
116	18.3	wisel 12:10 - still mix sed
139	20.5	crabs in fines (muddy sand)

Upper Beach Modifications

Description: Creosote bulkhead; riprap 1'

Foreshore

Erosion

Accretion

Low-tide terrace

Erosion

Accretion Nuetral

Exposed Bedrock:

YES NO

Type:

Drift Direction:

unknown

Driftwood/Wrack

Cross-shore extent of LWD: None

Average DBH of 10 nearest logs:

Average Orientation of 10 nearest logs:

Length of Extent of 10 nearest logs:

Barnacles present: YES NO

Alongshore consistency:

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

48 24 067 / 122 37400

GPS south end pavement 48 24 038 122 37 343

GPS Seaward:

GPS Landward: 48 24 052 122 37 369

Surveyor(s): BJS

Cross Section Id: 7

Form Completed by: TDP

Photos

East	7610
West	7612
North	7611
South	7613

up. foreshore substrate 7609

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
-20	8.0	~~boundary~~ brush
-14	2	ditch
0	0.7	edge of pavement (south end)
37' from northend	5.05	BKL parking lot
0		edge of pavement (northend)
33	5.75	fill top of bulkhead
33	9.8	sand
40	10.8	transition to gravelly cobble w/ fines
1821	18.3	wse @ 12:29
161	20.5	(transition to sand) sand

Upper Beach Modifications

Description: creosote bulkhead

Foreshore

(Erosion)

Accretion

Low-tide terrace

Erosion

Accretion Neutral

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD: None

Average DBH of 10 nearest logs:

Average Orientation of 10 nearest logs:

Length of Extent of 10 nearest logs:

Barnacles present: YES NO

Alongshore consistency: 30'

Drift Direction:

east to west

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 24 04 / 122 37 501

GPS Landward: 48 24 046 / 122 37 377

Surveyor(s): GJ

Cross Section Id: 8

Form Completed by: JDP

Photos

East	7617
West	7616
North	7615
South	7618
Substrate	7614

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	5.4	edge of pavement
22	6.6	top eroding bank
70	9.0	bottom of eroding bank / sand
92	10.7	sand/gravel transition
91	14.4	sand w/ cobbles
131	18.3	used 12:43
174	20.7	Sand) near former boat ramp

Upper Beach Modifications

Description: Construction debris

Foreshore

Erosion

Accretion Neutral to erosive

Low-tide terrace

Erosion

Accretion Neutral

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD: limited

Average DBH of 10 nearest logs: <1"

Average Orientation of 10 nearest logs: random

Length of Extent of 10 nearest logs: 1-5'

Barnacles present: YES (NO)

Alongshore consistency: 20-30'

Drift Direction:

East to west

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

AT WSEL!

GPS Seaward: 48 24 042/122 37 425

GPS Landward:

Surveyor(s): GSJ

Cross Section Id: 9

Form Completed by: JDP

Photos

East	7623
West	7622
North	7621
South	7624
substrate	7620

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	4.5	edge of pavement
5.2	5.9	edge of bulkhead
5.8	9.4	sand
5.9	10.5	sand to gravel
7.9	12.9	gravel to sand
10.7	14.8	Sand BKL
15.0	19.2	WSEL (sand) 12:56 near mud transition
19.5	20.	mud
⋮	⋮	⋮
-6.0	4.0	ditch
-15.0	0	marsh

Southern side of parking lot

Upper Beach Modifications

Description: creosote bulkhead

Foreshore

Erosion

(Accretion)

Low-tide terrace

Erosion

(Accretion)

Exposed Bedrock:

YES (NO)

Type:

Drift Direction:

East to west

Driftwood/Wrack

Cross-shore extent of LWD: None

Average DBH of 10 nearest logs:

Average Orientation of 10 nearest logs:

Length of Extent of 10 nearest logs:

Barnacles present: YES NO

Alongshore consistency: 100'

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 4824.020 / 122 37 460

Surveyor(s): GJS

GPS Landward:

Cross Section Id: 10

Form Completed by: JDP

Photos

East	7629
West	7627
North	7628
South	7630
Substrate	7626

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	3.8	restroom corner
62	5.8	bulkhead top
62	3.5	sand
109	14.6	sand/mud transition
151	17.9	mud/sand 1:08) scattered woody debris
170	19.6	mud

Upper Beach Modifications

Description: creosote bulkhead

Foreshore

Erosion

(Accretion)

Low-tide terrace

Erosion

(Accretion)

Exposed Bedrock:

YES (NO)

Type:

Drift Direction:

east to west

Driftwood/Wrack

Cross-shore extent of LWD: limited/random

Average DBH of 10 nearest logs: 6"

Average Orientation of 10 nearest logs: parallel

Length of Extent of 10 nearest logs: 6'

Barnacles present: YES (NO)

Alongshore consistency: 20-30'

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 24 010/122 37 477

GPS Landward: 4823 996/122 37 434

Surveyor(s): L & J

Cross Section Id: 11

Form Completed by: JDP

Photos

East	7634
West	7633
North	7632
South	7635
Substrate	7631

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
—	2.1	south edge of pavement
38	4.1	hill
102	6.2	top of bulkhead
102	10.6	sand
150	14.55	sand w/ cobbles & fines
184	17.8	WSOL = sand/mud transition
220	19.7	eelgrass

> blocked by bathrooms in between

Upper Beach Modifications

Description: Creosote bulkhead

Foreshore

Erosion

Accretion limited

Low-tide terrace

Erosion

Accretion Neutral

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD:	limited
Average DBH of 10 nearest logs:	18"
Average Orientation of 10 nearest logs:	90°
Length of Extent of 10 nearest logs:	50'
Barnacles present:	(YES) some NO
Alongshore consistency:	10-20'

Drift Direction:

West to east

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

GPS Seaward: 48 24002 / 122 37 488

Surveyor(s): G & J

GPS Landward: 48 23 981 / 122 37 454

Cross Section Id: 12 in line w/ culvert

Form Completed by: JDP

Photos

East	7638
West	7640
North	7637
South	7639
Substrate	7636

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
3	3.3	fill/gravel
20	3.3	edge of pavement
35	5.0	driveway
51	8.15	intertidal / sand w/ gravel
		sand w/gravel — line w/ bulkhead
87	11.7	
117	14.3	transition to pure sand
162	17.5	WSEL 1:32 — near mud transition
200	19.4	

Upper Beach Modifications

Description: fill (?)

Foreshore

Erosion

Accretion Neutral

Low-tide terrace

Erosion

Accretion but limited

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD: limited/random

Average DBH of 10 nearest logs: 6"

Average Orientation of 10 nearest logs: random

Length of Extent of 10 nearest logs: 2-3'

Barnacles present: YES (NO)

Alongshore consistency: 10'

Drift Direction:

undetermined

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

@ wsel @ outfall pipe

GPS Seaward: 48 23 953 / 122 37 489

GPS Landward: 048 23 975 / 122 37 568

Surveyor(s): G & J

Cross Section Id: 13

Form Completed by: JDP

Photos

East	7644
West	7642
North	7643
South	7645
substrate	7641

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum
0	3.41
18	
12	8.05
21	9.25
69	14.95
113	18.55
157	20.8

Substate

edge of pavement

tree/bank mowed

invert of culvert on marshside

edge of res/g gravel

wsel

increasing mud

1:58

invert of culvert on south side of road

6.75

1.85 to old setup

3.55 to new setup (further west)

Backside

Culvert running 0.1 - 0.5 cfs

Upper Beach Modifications

Description: limited riprap around culvert

Foreshore

Erosion

Accretion from stream

Low-tide terrace

Erosion

Accretion from stream

Exposed Bedrock:

YES NO

Type:

Drift Direction:

Indeterminant

Driftwood/Wrack

Cross-shore extent of LWD: None

Average DBH of 10 nearest logs:

Average Orientation of 10 nearest logs:

Length of Extent of 10 nearest logs:

Barnacles present: YES NO

Alongshore consistency: 20'

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

@ wsel **GPS Seaward:** 48 23 436 / 122 37 353

GPS Landward: 48 23 420 / 122 37 534

Surveyor(s): G & J

Cross Section Id: 14

Form Completed by: JDP

Photos

East	7649
West	7647
North	7648
South	7650
Substrate	7646

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	4.35	edge of pavement
2	4.55	top of bank
10	6.8	const. debris
25	10.7	wsel/mud/wrack
32	11.2	is mud/wrack
53	10.5	marsh plants (dry)
59	11.45	edge of veg/gravel
99	15.8	gravel/sand transition
122	18.58	wsel/sand/ 2:10 mud transition
154	20.65	mud no eelgrass

Upper Beach Modifications

Description: Construction debris along roadway

Foreshore

Erosion

Accretion Neutral

Low-tide terrace

Erosion

Accretion not exposed, possibly

Exposed Bedrock:

YES (NO)

Type:

Driftwood/Wrack

Cross-shore extent of LWD:	20'
Average DBH of 10 nearest logs:	12"
Average Orientation of 10 nearest logs:	~30°
Length of Extent of 10 nearest logs:	15'
Barnacles present:	YES (NO)
Alongshore consistency:	20'

Drift Direction:

indeterminant

General Notes/Comments:

Cornet Bay Restoration

Herrera Environmental Consultants

Project Number: 08-03620-000

@wsel **GPS Seaward:** 48 23924/122 37 572

GPS Landward: 48 23909/122 37 596

Surveyor(s): GSJ

Cross Section Id: 15

Form Completed by: JP

Photos

East	7654
West	7652
North	7653
South	7655
Substrate	7651

Boulder	> 256 mm
Cobble	64 - 256 mm
Gravel	2 - 64 mm
Sand	0.0625 - 2 mm
Silt	0.002 - 0.0625 mm
Clay	< 0.002 mm

X-section

Distance Seaward	Elevation wrt datum	Substate
0	5.0	edge of pavement
53	6.05	top eroding bank
62	9.85	edge of veg / bottom of bank ↓ gravel
108	15.7	gravel / sand transition
135	18.1	wsel sand/mud transition 2:21
173	20.35	mud

6.65 top of culvert between x-sec 14 & 15

6.2 wsel in marsh south of road

Upper Beach Modifications

Description: Bill (unprotected)

Foreshore

(Erosion) Slight

Accretion

Low-tide terrace

Erosion

(Accretion) Neutral to Slight

Exposed Bedrock:

YES (NO)

Type:

Drift Direction:

east to west

Driftwood/Wrack

(twiss < 1" DBH) small wrack only

Cross-shore extent of LWD:

Average DBH of 10 nearest logs:

Average Orientation of 10 nearest logs:

Length of Extent of 10 nearest logs:

Barnacles present: YES NO

Alongshore consistency: 50'

General Notes/Comments:

APPENDIX C

Environmental Considerations and Constraints, Cornet Bay – Hoypus Point, Deception Pass State Park

ENVIRONMENTAL CONSIDERATIONS AND CONSTRAINTS

Cornet Bay – Hoypus Point, Deception Pass State Park

Prepared for

Washington State Parks and Recreation and Island County MRC
(Marine Resources Committee)

Prepared by

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November 25, 2009

Contents

Tables

Figures

Executive Summary

There are a number of environmental constraints that should be taken into consideration during project design for Deception Pass State Park improvements at Cornet Bay – Hoypus Point. Environmental constraints include regulated environmental features (critical areas) and their associate buffers that may be affected by project activities. Based on review of pertinent background information and on-site observations, critical areas found within the project area likely include wetlands and jurisdictional ditches, fish and wildlife habitat conservation areas (FWHCA), geologic hazard areas (i.e., steep slopes and highly erodible soils), and shoreline areas (Figures 1 and 2). Since the purpose of this document is to inform and support the Basis of Design (BOD) for the project, information provided herein focuses on environmental constraints in portions of the project area where construction activities may impact regulated environmental features.

County, State, and Federal agencies implement rules and requirements that protect the water quality, habitats, physical and ecological processes, and associated critical areas around Cornet Bay (Island County 2008a). These agencies include Island County Department of Planning and Community Development, Washington State Parks and Recreation, Washington State Department of Health, Washington State Department of Fish and Wildlife (WDFW), National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NOAA Fisheries), U.S. Fish and Wildlife Service (USFWS), Washington Department of Natural Resources (WDNR), U.S. Army Corps of Engineers, and Washington State Department of Ecology.

Protection measures for regulated environmental features include permit administration, establishment of buffers, resource assessment and documentation requirements, and discussions/consultation with appropriate regulatory agencies. A summary of environmental considerations and constraints likely to directly influence design project considerations are provided in Table 1 and on Figures 1 and 2. A summary of likely required permits and compliance processes is provided in Table 2.

All information provided herein represents an approximation and general description of environmental constraints likely to affect the project compiled from on-site observations and review of existing background information. Efforts were made to provide an estimate of maximum feature extent and buffer requirements, in order to provide the project team with an idea of the maximum constraints requiring consideration during the design process. More thorough site assessments, including wetland delineations, Ordinary High Water Mark (OHWM)[1] determinations, and habitat surveys, may be required as part of environmental compliance and permitting for implementation of planned project activities. Also, buffer widths are all subject to modification by the Island County Planning Director (Planning Director) upon review of site conditions and project plans.

[1] While Island County uses the OHWM as a basis for some Critical Areas regulations, other regulatory agencies use the high tide line (or similar) as the boundary that defines their jurisdictional authority. To prevent confusion with regard to this terminology, and to be consistent with the definitions used by these agencies' regulatory language, this document uses the two terms as provided in applicable codes and/or regulations.

Table 1. Summary of environmental considerations and constraints associated with on-site environmental features potentially influencing project design at Cornet Bay – Hoypus Point, Deception Pass State Park.

Environmental Feature	Consideration/Constraint
Wetlands and jurisdictional ditches[2]	Buffers based on wetland characteristics (Wetland Rating from Island County Wetland Identification Guide). Triggers the requirement for an Island County Alteration Approval, supported by appropriate documentation (e.g., Wetland Report), applicable permits listed in Table 2, and mitigation measures (e.g., restoration). ▪ Mature forested wetlands[3] ~ 200 feet ▪ Shoreline forested and scrub-shrub wetlands (native plant wetland) ~ 110 feet ▪ Estuarine wetlands ~ 55 feet
Areas with which endangered, threatened, and sensitive species listed by the federal or state government have a primary association	Federal nexus (e.g., CWA Section 404 permit) triggers the requirement for appropriate documentation and ESA Section 7 consultation with NOAA Fisheries and USFWS. Presence of state protected species triggers the requirement for appropriate documentation and discussions with Island County, WDFW, WDNR WNHP, or other applicable agencies.
Forage fish spawning areas	Buffers are standard width and based on OHWM. Triggers the requirement for an Island County Alteration Approval, supported by appropriate documentation (e.g., Island County Biological Site Assessment [BSA] and Habitat Management Plan [HMP]) and mitigation measures (e.g., stormwater management plan). ▪ ~75 feet landward of OHWM
Kelp and eelgrass beds	Buffers are standard width and based on OHWM. Triggers the requirement for an Island County Alteration Approval, supported by appropriate documentation (e.g., BSA and HMP) and mitigation measures (e.g., stormwater management plan). ▪ ~75 feet landward of OHWM
Bald eagle	Buffers based on distance from nesting area. Triggers the requirement for the preparation of a BSA and Bald Eagle Management Plan (level of effort determined by distance of proposal to nesting area – plan approval by WDFW required) and habitat preservation requirements, including tree clearing restrictions. ▪ ~800 feet of nest site ▪ ~250 feet from OHWM of shoreline in all areas within 1/2 mile of nest ▪ Communal roosting area - ¼ mile (not depicted on Figure 1)
Blue heron	Buffers based on distance from nesting area. Triggers the requirement for providing nest location information on site plans and the preparation of a BSA and HMP, to be approved by Island County. WDFW should also be consulted. ▪ ~1,000 feet of nest site ▪ The presence of a rookery may require adherence to construction windows that avoid the breeding season (commences January-March, concludes July-September) or that ensure minimization of disturbance.

[2] Although jurisdictional ditches are not regulated by Island County and do not receive buffers, they are subject to U.S. Army Corps of Engineers CWA Section 404 requirements.

[3] No Alteration of a Mature Forested Wetland (Category A Wetland) is permitted in Island County, unless project activities are determined by the Planning Director to fall under the criteria for Reasonable Use (ICC 17.02A.050.B) or Exempt Activities and Uses (ICC 17.02A.060).

Table 1 (continued). Summary of environmental considerations and constraints associated with on-site environmental features potentially influencing project design at Cornet Bay – Hoypus Point, Deception Pass State Park.

Environmental Feature	Consideration/Constraint
Osprey	Buffers based on distance from nesting area. Triggers the requirement for providing nest location information on site plans and the preparation of a BSA and HMP, to be approved by Island County ▪ ~600 feet of nest site
Steep slopes	Buffers are based on height of steep slope. Triggers the requirement for Island County Alteration Approval, supported by appropriate documentation (e.g., Geotechnical Report), applicable permits listed in Table 2, and mitigation measures (e.g., erosion control plan). ▪ ~50 foot setback or greater from a slope that is between 10 feet and 30 feet in height ▪ ~75 foot setback or greater from a slope that is between 31 feet and 50 feet in height ▪ ~100 foot setback or greater from a slope that is greater than 50 feet in height
Highly Erodible Soils	Triggers the requirement for Island County Alteration Approval, supported by appropriate documentation (e.g., Geotechnical Report), applicable permits listed in Table 2, and mitigation measures (e.g., erosion control plan).
Shoreline areas	Triggers the requirement for appropriate shoreline development compliance, including applicable permits listed in Table 2. ▪ 200 feet landward of the OHWM of waters subject to the Washington State Shoreline Management Act ▪ Any wetlands associated with waters subject to the Washington State Shoreline Management Act
Likely work windows associated with each fish species expected at the project site. The approved work window will be the common days between all approved work windows.	▪ Puget Sound Chinook salmon: July 2 through March 2 ▪ Bull trout: July 16 through February 15 ▪ Pacific herring: April 15 through January 31 ▪ Pacific sand lance: March 2 through October 14 ▪ Surf smelt: Year-round closure; work window must be negotiated directly with the WDFW and the US Army Corps of Engineers ▪ Puget Sound steelhead: No approved work window has been established at this time; a site-specific work window to protect steelhead will be determined by NOAA Fisheries during the project consultation

Table 2. Summary of permit applications and compliance processes likely required in association with project activities at Cornet Bay, Deception Pass State Park.

Jurisdiction/Agency	Permit/Compliance
U.S. Army Corps of Engineers (Corps)	Clean Water Act Section 404 permit
U.S. Army Corps of Engineers	Rivers and Harbors Act of 1899 Section 10 permit
NOAA Fisheries and USFWS	Endangered Species Act, Section 7 consultation
Washington State Department of Ecology	Clean Water Act Section 401, Water Quality Certification
Washington State Department of Ecology	Coastal Zone Management Certification
Washington State Department of Fish and Wildlife	Hydraulic Project Approval
Washington State Department of Fish and Wildlife	Bald Eagle Management Plan
Washington State Department of Natural Resources	Use Authorization of State-Owned Aquatic Lands
Washington State Parks	Section 106/EO 05-05 compliance (cultural resources)
Washington State Parks or Island County	SEPA
Island County	Clearing and Grading Permit (including Critical Areas compliance)
Island County	Building permit
Island County	Shoreline Substantial Development Permit

Impacts to critical areas or their buffers should be avoided and minimized to the extent possible, but if impacts are deemed unavoidable, appropriate mitigation measures as determined by the governing jurisdiction or agency will likely be required as compensation. However, some of the restoration of elements of this project (e.g., bulkhead removal) may satisfy such requirements.

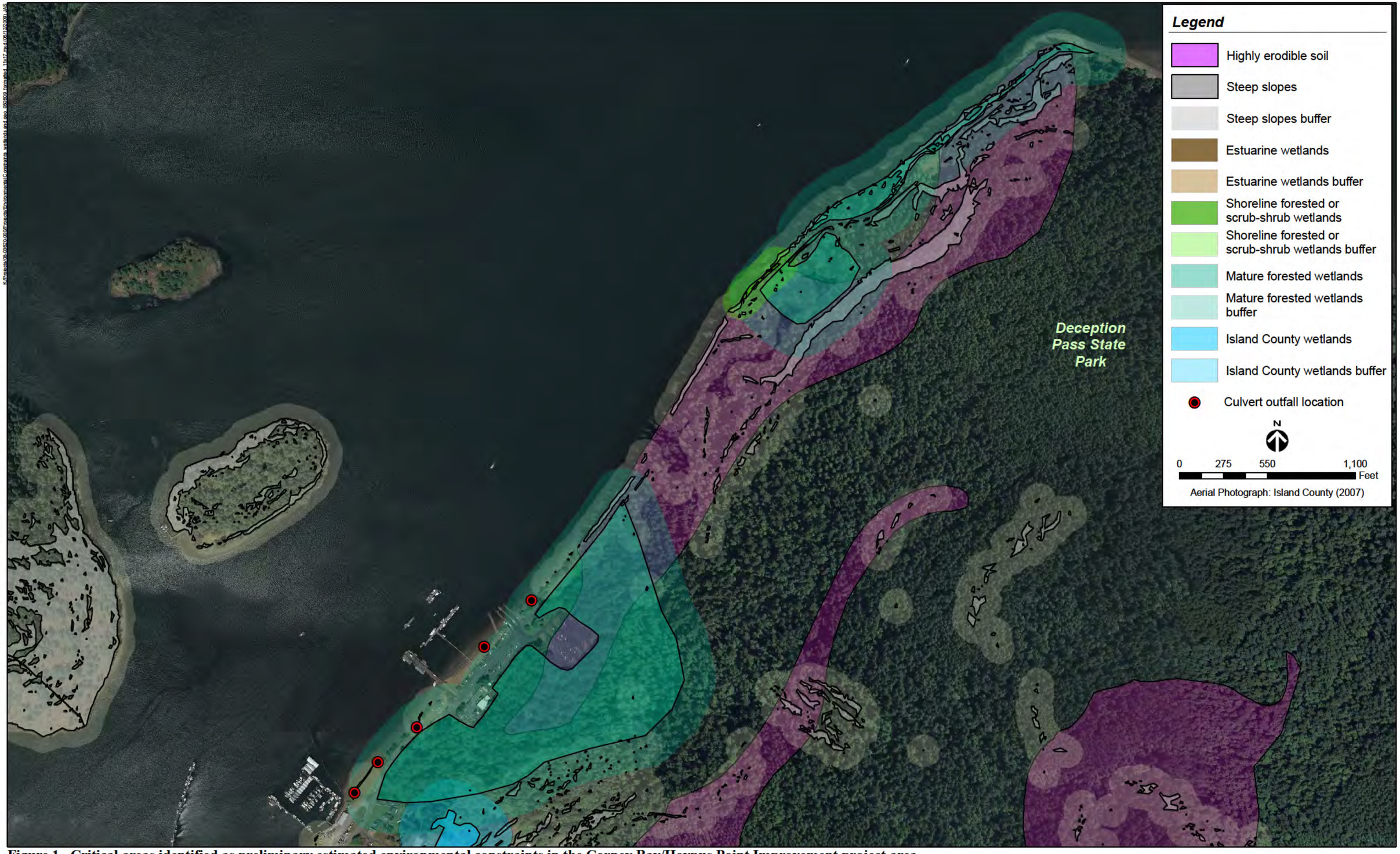

Figure 1. Critical areas identified as preliminary estimated environmental constraints in the Corney Bay/Hoypus Point Improvement project area.

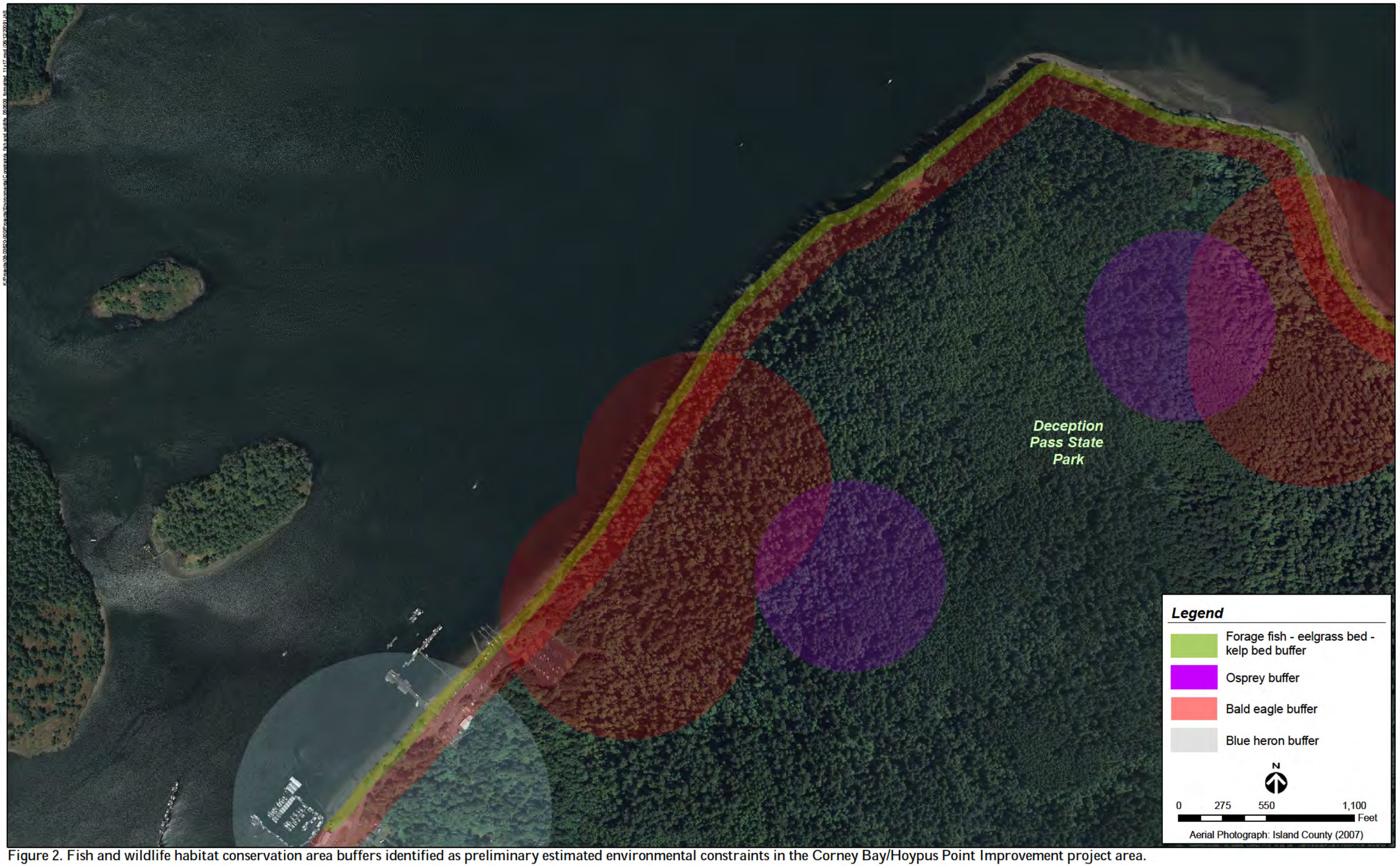

Figure 2. Fish and wildlife habitat conservation area buffers identified as preliminary estimated environmental constraints in the Corney Bay/Hoypus Point Improvement project area.

Introduction

Overview

There are a number of environmental constraints that should be taken into consideration during project design for Deception Pass State Park improvements at Cornet Bay – Hoypus Point. Environmental constraints include regulated environmental features (critical areas) and their associate buffers that may be affected by project activities. Based on review of pertinent background information and on-site observations, critical areas found within the project area likely include wetlands and jurisdictional ditches, fish and wildlife habitat conservation areas (FWHCA), geologic hazard areas (i.e., steep slopes and highly erodible soils), and shoreline areas (Figures 1 and 2). Since the purpose of this document is to inform and support the Basis of Design (BOD) for the project, information provided herein focuses on environmental constraints in portions of the project area where construction activities may impact these regulated critical areas.

Regulatory Framework

County, State, and Federal agencies implement rules and requirements that protect the water quality, habitats, processes, and associated critical areas around Cornet Bay – Hoypus Point (Island County 2008a). These agencies include Island County Department of Planning and Community Development, Washington State Parks, The Washington State Department of Health, Washington State Department of Fish and Wildlife (WDFW), National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, U.S. Fish and Wildlife Service (USFWS), Washington Department of Natural Resources (WDNR), U.S. Army Corps of Engineers, and Washington State Department of Ecology.

The project area is in Island County and is subject to Island County regulations; specific on-site environmental features classified as critical areas will be regulated. Information regarding regulations provided herein is based on the Island County Code (ICC), specifically the New Critical Areas Ordinance (Chapter 17.02A, Effective July 1, 2008), and includes all Critical Areas Ordinances except Fish and Wildlife Habitat Conservation Areas and Geologically Hazardous Areas), the Old Critical Areas Ordinance (for Fish and Wildlife Habitat Conservation Areas, ICC 17.02.050.C – as of 4/2009, this section in the process of being updated), which are found in Chapters 17.02 and 17.02A, respectively, of the ICC. Other pertinent ICC sections likely affecting the project include the Land Development Standards ordinance (ICC 11.01), the Clearing and Grading ordinance (ICC 11.02, includes Geologically Hazardous Areas), the Stormwater Management ordinance (ICC 11.03), and the Zoning Code (ICC 17.03).

Island County's mechanism for protecting regulated critical areas is to limit development within the critical area and to provide a protective buffer of sufficient width to protect the ecosystem

functions of the critical area, or in the case of geologic hazards, to protect public safety. Buffer and mitigation requirements for critical areas can vary significantly depending on the critical area, quality of habitat, nature of proposed impact, and degree of hazard (e.g., for steep slopes), in addition to other criteria. Implementation of these protective measures is accomplished through a Critical Areas Review and permitting processes (ICC 17.02A.040). Island County requires that all critical areas and their buffers be shown on all site plans (ICC 17.02A.040.B.4). An Island County Clearing and Grading permit is required for any clearing, filling, or excavation, in any quantities, within 200 feet of a regulated shoreline or critical area (ICC 11.02.080).

Shorelines are protected by the Island County Shoreline Master Program (SMP) and the Washington State Shoreline Management Act (SMA). With regard to applicability for this project, shoreline jurisdiction extends 200 feet landward of the Ordinary High Water Mark (OHWM) or MHHW where applicable and includes any wetlands associated with tidal waters subject to the SMA (ICC 17.05.040, RCW 90.58.030(2f), WAC 173-16-030(17), and WAC 173-22-030(10)). The overall goal of the SMP is to permit shoreline development so that it occurs in harmony with natural conditions and processes. This goal is stated as to: "*assure that conservation and development of Island County's shorelines are balanced, orderly, in suitable locations and done with minimum disruption to the natural environment.*" The rule has an overall goal of avoiding alteration of nearshore processes and habitats and translates to a permitting process that ensures that development along its shorelines is low-intensity. Shoreline areas are regulated under Island County's Shoreline Use Regulations, which are found in Chapter 17.05 ICC, which describes compliance requirements for shoreline uses. The entire shoreline associated with Cornet Bay, Deception Pass State Park falls under a "conservancy" shoreline designation (Island County 2004, Island County 2008b). Restoration of the shoreline to more natural conditions (e.g., bulkhead and associated fill removal) is consistent with these objectives.

Section 404 of the Clean Water Act (CWA) regulates the placement of fill materials in waters of the United States, which include wetlands (33 CFR 1344). The U.S. Army Corps of Engineers administers the permitting program under this law (high tide line[4] marks the landward extent of jurisdiction). Such permits include nationwide (general) permits for small areas of fill and individual permits for projects that require larger areas of fill. The U.S. Army Corps of Engineers does not regulate wetland buffers. Section 10 of the Rivers and Harbors Act of 1899 regulates structures and/or work in or affecting the course, condition, or capacity of navigable waters of the United States (mean high water[5] marks the landward extent of jurisdiction). In addition, Washington Department of Fish and Wildlife (WDFW) requires a Hydraulic Project Approval (HPA) permit for any work proposed waterward of the OHWM.

Section 401 of the Clean Water Act mandates that the State regulate water quality in association with impacts to aquatic resources (33 CFR 1341). The Washington State Department of Ecology, through their water quality standards (173-201A), administers the permits for compliance with this federal law in conjunction with application for any Section 404 permit.

[4] MHHW for the purposes of this document.
[5] MHHW for the purposes of this document.

All wetlands and aquatic habitats identified in this report are likely subject to U.S. Army Corps of Engineers jurisdiction as either jurisdictional wetlands or as "other waters of the United States." Mitigation and buffer requirements will, however, differ among the various wetland and aquatic resource types, and individual evaluation will be required if any impact to these areas is anticipated.

All species and critical habitats listed under the Endangered Species Act are protected under federal law, and the federal nexus of the project (e.g., CWA Section 404 permit) will likely trigger a required consultation with NMFS and USFWS during the planning process, given the potential presence of these species in the vicinity of the project area. Bald eagles are protected under the federal Bald and Golden Eagle Protection Act (16 USC 668), the federal Migratory Bird Treaty Act (50 CFR 10), and the Washington State Bald Eagle Protection Act (RCW 77.12.655). Other state-protected species are managed by WDFW and WDNR.

Methods

Review of Available Background Information

A review of existing data sources was conducted to obtain information on known site conditions prior to execution of field work. Data sources consulted for this review included:

- USFWS National Wetland Inventory (NWI) and Island County Wetland Inventory wetland data (Island County 2008a)
- Island County Code (ICC) (Island County 2008c)
- Bald eagle and osprey nest data (Island County 2008a).
- WDFW PHS list (WDFW 2008)
- NOAA Fisheries West Coast Salmon and Steelhead Status (updated September 2008)
- WDNR Washington Natural Heritage Program (WNHP) data for Island County (2009)
- Island County Critical Areas map (Island County 2008b)
- Island County Wetland Identification Guide (2008d)
- Cornet Bay Watershed Report (Island County 2008a)
- Biological Evaluation for the Cornet Bay Marine Area Improvements (CH2M Hill 2003)
- Water Resources Inventory Area 6 Multi-species Salmon Recovery Plan (Island County 2005)
- Skagit Chinook Recovery Plan (Beamer et al. 2005)

On-site Preliminary Assessment of Project Environmental Constraints

Field work conducted on March 27, 2009, comprised a preliminary assessment of critical areas to help inform initial project concept development and design. All information provided in this report therefore represents an approximation and general description of environmental

constraints likely to affect the project compiled from on-site observations and review of existing background information.

Information on sensitive habitats and species provided below has been compiled from existing sources of information, the most recent of which was provided in 2008. For this reason, it is recommended that State Parks request current WDFW Priority Habitats and Species (PHS) data and WDNR Washington Natural Heritage Program (WNHP) rare plant data for the Cornet Bay area and consult with the WDFW local habitat biologist and WNHP biologist to ensure that all protected species are considered during project planning.

Efforts were made to provide an estimate of maximum feature extent and buffer requirements, in order to provide the project team with an idea of the maximum constraints requiring consideration during the design process. Likewise, the map provided in Figure 1 represents an approximation of the locations and extents of on-site environmental features and depicts the maximum estimated buffer widths for these features. Thorough site assessments, including wetland and stream delineations, OHWM determinations, and species and habitat surveys, will likely be required as part of environmental compliance and permitting for implementation of planned project activities.

Investigation of Applicable Regulatory Requirements

Applicable regulatory information pertaining to on-site environmental features was investigated to determine constraints and requirements for project activities (e.g., buffers, mitigation requirements, etc.). Information consulted included the Island County Code and pertinent State and Federal regulations (see Regulatory Framework section). Information pertaining to these regulations for on-site environmental features is included in the corresponding sections below. Once again, the information provided herein is simply an approximation of the maximum environmental constraints that may face the project and is intended for use in consideration during planning and design phases and determination of actual regulatory requirements that should follow the complete critical areas survey.

Results

Data collected during the existing background information review were combined with features identified during field work to provide a comprehensive depiction of on-site environmental constraints (Figures 1 and 2). Preliminary investigation revealed the presence of wetlands, jurisdictional ditches, shoreline areas, fish and wildlife habitat conservation areas, and geologic hazard areas (i.e., steep slopes and highly erodible soils). As mentioned, this is not intended to be an exhaustive list of on-site regulated environmental features, as it is only based on preliminary investigation. The following sections are arranged according to the organization of critical area information presented in the Island County Code, in order to facilitate ease of reference to local regulations affecting the project.

Wetlands and Jurisdictional Ditches

Wetlands

Island County defines wetlands as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturated soil conditions (ICC 17.02A.030). Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands do not include artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands include those artificial wetlands intentionally created from non-wetland areas created to mitigate prior wetland impacts (ICC 17.02A.030).

In Island County, wetlands are classified by the Planning Director based on wetland type, resulting Wetland Categories A-E (ICC 17.02A.090.E). In summary, wetland category is generally based on wetland function, rarity, and significance to wildlife.

Island County regulates all Category A, B, C, and D wetlands ≥1,000 square feet, all Category E wetlands ≥5,000 square feet, and all wetlands smaller than these criteria that (a) are part of a mosaic wetland, (b) contain either a Protected Species or a Species of Local Importance, or (c) receive a rating score of ≥50 percent (ICC 17.02A.090.A).

The project area is characterized by the presence of a number of regulated wetland habitats, likely ranging from freshwater forested wetlands to shoreline forested wetlands to estuarine wetlands. Other wetland types may also be present. [Note: Many of the large wetland complexes are not identified by the Island County Wetland Inventory (Island County 2008a and 2008b), but ICC 17.02A.080.B states that not all wetlands in Island County have been captured by this inventory. The primary means by which new wetlands are identified and the inventory is updated is through development proposals (Island County 2009). Because no development has occurred in observed wetland portions of the State Park since inception of wetland regulations, it

stands to reason that they would not be included in Island County's inventory. In addition, Island County (2008a) states that since forested wetlands are difficult to identify using remote sensing (method for NWI's inventory), "the number and size of wetlands in this area is likely underestimated by all sources."

Submittal of a wetland report prepared by a wetland professional will likely be required by Island County for this development proposal, because the project is located on a lot that likely contains or is affected by a wetland or a wetland buffer (ICC.17.02A.090). Compliance with other Island County ordinances is also required (e.g., stormwater management).

All wetlands observed within the project area appear to exhibit a nexus with Puget Sound (i.e., they exhibit a hydrologic connection, via surface water or groundwater flow), which is a Traditionally Navigable Water (TNW) of the United States, rendering them subject to U.S. Army Corps jurisdiction under CWA Section 404.

Following is a brief description of each of the wetland types observed within the project area, including mature forested wetlands, estuarine wetlands, and shoreline forested and scrub-shrub wetlands.

Mature Forested Wetlands

Based on this preliminary investigation, many portions of the project area adjacent (east) to the existing impervious footprint and some areas adjacent to the road leading to Hoypus Point are likely to be classified by Island County as Category A, with a Habitat Function Score >40, Mature Forested Wetlands (ICC 17.02A.030, ICC 17.02A.090.E). These areas exhibited significant indicators of wetland hydrology (i.e., surface water present to 3-inch depth in some places during site visit), wetland vegetation, and are dominated by mature conifers (Sitka spruce and Western red cedar) >18 inches (minimum DBH for this category) in diameter. Mature forested wetlands appear to abut portions of the project area potentially slated for construction activity, including the day use parking lot. The suspected presence of wetlands in this area is supported by the mapped presence of Norma Silt Loam, which is identified as a hydric soil (NRCS 2006). In addition, this area is also adjacent to a large mapped wetland complex identified by Island County (Figure 1) (Island County 2008b).

The nature of the wetland habitats within this area is often convoluted, because upland species occur commonly within these wet areas (e.g., sword fern): they have established themselves in drier areas of the micro-topographically diverse habitat. This is a common phenomenon in some Pacific Northwest forested wetlands (Environmental Laboratory 2008). The U.S. Army Corps of Engineers explicitly identifies coastal Sitka spruce wetlands as a model for this situation: non-hydrophytic vegetation is often rooted on top of large tree roots or downed logs rather than in the soil substrate [6] (Environmental Laboratory 2008).

[6] Plants not rooted in the soil should not be considered in hydrophytic vegetation decisions (Environmental Laboratory 2008).

Care should be made to discern this natural wetland type, which may at first appear to be a wetland mosaic, from an actual mosaic wetland, which also likely occurs in other portions of the project area. In these situations, upland vegetation occurs on hummocks or ridge areas within a wetland matrix, and for this reason, the U.S. Army Corps of Engineers also has a separate sampling protocol for mosaic wetlands (Environmental Laboratory 2008). In Island County, mosaic wetlands are defined as a group of two or more wetlands less than 1 acre in size, located on average less than 100 feet apart, and at least 50 percent of the surface of the wetland and upland taken together is composed of wetlands (ICC 17.02A.030). The group of wetlands, including the upland area between the wetlands, will be regulated as one mosaic wetland (ICC 17.02A.030).

The Island County buffer widths for these two wetland types vary significantly – with mosaic wetlands requiring significantly smaller buffers (ICC 17.02A.090). Since the objective of this assessment is to provide the maximum estimated buffer width, and since a thorough delineation to determine the boundaries of these habitats has not been completed, these areas are treated as if they all were mature forested wetlands for the purposes of this documentation. In addition, ICC 17.02A.090 requires that the classification that provides the greatest protection shall be used for wetlands that exhibit the characteristics of more than one type.

Estuarine Wetlands

Based on this preliminary investigation, portions of the project area along the shoreline characterized by tidal marsh vegetation are likely to be classified by Island County as Category C, Estuarine Wetlands (Habitat Functions Score likely ICC 17.02A.030, ICC 17.02A.090.E). These habitats are dominated by pickleweed and saltgrass. These wetlands are identified as being particularly important for anadromous fish, and therefore represent a special case subset of this wetland category (ICC 17.02A.090.F). Estuarine Wetlands are found most often in narrow bands along the shoreline within the developed area of the park in the protected Cornet Bay area, but do not generally occur in the sections of the shoreline characterized by the presence of bulkheads (i.e., armored shorelines). The presence of this habitat type within the project area diminishes as the substrate coarsens moving northeast along the less protected shoreline toward Hoypus Point.

Shoreline Forested and Scrub-Shrub Wetlands

Based on this preliminary investigation, portions of the project area along the shoreline characterized by scrub-shrub and young forested wetland vegetation are likely to be classified by Island County as Category D, Native Vegetation Wetlands (Habitat Function Score likely 29-39) (ICC 17.02A.090.E). These areas occur in areas of lower topography along the generally low-bluff-dominated shoreline to the northeast of the main Park day use area – they are often associated with slumps or failures in the existing roadbed. Their hydrology is likely driven by groundwater expression facilitated by the marked elevation drop to the shoreline from the hillslope above, and their plant communities are characterized by typical Puget Sound coastal and hydrophytic vegetation, including western red cedar, hooker's willows, red alder, and salmonberry, Nootka rose, and Pacific crabapple.

Wetland Buffers

A buffer is defined as the area adjacent to the outer boundary of a critical area that protects the critical area from alterations caused by a development proposal (ICC 17.02A.030). Wetland buffers are presumed to be well-vegetated (may include some non-native species) to a degree adequate to protect wetland functions.

As mentioned previously, the scale of protection measures imposed by Island County in the form of buffers depends significantly on the quality of the resource, its sensitivity to impacts, and the land use intensity of the proposed project. Buffer widths are generally determined by Wetland Rating (Wetland Functions Score) and not by wetland category, except in the instance of special case buffers for specific wetland types (ICC 17.02A.090.F). Since formal establishment of wetland rating, wetland category, land use intensity, and wetland buffer size can only be accomplished by the Planning Director following extensive review of development proposal and worksheets from the Island County Wetland Identification Guide (Island County 2008d) and/or a wetland report, information provided in Table 3 comprises strictly an estimate of maximum buffer widths and constraints. As mentioned before, other wetland types may also be present. Buffers may be modified under authority of the Planning Director on a case-by-case basis (ICC.17.02A.090.G).

Table 3. Estimated maximum buffer widths and wetland characteristics for observed wetlands at Cornet Bay, Deception Pass State Park during preliminary field investigation.

Potential Wetland Type	Estimated Island County Wetland Category	Estimated Island County Habitat Functions Score	Estimated Buffer Width (for medium land use intensity in Island Co.)
Mature forested wetlands	A	>40	200 ft
Shoreline forested and scrub-shrub wetlands (Native Plant Wetlands)	D	29-39	110 ft
Estuarine wetlands	C[1]	Not needed[1]	55 ft

Information on Island County's Wetland Classification System and wetland categories is provided on page 825 of the County code (ICC 17.02A.090.E). Special case buffers have been identified for specific wetland types (ICC 17.02A.090.F.3), including estuarine wetlands, but all other buffer widths are determined through consideration of both habitat (Habitat Functions Score using the Habitat Rating System[7] found in the Island County Wetland Identification Guide) and water quality functions. If the Habitat Functions Score is determined to be ≥22, parameters in ICC 17.02A.090.F.4 should be used for determining buffer width. If the Habitat Functions Score is determined to be <22, parameters in ICC 17.02A.090.F.6 (Water Quality Buffers) should be used for determining buffer width.

[7] ICC page 795 indicates that Ecology's *Washington State Wetland Rating System for Western Washington – Revised* can be used to determine habitat score; however, Island County 2009 mandates that the Island County Buffer Worksheet – which determines Habitat Functions Score – be completed for EVERY development proposal.

As mentioned, determination of buffer width can only be accomplished following an assessment of land use intensity, which is based on the type, character, density, and location of the proposed development (ICC 17.02A.030 and 17.02A.090.D). Through preliminary completion of the Land Use Intensity Worksheet in the Island County Wetland Identification Guide and discussion with Island County Planning, it appears that this project would fall under a Medium Intensity Land Use (Craven 2009; Island County 2009). However, formal determination of land use intensity can only be made by the Planning Director.

For activities covered under the clearing and grading permit, all wetland buffers shall be temporarily marked when they are within 100 feet of identified and approved clearing limits. For construction of new structures, all wetlands and wetland buffers shall be temporarily marked as required by the Planning Director. Temporary markers shall be removed upon completion of the approved development proposal (ICC 17.02A.040.B.4).

Jurisdictional Ditches

Many ditches were also observed within the project area – some of these meet the three parameter criteria required for a wetland determination and others display indicators of relatively-permanent flow. Both of these scenarios, when coupled with a nexus to a TNW, render them jurisdictional under CWA 404. Wetland ditches meeting these criteria are classified as wetlands, whereas the second scenario triggers classification as jurisdictional ditches. Although jurisdictional ditches are likely not regulated by Island County, they are still subject to CWA Section 404 requirements.

Fish and Wildlife Habitat Conservation Areas

The following habitats and species potentially occurring within the project area are designated by Island County as Fish and Wildlife Habitat Conservation Areas (FWHCA) (ICC 17.02.050.C.2):

- Areas with which endangered, threatened, and sensitive species listed by the federal or state government have a primary association
- Streams (survey verification required)
- Kelp and eelgrass beds
- Forage fish spawning areas
- State natural area preserves or state natural resource conservation areas
- Island County species and habitats of local importance
- WDNR WNHP identified high quality ecosystems

In Island County, when a development proposal is located on lands which may contain a FWHCA (other than just bald eagle nesting territories) or when the applicant proposes to alter a

standard buffer, a Biological Site Assessment (BSA) is required (ICC 17.02.050.C.2). As mentioned previously, if the proposal is in an area potentially occupied by an ESA-listed species (and the project is characterized by a federal nexus), consultation with USFWS and NOAA Fisheries is required – this may occur in lieu of a BSA, as determined by the Planning Director. A BSA shall be prepared by the County or a qualified professional biologist, plant ecologist, or similarly qualified professional with experience assessing the relevant species and/or habitats and shall adhere to requirements in ICC 17.02.050.C.2. The level of detail in a BSA shall be determined by the Planning Director and shall be commensurate with the location, size, and impacts of the project proposal.

For non-residential development such as this project, a site plan must show all Fish and Wildlife Conservation Areas occurring within 100 feet of the area proposed for development, but for heron and osprey (both are identified as species of Local Importance) the minimum distance that triggers the need for mapping and a BSA is increased to 1,000 feet for heron and 600 feet for osprey. Site plans must also show nest locations for these species when these buffers fall within the project area.

Habitat Management Plans (HMPs) are required in association with a BSA (sometimes they can be combined) and shall be prepared by a professional ecologist or biologist and submitted to the county for approval (ICC 17.02.050.C.9). The Planning Director shall be consulted to determine what level of documentation is required. Compliance with other Island County ordinances (e.g., stormwater management) is also required.

It should be noted that Island County is currently in the process of updating the FWHCA portion of the Critical Areas code, with release scheduled for 2009. Amendments to environmental constraints and project requirements may be necessary following these updates.

Areas with which Endangered, Threatened, and Sensitive Species Listed by the Federal or State Government Have a Primary Association

The presence of one or more of the following species and/or critical habitats triggers the designation of a given area under this portion of ICC 17.02.050. These species are protected at the federal level by the Endangered Species Act (ESA) or other laws or at the State level as endangered, threatened, or sensitive species[8]. There are also a number of marine species that may be present in various life history stages within the project area (e.g., rockfish). Essential habitat (Essential Fish Habitat [EFH]) for these species is protected under the Magnuson Stevens Fishery Conservation and Management Act. During the environmental documentation and permitting process for this project, all of these species, and likely others, need to be considered as their use of the project area may affect project design[9].

[8] As the status of protected species may change, it is critical to research the current status of listed species on the NOAA Fisheries, USFWS, WDFW, and WDNR WNHP websites

[9] As previously mentioned, other protected species may be present, so it is recommended that WDFW PHS and WDNR WNHP data be requested to determine the full extent of FWHCA constraints to the project.

Fish and Marine Species

The USFWS (2009) lists the following species and critical habitats as occurring in Island County that are protected under the ESA:

- Bull trout
- Bull trout critical habitat

The NOAA Fisheries Northwest Regional Office (2009) lists the following species and critical habitats as occurring in Puget Sound that are protected under the ESA:

- Puget Sound Chinook salmon
- Chinook salmon critical habitat
- Hood canal summer chum
- Puget Sound steelhead
- Southern resident killer whale
- Southern resident killer whale critical habitat
- Humpback whale
- Steller sea lion
- Leatherback sea turtle

The Puget Sound Chinook salmon Evolutionarily Significant Unit (ESU), Puget Sound Steelhead Distinct Population Segment (DPS), and Hood Canal summer chum ESU are listed as threatened at the federal level (NOAA Fisheries 2008, Island County 2005). The U.S. Fish & Wildlife Service (USFWS) has listed the Coastal – Puget Sound population segment of bull trout as federally threatened (USFWS 2008a). Puget Sound coho salmon are listed as a federal species of concern (NOAA Fisheries 2008). Other marine species protected at the federal level that will need to be considered include southern resident killer whale, stellar sea lion, humpback whale, rockfish, and leatherback sea turtle, although they may not be likely found within the project area. Forage fish, including Pacific herring, sand lance, and surf smelt, are also important species that have been identified for protection (see Forage Fish section).

Also protected is Puget Sound Chinook, bulltrout, and southern resident killer whale critical habitat (NOAA Fisheries 2009; USFWS 2008a) and EFH.

Bald Eagles

Numerous bald eagle nests have been identified within the vicinity of project area by Island County and by USFWS (Island County 2008a; CH2M Hill 2003). Significant bald eagle presence is not surprising given that the Cornet Bay – Hoypus Point area lies on the most direct salmon migration pathway between the Skagit River system and the Pacific Ocean through Deception Pass, providing abundant prey resources for bald eagles. In addition, this area is characterized by high quality, mature and old growth coniferous forest habitat, with numerous large trees providing exceptional perching and nesting sites.

Per ICC 17.02.050.C.5, the County indicates that regulation of bald eagles as a Species of Concern is administered under the Bald Eagle Protection Act, RCW 77.12.655, with regulations stipulated in the Washington State Bald Eagle Protection Rules (WAC 232-12-292) and provided by WDFW (Stoefel et al. 2008). Bald eagles are also protected under the federal Bald and Golden Eagle Protection Act (16 USC 668) and the federal Migratory Bird Treaty Act (50 CFR 10), with regulations and guidelines provided by USFWS (2008b).

The closest identified nest to the Cornet Bay day use area is nest 4812245002, which lies approximately 350 yards due east of the main boat launch (Figure 1). Another nest, 4812245018, is located approximately 550 yards from the boat launch. Recent nesting activity has been documented by WDFW and at least four bald eagles were observed utilizing the project area during the March 27 field visit.

Given the location of the project area relative to these nests, it is likely that regulated areas (buffers) for the bald eagle affect a large portion of this area. WDFW buffers are 800 feet from any bald eagle nest, OR shoreline areas (250 feet from OHWM) within 1/2 mile of a bald eagle nest, OR 1/4 mile from any communal roost area. In these regulated areas, the project is required to:

- Retain all known perch trees and all conifers ≥24 inches dbh, measured at 4.5 feet above the ground).
- Retain at least 50 percent of pre-clearing or pre-construction conifer stand with diameter distributions representative of the original stand (>6 feet tall)

Also, one of two types of Bald Eagle Management Plan is required for all proposed projects that may affect these buffer areas:

1. A Standard Bald Eagle HMP to be submitted to WDFW is allowed if project activities occur within 800 feet of a bald eagle nest OR within 1/2 mile from a nest but within 250 of the shoreline.

2. A Site-Specific Bald Eagle HMP to be submitted to WDFW is required when project activities occur:

    - Within 400 feet of a bald eagle nest
    - Within 1/4 mile of a communal roosting site[10]

[10] Given the number of eagles observed near the project area (in the Hoypus Point vicinity) during the field visit, there is the potential for this area to be classified as a communal roost area (Stoefel et al. 2008). However, since a communal roost area was not indicated on the map provided in Island County (2008b), the other criteria were used to map bald eagle buffers on Figure 2. A communal roost is defined as a tree or group of trees in which at least three eagles roost for at least 2 nights and during more than 1 year. A mating pair is considered one eagle for purposes of establishing this designation.

Island County has developed a County Standard HMP for the bald eagle, and State Parks may accept and sign this existing HMP instead of preparing their own Standard HMP. This satisfies requirements of ICC 17.02.090.C as long as project activities do not encroach on buffer areas discussed previously (those that trigger the requirement for a Site-Specific HMP).

Consultation with USFWS, in addition to WDFW, will be required to ensure compliance with the federal bald eagle regulations mentioned previously. As of October 8, 2008, USFWS was in the process of finalizing a permit process for projects occurring within their recommended buffers (330 feet for general construction not within line of sight, 660 feet for general construction within line of sight) (USFWS 2007). WDFW buffer widths have been provided in Figure 2 because they are more restrictive than USFWS, and will therefore serve as the buffer widths that will impose the greatest constraint on the project.

Marbled Murrelets

Although intact mature and old growth forests in Puget Sound and the outer coast of Washington are used by marbled murrelets (*Brachyramphus marmoratus marmoratus*) for nesting, local USFWS wildlife biologists indicated that it would be unlikely for them to be on Whidbey Island, and that past surveys have not found marbled murrelets there (Flotlin 2009; CH2M Hill 2003).

Most murrelet nests south of Alaska have been found on large-diameter, mossy branches high up in old-growth trees (trees >81 cm DBH) within about 50 miles from the coast, and virtually all "occupied behaviors" (i.e. flying below the canopy) have occurred in stands with old growth trees (Ralph et al. 1995). Given the high quality, mature to old growth coniferous forested habitat with many trees exceeding 81 cm DBH found in the vicinity of the project site[11], it is highly recommended that WDFW and USFWS be consulted regarding project specifics early in the planning phase to determine if surveys would be required. In addition, USFWS indicated that marbeled murrelets are likely to be found foraging in the waters around the island, the implications of which will need to be discussed during ESA consultation and associated documentation (Flotlin 2009). Development of appropriate project accommodations to insure protection of this species will be required.

Flora

WDNR WNHP (2009) identifies one rare plant (State sensitive) species within Island County characterized by a habitat range that suggests its potential presence within the project area. Black lily (*Fritillaria camschatcensis*) is a perennial herb that grows 8 to 24 inches tall with one to eight dark purple-brown flowers. It occurs in moist to wet habitats, including wet meadows, salt marshes, freshwater marshes, sphagnum bogs, coniferous forested wetlands, and near lakes and streams from elevations of 0 to 3,000 feet. If surveys are conducted to search for its presence in the vicinity of the project area, they must be executed during the flowering period for this species (May-July) (WNHP 2009). Golden paintbrush (*Castilleja levisecta*) is the only ESA

[11] According to CH2M Hill (2003), there was no suitable habitat within the project area. However, observations conducted by HEC during field work suggested otherwise, so other surveys will likely be required.

listed plant species in Island County (federally threatened); it is also listed as endangered at the State level (WNHP 2009). However, the habitat type where this species is found, open grasslands, does not occur within the project area, and therefore impact to this species is not of concern to the project.

Streams

Island County defines streams as areas where naturally occurring surface water produces a defined channel, bed, bank or side, and where there is clear evidence of the passage of water such as bedrock channels, gravel beds, sand, silt beds and defined channel swales (ICC 17.02A.030). The channel or bed does not necessarily need to contain water year-round. This definition is not intended to include irrigation or drainage ditches or swales, canals, storm or surface water run-off devices or other artificial watercourses unless they are used by salmonids or to convey streams naturally occurring prior to construction of such watercourse.

Although no streams have been identified by Island County within the Cornet Bay area, multiple "pour points" have been mapped within the project area (Island County 2008a). These "pour points" were confirmed in the field (with flowing water observed in many instances) and are associated with culverts that convey water from the wetland on the east side of the project area under Cornet Bay Road and into Puget Sound (Figure 1). During field work, distinct channels with flowing were observed within the forested wetland areas on the east side of Cornet Bay road and are likely somehow contributing to the water flowing through these culverts, although no obvious inlet connections were observed. For this reason, it is recommended that a critical areas survey include thorough investigation of the source of hydrologic input to these wetland areas, as it may originate from a stream feature upslope from the project area. If any streams are identified, they will be subject to regulations and buffer widths described in ICC 17.02.050.C.3.

Kelp and Eelgrass Beds

Eelgrass beds area identified as occurring in many areas of Cornet Bay in the vicinity of the project area (CH2M Hill 2003; WDNR 1997). Eelgrass beds serve as important foraging areas for several fish and other marine species currently listed as endangered or threatened under the Endangered Species Act (ESA). Cornet Bay has been documented as one of the most productive growth areas for Dungeness crab in the Puget Sound, which depends on healthy eelgrass beds for continued productivity (Island County 2008a). Kelp beds have been identified in the vicinity of the project area (Nearshore Habitat Program 2001), and during field work a kelp bed was observed 75 feet offshore to the north of Hoypus Point.

Protection standards for kelp and eelgrass beds include preparation, submittal, and approval of a stormwater collection, treatment, and disposal system designed by a Professional Engineer and reviewed pursuant to ICC 11.01 (ICC 17.02.050.C.4).

Kelp and Eelgrass Buffers

Kelp and eelgrass beds require buffers of 75 feet landward of the OHWM (ICC 17.02.050.C.4). The Planning Director has the authority to increase the standard buffer widths on a case-by-case basis when a larger buffer is determined to be necessary. However, enhancement of this buffer may be permitted following review and approval of a BSA that demonstrates the benefits of the proposed project to forage fish spawning habitat.

Forage Fish Spawning Areas

Healthy forage fish populations – including surf smelt, Pacific herring, and sand lance – are critical to the continued survival of Puget Sound salmonids (Island County 2005). The nearshore of Whidbey Island, including the Cornet Bay area, provides important spawning habitat for forage fish (Island County 2005; Island County et al. 2003). A sand lance spawning site is documented in the project area, just northeast of the Public Access Boat Dock (Penttila 2009). Although surf smelt is commonly caught off the State Park dock, Penttila (2009) indicated that evidence has not been found that surf smelt are using the beaches around the dock or launch ramp for spawning. According to WDFW's biologist Dan Penttila, the closest known surf smelt spawning beach is at the northeastern end of the project area at Hoypus Point (Penttila (2009). This marks the northwestern-most extremity of a large surf smelt spawning area that stretches south along Whidbey Island down Skagit Bay and Saratoga Passage (Penttila 2009). The entire stretch of beach in front of the project area is identified by WDFW Salmonscape as being potential forage fish spawning habitat (WDFW 2009).

Protection standards for forage fish spawning areas include preparation, submittal, and approval of a stormwater collection, treatment, and disposal system designed by a Professional Engineer and reviewed pursuant to ICC 11.01 (ICC 17.02.050.C.4).

Forage Fish Spawning Area Buffers

Forage fish spawning areas and eelgrass beds require buffers of 75 feet landward of the OHWM (ICC 17.02.050.C.4). The Planning Director has the authority to increase the standard buffer widths on a case-by-case basis when a larger buffer is determined to be necessary. However, enhancement of this buffer may be permitted following review and approval of a BSA that demonstrates the benefits of the proposed project to forage fish spawning habitat.

Washington Department of Natural Resources (WDNR) Washington Natural Heritage Program (WNHP) Identified High Quality Ecosystems

Island County has provided a list of identified WDNR WNHP areas in the County and their associated protection measures in ICC 17.02.050.C (WNHP 2008a). Although the Cornet Bay area is not identified on this list, more recent mapping efforts by the County have identified most areas of the State Park near Hoypus Point as a Rare Plant Community (Island County 2008b). Also WNHP maintains a listing of locations (Township, Range, Sections) reported to contain high quality natural heritage wetland occurrences or occurrences of natural heritage features

commonly associated with wetlands (2008b). The Hoypus Point Area (T34N R02E S30) is on this list. In addition, WNHP (2008) has identified Known High-Quality or Rare Plant Communities for Island County that, upon preliminary observation, may occur within the project area. These ecosystems are provided in Table 4.

Table 4. WDNR WNHP identified known high-quality or rare plant communities for Island County (WNHP 2008a).

WNHP Community Type	Description
Distichlis spicata – (*Salicornia virginica*) Herbaceous Vegetation	Saltgrass – Pickleweed dominated salt marsh
Low elevation freshwater wetland	Low elevation freshwater wetland – general
Pseudotsuga menziesii – A*rbutus menziesii* / *Gaultheria shallon* Forest	Douglas fir – Pacific Madrone / Salal dominated forest
Alnus rubra / *Rubus spectabilis* / *Carex obnupta – Lysichiton americanus* Woodland	Red Alder / Salmonberry / Slough Sedge – Skunkcabbage dominated woodland

For these reasons, it is recommended that a thorough habitat survey be potentially completed and that State Parks coordinate actively with WNHP to ensure adequate protection for these important habitats.

Island County Species and Habitats of Local Importance

Species

Species of Local Importance, which are plants or animals designated by the County pursuant to Chapter 36.70A RCW (ICC 17.02A.030) are also regulated under ICC 17.02.050.C. Species falling under this designation known to occur within the project include great blue heron and osprey, although others may be present (e.g., pileated woodpecker) (Island County 2008a, 2008c). As mentioned above, mapping of nest locations on site plans and a BSA and HMP are required for projects occurring within 1,000 feet of blue heron nests and 600 feet of osprey nests. The project area likely falls within the buffers for both species (Figure 2). A blue heron rookery has been identified <300 feet to the east of Cornet Bay Road near the southwest extent of the project area.

Great Blue Herons tend to build their nests in close proximity to marine intertidal habitats, particularly eelgrass meadows and estuaries, in order to maximize foraging opportunities during nesting (Eissinger 2007). Following, the presence of a rookery in this close proximity to Cornet Bay is not surprising given the abundant eelgrass population here, which supports important prey species for Great Blue Herons.

Great Blue Herons generally tend to nest in the same areas year after year, and colonies tend to be established in areas that are not heavily affected by human noise impacts (Ecology 2009; Eissinger 2007). Great Blue Herons are extremely sensitive to disturbance during the breeding season, which commences in January-March and concludes with the fledgling of young in July-

September (Eissinger 2007). If a rookery is affected by human disturbance during the breeding period, the reproductive rate of the colony can drop or adult herons may move the entire colony (Ecology 2009).

It is somewhat surprising that the Cornet Bay rookery has persisted in this particular location given the close proximity of the residential development to the southwest and the shoreline development and frequent use to the north. Given that this rookery is in such close proximity to the project area, it is strongly suggested that the WDFW Area Habitat Biologist be closely involved with project planning and scheduling to ensure project elements that may involve noise disturbance do not occur during critical breeding times.

Habitats

The Cornet Bay Area is not one of Island County's Habitats of Local Importance as listed in Appendix A of ICC 17.02.

State Natural Area Preserves or State Natural Resource Conservation Areas

Being that the project area is within Deception Pass State Park, its status as a part of the Washington State Parks system classifies it as a FWHCA by Island County. For this reason, special considerations for preservation of habitat integrity are essential, which will require thorough site assessments and careful consultation with Island County Planning and Community Development and WDFW.

All Other Fish and Wildlife Habitat Conservation Areas

All other Fish and Wildlife Habitat Conservation Areas shall be protected on a case-by-case basis through consultation with the Planning Director (ICC 17.02.050.C.8). An HMP will likely be required in addition to a Biological Site Assessment (BSA).

Portions of the shoreline within the project area from near the Park entrance to just beyond the main day use facilities have been also identified explicitly by Island County as offshore Marine Fish and Wildlife Habitat Conservation Areas, and should be managed accordingly (Island County 2008b).

Geologically Hazardous Areas

Island County defines Geologically Hazardous Areas as areas that consist of Erosion, Landslide, Seismic, Volcanic, Coal Mine, and Tsunami Hazards (ICC 17.02.030, as amended Island County 2006). Geologically Hazardous Areas likely found in the project area include Landslide Hazard Areas (Steep Slopes) and Highly Erodible Soils. Information on these critical areas depicted in Figure 1 was provided by Island County associated with the Cornet Bay Watershed

Characterization Report (Island County 2008a). Areas that are characterized by both Steep Slopes and Highly Erodible Soils are especially at risk of slope failure.

A geotechnical engineering report is required for any project involving land disturbance occurring within a geologically hazardous area or its buffer. The report must be prepared and sealed by a geotechnical engineer. If appropriate, a geologist may contribute to the geologic aspects of the project (ICC 11.02.140). Compliance with other Island County ordinances (e.g., stormwater management) is also required.

Landslide Hazard Areas or Steep Slopes

Island County defines Landslide Hazard Areas as areas that, because of their susceptibility to erosion, sliding, or other geologic events, are generally not suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns. These areas include, but are not limited to, those lands designated in the Department of Ecology Coastal Zone Atlas dated April 1979, as it may be amended or revised, as land which has had recent or historical slide activity and/or has unstable slope conditions, including those lands within 100 feet (either top or base) thereof (ICC 17.02.030 as amended, Island County 2006).

Landslide hazard areas are also defined as areas potentially subject to landslides based on risk of mass movement due to a combination of geologic, topographic, and hydrologic factors. Landslide areas include any areas susceptible because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors (ICC 11.02.030, as amended in Island County 2006).

Steep slopes are defined in ICC 17.02A.030 and ICC 11.02 (as amended in Island County 2006, C-41-06) as those slopes that are 40 percent and steeper within a vertical elevation change ≥10 feet, except in areas of consolidated rock. A slope is delineated by establishing its toe and top and is measured by averaging the inclination over at least 10 feet of vertical relief. For the purposes of this definition:

- The **toe** of the slope is a distinct topographic break in slope that separates slopes inclined at <40 percent from slopes ≥40 percent. Where no distinct break exists, the toe of a steep slope is the lowermost limit of the area where ground surface drops 10 feet or more vertically within a horizontal distance of 25 feet.

- The **top** of the slope is a distinct topographic break in slope which separates slopes inclined at <40 percent from slopes ≥40 percent. Where no distinct break exists, the top of a steep slope is the uppermost limit of the area where the ground surface drops 10 feet or more vertically within a horizontal distance of 25 feet.

Erosion Hazard Areas or Highly Erodible Soils

Highly Erodible Soils are defined as soils that show extensive ongoing erosion as a result of land uses or that have a "severe" or "very severe" rill and inter-rill susceptibility to erosion from water according to the NRCS (ICC 17.02.030). In the project area, the soils matching these criteria are classified as Hoypus Gravelly Loamy Sand (Hg) on 15 to 30 percent slopes (Island County 2008a) (Figure 1).

The recently amended definition (April 2006) of erosion hazard areas includes areas of slopes greater than 15 percent and with soils identified by the Natural Resources Conservation Service as having a "severe" or "very severe" rill and inter-rill erosion hazard. All of Island County has been identified as an Erosion Hazard Area in the Island County Comprehensive Plan (C-41-06).

Geologically Hazardous Areas Buffers

Buffers for Geologically Hazardous Areas in Island County are generally associated with steep slopes and are based on the height of the slope. The minimum Steep Slope setbacks that will generally not require a geotechnical report are as follows:

- Fifty (50) foot setback or greater from a slope that is between 10 feet and 30 feet in height
- Seventy-five (75) foot setback or greater from a slope that is between 31 feet and 50 feet in height
- One hundred (100) foot setback or greater from a slope that is greater than 50 feet in height

Since determining the height of the slopes in the vicinity of the project area, and therefore precise buffer widths, would require significant analysis, information provided in Figure 1 comprises a conservative setback (i.e., 100-foot buffer) to provide the maximum possible constraint that may affect the project. All ground disturbing activities proposed within these buffer areas will require a Geotechnical Report and appropriate review by the County. Buffer widths and other requirements are subject to modification by the Planning Director.

Mitigation

Island County's Critical Areas Review process will ensure that the development proposed by State Parks adheres to the following stepwise process (ICC 17.02A.040):

1. Avoidance – When practical and reasonable, alteration of a critical area or critical area buffer shall be avoided.

2. Reduction – When avoidance of a critical area or critical area buffer is not practical and reasonable, then the alteration shall be reduced in scale or magnitude.

3. Restoration – When avoidance or reduction of a development proposal is not practical and reasonable, then impacts of the alteration shall be rectified by restoring the area affected by the alteration.

4. Compensation – When none of the previous three steps are practical and reasonable (i.e., impacts will occur and they will be permanent), then compensation for the alteration shall be achieved through mitigation.

When the sequencing above leads Island County to determine that mitigation provides appropriate compensation for any approved alteration to a wetland, fish and wildlife habitat conservation area, or geologically hazardous area, a mitigation plan will need to be prepared by the county or a qualified professional (ICC 17.02A.070). Mitigation plan requirements for wetlands are provided in ICC 17.02A.090, for fish and wildlife habitat conservation areas in ICC 17.02, and for geologically hazardous areas in ICC 11.02.140. In summary, mitigation plans need to include specific strategies for re-establishment, rehabilitation, creation, enhancement, or preservation of required target habitats and/or impact minimization measures, and also must include appropriate mitigation ratios and approaches for development and achievement of performance standard. Any mitigation project associated with this development proposal will need to be monitored by State Parks and a contingency plan will be required in case mitigation efforts are not successful.

Wetlands

Mitigation shall be required only if the approved alteration to a wetland or wetland buffer cannot be restored with 2 years of the alteration (ICC 17.02A.090.H). Mitigation plans should be prepared by a wetland professional based on applicable portions of Ecology's *Guidelines for Developing Freshwater Wetland Mitigation Plans and Proposals, 2004* (or appropriate guidance) (ICC 17.02A.090.J). Appropriate mitigation ratios for this project are provided in Table 5.

Table 5. Estimated mitigation ratios for various mitigation strategies for wetlands observed within the project area at Cornet Bay, Deception Pass State Park.

Potential Wetland Type	Estimated Wetland Category	Re-establishment or Creation	Rehabilitation	Enhancement
Mature forested wetland	A	6:1	10:1	20:1
Estuarine wetland	C	2:1	4:1	8:1
Shoreline forested wetland (Native Plant Wetland)	D	2:1	4:1	8:1

Generally, mitigation for alteration of a wetland or wetland buffer shall provide equal or better wetland functions. Mitigation should be completed in advance of activities that will disturb wetlands whenever practical and reasonable and must be based on a mitigation plan approved by the Planning Director (ICC 17.02A.090.H.5). If mitigation is not completed in advance, then it should be completed before completion of the approved development proposal. Otherwise, mitigation shall be completed within 1 year of the decision to require mitigation.

Island County has developed a ranked list for types of wetland mitigation activities, with re-establishment being the preferred technique (ICC 17.02A.090.H.3). Generally, mitigation should occur on-site near the location of the alteration, but off-site mitigation may be approved when it is shown that it would be more beneficial to retention of watershed functions (ICC 17.02A.090.J, Craven 2009). Fee in-lieu of mitigation and purchase of credits from wetland mitigation banks may also be allowed on a case-by-case basis (ICC 17.02A.090).

No alteration of a Category A Wetland is permitted in Island County, unless project activities are determined by the Planning Director to fall under the criteria for Reasonable Use (ICC 17.02A.050.B) or Exempt Activities and Uses (ICC 17.02A.060). Cursory review suggests that project activities would be classified as a Reasonable Use of the property; however consultation with the Planning Director is required to determine whether this project meets these criteria. This is an important clarification that needs to be made between State Parks and Island County because it is likely that project activities, if executed in certain locations, would impact Category A wetlands.

Mitigation ratios for an approved alteration to a wetland buffer shall be determined by the Planning Director on a case-by-case basis, but are generally 1:1 (ICC 17.02A.090.H.4). Buffer mitigation may include any actions that can achieve equal or improved wetland functions. When enhancement of the altered buffer is not practical or reasonable, mitigation preferences will otherwise be the same for wetland mitigation.

Given the close proximity of the project to these critical areas, it is likely that construction activities would impact wetlands and/or wetland buffers, triggering the need for an Alteration Approval from Island County.

Project activities that involve shoreline restoration and improvement of neighboring wetlands may be classified under Specific Use Standards: Voluntary Wetland Improvement Projects, and likely be encouraged by Island County (ICC 17.02A.050.D). Activities fitting this classification include re-establishment, rehabilitation, or enhancement of wetlands that have been previously altered – in this case, fill and bulkhead installation occurred before Island County's adoption of wetland regulations on December 31, 1984. Improvement actions must not reduce wetland functions and plans must be approved by the Planning Director prior to implementation.

It is highly recommended that a pre-application meeting be scheduled with Island County Planning prior to discuss the suite of regulatory issues potentially affecting this project prior to finalization of project design.

Fish and Wildlife Habitat Conservation Areas

Following thorough site surveys, impacts to State and Federally Listed species will need to be assessed through appropriate documentation and potential consultation with NMFS and USFWS. Appropriate work windows (timing restrictions) will likely be needed to avoid or minimize impacts to protected species.

If adverse impacts to Island County protected species or habitats are likely to occur, a conceptual mitigation plan, including an analysis of sequencing and mitigation alternatives, must be prepared and accepted by the County (ICC 17.02.050.C.2.f). "Habitat replacement should provide an insurance factor to take into account the risk of mitigation and the loss of fish and wildlife until the mitigation site becomes productive" (ICC 17.02.060).

Geologically Hazardous Areas

Mitigation requirements for impacts to Geologically Hazardous areas, including erosion control measures and a vegetation management and/or restoration plan and/or other means for maintaining long term stability of slope, are provided in ICC.11.02.040. Plans must be reviewed and approved by the Planning Director prior to implementation.

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APPENDIX D

Background Information on Sitka Spruce Wetlands and Implications for Cornet Bay

Background Information on Sitka Spruce Wetlands and Implications for Cornet Bay

Sitka spruce swamps are described as unique habitat types even within the *Picea Sitchensis* forest zone that occupies the coastal fog belt of the Pacific Coast south to northern California (Franklin and Dyrness 1973). In most climax coastal swamp communities characterized by notable freshwater source, Sitka spruce is a co-dominant with Western red cedar, with Western hemlock and Douglas fir playing subordinate roles (Banner et al. 1976), as is the case at Cornet Bay. In communities characterized by higher levels of salinity, it is suggested that Sitka spruce serves more of a dominant role because these other species have greater sensitivity to the cations and anions (in the form of calcium and magnesium) in ocean water (Cordes 1972). Some studies indicate that Sitka spruce has adapted to take significant advantage of ocean-derived nutrients (namely calcium, magnesium, and phosphorus), and that such utilization contributes to the exceptional growth that allows this species to attain the greatest biomass of any Pacific Northwest tree species (Krajina et al. 1982; Cordes 1972; Peterson 1997).

In wetlands dominated primarily by Sitka spruce, development of a dense shrub stratum is more common than in communities where other co-dominant conifer species provide additional canopy cover/closure (Peterson 1997). Red alder typically occupies canopy gaps, and often may persist, even though it is a relatively short-lived species, because of its ability to exclude conifer establishment through its rapid and dense growth, wide tolerance range, and the common presence of a dense shrubby understory (often comprised of salmonberry) (Peterson 1997).

Typical subcanopy and understory plants of this wetland type include Pacific crabapple, salmonberry, red elderberry, red huckleberry, skunk cabbage, slough sedge, (Peterson 1997; Franklin and Dyrness 1973), as was observed in the forested wetland areas at Cornet Bay.

Sitka spruce is generally limited to areas above the upper extent of a high marsh: no lower than 1 to 2 feet higher than MHHW to above the EHW (extreme high water) line (Jefferson 1975).

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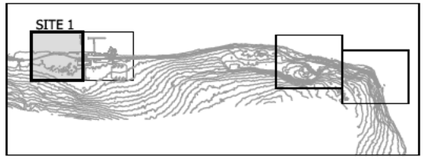
APPENDIX E

Plan View and Cross Sections of the Preferred Alternative

KEY MAP



EXISTING MAINTENANCE FACILITY DOCK

REMOVE FILL TO NATURAL BEACH SLOPE

BERM REMOVAL TO NATURAL BEACH CONTOURS

BERM REMOVAL TO NATURAL BEACH CONTOURS

REMOVE BULK HEAD AND EXCAVATE TO NATURAL BEACH CONTOURS

THUNDER BIRD DOCK ABUTMENT EXTENSION AND FILL REMOVAL

TOP OF SLOPE (BEACH SETBACK)

8' PERVIOUS PEDESTRIAN PATH

TOP OF SLOPE (BEACH SETBACK)

POTENTIAL LOCATION OF FUTURE LARGE CULVERT INSTALLATION

MATCHLINE - SEE SHEET 9

40' 0 80'

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REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

DECEPTION PASS STATE PARK

CORNET BAY/ HOYPUS POINT DAY USE

SITE 1 SITE PLAN

SCALE AS SHOWN

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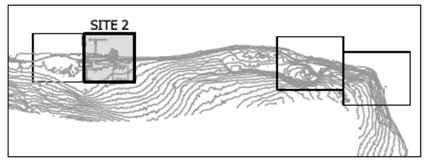
EXISTING MAINTENANCE FACILITY DOCK

EXISTING PUBLIC ACCESS DOCK

KEY MAP



40'
0
80'

DOCK ABUTMENT FILL REMOVAL TO NATURAL BEACH ELEVATION

REMOVE BULKHEAD AND REMOVE FILL SOIL TO NATURAL BEACH SLOPE

TOP OF SLOPE (BEACH SETBACK LINE)

STEPPED (TERRACED) WALL

REMOVE BULKHEAD AND REMOVE FILL SOIL TO NATURAL BEACH SLOPE

TOP OF SLOPE (BEACH SETBACK LINE)

8' PERVIOUS PEDESTRIAN PATH (TYP)

MATCHLINE - SEE SHEET 8

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WASHINGTON STATE PARKS AND RECREATION COMMISSION

DECEPTION PASS STATE PARK

CORNET BAY/ HOYPUS POINT DAY USE

SITE 2
SITE PLAN

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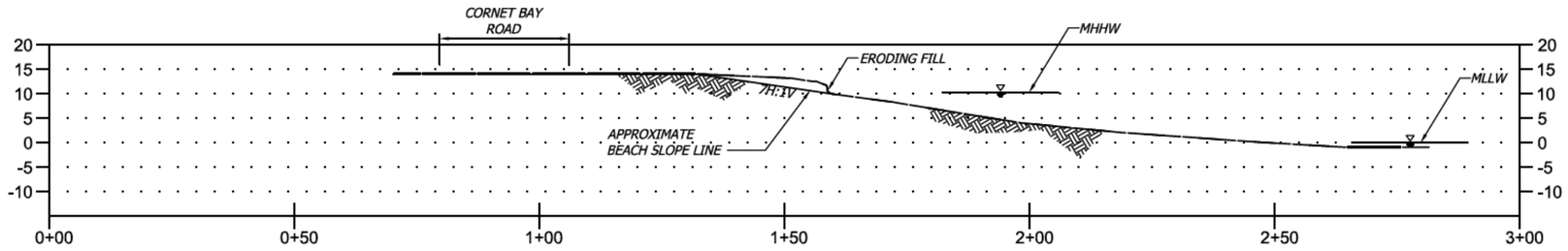
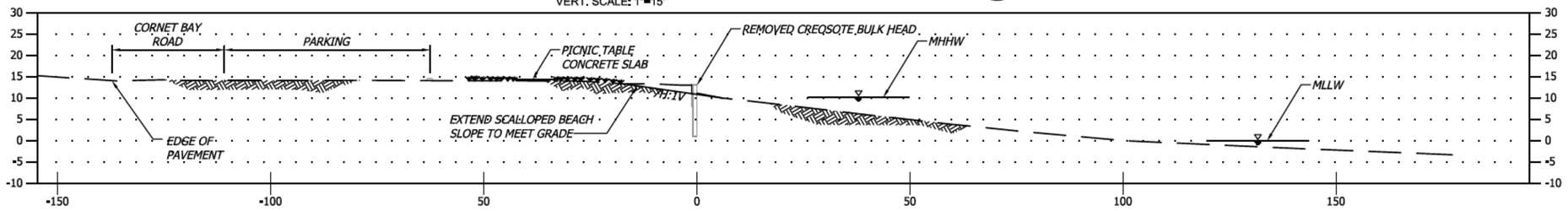


PROFILE A
HORIZ. SCALE: 1"=15'
VERT. SCALE: 1"=15'

NOTES:

1. ELEVATIONS SHOWN ARE FEET (MLLW).



PROFILE D
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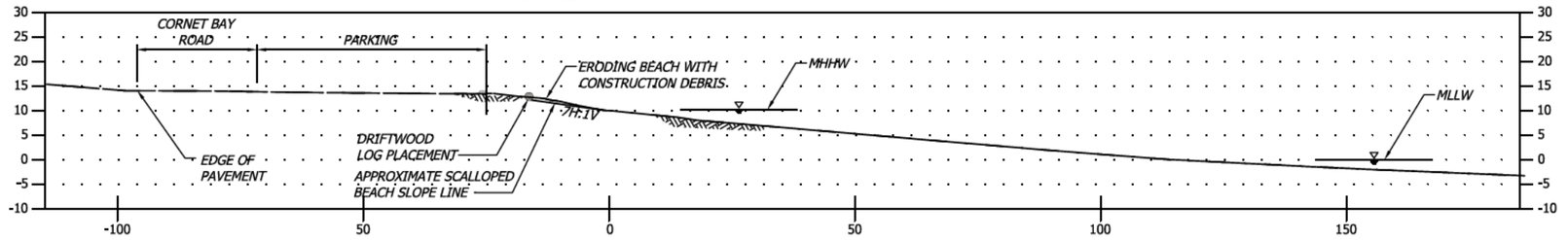
VERT. SCALE: 1"=15'



PROFILE F
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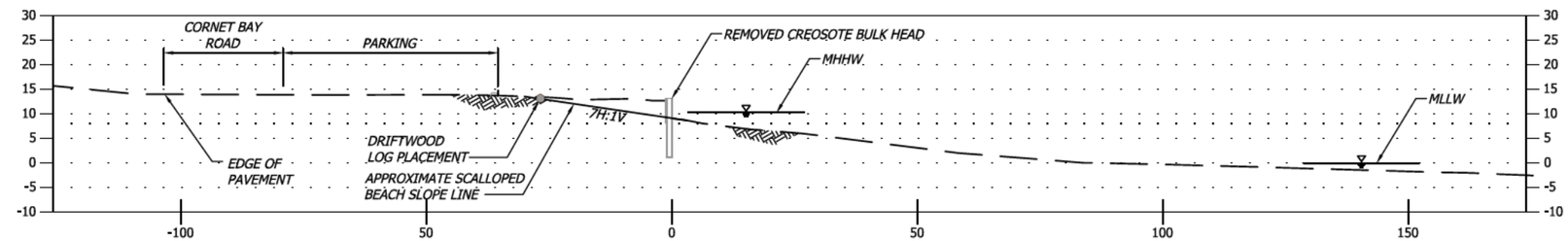
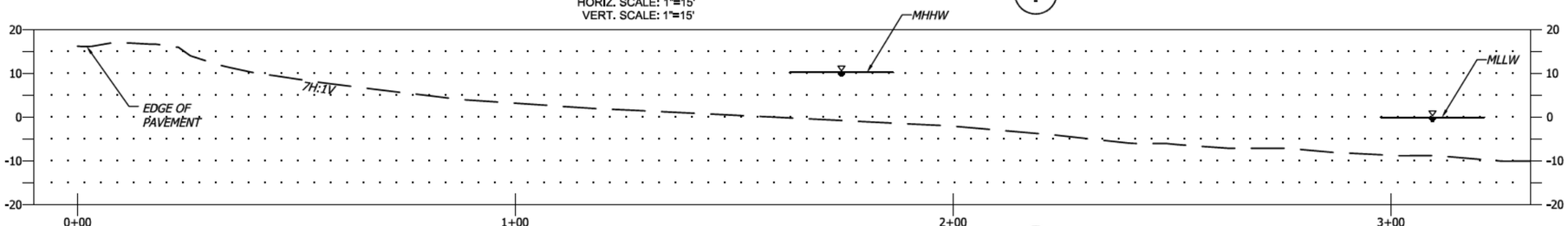
VERT. SCALE: 1"=15'



PROFILE G
HORIZ. SCALE: 1"=15'
VERT. SCALE: 1"=15'



REFERENCE PROFILE I
HORIZ. SCALE: 1"=15'
VERT. SCALE: 1"=15'

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REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

DECEPTION PASS STATE PARK

CORNET BAY/ HOYPUS POINT DAY USE

PROFILES

SCALE
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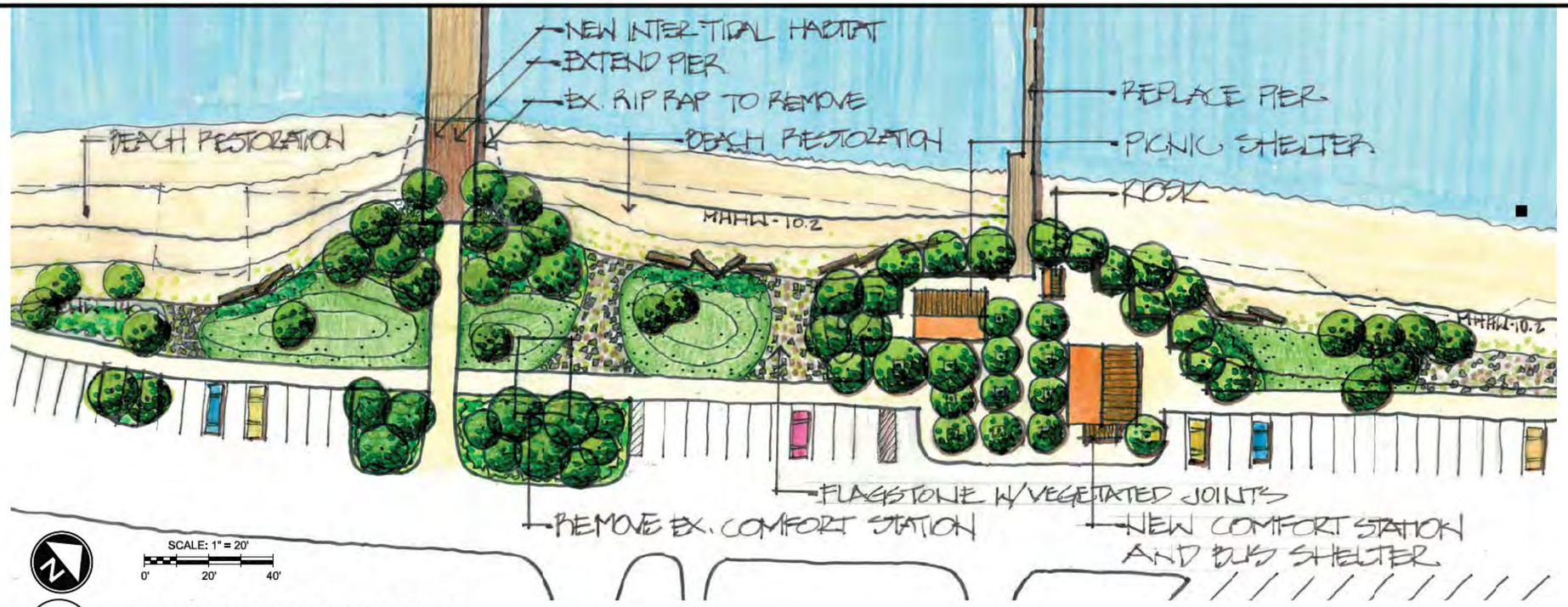
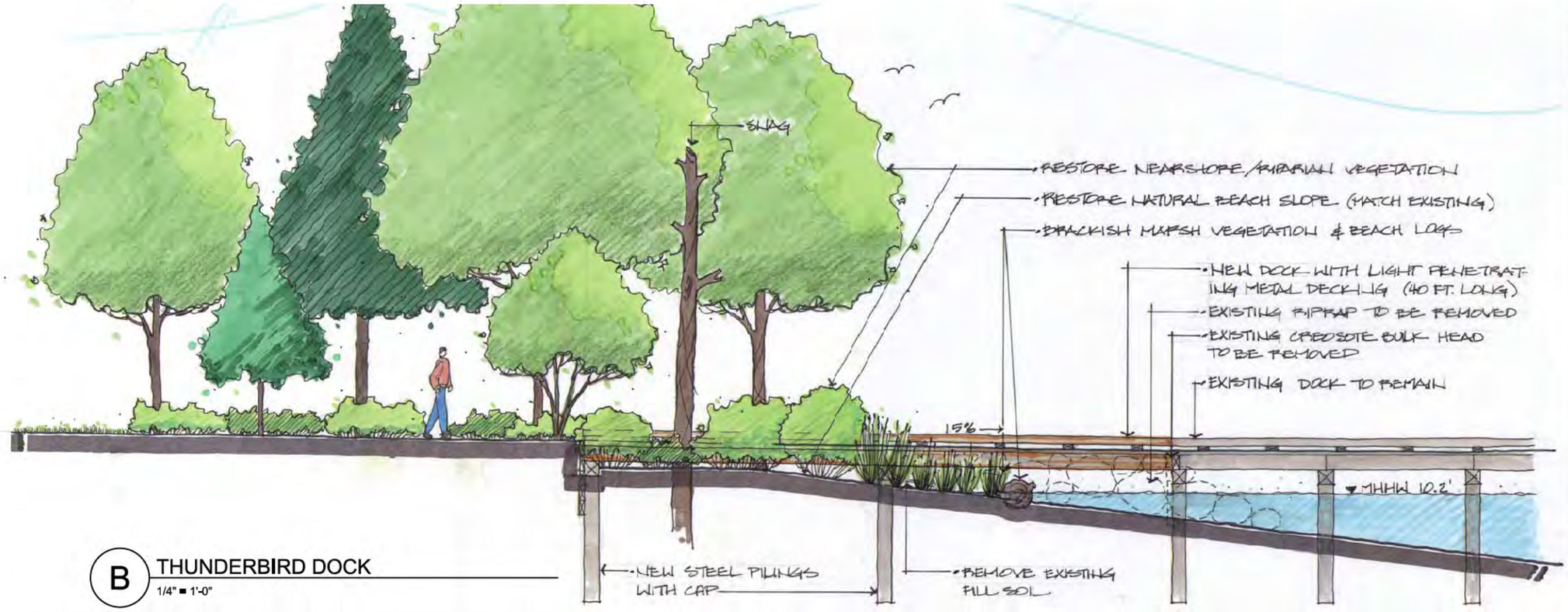
APPENDIX F

Conceptual Design Drawings – Restoration Opportunity Number 5



A COMFORT STATION AND DOCKS

1" = 40'



B THUNDERBIRD DOCK

1/4" = 1'-0"

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CONCEPT DESIGN

ACTION	BY	DATE
DESIGNED	JB/TW	08/14/09
DRAWN	TW/MJ	08/14/09
CHECKED (FIELD)		
CHECKED (HDQTS.)		

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

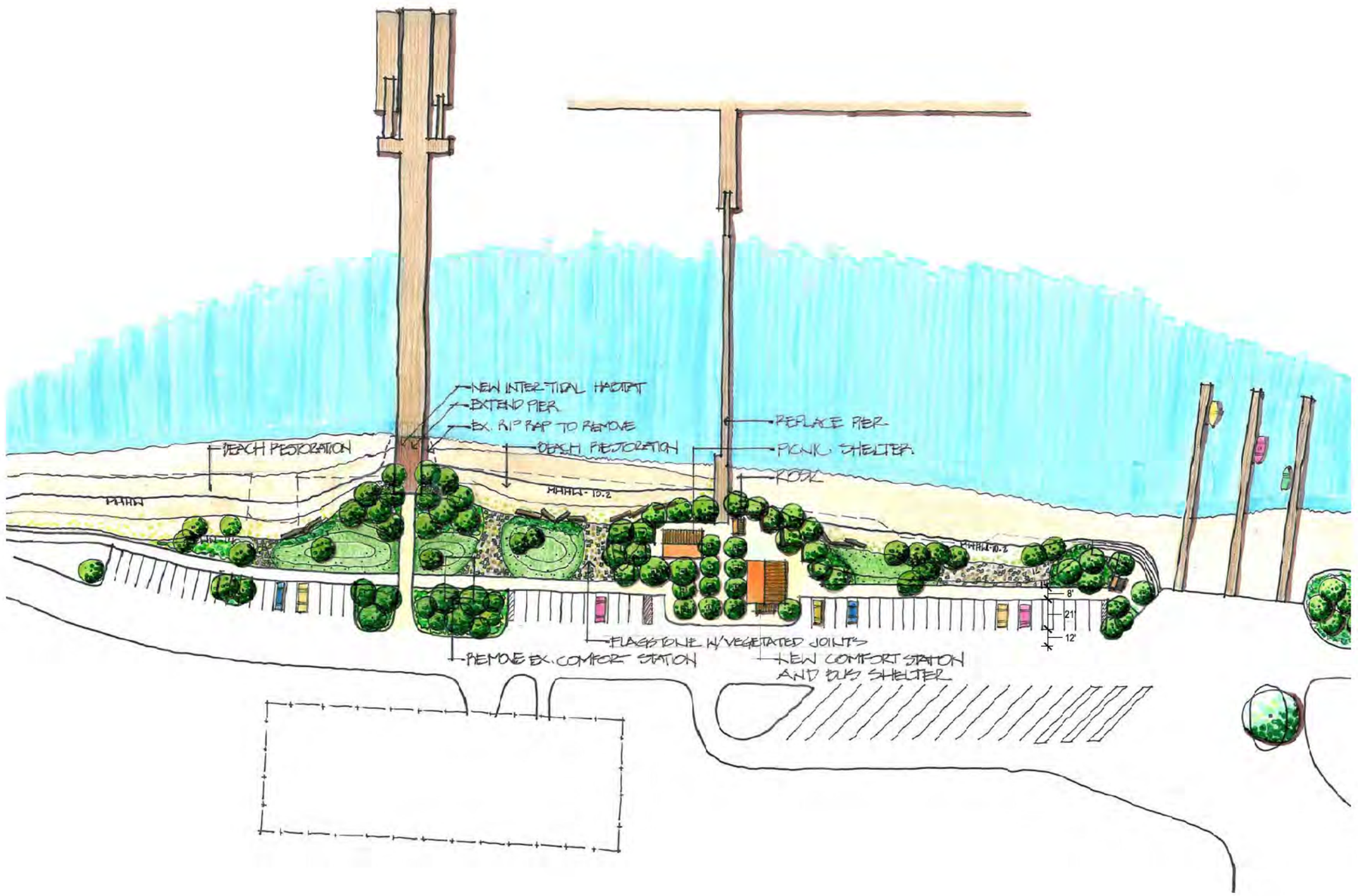
DECEPTION PASS STATE PARK

CORNET BAY/ HOYPUS POINT DAY USE

SCALE

AS SHOWN

FILE NO.



SCALE: 1" = 40'
0' 40' 80'

CAD NO. Cornet-Bay--schematic-layout.dwg

NO.	REVISIONS	INT.	APP.	DATE
	CONCEPT DESIGN			

ACTION	BY	DATE
DESIGNED	JB/TW	08/14/09
DRAWN	TW/MJ	08/14/09
CHECKED (FIELD)		
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CORNET BAY/ HOYPUS POINT DAY USE

SCALE
AS SHOWN

FILE NO.

Path: P:\Cornet Bay - Hoypus Point\Cad\Schematics\Sheets\Cornet-Bay--schematic-layout.dwg
Plot Date: 8/14/2009 4:41 PM Cad User: Meghan James