CITY OF OAK HARBOR
SHORELINE MASTER PROGRAM UPDATE

INVENTORY AND CHARACTERIZATION

PREPARED FOR:

CITY OF OAK HARBOR
DEVELOPMENT SERVICE DEPARTMENT
865 SE Barrington Dr,
Oak Harbor, WA 98277

PREPARED BY:

GRETTE ASSOCIATES, LLC
2102 NORTH 30TH SUITE A
TACOMA, WASHINGTON 98403
(253) 573-9300

AHBL
1200 6TH AVENUE
SEATTLE, WASHINGTON 98101
(206) 267-2425

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INTRODUCTION

The City of Oak Harbor is required to conduct a comprehensive Shoreline Master Program (SMP) update consistent with the Washington State Department of Ecology (Ecology) 2003 Shoreline Master Program Guidelines (Chapter 173-26 WAC). While the SMP is developed according to these standards, SMPs are tailored to the specific conditions and needs of individual communities.

One of the first steps of the SMP update process is to inventory and characterize the City of Oak Harbor's (City) shorelines. This report is intended to provide baseline information on the existing conditions, ecological functions and shoreline processes occurring within the City's shoreline jurisdiction. The City is required to demonstrate that its updated SMP yields "no net loss" in shoreline ecological functions relative to the baseline established in this report. The Guidelines require the City to identify and assemble all reasonably available scientific and technical information as it applies to Oak Harbor's shorelines. This document is supplemental to the Shoreline Inventory, submitted to the Washington State Department of Ecology (Ecology) in January 2011 as part of the SMP update, and incorporates much of the information presented therein. This document describes existing physical and biological conditions, larger-scale (i.e., watershed or ecosystem) physical and biological processes occurring in the City's shoreline jurisdiction, as well as specific shoreline functions based on a shoreline reach analysis. Finally, this report analyzes opportunities for shoreline protection and restoration, public access and shoreline uses, and provides information on specific data gaps or limitations that were identified during the analysis and characterization process.

1.1 STUDY AREA BOUNDARY

The City of Oak Harbor is located in Island County. The City is 9.5 square miles in area and is located adjacent to the glacially carved inlets of Oak Harbor and Crescent Harbor at the north end of Saratoga Passage. Figure 1 shows an aerial view of the City and surrounding areas. In 2010, the City's population was 22,075. The shoreline within the City of Oak Harbor is approximately 13.05 miles long and the City's "shoreline jurisdictional area" (i.e., those areas within 200 ft of the shoreline) includes approximately 999 acres, divided into 150 parcels. A substantial part of the property within the boundaries of the City (4,527 acres, including 10.09 miles of shoreline) is part of the Naval Air Station – Whidbey Island (NASWI).

This document includes review of the shoreline jurisdiction within the City of Oak Harbor and to a lesser extent aspects of areas upland of the shoreline jurisdiction with respect to their interaction with and impact on the shoreline jurisdiction. Shorelines of the state located within the City, as defined by the Shoreline Management Act (RCW 90.58), include:

- All marine waters.
- Associated wetlands.
- Shorelands adjacent to these water bodies, typically 200 feet landward of the water body.

In addition, specific larger water bodies, such as the Puget Sound, are also classified as Shorelines of Statewide Significance (RCW 90.58.030(2)(e). Shorelines of the State, as defined

by the Shoreline Management Act also include rivers and streams with more than 20 cubic feet per second mean annual flow (cfsmaf) as well as lakes and reservoirs greater than 20 acres in area. However, neither of these types of water bodies are found within the boundaries of the City.

The shorelines of Oak Harbor and Crescent Harbor are defined as "shorelines of statewide significance" waterward of the line of extreme low tide (RCW 90.58.030(2)(e)(iii)), extending waterward to the offshore shoreline jurisdictional boundary as shown in the following image.

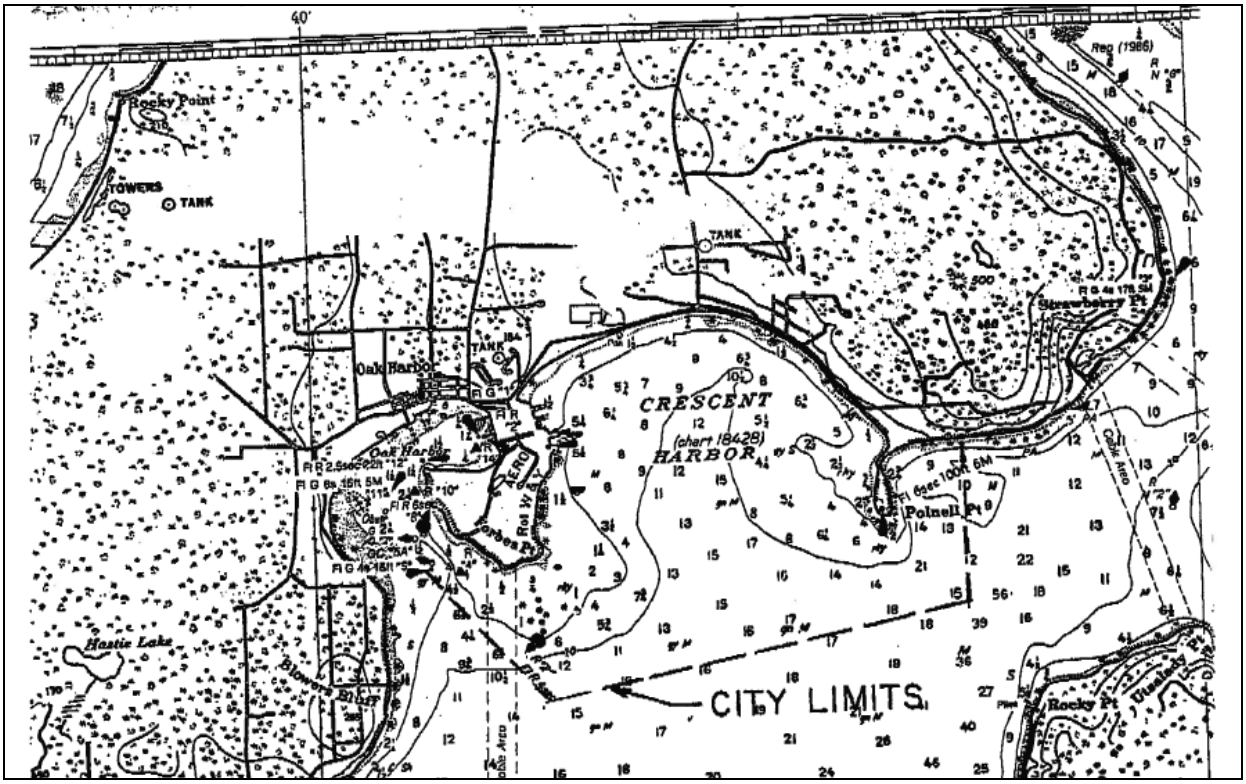

Image 1: Depiction of Waterward City Limits

There are no lakes or streams within the City or UGA that qualify as a "shoreline of the state". All portions of wetlands that are directly hydraulically connected to shorelands are included within the City's shoreline jurisdictional boundary.

Although not required during the SMP update process, cities can chose to pre-designate the shoreline environment within its urban growth area (UGA). However the City does not need to address pre-designation within its UGA as the City has no unincorporated UGA within the shoreline jurisdiction.

The City of Oak Harbor is located in Water Resource Inventory Area 6 – Island County (WRIA 6). For review purposes, WRIAs are often divided into sub-watersheds and/or sub-basins to facilitate analysis of water resources (e.g., movement, storage, and quality). The boundaries of these sub-watersheds and sub-basins are generally defined by water flow and topographical

breaks. For example, Ecology divided WRIA 6 into seven (7) sub-watersheds for the purposes of water quality assessment, and the Washington State Conservation Commission divided WRIA 6 into 126 sub-basins for the Salmon Limiting Factor analysis. The City is located within the Whidbey-Island Saratoga Passage sub-watershed as identified by Ecology and spans the Crescent and Oak Harbor sub-basins as identified by the Washington State Conservation Commission. As these units are based upon water flow, the boundaries of the Whidbey Island – Saratoga Passage sub-watershed and the Oak Harbor and Crescent sub-basins generally coincide. During the inventory process, it was discovered that the WRIA 6 and Whidbey Island-Saratoga Passage watershed provided more landscape scale information and the Washington State Conservation Commission provided a greater level of data on the immediate vicinity of Oak Harbor. Therefore, for the purposes of the landscape analysis within this document, the term watershed is used to refer to the Whidbey-Island Saratoga Passage watershed. However, when a greater level of resolution is required or additional data is available, the sub-basin data is provided.

1.2 METHODOLOGY

The purpose of this document is to provide baseline information regarding City shorelines in order to inform the SMP update. It is intended to integrate information from a number of existing sources in order to address the requirements of the Shoreline Management Act (SMA), and to identify gaps for which existing information is not available. It relies heavily on adaptation of existing information and analyses of City shorelines. New data gathering and extensive re-analysis of existing data are outside of the Ecology required scope of the City's current SMP update.

This document addresses City shorelines at two different spatial scales: watershed and reach. Regional information is largely in narrative form and comes from documents addressing conditions at WRIA, County, watershed, or basin level. Primary sources from which regional-scale information were drawn include:

- *City of Oak Harbor Comprehensive Plan* (City of Oak Harbor 2010)
- *Salmonid Habitat Limiting Factors WRIA 6 Island County* (Washington Conservation Commission 2000)
- *Soil Survey of Island County, Washington* (Ness 1958)

Reach scale information is largely based on various documents as well as geospatial data available in map format, as summarized in the Shoreline Inventory. Additionally, aerial photos, site visits, and institutional knowledge within the City were also used to supplement information at the reach scale.

In order to best utilize grant resources, this Inventory and Characterization is focused on reach-scale analysis of conditions and opportunities within the City shorelines. Regional watershed information is presented within the context of City shorelines where it is available from the sources listed above, but will not be the sole source of information used by the City during the SMP update process. For example, Island County is conducting its SMP update concurrent with

the City effort, and has prepared a county-wide assessment of regional conditions including watershed processes and shoreline functions. Available Island County data as well as information provided by the Department of Ecology has been reviewed for the creation of this document and significant information from those sources has been integrated into this document.

1.3 REPORT ORGANIZATION

This report is organized to correlate with requirements of Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and its implementing guidelines in Washington Administrative Code (WAC) 173-26. It is intended to review large-scale information, and scale down sequentially to smaller reaches (reaches are defined in Section 1.4). This approach combines the requirement outlined in WAC 173-26-201(3)(d), Ecology's draft SMP Handbook Chapter 7 *Shoreline Inventory and Characterization* (Ecology 2009), and Ecology's guidance document *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes* (Stanley et al. 2005).

1.4 SHORELINE REACHES

During the inventory process, the City of Oak Harbor was divided into eleven (11) reach segments based upon an initial assessment of environmental characteristics, shoreline features and processes (e.g., vegetation, slope type) and the resultant conditions (e.g., development patterns) along the shoreline (Table 1 and Figure 16). Shoreline drift cells were also utilized to a lesser extent in the determination of the reach segments.

Table 1. Shoreline Reaches

Designated Reach -Reference Name	Description	Approx. Length (ft)	Approx. Length (mi)	Area (acres)
Marine Reach 1 (MR1) – (Scenic Heights Segment)	This segment extends from the western boundary of the City adjacent to the shoreline north to the southern edge of Freund Marsh. The Scenic heights segment consists of low density single-family residential development.	2,351.8	0.45	10.9
Marine Reach 2 (MR2) - Freund Marsh Segment	This segment corresponds to the mapped boundaries of Freund Marsh and land use is primarily open space. The shoreline associated with this segment is located between the residential development associated with MR1 and the single-family residential development located in MR3a.	859.8	0.16	56.9
Marine Reach 3 (MR3) - Oak Harbor Beach Segment	This segment extends from northwest boundary of Freund Marsh adjacent to the shoreline to the eastern property boundary of the Harbor Park Condominiums. This segment is characterized by Public Recreation and park areas such as Oak Harbor Beach and Windjammer Park as well as single and multifamily residential development. For the purposes of analysis this reach is divided into three sub-reaches (3a, 3b and 3c) to provide a greater extent of clarity regarding shoreline use (refer to Figure 16 and Section 4.3).	5,499.8	1.04	22.5

Designated Reach -Reference Name	Description	Approx. Length (ft)	Approx. Length (mi)	Area (acres)
Marine Reach 4 (MR4) - SE Bayshore/ Pioneer Way Segment	This segment begins at the western property line of Flintstone Park and extends to the east to the VFW Memorial Park but does not extend into the Oak Harbor Marina. This area contains primarily business and high-density residential zoning.	5,007.6	0.95	22.8
Marine Reach 5 (MR5) - Oak Harbor Marina Segment	This segment extends from the northern end of the Oak Harbor Marina into the NASWI property.	1,948.9	0.34	9.0
Marine Reach 6-11 (MR6-11) - NASWI[1]	This segment extends from the southern end of the Oak Harbor Marina around Maylor Point and east to the end of the City boundary. This reach encompasses the shoreline of the Naval Air Station Whidbey Island (NASWI) which includes residential development, habitat restoration projects, and undeveloped shoreline. The reaches were primarily provided to define the boundaries of specific vegetation and land use patterns.	53,257.6	10.09	876.7
	• NASWI - MR6: Vegetation Canopy includes heavily forested area.	2,526.6	0.48	10.7
	• NASWI - MR7: Wetland area located on the Maylor Point peninsula	7,212.8	1.37	98.8
	• NASWI - MR8: Developed residential area including Maylor Point	4,261.0	0.81	21.7
	• NASWI - MR9: Primarily an emergent and scrub/shrub vegetated area with associated impacts from residential development.	5,802.3	1.10	38.0
	• NASWI - MR10: Marina area, majority of land is fill.	4,676.2	0.89	15.8
	• NASWI - MR11: Variable vegetation area with associated wetlands adjacent to Crescent Harbor	28,778.7	5.45	691.7
	Total Jurisdictional Shoreline	**68,925.4**	**13.05**	**998.8**

[1] Navy activities are not subject to SMA provisions when those activities are conducted within the boundaries of the station, and the City does not have permit authority on Navy land. However, non-federal actions on federal land, e.g. expansion of the City's sewer treatment plant, would be subject to the SMA and SMP. Based upon direction from DOE staff, review of reaches 6 through 11 has been combined to provide an ecosystem-scale analysis that can be used to make environmental designations, policies and regulations that can be used to address the potential for non-federal actions on federal lands.

1.5 REGULATORY FRAMEWORK OVERVIEW

City of Oak Harbor

Within the City of Oak Harbor, land use/development within the shoreline jurisdiction is subject to the SMP, as well as the City's Critical Areas Ordinance, Zoning Code, Comprehensive Plan, International Building Code (if the project incorporates development of a structure), as well as various other City, state and federal laws. Prior to commencing any use, development, or activity, an applicant must comply with all applicable laws.

State and Federal Regulations

In addition to City regulations, in and over-water development within the City's shoreline jurisdiction must also comply with the following state and federal regulations: the state Hydraulic Code, the state Shoreline Management Act, the federal Clean Water Act, and the federal Endangered Species Act. In addition to those regulations listed at the outset of this section, other federal laws that may be relevant to a specific project review include the Clean Air Act, the National Environmental Policy Act, Anadromous Fish Conservation Act, and the Migratory Bird Treaty Act. Additional state laws that may be relevant to a specific project review include the State Environmental Policy Act, Growth Management Act, Water Resources Act, Salmon Recovery Act, and the Water Quality Protection Act. In addition, projects may also be subject to local, state, and federal tribal agreements and/or case law.

Hydraulic Code

The Hydraulic Code (RCW 77.55) gives the Washington Department of Fish and Wildlife (WDFW) the authority to review, condition, and approve or deny "*construction activity that will use, divert, obstruct, or change the bed or flow of state waters*." During the department's review process, regulators can condition projects to avoid, minimize, restore, and compensate all adverse impacts associated with development.

Within the City, WDFW must review and approve most development activities within the marine shoreline as well as associated wetlands and streams. These development activities are primarily likely to include but are not limited to shoreline armoring, restoration and mitigation activities as well as overwater development (including pier and bulkhead repair or construction), among others.

Shoreline Management Act (SMA)

The SMA (RCW 90.58) is administered by the Washington State Department of Ecology. The goal of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." The three basic policies of the Act address shoreline use, environmental protection and public access. The SMA also requires that each city and county with "shorelines of the state" must prepare and adopt an SMP. SMP updates, such as the process for which this document is being prepared, as well as amendments to existing SMP regulations are effective only after Ecology approval.

Federal Clean Water Act

The Federal Clean Water Act is divided into two primary sections. These are Section 401 and Section 404.

Section 401 is related to the review, conditioning of projects, and approval or denial of federal permitted actions that result in discharges to state waters, including wetlands. Within the State of Washington, Section 401 of the Federal Clean Water Act is administered by the Washington State Department of Ecology.

Section 404 is related to review of projects that result in the discharge of dredged or fill material into waters of the United States, including wetlands. Section 404 applications are reviewed by the United States Army Corp of Engineers (USACE), with oversight from U.S. EPA. Within the State of Washington, Section 404 permits that encompass actions within streams, lakes or wetlands are also reviewed by the Washington State Department of Ecology.

For both review processes, the agencies review project proposals to ensure that impacts are addressed in order of avoidance, minimization, restoration, and then compensation.

Federal Endangered Species Act (ESA)

Projects are often reviewed for impact on endangered species pursuant to the regulations provided by the Federal Endangered Species Act (ESA). Projects are prohibited from "take" of listed species (Section 9). Specifically, "take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (Section 3). The take prohibitions of the ESA apply to everyone, so any action of the City that results in a take of listed fish or wildlife would be a violation of the ESA and exposes the City to risk of lawsuit. Additionally, Section 7 of the ESA requires that activities with the potential to affect federally listed or proposed species and that either require federal approval, receive federal funding, or occur on federal land must be reviewed by the National Marine Fisheries Service (NOAA Fisheries) and/or U.S. Fish and Wildlife Service (USFWS) via a process called "consultation."

Federal Emergency Management Agency (FEMA)

If within a flood way or zone, projects must also comply with National Flood Insurance Program (NFIP) guidance as provided by the Federal Emergency Management Agency (FEMA). Under NFIP, the City is responsible to make sure development proposals comply with the following for the following:

1. Sites are reasonably safe from flooding.
3. Subdivision proposals are safe from flooding and provides for adequate drainage.
4. The lowest floor of residential structures (including basement) are elevated at least to or above the Base Flood Elevation (BFE).
5. Non-residential structures are required to have the first floor elevated or flood-proofed one foot above the BFE.
6. Require manufactured homes to be elevated and anchored.

7. Require water supply systems designed to eliminate infiltration of flood waters.
8. Require new and replacement sanitary sewage systems be designed to minimize or eliminate infiltration of flood waters.
9. Assure flood carrying capacity of altered or relocated watercourses is maintained.

FEMA is currently in the process of defining the locations of the floodways and flood plains within the State including the City.

2 ECOSYSTEM CONTEXT

Oak Harbor and Crescent Harbor are the major bodies of water within the City of Oak Harbor's jurisdiction. Relatively wide and shallow, both harbors receive the majority of their water input from the Saratoga Passage. Only minor input is received from upland bodies of freshwater, including Freund Marsh as well as four unnamed streams (two that flow into Oak Harbor and two that flow into Crescent Harbor). None of the freshwater stream inputs within the City are under SMA jurisdiction based on flow rate[2]. In order to place the jurisdictional marine shorelines within an ecosystem context, the following subsections describe the natural and development characteristics of the larger watershed.

2.1 WATERSHED NATURAL CHARACTERISTICS

2.1.1 Climate and Precipitation[3]

As is typical throughout the Puget Sound trough, Island County typically experiences short, cool, dry summers and longer, mild, wet winters. Island County is noted as having one of the most uniform marine climates of any area in the United States. Temperatures are modified by the prevailing westerly winds and the salt air, resulting in temperatures that rarely go below freezing (32 degrees) or above 90 degrees Fahrenheit. Within the City of Oak Harbor, the climate generally is generally mild. On average, the warmest month is August (average maximum temperature is 66.6 degrees) and the coldest month is January (average minimum temperature 34.7 degrees). Temperature fluctuations between night and day are most commonly between 12 and 16 degrees.

The annual average precipitation for the City is 20.24 inches, and rainfall is fairly evenly distributed throughout the year. The wettest month of the year is usually November, with an average accumulation of 3.06 inches. Snow has little to no influence on seasonal hydrology in this region.

2.1.2 Vegetation

Watershed-scale vegetation information is discussed in the *Island County Soil Survey* (Ness 1958) and *Salmon Limiting Factors Analysis* (Washington State Conservation Commission 2000). In the Whidbey Island – Saratoga Passage watershed, uplands were historically forested with Douglas fir interspersed with areas of western hemlock and western red cedar. All of the virgin timber has been removed from the landscape, and in some places second and third cuttings have occurred. Other common trees and shrubs within the area include vine maple, Oregon Maple, elderberry, madrone, cascara, huckleberry, red huckleberry, snowberry, Oregon grape and salal. Herbaceous species including nettle, bracken fern and sword fern are also common in upland areas. Relatively small peat bogs are located throughout the County. Dominant plant species for these areas include: various sedges, cattails, skunk-cabbage, hardhack, Labrador-tea, and sphagnum moss. Clusters of Garry oaks grow in the city. GIS analysis indicates that

[2] Pursuant to RCW 90.58.030 (2)(e), streams that do not exceed a mean annual flow rate of twenty (20) cubic feet per second are not required to be included in SMA jurisdiction.

[3] Climate and precipitation information are discussed in a number of WRIA 6 documents as well as the Island County Soil Survey (Washington Conservation Commission 2000, Ness 1958).

urbanization within the City limits has resulted in a 40% loss of overall vegetative cover. Vegetation-related stressors within the watershed include urbanization, agricultural uses, riparian fragmentation, floodplain modifications, and increased impervious surface.

Shoreline vegetation adjacent to Oak and Crescent Harbors has been largely affected by development, including urbanization within the City and the development of the Naval Air Station. Roads, residences, parks, marine facilities, and commercial uses have all altered shoreline vegetation presence and cover. The largest amount of alteration has occurred within the developed area of the City and to a lesser extent within the boundaries of the Seaplane Base..

2.1.3 Surficial Geology and Soils

Information on the soils within Oak Harbor was primarily derived from GIS resources and the *Soil Survey of Island County, Washington* (Ness 1958). The soils of Island County formed in glacial drift deposited by a continent-sized glacial ice sheet. This 3,000-foot thick glacier, originating from Canada, formed most of the topography and waterways of the Puget Sound between 13,000 and 15,000 years ago. The resulting large masses of till deposited by the glaciers, commonly referred to as moraines, provided the parent materials of the soils that are located in Oak Harbor.

Several differing soil types are found within the City of Oak Harbor. The primary soil series found along the shoreline include: Coupeville loam, Coveland loam, Dugualla muck, Everett-Alderwood complex, Indianola loamy sand, Puget silty clay loam, Sucia loamy sand and Whidbey-Hoypus Complex (Figure 8).

The majority of the soil types within the city of Oak Harbor (e.g., those of the Everett-Alderwood, Indianola, Sucia loamy sand, and Whidbey-Hoypus Complex series) are classified as “moderately well drained” to “excessively drained”. A minority of the soil types are classified as “poorly drained” or “somewhat poorly drained” (e.g., Coupeville loam, Coveland Loam, Puget silty clay loam) to “very poorly drained” (Dugualla muck). Those areas classified as “poorly drained” to “very poorly drained” often coincide with mapped wetland areas, including the Freund Marsh and the wetland area on the Maylor Point peninsula (Figure 3a and 8).

Places that are highly susceptible to erosion, landslides, earthquakes or other geologic events are referred to as geologically hazardous areas. Within the shoreline jurisdiction of the City, the primary geologically hazardous areas are the marine shoreline bluffs that exceed 15% grade, such as those found at the western end of the City’s shoreline (Figure 3a).

2.1.4 Topography

Oak Harbor’s landscape is typical of Island County, with numerous hills, valleys, streams and frontage on the waters of Puget Sound. Elevations range from sea level to 520 feet, with areas of low marine banks as well as areas of steep coastal bluffs. Two main ridges run along each side of the City: one ridge is located along the western side of the Oak Harbor water body, the other is located along the eastern side of Crescent Harbor. A lesser ridge extends through the center of the City and divides Oak and Crescent Harbors. The City also contains two peninsulas: one extends from the central lesser ridge that divides the two Harbor areas and contains Maylor and

Forbes points, and the second peninsula extends from the ridge located on the eastern side of the City and terminates at Polnell Point.

2.1.5 Habitat

The shoreline jurisdiction within Oak Harbor is comprised primarily of marine and wetland ecosystems. Generalized information about these two habitats area described below. Specific habitat information for each reach is provided in Chapter 5 of this document.

Marine Shoreline and Aquatic Habitat

Riparian vegetation communities along the marine shoreline within the City are quite varied, and a substantial portion of the upland marine shoreline area associated with Oak Harbor has been modified and developed. Photographs of a portion of each reach are provided in Appendix D of this document. The most developed areas within the City begin to the east of Freund Marsh and extend along Oak Harbor to the east to the southern end of the Oak Harbor Marina. Portions of Crescent Harbor have also been modified and developed although to a relatively lesser extent than found in Oak Harbor. The most developed portion of the Crescent Harbor shoreline coincides with the marina.

The eastern side of Oak Harbor contains marine bluffs with multi-story overhanging vegetation. However, the remainder of the upland shoreline adjacent to Oak Harbor is either limited to grass and shrub species as evidenced in Windjammer Park or the multi-story vegetation is separated from the shoreline by trails and/or shoreline armoring as seen to the south of the Oak Harbor Marina. The limited overhanging vegetation reduces the amount of shading and biotic inputs provided to the intertidal area and may result in large temperature fluctuations on the beach reducing its suitability for forage fish spawning as well as other habitat functions.[4] The limited shoreline vegetation is also likely to reduce upland sequestration of nutrients and toxic compounds.

The Washington State Department of Natural Resources (DNR) Shorezone data indicates that both harbors contain areas of dune grass (Figure3b). Patchy dune grass areas are mapped along the northern boundary of Oak Harbor and along the northeast and southwest boundaries of Crescent Harbor. Continuous dune grass is mapped along the riparian edge of the salt marsh wetland area located on the Maylor point peninsula. Dune grass areas promote ecosystem diversity by providing a vegetated beach transition zone that is commonly utilized by birds as nesting habitat and terrestrial species as forage area.

In addition to upland vegetation, the marine shorelines within the Oak Harbor shoreline jurisdiction also have mapped aquatic vegetation including kelp and eelgrass beds (Figure 3b). DNR shorezone data indicates that there are patchy eelgrass beds along the majority of the northern border of Crescent Harbor. Priority Habitat and Species data obtained from the Washington State Department of Fish and Wildlife indicates that there is a large eelgrass patch

[4] However, some of this temperature fluctuation may be offset by the amount of large woody debris located on the Oak Harbor shorelines. No scientific studies related to Oak Harbor were identified that identify temperature variation between shorelines with overhanging vegetation and shorelines with significant amounts of woody debris.

located at the mouth of Oak Harbor. However, this data may be inaccurate as eelgrass beds are unlikely in the depth of the water mapped in the area. Eelgrass beds serve a variety of purposes including but not limited to providing structure to aquatic substrate habitats and providing food and shelter for juvenile fish species, including salmonids, and shellfish.

The marine shoreline topography and bluff types adjacent to Oak and Crescent harbors are as varied as the vegetation types found in the area. A 2005 study conducted by Coastal Geologic Services entitled *Island County Feeder Bluff and Accretion Shoreform Mapping: Final Report*, identified bluff types include modified bluffs, transport zones, accretion shore forms, as well as feeder bluffs with the City limits (Coastal Geologic Services 2005). Modified shorelines generally coincide with areas developed for urban and residential uses. It is assumed that general wave energy in both harbors is also modified as a result of shoreline modification but it is unknown as to what extent. Generally both bays show evidence of being fairly low energy, wide flat beaches and the capture and retention of woody debris.

The aquatic marine habitat of Oak Harbor provides habitat to Puget Sound anadromous fish species including: bull trout, chinook salmon, chum salmon, coho salmon and steelhead trout as well as to stellar sea lions and other marine mammals. There is a mapped seal and sea lion haul out site located to the south of Forbes Point (Figure 3c). Shellfish is mapped on both sides of Crescent harbor (Figure 3c). In addition aquatic and upland shoreline habitat within the city of Oak Harbor may also be utilized for foraging by marbled murrelets, migrating bird species, and bird of prey species such as raptors and bald eagles. Oak harbor may be used by breeding seabirds (Figure 3c and Island County Inventory and Characterization Data 2011). Shorelines of Crescent and Oak harbor provide Pacific Sand Lance and Surf smelt habitat (Figure 3c)

Wetland Habitat

The City of Oak Harbor also has three substantial wetland areas associate with the marine shoreline. These wetland areas areas include Freund Marsh, a wetland area on the Maylor Point peninsula, and a large wetland complex associated with Crescent harbor. Wetland habitats associated with shorelines not only provide habitat for terrestrial and aquatic species but also provide coastal protection during storm events as well as water storage during flood events. Wetland habitats may also remove excessive nutrients, sediment, and toxic compounds from ecosystems, store water and maintain base flows, store sediment and support vegetation thereby serving as a source for wood debris and other organic material.

The wetland area on the Maylor Point peninsula is the only mapped salt marsh habitat within the City; however, salt tolerant vegetation was also identified during a brief on-site review of Freund Marsh. Salt marshes are often impacted by development and as such are a limited marine ecosystem resource within the Puget Sound. Although no specific studies of this marsh were identified during the inventory process, this marsh area may provide many of the general habitat components normally identified within salt marshes including but not limited to: space or conditions for reproduction, resting, hiding and migration; and food production and delivery.

The wetland area on the Maylor Point peninsula appears to be primarily a saltwater estuary. Whereas, Freund Marsh and the wetlands associated with Crescent Harbor all appear to have

hydrologic inputs that are likely to be a combination of tidal influences and upland freshwater inputs resulting in variable communities of freshwater marsh and saltwater tolerant vegetation. In addition, Freund marsh may provide floodwater storage from the surrounding developed areas.

All three of these wetland areas are likely to provide habitat for aquatic and shoreline-dependent birds, invertebrates, mammals; amphibians; and anadromous and resident native fish species.

2.2 LAND USE

2.2.1 Historic Land Use

The area that is now known as the City of Oak Harbor was originally occupied by the Skagit tribe. American and Irish settlers began moving into the area during the early 1850s, partially as a result of the Oregon Donation Land Law passed by Congress in 1850. One of the first settlers named the town after the Garry oak trees (*Quercus garryana*) and Crescent Harbor was named for its shape. The population of the area remained largely the same from 1850 to 1890. In the 1890s, the area underwent a second influx of settlement by Dutch farmers from Michigan. The resulting community was supported primarily by farming and fishing.

Oak Harbor became a city on May 14, 1915. From the early 1900s to the 1930s, Oak Harbor served as a relatively small port utilized by steam and freight vessels that carried passengers and freight to and from Whidbey and Fidalgo Islands to the mainland. The inhabitants relied entirely upon water transportation to come and leave the island- first canoes, then steamers, then car ferry - until the Deception Pass Bridge was built.

Oak Harbor remained a small town of approximately 600 residents until two major events occurred: the first was the building of the Deception Pass Bridge in 1935 and the second was the completion of the Naval Air Station Whidbey Island (NASWI) in 1942. NASWI is composed of two bases five miles apart – the Seaplane Base, located on the eastern shore of the island at the edge of the City of Oak Harbor, and Ault Field, northwest of the Seaplane Base and outside of Oak Harbor's boundaries.

In early 1941, the US Navy began searching for a location suitable for a base from which to rearm and refuel Catalina flying boats, the principal anti-submarine and patrol plane at the time. The Navy required a spot that would allow pilots to land where fog was unlikely, since flying solely by instruments at the time was potentially hazardous. The commanding officer of Naval Air Station Seattle recommended the site of Saratoga Passage on the shores of Crescent Harbor and Forbes Point as a base suitable for seaplane takeoffs and landings under instrument conditions.

A narrow strip of land tied Oak Harbor to Maylor Point. Construction of NASWI involved extensive modification of the shoreline including the placement of fill to create the land area for the Seaplane base (see Image 2 and 3). Dredging, filling, and running water and power lines to the city had already started in late 1941 when orders were given to find a land plane site as well. Survey work on Ault Field began in late 1941. Construction of the airport began in 1942 and was expedited by the onset of America's involvement in World War II.

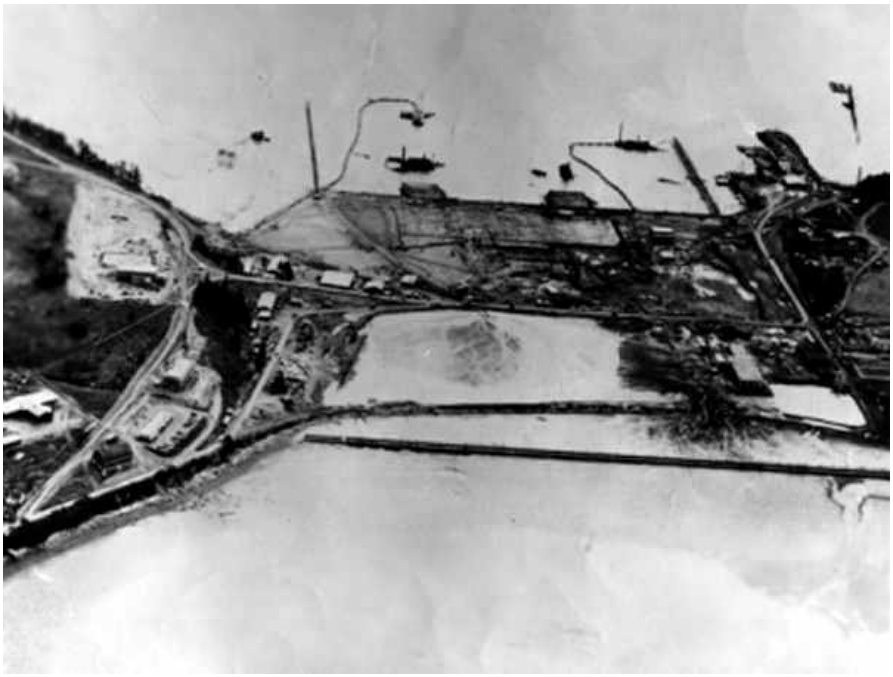

Image 2: Construction of the NASWI Seaplane Base 1942. ***Note: Aerial view of landmass is taken from Oak Harbor facing east (Photo provided by the Oak Harbor Historical Society).***

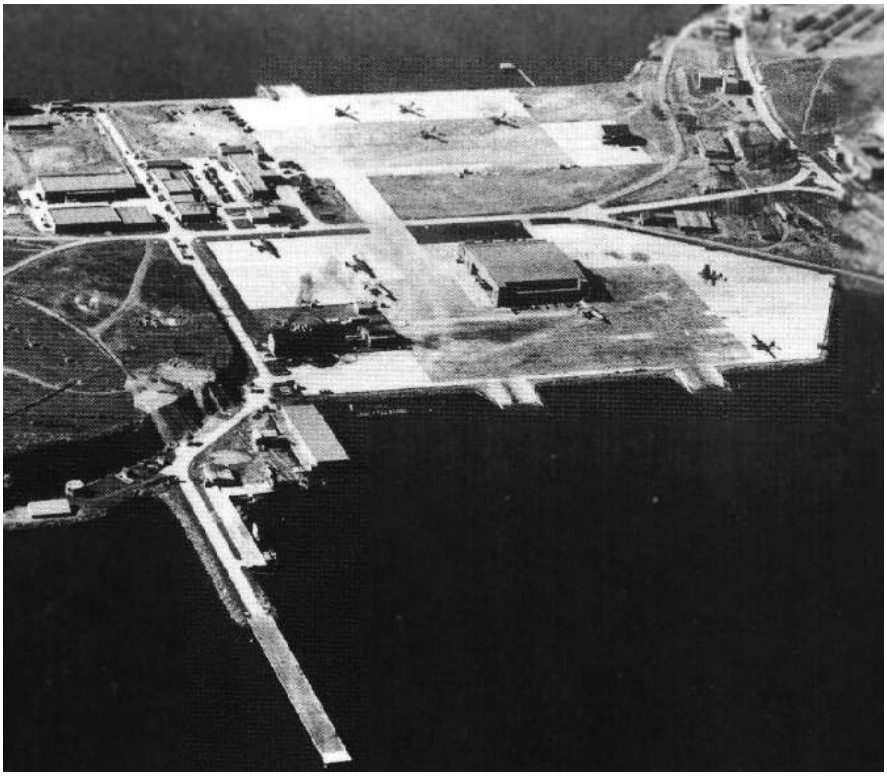

Image 3: Oak Harbor Seaplane base 1943. Note: Aerial view of landmass is taken from Crescent Harbor facing west (*Photo provided by the National Archive*).

By September 21, 1942, one of the primary buildings of the Air Station, Building 12, was complete and the orders that officially commissioned NASWI were given. The population of Oak Harbor tripled from 1941-1945 as a result of the Naval base. Operations at NASWI were reduced after the war ended in 1945, but once it was determined that NAS Sand Point in Seattle could not be enlarged, NASWI once again expanded. A new, 8,000-foot runway increased the base's capabilities in 1952. In the 1960s, the base was expanded to include Maylor's Capehart Housing for Naval families. During the last half of the twentieth century, the amount of activity on NASWI continued to increase as operations in Guam, Hawaii, and California were phased out and their aircraft and personnel were transferred to the Pacific Northwest.

In 1973 the City of Oak Harbor acquired part of the Seaplane Base from the federal government. The property was deeded to the City as Catalina Shorelines Park. In 1974 the City began construction of the marina. In 1987, additional guest moorage facilities and breakwater dock were constructed. Limited additional repairs and improvements were constructed in 1989 and 2000.

2.2.2 Current Land Use

Today, Oak Harbor is Island County's largest urbanized area (Washington State Conservation Commission 2000). The urbanization has been due in part to the proximity of the Naval Air Station and in part to Oak Harbor's proximity to Washington State Highway 20.

The majority of Oak Harbor shoreline is located within the boundaries of the Naval Air Station (10.09 out of 13.05 total miles of shoreline). The remainder of the shoreline within the City is zoned and developed for park/open space (59.4%), residential (25%), and commercial use (15.9%) (Figure 10). Single-family residential lots with shoreline view access from SW Scenic Heights Street and SW Peters Lane have generally been modified to a lesser degree due to the presence of large marine bluffs. As a result of these bluffs, this area is the least modified shoreline within the central portion of the City. A public marina (Oak Harbor Marina) and a private marina (associated with the Naval Air Station) are located on the peninsula separating Oak Harbor from Crescent Harbor. The shoreline associated with Crescent Harbor is more gently sloped and is part of the Naval Air Station. It is not as developed as the shorelines adjacent to Oak Harbor and exhibits less shoreline modification and armoring.

3 WATERSHED PROCESSES

Ecology's *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes* guidance (Stanley et al. 2005, referenced hereafter as *Protecting Aquatic Ecosystems*) provides a framework for assessing important watershed processes. Use of this framework is further described in the document *Puget Sound Watershed Characterization Project: Description of Methods, Models and Analysis* (Stanley et al. 2010). The six processes addressed by these guidance documents are the delivery, movement, and loss of water; sediment; phosphorus and toxins; nitrogen; pathogens; and large woody debris within a watershed. The analysis of watershed processes within this document employs the guidance of both documents to fulfill the regional-scale analysis of shoreline process and function during the SMP update process.[5]

The City of Oak Harbor's designated shorelines are primarily marine with some areas of associated wetland. For each of the six watershed shoreline process addressed below, the relative importance of each in influencing Oak Harbor's shorelines is assessed. This is followed by a brief discussion of delivery, movement, and loss of each process component within the watershed. Finally, potential alterations of those processes are assessed as much as possible based on inventory information. This assessment has been completed using modified tables describing indications of alteration based on *Protecting Aquatic Ecosystems* appendices.

Information in this section is largely drawn from the *Salmonid Habitat Limiting Factors Analysis* (Washington State Conservation Commission 2000) and the *Soil Survey of Island County* (Ness 1958), with other documents referenced as noted.

[5] It should be noted that both guidance documents have been generated to address watershed processes on a scale that is more in line with the level of effort expended as part of a county SMP update process. The watershed-scale or regional analysis within this document has been limited to what can reasonably be inferred from the documents and information gathered during the Inventory and Characterization process. The City has reviewed County data as well as information provided by the Department of Ecology in conjunction with the data provided within this document during the SMP update process.

3.1 WATER

The movement of water through a watershed is the primary focus of study since it affects all other watershed processes. Water can be delivered into a watershed through precipitation, groundwater movement, or tidal movement. (Freshwater delivery from precipitation is described in depth in Section 2.1.1) The patterns of precipitation, including quantity, type, and timing, are determined by the regional climate and affect the quantity, type, and timing of surface and groundwater movement. Once water has entered a watershed, it moves through the system as surface or groundwater.

Movement of water on the earth occurs through a system known as the hydrologic process, which involves the continuous movement of water between the earth and the atmosphere. In this process, water falls to the land as precipitation, evaporates into the atmosphere where it condenses, and then falls to the earth again as precipitation. The water that falls to the ground either collects in streams, rivers, lakes, or oceans, or soaks into the land to become groundwater. Groundwater can then be used by plants, humans (via wells), or can move within the water table until it surfaces and becomes surface water. The hydrologic process can be impacted in the following ways:

- Increases to impervious surfaces (i.e., roads and buildings) and the removal of forest cover - these actions may modify the ability of the system to take in groundwater and result in an increase to erosion and sedimentation. Increased amounts of impervious surface along the shoreline are especially important to urban areas such as Oak Harbor.
- Water withdrawals (such as wells) – Groundwater resources are commonly slow to recharge and increased levels of withdrawal may result in less water within the system overall. As shoreline processes within Oak Harbor are primarily tidally influenced, this impact to hydrologic function is somewhat less relevant to shoreline function within the City than the other impacts.
- Filling of depressional wetlands – reduces the ability of the watershed to provide floodwater storage and attenuation of flows. In addition, depressional wetlands also provide filtration and sequestration of toxins, pathogens, nitrogen and phosphorus. Filling of depressional wetlands occurred within the City during shoreline development.
- Alteration of flow (such as dams) – the modification can result in a reduction or increase to water flow and is also likely to result in alteration to flooding regimes and habitat. Review of historic and current aerial photographs indicate that flow alteration has occurred within the City including but not limited to the areas surrounding Freund Marsh, Oak Harbor Marina and Crescent Creek/Harbor in relation to the installation of the waste water treatment lagoon facility.

The movement of marine waters caused by tides (which are the result of gravitational changes created by the moon's rotation around the earth) can also influence shoreline processes and functions. The height of tides can be affected by storm events or general sea level rise, and because tides are a function of earth-scale processes, they are not controllable at a state or local level. Tidal influences within the local area can, however, be modified or interrupted by changes to beach elevations (such as fill) and shoreline armoring at or below the ordinary high water mark, resulting in a modification to the location of the tidal water's influence and energy. The type of shoreline armoring as well as the characteristics of the tidal elevation play will determine the extent and effect of the alteration.

Water movement within the City's shoreline jurisdiction is primarily controlled by tidal exchange. Freshwater inputs into Oak and Crescent Harbors are limited to four relatively small streams (two of which flow into Oak Harbor and two of which flow into Crescent Harbor). Therefore, the (tidal) movement of water within the Sound will affect water movement function of the City's shoreline jurisdiction more than that of upland, freshwater watershed processes.

A number of the indicators of alteration described in Table B-3 of *Protecting Aquatic Ecosystems* are present in the Whidbey Island – Saratoga Passage sub-watershed, in particular those related to impervious surfaces and modification of hydrography, such as the channel modification to Crescent Creek (Table 2). These indicate that water movement, particularly surface and shallow sub-surface movement, has been altered in this system. However, as stated previously, water movement within shoreline areas is primarily controlled by tidal exchange rather than watershed-processes. Therefore, watershed-scale alterations are unlikely to significantly affect shoreline conditions.

Most of the City's shorelines include areas of direct runoff into the Sound, including overland flow as well as small unnamed drainages and outfalls. Within the Oak and Crescent Harbor sub-basins, surface waters drain to the harbors and into Saratoga Passage via smaller creeks and streams. There are also a number of wetlands and areas of hydric soils that provide water storage. City shorelines within the central portion of Oak Harbor are primarily developed, which substantially decreases their capacity for surface water storage. The undeveloped and restoration sites inside the Naval Air Station are likely to provide necessary storage capacity, as may some of the smaller drainages. However, most of the developed shoreline more than likely feeds directly into Oak Harbor, and to a lesser extent into Crescent Harbor, either overland or by way of the City's storm drain system. Some groundwater recharge may occur, particularly around the aquifer recharge areas found in MR3 and MR6-11 (Figure 4).

Within the Oak Harbor and Crescent Harbor sub-basins, some amount of water loss would be expected from evaporation and transpiration. However, the majority of surface water loss is due to impervious surfaces associated with development and subsequent drainage into Puget Sound. Once water has drained to marine areas, tidal processes become the dominant mechanism behind its movement, including export outside of the harbors. At the City scale, tidal export would be the dominant form of water loss by far.

Table 2. Indicators of altered water delivery, movement, and loss within the Oak and Crescent Harbors Sub-basins.

Component of Process	Sub-Component	Indicators of Alteration	Present in Oak and Crescent Harbor Sub-basins.
Delivery	Climate	(none included in Protecting Aquatic Ecosystems Table B-3)	Not evaluated[1]
	Precipitation	▪ Non-forested vegetation in rain-on-snow zones	No
Movement	Surface, overland flow	▪ Watershed imperviousness ▪ Stormwater discharge pipes ▪ Drainage ditches in seasonally saturated areas ▪ Loss of seasonally saturated areas	Yes – all indicators of alteration are present.
	Surface, storage	▪ Loss of depressional wetlands ▪ Straight-line hydrography in depressional wetlands ▪ Straight-line hydrography of stream reaches with floodplains ▪ Dikes and levees on stream reaches with floodplains ▪ Dams	Yes – primary indicators of alteration in Oak Harbor include loss of depressional wetlands and straight line hydrography in depressional wetlands.
	Below surface, shallow subsurface flow	▪ New construction ▪ Land uses with impervious cover on geologic deposits of low permeability ▪ Non-forested vegetation on geologic deposits of low permeability	Yes – all indicators of alteration are present.
	Below surface, recharge	▪ Non-forested vegetation on geologic deposits of high permeability ▪ Land uses with impervious cover on areas of high permeability ▪ Utility lines ▪ Septic systems ▪ Unlined irrigation canals	Yes – all indicators of alteration are present with the exception of unlined irrigation canals.
	Below surface, vertical and lateral subsurface flow	▪ Drawdown patterns ▪ Baseflow trends	Not evaluated[2]
	Below surface, subsurface storage	▪ Constantly wet road ditches	Not evaluated[2]
	Return to surface, discharge	▪ Well locations pumping rates and volumes	Not evaluated[2]

Component of Process	Sub-Component	Indicators of Alteration	Present in Oak and Crescent Harbor Sub-basins.
Loss	Evaporation	(none included in Table B-3)	Not evaluated[1]
	Transpiration	▪ Land cover	Yes
	Streamflow out of basin	▪ Diversion structures	Not evaluated[2]
	Groundwater flow out of basin	▪ Baseflow trends ▪ Well locations, pumping volumes	Not evaluated[2]

[1] Where climate is the major natural control, evaluation of these indicators is beyond the scope of regional analyses (Stanley et al. 2005).
[2] Data specific to the presence of this process within the Oak and Crescent Harbor sub-basins was not available at the time this document was generated.

3.2 SEDIMENT

The sand, soil and other particles that are deposited within waterbodies are referred to as sediment. Sediment is delivered into the water system from steep slopes with unstable or unprotected soils, landslide hazard areas, and river and stream channels. Sediment loads are stripped from the shoreline through general erosions within the watershed, shoreline erosion, and mass wasting events (e.g., landslides). As sediment moves through the ecosystem it becomes deposited in wetlands, floodplains, and along freshwater and marine shorelines. It is the movement of sediment within a system that forms beaches, deltas and estuaries. Sediment also provides habitat for aquatic plants and animals as well as nutrients and minerals that are necessary for ecosystem function.

The amount and location of sediment within the system can be altered by humans through the draining or filling of wetlands, activities that reduce shoreline variability (e.g., the removal of large woody debris), channelization of streams, shoreline armoring, clearing of vegetation within the shoreline, increases of impervious surfaces within a shoreline, as well as the development and placement of in-water structures. Dredging and erection of bulkheads can also affect how much sediment is present in aquatic shoreline areas. Changes to the amount of sediment moving through a system may result in either surpluses or deficits within the system and can change the overall substrate composition of the waterbodies.

Sediment delivery within the Oak and Crescent Harbor sub-basins likely occurs primarily through surface erosion and mass wasting events. However, it is presumed that vegetation clearing and high percentages of impervious surfaces within the City are also likely to contribute sediments into the habitat system via stormwater runoff. Sediment is also delivered into the marine system, however to a much lesser extent, through the inputs of smaller tributaries associated with both harbors (Table 3). The lack of significant sediment input from small tributaries associated with the marine shoreline dictate that bluff erosion and drift cells are responsible for the majority of sediment influx in this system. A number of the indicators of alteration to sediment delivery as described in *Protecting Aquatic Ecosystems* are present.

The primary source of movement of sediment within the area is the result of drift cells (Figure 15). The right-to-left drift along the eastern sides of both harbors and the-left-to-right drift along

the western side of both harbors push sediment further into each harbor's center. In addition, the area of no appreciable drift within Oak Harbor is likely to result in sediment accumulation at this location.

In terms of sediment characterization, Ecology's 303(d) listing maps indicate that the sediment within the southern portion of the Oak Harbor Marina, roughly associated with the southern portion of MR5 and the eastern portion of MR6 (Figure 16), meet water quality standards for commonly tested sediment components including but not limited to: arsenic, benzoic acid, copper, lead and mercury.

Table 3. Indicators of altered sediment delivery, movement, and loss within the Oak and Crescent Harbor Sub-basins

Component of Process	Sub-Component	Indicators of Alteration	Present in the Oak and Crescent Harbor Sub-basins
Delivery	Surface erosion	▪ Non-forested land cover on highly erodible slopes adjacent to aquatic resources ▪ New construction draining to aquatic resources ▪ Row crops agriculture draining directly to aquatic resources ▪ Roads within 200 ft of aquatic resources	Yes – primary indicators of alteration within basin are new construction draining to aquatic resources and roads within 200 feet of aquatic resources.
	Mass wasting	▪ Roads in high mass wasting hazard areas ▪ Non-forested land cover on high mass wasting hazard areas	Not evaluated[1]
	In-channel erosion	▪ Straight-line hydrography in unconfined channels ▪ Urban land cover	Yes – both indicators of alteration are present.
Movement	Sedimentation	▪ Loss of depressional wetlands ▪ Straight-line hydrography in depressional wetlands ▪ Straight-line hydrography on stream reaches with floodplains or depositional channels ▪ Dikes and levees on stream reaches with floodplains	Yes – primary indicators of alteration include loss of depressional wetlands and straight line hydrography in depressional wetlands.
Loss	n/a	Use local data[1]	Not evaluated[2]

[1] General indicators of alteration to sediment loss processes have not been identified within guidance documents (e.g. *Protecting Aquatic Ecosystems*) at this time.

[2] Local data regarding sediment delivery and loss and the presence of these processes components and sub-components is not available at this time.

3.3 PHOSPHORUS AND TOXINS

Phosphorus

Phosphorus naturally occurs within the ecosystem and is generally delivered into waterbodies through the weathering of rocks or from air born dust particles. Once in the aquatic system, it is transported as either a solute or a particulate. The amount of phosphorus within the aquatic system can be increased through the application of fertilizers or manure on land which then experiences runoff. Often, increased levels of phosphorus within a watershed result in algae blooms and subsequent loss of deep water oxygen in freshwater.

Toxins

Toxins are substances that can be harmful to plants, animals and humans. Some toxins are produced by humans, including but not limited to manufactured herbicides, pesticides, vehicle emissions, copper particulates from brake pads, antibiotics and artificial hormones. Other toxins, such as copper, lead, zinc mercury, cadmium and nickel, occur naturally within the environment and are only harmful in large amounts. In general, these toxic metals are found in relatively low concentrations throughout Puget Sound lowland streams and lakes. It is worth noting that the existence as well as the amount and degree of impervious surfaces may contribute to the rate at which toxins move into an aquatic ecosystem by encouraging runoff.

Once within the watershed system, neither phosphorus nor toxins can be completely removed, unless they are transported to another watershed system. However, they may be sequestered in plants, wetlands, or sediment.

Only limited information has been identified during the SMP update that directly informs phosphorus and toxins movement in the Oak and Crescent Harbor sub-basins. Most of the stormwater that enters the harbors from the City is untreated, and the high percentage of impervious surfaces within the City may serve as a source of phosphorus and/or toxins to the shoreline environment.[6] In addition, the City has not tracked phosphorus or toxins amounts within stormwater inputs into Oak and Crescent harbors[7]. However, the City of Oak Harbor is a Phase II NPDES jurisdiction and as such is now required to annually test for phosphorous and toxins in stormwater entering the bay according the provisions of the Phase II permit. The level of toxins within the City's stormwater entering Oak Harbor Bay is required to meet total maximum daily loads (TMDLs) set by the State and the EPA. Additionally, as part of the Phase II program, all new development exceeding 1-acre in size is required to meet stormwater control and treatment specs in the Western Washington Stormwater Manual.

[6] Despite efforts by the City to improve stormwater control and treatment such as increases to the amount of stormwater ponds within the city since the 1980's, It is currently estimated that only 35% of the stormwater that enters the harbors from the City is treated.

[7] However, neither phosphorus nor specific toxins are currently mapped by the State under the 303(d) program as being of specific concern within either sub-basin. Ecology's 303(d) Category 5 listings within the shoreline jurisdiction of Oak Harbor are limited to fecal coliform and dissolved oxygen for Crescent Harbor Creek before it flows into the waste water treatment plant utilized by the NASWI Seaplane Base.

Although the processes responsible for the accumulation and movement of phosphorus and toxins are likely to have been altered within the Oak and Crescent Harbors, measured conditions indicate that this has had relatively little effect on shoreline function in comparison with other watershed-scale processes. Because the City's shorelines are generally marine with associated wetlands and only minor freshwater input, the watershed-scale processes responsible for the accumulation and movement of phosphorus and toxins are pertinent to City shorelines primarily in terms of how they affect delivery into Oak and Crescent Harbors, whether from the sub-watersheds or areas draining directly to the harbors. Generalized delivery, movement and loss information is provided in Table 4.

Table 4. Indicators of altered phosphorus and toxins delivery, movement, and loss within the Oak and Crescent Harbor Sub-basins.

Component of Process	Sub-Component	Indicators of Alteration	Present in Oak and Crescent Harbor Sub-basins.
Delivery	Phosphorus sources	▪ Urban land use ▪ Agricultural land use ▪ Agricultural land use adjacent to dairies	Yes, primary indicator within Oak Harbor is urban land use.
	Toxin sources	▪ Urban land use ▪ Row crop land use	Yes, primary indicator within Oak Harbor is urban land use.
	Surface Erosion	(Table 3 – Sediment Delivery, Movement, and Loss)	Yes (see Table 3)
Movement	Biotic uptake and decomposition	(none included in Protecting Aquatic Ecosystems Table D-2)	Not evaluated[1]
	Adsorption (P)	▪ Straight-line hydrography in depressional wetlands with mineral soils ▪ Loss of depressional wetlands with mineral soils ▪ Urban land cover in areas of clay soils adjacent to aquatic ecosystems	Not evaluated[1]
	Adsorption (T)	▪ Straight-line hydrography in wetlands with organic or clay soils ▪ Loss of wetlands with organic or clay soils	Not evaluated[1]
	Sedimentation	(Table 3 – Sediment Delivery, Movement, and Loss)	Yes (see Table 3)
Loss		(Table 2 – Water Delivery, Movement, and Loss)	Yes (see Table 2)

[1] Data specific to the presence of this process within the Oak and Crescent Harbor sub-basins was not available at the time this document was generated.

3.4 NITROGEN

Nitrogen is naturally delivered into the watershed primarily through the decomposition of organic material, and it can occur in gas, solid, or liquid form. It can also be delivered into the watershed to a much lesser extent by lightening. Nitrogen will move through the system by nitrification, biotic uptake, and adsorption. Nitrogen can be removed from the watershed through volatilization and it can be sequestered within the watershed through denitrification. Human modification of the nitrogen cycle within the watershed occurs through the application of soil amendments such as fertilizers, leaky septic systems, drainage or fill of depressional wetlands or channelization of lowland headwater streams, as well as through the interception of shallow groundwater flow into riparian areas. Additionally, it has been found that non-native plant species along the shoreline may also increase the amount of nitrogen present within the system. Modifications to the amount of nitrogen within a watershed in either direction can result in reduced functionality of the system.

No information sources have been identified during the SMP update process that directly inform nitrogen movement within the City or its associated sub-basins. However, generalized delivery, movement and loss information is provided in Table 5. Ecology's Water Quality Assessment information for Oak and Crescent Harbors is discussed in Section 3.4. Nitrogen is not listed within either sub-basin as an impairment (e.g., 303(d) Level 5). Although potential for process alteration exists with Oak Harbor and Crescent Harbor based on Table E-2 in *Protecting Aquatic Ecosystems*, conditions the both harbors appear to have had relatively little effect on shoreline function in comparison to other watershed-scale processes.

Table 5. Indicators of altered nitrogen delivery, movement, and loss within the Oak and Crescent Harbor Sub-basins.

Component of Process	Sub-Component	Indicators of Alteration	Present in Oak and Crescent Harbor Sub-basins
Delivery	Nitrogen sources	▪ Agricultural land use ▪ Rural residential land use	Yes – Lower intensity residential uses, similar to rural residential land uses are present in Oak Harbor. Agricultural land use may also be present.[1]
Movement	Biotic uptake and decomposition	▪ Straight-line hydrography in headwater streams	No – however straight line hydrography is present within Crescent Creek. Review of aerial photography does not indicate that the head waters have been modified.
	Nitrification	▪ Straight-line hydrography in depressional wetlands ▪ Loss of depressional wetlands	Not evaluated[2]
	Adsorption	▪ Straight-line hydrography in headwater streams	No – however straight line hydrography is present within Crescent Creek. Review of aerial photography does not indicate that the head waters have been modified.
Loss	Denitrification	▪ Straight-line hydrography in	Not evaluated[2]

		depressional wetlands ▪ Loss of depressional wetlands	

[1] In addition, rural residential land use is present in the larger scale watershed but not within the city.
[2] Data specific to the presence of this process within the Oak and Crescent Harbor sub-basins was not available at the time this document was generated.

3.5 PATHOGENS

Pathogens are disease-causing microorganisms such as bacteria, protozoans, viruses, or fungi. In natural conditions, pathogen delivery is commonly the result of fecal matter from wild animals that has drained into the aquatic system. The amount of pathogens within the system may increase in areas with high concentrations of untreated human and animal fecal material, including inputs from faulty septic systems, livestock manure, and pet waste. In addition, impervious surfaces and the channelization of watercourses increase water velocity and subsequently can also increase the amount of pathogens that are delivered to the aquatic system. Once within the aquatic system, pathogens move via in-water transport or may become sequestered within the system via adsorption and sedimentation. Pathogens that were previously sequestered may be re-introduced into the system after disturbance of the area in which the pathogens were located. Permanent loss of pathogens within the watershed system occurs after their death. Primary factors that cause pathogen death include significant changes in temperature, pH, UV radiation, or salinity, predation, and starvation.

Pathogens may be a concern within Oak and Crescent Harbors. Neither of the harbors is included in Ecology's 303(d) list for fecal coliform contamination. However, part of Crescent Harbor Creek, a portion of which is located within the shoreline jurisdiction for Oak Harbor, is mapped as a Level 5 contaminant for fecal coliform. In addition, the Washington State Department of Ecology does water quality monitoring at multiple locations in Windjammer Park. The City also tests for and has found fecal coliform at the 42-inch outfall location before it enters the bay. The Washington State Department of Ecology and the Washington State Department of Health, in cooperation with local governments, have a BEACH Program that provides information about pollution and related risks to recreationists. As of June 2, 2011, the BEACH Program lists Windjammer Beach as "caution" and Windjammer Lagoon as "good". Under the definitions of this program, "caution" means bacteria levels exceed EPA recommendations. Children, elderly, and those in ill health are advised not to swim. "Good" means that Bacteria levels are considered acceptable according to EPA recommendations. In addition, the entire Oak Harbor and portions of Crescent Harbor are closed to the harvest of shellfish due to Marine Biotoxin. Generalized delivery, movement and loss information is provided in Table 6.

Table 6. Indicators of pathogen delivery, movement, and loss within Oak and Crescent Harbor Sub-basins.

Component of Process	Sub-Component	Indicators of Alteration	Present in Oak and Crescent Harbor Sub-basins
Delivery	Fecal inputs	▪ Rural residential land use	Yes – Lower intensity residential uses, similar to rural residential land uses are present in Oak Harbor. [2]
Movement	Transport (overland, surface, and	▪ Straight-line hydrography ▪ Urban land cover and/or impervious cover	Yes – Primary indicator of alteration is urban land cover and impervious surface cover. However, ditching on

	subsurface flow; recharge)	▪ Ditching on geologic deposits of low permeability	geologic deposits of low permeability are also evident in Freund Marsh and Crescent Marsh.
	Adsorption	▪ Loss of depressional wetlands ▪ Straight-line hydrography in all depressional wetlands	Not evaluated[1]
	Sedimentation	(Table 3 – Sediment Delivery, Movement, and Loss)	Yes (see table 3)
Loss	Death of Pathogen	▪ Loss of depressional wetlands	Yes – Marina fill and development around Freund Marsh likely resulted in loss of depressional wetlands.

[1] Available Island County data as well as information provided by the Department of Ecology has been reviewed for the creation of this document and significant information from those sources has been integrated into this document.

[2] In addition, rural residential land use is present in the larger scale watershed but is not necessarily present within the boundaries of the city.

3.6 LARGE WOODY DEBRIS

The term "large woody debris" (LWD) is generally used to refer to fallen trees, logs, branches, stumps, and/or root wads that are located along the edges of freshwater and marine shorelines. LWD is delivered into a watershed through streambank erosion, windthrow, and mass wasting events. LWD is then transported either downstream or throughout the Puget Sound until it lodges into a portion of the shoreline.

LWD can serve multiple functions to shoreline and riparian areas, including:

- The creation of habitat complexity within a river and along marine shorelines
- Shoreline stabilization and reduction of erosion
- Provision of food sources and habitat for aquatic insects and wildlife along shorelines

LWD may be prevented from entering the watershed system through the removal of shoreline vegetation from riparian areas (preventing input) or the reduction of waterflow in stream and river systems (preventing adequate water velocity for conveyance downstream). Additionally, shoreline armoring may also prevent LWD from entering the system and/or prevent LWD already in the system from lodging itself in place.

Because the City's shorelines are primarily marine with associated wetlands and only minor freshwater inputs, the watershed-scale LWD processes including LWD resources, inputs, movement and modification of riverine habitat are less important to City shoreline function than is direct input of LWD from City shorelines. The tributaries to Oak and Crescent Harbors are relatively small and any LWD originating along them would not be expected to move very far downstream. In addition, the marine shorelines within the City have a significant lack of trees, in part due to development, that limit the uplands from being a substantial source of LWD. Although, due to the historic presence of emergent and scrub shrub wetlands along the shoreline,

the marine shorelines of Oak Harbor may not have been a historic source of LWD for the shoreline.

Despite the lack of LWD sources within the Oak and Crescent Harbor sub-basins, both harbors have large areas of LWD accumulations. These pieces of LWD, thought to have been generated from the Skagit River system, have been deposited by tidal fluctuations of the Sound. The accumulation of LWD along the shoreline is likely to provide moderation of soil temperature, food sources and habitat for invertebrates, structural complexity, and sediment trapping and bank erosion control.

A number of the indicators of alterations described in *Protecting Aquatic Ecosystems* Table G-2 are present within the watershed (Table 7).

Table 7. Indicators of altered large woody debris delivery, movement, and loss within the Oak and Crescent Harbor Sub-basins.

Component of Process	Sub-Component	Indicators of Alteration	Present in the Oak and Crescent Harbor Sub-basins
Delivery	Streambank erosion	▪ Dikes and levees ▪ Straight-line hydrography in floodplains ▪ Non-forested land cover within 100 ft of stream in a floodplain	Yes – straight-line hydrography associated with Crescent Marsh.
	Mass wasting	▪ Non-forested land cover on high mass wasting hazard areas	Yes – Aerial photographs do not reflect recent mass wasting events. However, the Coastal Zone atlas does map slide areas within the boundaries of Oak Harbor.
	Windthrow	▪ Non-forested land cover within 100 ft of streams	Yes – Based upon review of aerial photography, Crescent Creek has non-forested land cover within 100-feet.
Movement	Storage	▪ Dikes and levees ▪ Straight-line hydrography in floodplains	Yes – straight-line hydrography associated with Crescent Marsh.
Loss	Breakage/Decomposition	(not included in Protecting Aquatic Ecosystems Table G-2)	

4 CITY SHORELINE OVERVIEW

4.1 LAND USE

4.1.1 Land Use Patterns within the Shoreline

All information regarding land use patterns within the City of Oak Harbor was derived from GIS mapping resources including assessor land use data, City Zoning, and future land use designations. A full description of these mapping resources is provided within the Shoreline Inventory Document (Appendix A). Tables 8, 9, and 10 below provides a general overview of the percentages of existing land use and future land use designations as well as current zoning classifications within the City's shoreline jurisdiction.

Table 8. Existing Land Use designations within the City's Shoreline Jurisdiction

Generalized Assessor Land Use Type Associated with Existing Land Use Designation	Land Use Designation	Acreage	Percentage of Shoreline Jurisdiction
Residential	Single Family Residential	17.2	1.7
	Multi-Family Residential	3.9	0.4
	Community Property	0.4	0.0
Commercial	Commercial	2.8	0.3
	Marina Parcels	7.8	0.8
Public Use	Park/Open Space	57.5	5.8
	Public Facility	0.9	0.1
Other	Naval Air Station Whidbey Island (NASWI)	881.8	88.3
	Vacant	3.7	0.4
	None[1]	22.9	2.0

[1]"None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations.

Existing Land Use

The majority of land use within Oak Harbor's shoreline jurisdiction is NASWI (88.3%). Outside of NASWI, the majority of the shoreline is characterized by Parks, open space and public facilities (5.9%), single and multifamily residential use (2.1%), and commercial use (1.1 %, including marina properties). Percentages of land use for each reach are provided within Section 5 of this document.

Table 9. Current Zoning Designations within City's Shoreline Jurisdiction

Generalized Assessor Land Use Type Associated with Current Zoning Designation	Current Zoning	Acreage	Percentage of Shoreline Jurisdiction
Residential	Single Family Residential, R-1	16.8	1.7
	Limited Multi-family Residential, R-2	7.2	0.7
	Multi-Family Residential, R-4	5.8	0.6
Commercial	Community Commercial, C-3	0.6	0.1
	Highway Corridor Commercial, C-5	2.9	0.3
	Central Business District, CBD	3.4	0.3
	Central Business District 1, CBD-1	2.7	0.3
Public Use	Open Space, OS	41.9	4.2
	Public Facility, PF	15.4	1.5
Other	None[1]	902.3	90.0

[1] "None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations. In this instance, the "None" designation is primarily lands within NASWI, which does not have a zoning designation.

Table 10. Future Land Use Designations within City's Shoreline Jurisdiction

Generalized Assessor Land Use Type Associated with Future Land Use Designation	Future Land Use	Acreage	Percentage of Shoreline Jurisdiction
Residential	Low Density Residential	16.8	1.7
	Medium Density Residential	7.2	0.7
Commercial	Residential Office	3.5	0.4
	Central Business District	6.1	0.6
	Community Commercial	0.6	0.1
	High Density Residential	4.4	0.4
	Highway Corridor Commercial	2.9	0.3
Public Use	Open Space	41.9	4.2
	Public Facilities	25.0	2.5
Other	Naval Air Station – Whidbey Island	882.0	88.0
	None[1]	12.3	1

[1]"None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations.

Current Zoning and Future Land Use Designations

Zoning classifications and Future Land Use designations are largely similar to each other. The majority of the land within the City boundaries is designated for NASWI. However there are a few areas where the current zoning and future land use designations differ. These areas include the areas adjacent to Freund Marsh (MR2) and SE Pioneer Way (MR4). The differences between current zoning and future land use designations are described in detail within Section 5.

4.1.2 Public Access

Information about public shoreline access in the City was primarily drawn from GIS data layers, City documents and maps as well as state public access websites (Refer to Appendix A).

When compared to other cities within the Sound, the City has a relatively extensive amount of public access to the shoreline jurisdiction (See Figure 12). Public facilities and open space areas such as Freund Marsh, Windjammer Park, VFW Park, Scenic Heights Trailhead, and Oak Harbor marina all provide for either direct or view access to the shoreline. In addition, the City also has a waterfront trail that extends along almost the entire length of Oak Harbor, from Freund Marsh to the NASWI Seaplane Base. Existing public access is so extensive that future public access is likely to include improvements to existing public access only.

Existing public access for each reach is described in greater detail for each in Section 5 and illustrated on Figure 12.

4.1.3 Stormwater and Wastewater facilities

Stormwater

The City's management of surface water is regulated by OHMC Chapter 12 in accordance with the City's Phase II permit issued by the Washington State Department of Ecology. In general terms, the purpose of these regulations include minimizing water quality degradation and impacts of increased run off, protecting and maintaining groundwater resources, decreasing environmental impacts, and promoting site planning.

As identified in Figure 5, there are multiple stormwater catch basins and outfalls within the City's shoreline jurisdiction area that empty into Puget Sound. Although not captured in the data, stormwater from recently developed or redeveloped areas does receive water quality treatment prior to discharge pursuant to current stormwater requirements. Specific information regarding existing outfalls and catch basins within each shoreline reach is provided in Section 5 of this document.

In addition to existing stormwater regulations, a Comprehensive Storm Drainage Plan for the City was adopted by the Mayor and City Council in 2007. The Plan contains background information, water quality assessment, alternative solutions for improving Oak Harbor's run off quality, and funding alternatives for implementing the Comprehensive Plan.

Wastewater

Wastewater within the City is treated at two facilities: a rotating biological contactor (RBC) facility near Windjammer Park; and a lagoon facility on the Navy's Seaplane Base. Treated water from both facilities flows through an outfall pipe into Crescent Harbor bay. However, the RBC facility is reaching the end of its useful life and the lagoon facility is not large enough to serve the current or projected future City population. Because neither facility can be cost-effectively modified to meet future water quality regulations, the City is currently reviewing alternatives to determine the best site for a new treatment process plant and it is projected that a

site will be chosen during late in 2011. Construction is proposed for 2015 with completed installation slated to occur by 2017.

A relative small number of parcels within the shoreline utilize on-site septic systems for wastewater disposal. Parcels utilizing septic systems are generally located along the western side of Oak Harbor including the single family residential developments located on the marine bluff as well as some of the residences to the east of Freund Marsh in the Dillard's addition area. Use of these on-site systems is regulated by the Island County Public Health Department. On-site septic systems are subject to state, county and local regulations. Regulation of these systems is important because failing systems can result in excessive nitrogen, phosphorus and toxins being released into the system resulting in water contamination and impacts to habitat and wildlife. The City and Ecology have tested for and found fecal coliform in the area of the 42-inch stormwater outfall, next to the Dillard's addition neighborhood. Ecology's BEACH Program currently has a "caution" for Windjammer Beach based on this data.

Figure 6 identifies existing sanitary sewer pipelines and parcels with on-site septic within the City. Specific information regarding wastewater facilities within each shoreline reach is provided in Section 5 of this document.

4.1.4 Impervious Surfaces

Current research of impervious surfaces within an ecosystem indicates that there is a direct correlation between the amount of impervious surface and the level of impact to hydrologic function. This relationship is largely due to the interrelation between impervious surfaces and the amount and velocity of stormwater runoff. Vegetated areas commonly function to slow the movement of precipitation, primarily through canopy cover and secondarily by providing a variable ground surface, and as a result can retard the movement of water into streams and other waterbodies. It can also provide time for water filtration and movement of surface water into the ground.

The creation of impervious surfaces results in a modification to the hydrologic function and as a result alters (often increasing) the amount of sediment and pollutants that are provided to streams and other waterbodies (Booth 1998; Arnold and Gibbons 1996). Increased surface water velocity associated with impervious surfaces can also destabilize banks and increase the amount of erosion (May et al. 1997).

The majority of impervious surface research relates to the interaction between impervious surfaces and stream function. This research generally supports the finding that amount of impact to water and habitat quality is related to the amount of impervious surface and that this impact can be divided into two thresholds. After an area exceeds a 10% impervious surface threshold, stream elements such as general composition of the bed are removed from the system (Booth 1991). After an area exceeds a 20 to 30% impervious surface threshold, stream indicator such as water quality, overall habitat and diversity are often reduced to a poor rating (May et al 1997). In the absence of specific threshold data relating to impact of impervious surfaces to marine systems, the use of the stream data thresholds as defined above is commonly utilized for marine regulations as well.

For the purposes of this analysis, the amount of impervious surface within the City was estimated utilizing data from National Land Cover Data (NLCD) and is visually represented in Figure 8. The City does not currently have an impervious surface GIS data layer. GIS analysis of the data presented in Figure 8 indicates that 11.52% of the City's shoreline jurisdiction is covered by impervious surface. However, it is assumed that this percentage is, at least to some degree, inaccurate. The mapped impervious surface data layer does not appear to correspond well to the aerial photograph (i.e. some areas that are impervious have no defined percentage of impervious and some areas where no impervious surface is visible have mapped impervious surface). This results in either an over or under estimation of impervious surfaces within the shoreline reaches. One of the best areas where this disarticulation of map layers can be seen is in the vicinity of the Oak Harbor Marina, where areas covered by impervious surface adjacent to the shoreline reflect a zero percent impervious surface rating.

Despite the noted inaccuracies, this impervious surface data is currently the best available information and is therefore utilized to provide estimated impervious surface coverage for each shoreline reach within Section 5.

4.1.5 Shoreline Modification

For the purposes of this document, shoreline modifications specifically refer to human alteration to the shoreline and nearshore environment. Shoreline modifications can include, but are not limited to: shoreline armoring, fill, straightening of stream channels, levees, dikes, and overwater development (i.e. piers, docks, covered moorage, etc.). Shoreline modifications can result in the alteration of the location of the shoreline, erosion and sediment transport processes, natural channel migration, water flow, and both upland and aquatic habitat distribution.

Data regarding the extent of shoreline modification within the City was provided by GIS data resources, review of aerial photographs and a site visit.

Figure 13 identifies shoreline modifications. Areas of nearshore fill are particularly evident. In addition, historic aerial photographs of the City provide insight into the extent of shoreline modification within the City. Large quantities of fill were used to extend the Maylor Point peninsula to the north and east (See Figure 13 and (A) in Image 4), presumably to provide greater protection from storms for the Seaplane Base that was constructed on fill in the narrow low lying area that connected the main portion of Oak Harbor with Maylor Point (B). In addition, portions of Freund Marsh which previously contained an estuary area with a braided channel were filled and the fill was extended past the current location of Flintstone Park and east along Pioneer way. (C). Historic fill is also evident for several miles along the southern shoreline of Crescent Harbor where it appears to serve as a dike for Crescent Marsh to the north.

Shoreline armoring is evident below the bluffs of Scenic Heights. There is more than a mile of natural beach before armoring is again evident protecting areas of historic fill just west of Flintstone Park. This rip rap armoring extends east along Pioneer Way, with a short area of semi-natural shoreline, and then rip rap again along the Marina shoreline and extending south and west to the areas of historic fill on the northwest portion of the Maylor Point peninsula. Armoring is also evident on Crescent Bay at NASWI from south of the pier, extending north and protecting

the historic fill for the Seaplane Base and continuing roughly a mile to the northeast along the shoreline of Crescent Harbor.

Overwater structures are limited to public properties and include an old pier in disrepair near Flintstone Park and extensive docks and floats associated with Oak Harbor Marina. There is also a large pier at NASWI on Crescent Harbor which provides temporary moorage facilities for military vessels and moorage facilities for smaller recreational vessels.

Image 4: Aerial of Oak Harbor (Date Unknown, but pre Seaplane Base Construction in 1941-42). ***This historic photo used with permission and courtesy of Peggy Darst Townsdin, local author and historian.***

Reach specific shoreline modifications are described in greater detail for each shoreline reach in Section 5.

4.2 CRITICAL AREAS

A complete listing of citations used to compile information on critical areas including GIS data layers is provided in Appendix A. Shoreline relevant Oak Harbor critical areas include wetlands, fish and wildlife habitat conservation areas, geologically sensitive areas and critical aquifer recharge areas. Refer to Figures 3 and Figures 3a-c.

Wetlands

Wetlands within the City of Oak Harbor are generally defined as follows:

> "*those 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 vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps,*

marshes, bogs, and similar areas. Wetlands do not include those 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 may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands." (Oak Harbor Municipal Code, OHMC, 20.02.020 (72))[8]

The wetland data sources utilized to map and identify wetland areas during the shoreline analysis process included information from various data sources such as City of Oak Harbor, Island County, and NASWI. The wetland boundary information as shown on Figure 3a reflects data received from these resources. This data is approximate and does not reflect the results of a formal delineation or survey. Formal site specific analysis of on-site wetlands is generally a requirement for development on parcels that are mapped as having wetlands on-site or in the immediate vicinity (commonly within 300 feet). The mapped location of wetlands (i.e. increases or reductions to the extent of the wetlands) may be delineated as a result of development analysis.

Within the City of Oak Harbor shoreline jurisdiction, there are three areas that are predominately wetland. These areas are: Freund Marsh, the wetland area located on the Maylor Point peninsula and the wetland area associated with Crescent Harbor and Crescent Creek.

Fish and Wildlife Habitat Conservation Areas and Priority Species

Fish and wildlife habitat conservation areas (FWHCA) include:

(1) *Areas with which state or federally designated endangered, threatened, and sensitive species have a primary association. The Washington State Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service should be consulted for current listing status;*

(2) State priority habitats and areas associated with state priority species, as identified by the Washington State Department of Fish and Wildlife;

(3) Garry oak (Quercus garryana) stands and individual trees;

(4) Other habitats and species of local importance, as identified by the city in accordance with OHMC 20.25.020;

(5) Commercial and recreational shellfish areas, including all public and private tidelands or bedlands suitable for shellfish harvest as well as shellfish protection districts established pursuant to Chapter 90.72 RCW;

(6) Geoduck concentration areas, including all public and private bedlands suitable for geoduck colonization;

(7) Eelgrass beds;

(8) Forage fish spawning areas;

(9) Lakes or ponds that provide fish or wildlife habitat, except artificial ponds created for a nonwildlife purpose such as stormwater detention facilities, wastewater treatment facilities, farm ponds, and temporary construction ponds; and

(10) Areas of rare plant species or high-quality ecosystems identified by the Washington State Department of Natural Resources through the Natural Heritage Program under Chapter

[8] The definition of wetland used by the City of Oak Harbor is identical to the Shoreline Master Act definition as shown in RCW 90.58.030(2)(h).

79.70 RCW. (Ord. 1440 § 4, 2005). (OHMC 20.25.010)

No field delineated FWHCA GIS data sets were identified during the shoreline inventory and analysis process. Figures 3, 3b and 3c provide an initial resource for determining the general location of FWHCA as provided by the definition above. Data resources for the mapped areas on this figure include the Washington State Department of Fish and Wildlife, Washington State Department of Ecology and Island County. However, site specific data regarding the locations of FWHCA, is provided by the project applicant for parcels with a probability of containing such areas before development occurs. Specific habitat conditions of each of the shoreline reaches based upon available inventory data are provided in Section 5.

As noted above, habitats and areas associated with federal and state designated endangered, threatened, and sensitive species are also included in FWHCA regulations. The City may also include local species of importance within FWHCA regulations, such as Garry Oak, pursuant to the process outlined in OHMC. The following habitat areas were identified during this analysis:

- Forage fish spawning habitat (specifically Pacific Sand Lance and Surf Smelt)
- Bald Eagle (due to Washington State special status and OHMC requirements)
- Shellfish locations
- Areas with marine vegetation (including eelgrass)
- Garry Oaks

Use of the marine shoreline by all Puget Sound anadromous fish species including: bull trout, chinook salmon, chum salmon, coho salmon and steelhead trout is assumed. In addition to anadromous fish species, use of Oak and Crescent Harbors by bald eagle and marbled murrelet is also assumed. Stellar sea lions may utilize Oak and Crescent Harbor including the haulout site identified on Figure 3c. Use within the City Shoreline jurisdiction by other threatened and endangered species commonly found within the Puget Sound such as, humpback whales and Southern Resident Killer Whales is generally unlikely due to the shallow nature of both harbors. However, occasional sitings of SRKW and gray whales to the east of Polnell point are noted on the Orca Network website (Orca Network 2011). The occurrence of sea turtles, such as leatherbacks, within the state of Washington is considered an extremely rare occurrence.

Relevant species are described in greater detail for each shoreline reach within Section 5.

Geologically Sensitive Areas

Geologically Sensitive Areas within the City include:

Areas susceptible to erosion, sliding, earthquake, or other geologic events and conditions. …Areas susceptible to one or more of the following types of hazards shall be designated as a geologically sensitive area:

(a) *Areas mapped on the city of Oak Harbor geologically sensitive areas map;*
(b) *Unstable slopes, as defined in OHMC 20.02.020;*
(c) *Steep slopes, as defined in OHMC 20.02.020; and*
(d) *Areas of moderate to high liquefaction due to soil type and/or location or seismically induced ground disturbance such as surface rupture, fissuring, and lateral spreading.* (OHMC 20.28.)

Within the shoreline jurisdiction of the City, Geologically Sensitive Areas generally include slopes greater than 15% and areas of moderate-high liquefaction susceptibility. Geologically hazardous areas for each shoreline reach are discussed further in Section 5 and are visually represented on Figure 3a.

Critical Aquifer Recharge Areas

> *Critical aquifer recharge areas (CARAs) are those areas with a critical recharging effect on aquifers used for potable water. CARAs have prevailing geologic conditions associated with infiltration rates that create a high potential for contamination of ground water resources or contribute significantly to the replenishment of ground water. These include aquifer recharge areas moderately or highly susceptible to degradation, as identified by the Island County aquifer recharge area map or other study using criteria established by the Washington State Department of Ecology for soil permeability, geologic matrix, infiltration and depth to water.* (OHMC 20.32.010 (1))

The City's Aquifer recharge areas are mapped with qualitative ratings of high, moderate and low critical aquifer recharge susceptibility (Figure 4). The majority of the City has low to moderate susceptibility. Specific critical aquifer recharge susceptibility information for each reach is provided in Section 5.

4.3 100 –YEAR FLOOD PLAIN

The City of Oak Harbor has relatively few areas that are subject to flooding (Figure 3d). These areas are generally low-lying, undeveloped, and associated with shoreline wetlands located in the central part of each harbor. The City identifies these areas by a 100-year flood plain designation that is broken into two distinct sub-designations. The first designation is "AE", which indicates floodplains where the base flood elevation is provided. The only area to receive this designation within the City is the 100-year flood plain associated with Freund Marsh. The second designation is "A", which represents a base flood plain that was mapped by approximate methods.[9] Areas within the City that are designated as 100-year flood plain A include portions of Windjammer Park and some of the surrounding development to the north, the Oak Harbor Marina dock area, and the wetland complex adjacent to Crescent Harbor including the waste water treatment plant.

4.4 HISTORICAL OR ARCHAEOLOGICAL SITES

Significant documented historical and cultural resources are found with the Oak Harbor SMA. These resources are described generally in this section, based on data supplied by the

[9] The exact methodology utilized to map this layer could not be determined. However it is anticipated that this designation was mapped, at least in part, utilizing existing contour data.

Washington State Department of Archaeology and Historic Preservation (DAHP). Specific locations of cultural sites are not included to protect these resources. RCW 42.56.300 exempts cultural site locations from public disclosure. The City can respond to specific inquiries about the existence of cultural sites on a specific property by responding "yes" or "unknown" based on the DAHP data.

When development activity is proposed within the location of a known archaeological or historic site, the City will require the project proponent to engage a professional archaeologist to investigate and report to the City and DAHP on the location, condition, and the extent of the site; impacts associated with the proposal and any recommended mitigation. The City will consult with concerned tribes and DAHP to solicit comments on proposed development and related mitigation for cultural resources. The City will condition project approval to avoid impacts and require necessary mitigation.

There are no properties on the federal, state or local historic registers within the Oak Harbor SMA. There is a historic home that is on the state and federal register and a barn and water tower on the state register, but these are located a considerable distance from the SMA. There are numerous buildings in the SMA that are included in the historic inventory provided by DAHP. Two buildings on the inventory are located on private property in Reach 4 of the SMA:

- Christian Reformed Church and Parsonage Building (also known as First Holland Christian Reformed Church of Oak Harbor or Whidbey Presbyterian Church) on Midway Blvd.

Within NASWI, there are seven historic property inventory points. Many of the inventory points include multiple buildings. Inventory locations on the NASWI Seaplane Base include:

- Fuel Farm No. 2 - Buildings 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234
- Building 201705, Seawall
- Torpedo Magazine - Building 213, Boat and Gear Storage
- Ready Lockers - Buildings 446, 447, 448, 449, 451, Storehouses
- Ready Lockers - Buildings 446, 447, 448, 449, 451, Storehouses,
- Igloo Magazines - Buildings 35, 432-445, Inert Storehouses
- Buildings 2588-2589, Seaplane Ramps and Apron

There are 18 documented archaeological sites in the DAHP inventory within the Oak Harbor SMA, as well as two cemetery sites where human remains have been discovered and an additional site where human remains were known to have been uncovered in the 1980's. These sites have not been evaluated for eligibility for listing on state or national registers. Archaeological resources that have been found within the SMA include:

- Location of an early historic native settlement
- Several shell middens, containing shells and other debris associated with domestic waste, dating back prior to contact with European settlers
- Debitage, i.e. sharp-edged waste material created during the production of stone tools
- Fire cracked rock, charcoal and ash from native activities
- Animal and fish bones and other debris indicating human use

- Remnants of a historic structure from the late 19th or early 20th century
- Historic debris from 1940-1950's, including barrel, jars and glass

5 SHORELINE REACH CHARACTERISTICS AND FUNCTIONS

This portion of the document provides a summary of the available information on current land use and ecological functions for the Marine Reaches within the City of Oak Harbor. Each reach is described within a separate subsection of this chapter with the exception of the reaches that coincide with NASWI, which are described under a single subsection.

The Current and Future Land Use section for each of the reaches provides information on existing land use as well as zoning designations and comprehensive plan descriptions. Existing land use data was obtained from current land use GIS data layers obtained from the Island County Assessor's Office. The current zoning designations were established by current zoning maps and future land use was established utilizing the City of Oak Harbor's Comprehensive Plan. Anticipated future development and information on public access within the reach, including direct and/or view access as provided by City parks, trails/pedestrian easements, and public street ends, is also addressed.

In addition to the current land use analysis, an assessment of the characteristics and functions of the shoreline is necessary to provide a means of developing viable land use regulations and permitting frameworks. Per WAC 173-26-201(3)(d)(i)(C), the shoreline ecological functions analysis of marine waters must include an analysis of the hydrologic, vegetation and habitat functions within a reach.

The *Hydrologic Function* section provides a review of alterations to the hydrologic functions within the reach. Such alterations can result in impacts to water quality, including the ability of the reach environment to provide filtration, conversion or retention of sediment, phosphorus, toxins, and other inputs, and water quantity, including slowing, diversion, or acceleration of water flow. This analysis includes data on impervious surfaces, linear length of road, general information on sewage transport within the reach (i.e., whether or not development within the reach relies primarily on sanitary sewer or on-site sewage disposal for wastewater treatment), stormwater conveyance (especially for areas where stormwater is directly input into the marine reach), and identification of floodplain quality and location. Information regarding vegetation cover as it relates to hydrologic function is also provided, although the majority of available information on vegetative cover is provided within the *Vegetation Function* subsection.

The *Vegetation Function* section provides a qualitative overview of the vegetation within the reach. Although quantitative GIS analysis regarding land cover was generated as part of the analysis process, the resulting data did not correspond well to visual analysis of current aerial photographs (Figure 14). For example, using GIS, barren land percentages were abnormally high for almost all reaches, in some instances exceeding 30 to 50%. Therefore, in order to ensure the most accurate representation of vegetation cover possible, the data generated by this type of analysis was not included in this document.

The *Habitat Function* section provides qualitative and quantitative information on habitat within the reach including fish use, wetlands, and terrestrial habitat. When data were available for a particular reach segment, quantitative information regarding the linear length of shoreline stabilization, acres of permanently protected areas or floodplain areas without development,

overwater development, impervious surfaces, and road length is also provided. For all reaches within the Oak Harbor jurisdiction the following items related to habitat function are assumed:

- All saltwater and wetland areas are considered Fish and Wildlife Habitat Conservation Areas pursuant to Oak Harbor Municipal Code.
- Shoreline use by Puget Sound anadromous fish species including: bull trout, chinook salmon, chum salmon, coho salmon and steelhead trout.
- Aquatic and upland use by bald eagle and marbled murrelet.
- Aquatic use by Stellar Sea lions

The quantitative data analysis utilized for the hydrologic and habitat analysis is largely based on the no net loss indicators as defined within the *Department of Ecology Shoreline Master Program Update Handbook*. Although there are limitations for each indicator, these are generally recognized as the best way to establish a quantitative baseline for jurisdictions required to provide an SMP update. Table 8 below identifies all of the no net loss indicators for urban SMPs as provided within the handbook, the functions that are affected by each indicator, and where this information can be found in this document. Those indicators for which data were unavailable or are not applicable to the Oak Harbor jurisdiction are noted as well.

Table 11. Urban No Net Loss indicators

Indicator	Functions Affected	Data Availability and Location of data within document
Shoreline stabilization (linear feet of bulkheads, revetments, bioengineering, seawalls, groins, retaining walls, gabions)	Habitat – specifically sediment supply	Data regarding linear feet of bulkhead is provided in the *Habitat Function* subsection for each reach.
Marine and freshwater Riparian vegetation (linear feet and/or percent cover)	Water quality – sediment, phosphorus and toxin filtration/conversion/retention, temperature regulation Water quantity – flow regulation Habitat input or organics, prey base, and LWD – Structure for habitat needs	A GIS data layer with information on vegetation coverage was collected during the inventory process. However, during reach analysis this data was determined to be substantially inaccurate and was not utilized further. As such, this information is not included in this document.

Indicator	Functions Affected	Data Availability and Location of data within document
Permanently protected areas (acres of areas with limited or zero development, public ownership, or within a conservation easement)	Water quality – including sediment, phosphorus and toxic filtration/conversion/retention temperature regulation Water Quantity – flow regulation Habitat – provides riparian/aquatic habitat, sediment supply, input of organics, prey base, LWD and structure for habitat life needs	None of the parcels within the shoreline jurisdiction can be defined as "permanently protected". However, City Parks and Open Space areas are described within the *Current Land Use* subsection.
Overwater Development (number and square footage of piers, docks, floats, and similar structures)	Habitat – shading resulting from overwater development may increase predation of juvenile salmonids (May also impact Water quality by increasing amount of toxics)	Data regarding the number of overwater structures is provided in the *Habitat Function* subsection for each reach.
Road Lengths (feet) within 200 feet of waterbody (shoreline jurisdiction)	Water quality, Water quantity, Habitat-connectivity	Data regarding the linear feet of road is primarily provided in the *Hydrologic Function* subsection. Additionally, if road lengths within the reach impact habitat connectivity within a reach, it is described in the *Habitat Function* subsection.

Indicator	Functions Affected	Data Availability and Location of data within document
Road crossings (number)	Habitat - fragmentation Water quality – Possible source of contaminants through untreated surface water	Data regarding the number of road crossings within a reach, if applicable, is primarily provided in the *Hydrologic Function* subsection. Additionally, if road crossings within the reach impact habitat connectivity within a reach, it is described in the *Habitat Function* subsection.
Water quality 303(d) list	Water quality – identifies areas of impaired surface water	Ecosystem data regarding the Water quality 303(d) list is Watershed Process (Section 3). Specific reach information regarding 303(d) listings is provided in the *Hydrologic Function* section of the reach analysis where applicable
Levees/dikes (linear feet)	Water quality – sediment removal, temperature Water quantity – flood storage Habitat – may modify available water and/or velocities within a stream or river	Although there are no formally mapped dikes within the City, fill within the shoreline may function as a dike. In addition, the Federal Emergency Management Agency has identified a portion of Freund Marsh as containing a dike and the site visit confirms its existence (Refer to Appendix D – Figures for Reach 2.) If applicable, qualitative data regarding floodplain within a reach may be provided within

Indicator	Functions Affected	Data Availability and Location of data within document
		the *Hydrologic* and *Habitat Function* subsections.
Floodplain areas (square feet)	Water Quality – removal of toxics, sediment, phosphorus and pathogens through adsorption/filtration/retention Water quantity- storage and flow regulation Habitat- connectivity	Data regarding square feet of floodplain area per reach is not provided as floodplain storage is generally more applicable to freshwater stream systems. However qualitative data regarding floodplain within a reach may be provided within the *Hydrologic* and *Habitat Function* subsections, if relevant to shoreline function for a reach.
Invasive species (percent cover)	Habitat – sediment supply, input of organics and LWD, habitat structure	GIS data layers regarding percent cover by invasive plant species were not identified during the inventory and analysis process. As such, this information is not included in this document.
Impervious Surface (area)	Water Quality – removal of toxics, sediment, nitrogen, phosphorus, and pathogens; Temperature regulation Water Quantity – water storage and flow regulation Habitat – structure, LWD, sediment transport, organic input	Data regarding the percent of Impervious Surface is provided in the *Hydrologic Function* subsection for each reach.

Indicator	Functions Affected	Data Availability and Location of data within document
Wetlands (acres)	Water quality – wetland areas serve to filter pollutants and store sediment. Water Quantity – groundwater storage flow regulation Habitat – structure	The percentage and square feet of wetland area within the reach is provided in the *Habitat Function* subsection where applicable.

For each reach, the hydrologic, vegetative and habitat function subsections are concluded with a qualitative assessment of the overall functionality. A summary rating of high, medium-high, medium, medium-low or low based upon the identified components is provided. A reference table summarizing the function assessment for each reach is provided at the end of this chapter (Table 13).

5.1 MARINE REACH 1 (SCENIC HEIGHTS SEGMENT)

Marine Reach 1 (MR1) is located along the western shoreline of Oak Harbor and extends from the City boundary to Freund Marsh (Refer to Appendix E - Figure 16). The reach is approximately 0.45 miles in length. MR1 is characterized by single-family residential development.

Table 12. MR1 Summary

Current Land Use	Acres	Percent of Reach[1]	Current Zoning	Acres	Percent of Reach[1]	Future Land Use	Acres	Percent of Reach[1]
Single Family Residential	10.9	100%	Single Family Residential, R-1	10.9	100%	Low Density Residential	10.9	100%
Total Acreage of Reach			10.9 acres					
Public Shoreline Access[2]			None					
Habitat [3]			The entire shoreline within this reach has been developed for residential use. Marine bluffs remain largely undeveloped and are likely to provide habitat function within the reach.					

[1] Data derived from analysis of City of Oak Harbor GIS data. Percentages may not total to 100%t due to rounding.
[3] Data derived from analysis of City of Oak Harbor GIS data.
[3] Data derived by aerial review conducted by Grette Associates.

Current and Future Land Use

Current land use for the entire reach is single-family residential and the zoning designation is R-1, Single Family Residential (Figures 9 and 10, respectively). The Comprehensive Plan Land Use Designation (i.e. future land use) for this reach is Low Density Residential (Figure 11). Therefore, it is anticipated that future development activity within this reach is likely to be limited to improvements and redevelopment of previously developed properties.

This reach does not contain any designated shoreline public access (Figure 12) or specific water dependent uses. However, residential uses are a preferred shoreline use under the Shoreline Management Act, RCW 90.58.

Hydrologic Function

There is no evidence of impaired hydrologic function within this reach (e.g., 303(d) listings), and only limited amounts of alteration to the hydrologic function are evident within this reach. There are no stormwater outfalls or catch basins mapped within the shoreline jurisdiction of this reach (Figure 5). However, several areas of varying types of stormwater pipe extending from the marine bluff onto the shoreline were noted during field review of the shoreline within this reach. GIS analysis indicates that 13.03% of the surface area of the reach is covered by impervious surfaces (Figure 7). Impervious surfaces have been linked to increased level of toxins, phosphorus, nitrogen and pathogens as well as to increases in stormwater volumes and velocities. Based upon available GIS data layers, it is assumed that all of the parcels within this reach utilize on site sewer systems. The sewer line does not extend to the residences within this reach (Figure 6). Failure of any septic systems within this reach could add pathogens to the hydrologic system.

Direct sources of water input into the shoreline are limited within MR1. There are no stormwater outfalls or catch basins mapped within this reach (Figure 5). However it should be noted that it is common practice for waterfront lots, especially those built prior to current shoreline regulations, to drain stormwater onto the beach through discharge pipes extending down the face of marine bluffs. As such, it is not unreasonable to assume that some of the residential lots within this reach may drain stormwater into Oak Harbor. The majority of transportation infrastructure serving the parcels within this reach is located outside of the Shoreline Management Zone. Only 224.2 linear feet of road is located within this reach.

The vegetated slopes along the shoreline's marine bluffs may provide some water storage and filtration prior to delivery into Oak Harbor. Primary soil type in this reach is Everett-Alderwood complex, with 15 to 40% slopes (Figure 8). This soil is rated as a "somewhat excessively drained" soil type which indicates that little water storage occurs within this reach. The lack of mapped wetlands within this reach (Figure 3a) may indicate minimal water storage as well. This reach has low to moderate aquifer susceptibility (Figure 4).

Due to an absence of direct stormwater input areas, relatively low impervious surface percentages, and the presence of vegetated marine bluffs, the hydrologic function of this reach is considered to be medium.

Vegetation Function

The natural shoreline located within MR1 has been somewhat altered by residential development. Typical residential yard areas, comprised of lawns and ornamental shrubs, are visible in aerial photographs. Most of the yard areas are set back from the shoreline due to the existence of marine bluffs that exceed a slope of 15%. Dominant vegetation within the marine bluffs includes Douglas fir trees and Madrone as well as invasive species such as Himalayan blackberry and English ivy. Aerial photographs indicate that the marine bluffs provide a native vegetative area (comprised of trees and other vegetation) of approximately 50 feet between the shoreline and landscaped lawn areas associated with the residential development. Expansive lawn areas are known to be a point source for pathogens, toxins, nitrogen and phosphorus. However, the vegetated marine bluffs likely function to filter out some of these before they reach the shoreline.

Although the marine bluffs result in increased shoreline vegetation, in most cases the area directly landward of the top portion of the marine bluff is cleared for yard and view purposes. This clearing may have a resulting impact on the overall stability of the marine bluffs.

In addition, removal of shoreline vegetation, such as that resulting from development, can lead to erosion of the shoreline and may contribute to landslide activity. The remaining vegetation on the bluff is likely to provide slope stability on the marine bluffs. Although there is evidence of alteration to the vegetation function, in comparison to adjacent shoreline environments the amount of impact is fairly low. Overall, the vegetation function of this reach is considered to be medium-high.

Habitat Function

The vegetative marine bluffs, as described above, may provide suitable habitat structure including hunting areas for bald eagles (Figure 3c). However, the benefit of this habitat may be somewhat reduced by the close proximity to the residential development. In addition, there are no mapped wetlands within this reach. Only 1.4% of the reach contains nearshore fill according to the GIS data (Figure 13), which indicates that the general location of the shoreline is likely to be similar to its predevelopment location. Lack of nearshore fill may also indicate a lack of impact to nearshore habitat as well. However, nearshore fill is only one of many factors that may be used to determine impact to habitat function.

The entire length of the reach has slopes identified as unstable (Coastal Zone Atlas); 57% of the slopes within this reach exceed 15% (Figure 3a). Within the Puget Sound, failure of unstable slopes often serves as a source of sediment since drift cells carry materials along the shoreline. Because this reach is part of a larger drift cell with left-to-right transport, slope failures in this area may have originally served as a feeder bluff for the eastern portions of Oak Harbor (Figure 15). However, currently 94% of the reach is characterized by some form of shoreline stabilization, primarily rip rap (Figure 13).

This data is generally consistent with the findings of a study of Island County Feeder Bluff and Accretion Shoreform Mapping which identifies those portions of the reach that are not modified as feeder bluffs (Johannessen 2005). The shoreline armoring within this reach is likely to have modified the natural source of sediment transport into the harbor that was originally generated by this reach. In addition, the shoreline armoring is likely to modify wave and tidal energy within the subject reaches and adjacent reaches resulting in modification to intertidal habitat. Shoreline armoring can also modify wave energy within a reach and adjacent areas. However, based upon review of aerial images it appears that the beach is wide and gently sloping, indicating that wave energy has not been increased to such an extent that beach habitat has been greatly impacted. The shoreline within the reach contains large woody debris and mapped habitat for forage fish spawning which may indicate the shoreline is functioning adequately.

In fact, the extent of the shoreline within this reach is mapped as documented intertidal forage fish habitat for surf smelt (Salmonscape queried March 2011). Additionally, the lack of overwater structures within this reach also provides reduced opportunity for predation of salmonid species (Williams, et alt 2003). This reach is also mapped as containing patchy dune grass habitat[10] (Figure 3b).

Due to the minimal area of mapped wildlife habitat compared to other Oak Harbor reaches, and due to the resulting alterations to its function, the habitat function rating for this reach is medium.

[10] This designation was assigned utilizing Washington State Department of Natural Resources Shorezone data. The specific meaning of the term "patchy" as it is used in this instance is not defined, however it was interpreted by those that generated this document to mean existing in small isolated areas and not of the same density throughout the mapped area.

5.2 MARINE REACH 2 (FREUND MARSH SEGMENT)

Marine Reach 2 (MR2) coincides with the area known as Freund Marsh. This reach begins at the southern end of the marsh and extends along the marine shoreline to the beginning of the residential development located to the east of the marsh (Refer to Appendix E - Figure 16). This reach also extends landward from the marine shoreline to the north and northwest in association with the boundaries of the mapped wetland area (Figure 3a and 16). Along the marine shoreline, the reach is approximately 859.8 feet in length. MR2 is primarily characterized by the open space area land use designation associated with Freund Marsh.

Table 13. MR2 Summary.

Current Land Use	Acres	Percent of Reach[1]	Current Zoning	Acres	Percent of Reach[1]	Future Land Use	Acres	Percent of Reach[1]
Commercial	1.9	3.3	Community Commercial, C-3	0.6	1.1	Community Commercial	0.6	1.1
Park/Open Space	43.0	75.4	Open Space, OS	41.9	73.6	Open Space	41.9	73.7
Single Family Residential	2.4	4.3	Single Family Residential, R-1	1.9	3.3	Low Density Residential	1.9	3.3
Vacant	9.6	17	Limited Multifamily residential, R-2	7.2	12.6	Medium Density Residential	7.2	12.6
			Highway Corridor Commercial, C-5	2.9	5.0	Highway Corridor Commercial	2.9	5.0
			None[2]	2.5	4	None	2.5	4
Total Acreage of Reach			56.9 acres					
Public Shoreline Access[3]			Freund Marsh					
Habitat [4]			Entirety of reach is Freund Marsh. Relative provision of habitat, as compared to other reaches within the habitat level is high. However, habitat may be limited due to adjacent light and noise inputs from surrounding development may restrict movement of wildlife.					

[1] Data derived from analysis of City of Oak Harbor GIS data. Percentages may not total 100% due to rounding.
[2] "None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations
[3] Data derived from analysis of City of Oak Harbor GIS data and on-line public access mapping resources.
[4] Data derived by aerial photograph review conducted by Grette Associates.

Current and Future Land Use

The current land use for the majority of this reach is open space associated with Freund Marsh. This reach also contains smaller areas of commercial and residential land use that surround the open space (Figure 9). Current zoning within this reach varies slightly from the identified land use for some parcels. For example, this reach contains two parcels that are currently identified as

single family residential land use. One parcel is located to the south west of the right angle turn of SW Bayshore Drive and the other is located to the north east of the terminus of SW Bayshore Drive. Of these two parcels the one located to the south west of the right angle turn of SW Bayshore Drive is zoned Open Space. The other parcel is zoned Highway Corridor Commercial (note: this parcel appears to be vacant in current aerial photos). In addition, the parcels on either side of the northeastern finger of the Freund marsh are currently vacant but are zoned as R-2 Limited Multi-family Residential (Figure 10). This zoning designation allows up to 12 units per acre. Future land use within this reach is consistent with current zoning (Figure 11). It is anticipated that future development in this reach may include development of these parcels with low to medium density multifamily development, development of new commercial uses along Pioneer Way, and potentially redevelopment or expansion of existing properties with similar uses. Development on parcels in Reach 2 may be limited by the presence of wetland areas and would be subject to wetland buffers associated with Freund Marsh.

This reach does not contain any specific water dependent uses (e.g., boat ramps and/or docks). However, trails within Freund Marsh provide public access to the shoreline jurisdiction (Figure 12). Public use of this marsh can be categorized as passive shoreline recreation and water enjoyment which are preferred shoreline uses pursuant to the Shoreline Management Act, RCW 90.58. The City recently constructed a trailhead on Scenic Heights (trail connects to Freund Marsh and the waterfront trail). The project includes a trailhead area with parking, informational kiosk and plaza utilizing LID features (pervious pavements and rain gardens).

Hydrologic Function

Review of historic aerial photos indicates that the original hydrologic function of this reach as well as MR3 has been greatly modified.

Image 5: Portion of Freund Marsh area – view looking east from west of present location of SW Erie Street (exact date of photo unknown, but predates 1960). ***Source: City of Oak Harbor.***

Image 6: Aerial of Freund Marsh (Image dated 4-3-1976)

Image 7: Recent Google Maps image of Freund Marsh (imagery date May 27, 2007)

Extensive historic modification to hydrologic function has occurred within this reach, as demonstrated in the images provided. However, there are no mapped areas of 303(d) impaired waters within this reach at this time. The reach has one stormwater outfall and one stormwater catch basin mapped directly along the marine shoreline as well as 18 additional catch basins that collect stormwater from the northeast portion of the reach and convey the water via ditches to the shoreline (Figure 5 and analysis of GIS data). GIS analysis also indicates that this reach contains 526.8 linear feet of roadway within the shoreline jurisdiction and 25.46% of the surface area within this reach is impervious surface[11]. Although the reach does contain some impervious surface related to the urbanization surrounding the marsh area, it is likely that this figure is artificially high due to mapping inaccuracies (Figure 7). It is likely that the Freund marsh provides stormwater storage within this reach. However, this storage is likely impeded by ditches within the marsh (these ditches are visible in Image 7 above).

None of the parcels within this reach are mapped as relying upon on-site sewer systems for septic disposal. Given the proximity of the sanitary sewer line to the north, it is assumed that all of the parcels within this reach have sanitary sewer service (Figure 6).

The primary soil types within this reach include Semiahmoo Muck, 0 to 2% slope, and Puget silty clay loam, 0 to 2% slope (Figure 8). These soil types are rated as “very poorly drained” and “poorly drained respectively”. Based upon the soil types present, it can be inferred that water

[11] In review of aerial photographs of the reach, the impervious surface percentage derived from GIS analysis appears to be higher than visual estimations would suggest. Refer to Section 4.1.4 of this document for further information.

would move through this area more slowly than areas with well drained soils. Mapped areas of poorly drained soils commonly coincide with mapped wetland areas. Due to the poorly drained nature of the soil types within this reach, it has a low to moderate aquifer susceptibility (Figure 4).

The northern portions of the Freund Marsh are mapped as within the 100 year floodplain (Figure 3a). Maintaining this area as open space is likely to provide the City with necessary floodwater storage and velocity attenuation during rain events.

The hydrologic function of this reach is considered to be medium-high.

Vegetation Function

The vegetation within MR2 is primarily emergent, scrub-shrub wetland characterized by Freund Marsh. Dominant vegetation within this reach includes: Velvetgrass (*Holcus lanatus*) and common cattail (*Typha latifolia*), reed canarygrass (*Phalaris arundinacea*), and red osier dogwood (*Cornus sericea*) (Adolfson 2007). As evident by the aerial photographs provided in the hydrologic function review, this area has been greatly modified from its original vegetation function. However, restoration of this area to pre-development conditions is implausible due to surrounding development. Despite this limitation, further enhancement to Freund Marsh, including plantings and increasing hydrologic complexity, can provide the opportunity to lift shoreline function within this reach as has been anticipated in the Waterfront Redevelopment, Branding, and Marketing Program.

Due to the presence of Freund marsh and the restoration efforts by the City, the vegetation function of this reach is considered to be high, relative to the other reaches within the City.

Habitat Function

The majority of this reach (96%; approximately 2,374,380 square feet) is comprised of Freund Marsh (Figure 3a). It is the largest shoreline habitat area within the core City reaches (excluding MR6-11 NASWI). This habitat area may provide suitable habitat structure including hunting areas for bald eagles and/or other raptor species as well as traveling waterfowl (Figure 3c).

The length of the reach along the marine shoreline is mapped as providing patchy saltwater habitat (3b). The entire marine shoreline within this reach is documented surf smelt spawning habitat. (Salmonscape March 2011 and Figure 3c). The lack of overwater structures within this reach also provides reduced opportunity for predation of salmonid species.

Slopes in this reach are identified as unstable directly adjacent to the shoreline and of intermediate stability within the marsh (Coastal Zone Atlas). No shoreline stabilization or nearshore fill is mapped within this area (Figure 13). However, site visits conducted during the inventory and characterization process indicate that although the beach is somewhat naturalized shoreline armoring associated with the Freund Marsh dike is evident (Refer to the Reach 2 photos provided in Appendix D). Any sediment provided from this reach is likely to be pushed towards Oak Harbor Marina by the left-to-right drift cell that spans MR1 to the end of MR3 (Figure 15). This data is generally consistent with the findings of a study of Island County

Feeder Bluff and Accretion Shoreform Mapping which identifies the area in this reach as an accretion shoreform[12] (Johannessen 2005).

The habitat function rating for this reach is medium high.

[12] An accretion shoreform is a shore area that is form by the gradual accumulation of sediment.

5.3 MARINE REACH 3 (OAK HARBOR BEACH SEGMENT)

Marine Reach 3 (MR3) is located within Oak Harbor and corresponds to the central waterfront portion of Oak Harbor (Refer to Appendix E - Figure 16). This reach has been divided into three sub-reaches identified by the alpha-numeric of 3a, 3b, and 3c (Figure 16). This subdivision enables the identification of variable land use within this reach including single family residences (3a), Windjammer Beach (3b), and multifamily and single family residences (3c). The hydrologic, vegetative and habitat functional analysis is provided for the entire reach as a single unit unless modifications to function are specifically relevant only to a single subsection of the reach. In total, the shoreline of the reach is approximately 0.95 miles in length.

Table 14. MR3 Summary

Current Land Use	Acres	Percent of Reach[1]	Current Zoning	Acres	Percent of Reach[1]	Future Land Use	Acres	Percent of Reach[1]
Multi-Family Residential	2.6	11.5	Central Business District – 1, CBD-1	2.7	11.9	Central Business District	2.7	11.9
Park/Open Space	12.8	57.1	Public Facilities, PF	12.8	57.0	Public Facilities	12.8	57.1
Single Family Residential	3.0	13.6	Single Family Residential, R-1	4.3	19.3	Low Density Residential	4.3	19.3
None[2]	2.7	12	None[2]	2.7	12	None [2]	2.7	12
Vacant	0.9	4.0						
Community Property	0.4	1.8						
Total Acreage of Reach			22.5 acres					
Public Shoreline Access[3]			This reach has public shoreline access along the entire extent of the beach. Windjammer Park					
Habitat [4]			Majority of reach contains residential or park development. Grassy fields associated with the park may provide resting areas for migrating waterfowl. In addition, LWD habitat waterward of the OHWM may provide foraging habitat. However, it is unlikely that suitable nesting habitat exists in this reach.					

[1] Data derived from analysis of City of Oak Harbor GIS data. Percentages may not total 100% due to rounding.
[2] "None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations
[3] Data derived from analysis of City of Oak Harbor GIS data.
[4] Data derived by aerial photograph review conducted by Grette Associates.

Current and Future Land Use

Sub-Reach 3a

Current land use for sub-reach 3a includes single family residential, community property/open space, and vacant (Figure 9). Similarly, zoning for the entire reach is R-1 Single Family Residential and future land use is Low-Density Residential (Figures 10 and 11). Based upon these designations, it is anticipated that future development within this reach is likely to be

limited to development of the few remaining vacant parcels with single family homes and potential expansion or redevelopment of existing single family properties. However, many of the existing homes in this reach are large in comparison to their lot size and appear to be relatively new, so redevelopment activity may be limited.

This sub-reach does not contain designated shoreline public access or specific water dependent uses (Figure 12). However, single-family residential uses are a preferred use under the Shoreline Management Act, RCW 90.58.

Sub-Reach 3b

The current land use for sub-reach 3b is park/open space (Figure 9). Zoning and future land use for the parcels within this reach is Public Facility (Figure 10 and 11). Based upon zoning designations, future land use, and the adopted Waterfront Redevelopment, Branding, and Marketing Program, it is anticipated that future development within this reach may include improvements to the park space but is unlikely to include residential or commercial development.

This sub-reach has both view and direct public access to the marine shoreline through Windjammer Park and the waterfront trail (Figure 12). Windjammer Park is approximately 28.5 acres in size. This park includes amenities such as shoreline picnic tables with windbreaks, a boat launch, playgrounds, a windmill landmark, and seasonal gardens. Windjammer Park also includes a swimming lagoon that is located in the center of the park and directly connected to Oak Harbor via a tidal channel (Figure 16). The west end of the park includes a recreational vehicle park with 56 serviced sites and 30 non-serviced sites adjacent to the main park area. This park also contains a kayak campsite that is part of the Cascadia Marine Trail.

Sub-Reach 3c

Current land use for sub-reach 3c is multifamily residential (Figure 9). However, several single-family homes are located in this reach, so it is possible that the data does not completely and accurately reflect current use on the ground at this location. Zoning and future land use for the parcels within this portion of the reach is Central Business District and Central Business District 1, respectively (Figures 10 and 11). Based upon zoning and future land use designations, it is possible that redevelopment within this portion of the reach could include commercial, mixed use or higher density multifamily residential development (Oak Harbor Municipal Code 19.20.305). Based on existing land uses, future development is likely to be multifamily residential.

This sub-reach has both view and direct public access to the marine shoreline via the waterfront trail (Figure 12). In addition, this subsection of the reach contains single-family residential development which is a preferred shoreline use under the Shoreline Management Act, RCW 90.58.

Hydrologic Function

Although there are no mapped 303(d) sites within this reach, there is ample evidence of impaired hydrologic function. The Washington State Department of Fish and Wildlife has closed the Oak Harbor beach to all public oyster and clam harvesting. Ecology's BEACH Program indicates there is a "caution" for swimming at Windjammer Beach due to bacteria levels. There are four stormwater outfalls and four stormwater catch basins within the reach (Figure 5) including the City's 42-inch outfall that collects stormwater from the City's largest basin (Dry Creek – 4.54 square miles). GIS analysis indicates that 37.14% of the reach is covered by impervious surfaces[13] (Figure 7), and this reach has a relatively large amount (6,095.5 linear feet) of road. This increased level of impervious surface may allow toxins and other contaminants to enter into the hydrologic system via runoff. In addition, the amount of impervious surface within this reach is likely to modify water flow, prevent groundwater recharge, and/or increase stormwater velocities. The majority of this reach is mapped within the 100-year floodplain associated with Oak Harbor (Figure 3), although the development in subsections 3a and 3c may prevent adequate flood water storage.

Only 30% of the parcels within this reach are on septic systems. However, all of the parcels utilizing septic systems are located with the 3a portion of the reach, and nearly all of the residential development within subsection 3a is reliant upon septic systems (Figure 6). Any failing systems within 3a may allow pathogen input into the hydrologic system. The other developed parcels within this reach are likely to be connected to the Oak Harbor Wastewater Treatment Plant which is located within the boundaries of Windjammer Park. It is over 200 feet from the mapped Ordinary High Water Mark and therefore not within the shoreline jurisdiction for this reach.

The primary soil types in this reach include Sholander, cool-Spieden complex, 0 to 5% slopes, and Beaches-Endoaquents, tidal-Xerothents association, 0 to 5% slopes (Figure 8). The Sholander soil type is rated as "poorly drained" and the Beaches-Endoaquents does not have a rating. The reach has areas of high and moderate susceptibility for critical aquifer recharge (Figure 4).

Based upon the level of alteration to function resulting from development and associated impervious surfaces, outfalls and septic systems, the hydrologic function of this reach is considered to be medium.

[13] However, it is assumed that this percentage is, at least to some degree, inaccurate. The mapped data layers do not correspond well to one another resulting in either an over or under estimation of impervious surfaces within the shoreline reaches.

Vegetation Function

The natural shoreline located within the MR3 reach has been altered by development. Vegetation throughout the reach is limited to residential yards and expanses of grass associated with Windjammer Park. As noted by the DOE SMP update handbook and *Protecting Aquatic Ecosystems*, expansive lawn areas may be a point source for pathogens, toxins, nitrogen and phosphorus.

The single family residences within subsection 3a have very limited vegetation and houses are set back on average 50 feet or less from the shoreline. The vegetation within Windjammer Park, subsection 3b, is primarily grass with sparse trees including maples, poplars, and pines. Subsection 3c includes three single-family residences within the central portion of the subsection that are set back from the shoreline 100 to 150 feet or more. However, these lots are flanked on the western end of the subsection by large multi-family residences that are directly adjacent to the shoreline (e.g., 5 to 20 feet as measured by aerial analysis). The multifamily residences, on the eastern end of MR3c, are 40 to 75 feet from the shoreline as measured by aerial analysis.

Due to the amount of alteration to the vegetation throughout the majority of the reach, the lack of trees and other native shoreline vegetation, the vegetation function of this reach is considered to be low.

Habitat Function

The development and resultant lack of vegetation as described previously greatly limit the function of terrestrial habitat within this reach. Further, there are no wetlands within this reach (Figure 3a) and the marine nearshore area is mapped as having patchy saltwater habitat (Figure 3b). There are three overwater structures within this reach, all of which are located in 3b. Two of the structures are associated with the community swimming area (the bridge and the dock) while the third structure provides boat launch access to the marine shoreline. Only 1.9% of the reach contains nearshore fill (Figure 13).

Intertidal and nearshore habitat appears to have greater functionality than the upland habitat. The entire reach is mapped as documented intertidal forage fish habitat. The primary forage fish habitat documented within this reach is for surf smelt, though there are also smaller areas of sand lance spawning habitat. (Salmonscape queried March 2011 and Figure 3c).

Slopes in this reach are identified as stable (Coastal Zone Atlas). There is no mapped shoreline stabilization within this reach (Figure 13). MR3 is located within a drift cell with left-to-right transport (Figure 15). Sediment from this reach would be transported towards the marina. This data is generally consistent with the findings of a study of Island County Feeder Bluff and Accretion Shoreform Mapping which identifies the area in this reach as an accretion shoreform (Johannessen 2005).

Due to the minimal amount of mapped habitat and in consideration of the existing level of hydrologic and vegetation function, the habitat function rating for this reach is medium.

5.4 MARINE REACH 4 (SE BAYSHORE/PIONEER WAY SEGMENT)

Marine Reach 4 (MR4) is located within Oak Harbor and corresponds to the shoreline areas along SE Bayshore Drive and Pioneer Way (Refer to Appendix E - Figure 16). The shoreline of this reach is approximately 0.95 miles in length.

Table 15. MR4 Summary

Current Land Use	Acres	Percent of Reach[1]	Current Zoning	Acres	Percent of Reach[1]	Future Land Use	Acres	Percent of Reach[1]
Commercial	0.9	4.2	Central Business District, CBD	3.4	15.1	Central Business District	3.4	12.9
Multi-Family Residential	1.3	5.7	Multi-Family Residential, R-4	5.7	25.2	High Density Residential	4.3	16.2
Public Facility	0.9	3.8	Public Facilities, PF	2.6	11.3	Public Facilities	8.2	30.7
None[2]	9.2	40	None[2]	11.1	48	None[2]	6.9	26
Park/Open Space	1.7	7.5				Residential Office	3.5	13.3
Single Family Residential	2.2	9.7				NASWI	0.3	1.0
Vacant	2.8	12.4						
Marina Parcels	4.3	16.6						
Total Acreage of Reach			22.8 acres					
Public Shoreline Access[3]			Waterfront trail (view/direct waterfront access is primarily located within the western portion of this reach)					
Habitat [4]			Habitat is limited to a strip of upland marine bluff (approximately 20-50 feet in width) located between the Ordinary High Water Mark and the adjacent roadway. The area is unlikely to provide substantial terrestrial habitat. Nearshore habitat was improved by the addition of fish mix substrate. The substrate was provided as part of a marina mitigation project.					

[1] Data derived from analysis of City of Oak Harbor GIS data. Percentages may not total 100% due to rounding
[2] "None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations
[3] Data derived from analysis of City of Oak Harbor GIS analysis.
[4] Data derived by aerial photograph review conducted by Grette Associates.

Current and Future Land Use

Current land use within this reach includes park/open space, commercial, parking, vacant, single- and multi-family residential uses, as well as street right of way and portions of Catalina Park that are coded as marina parcels in the data (Figure 9). Zoning designations within this reach include: Public Facility, Central Business District, and R-4 Multi-Family Residential (Figure 10). Future land use designations include: Central Business District, Residential Office, High Density Multifamily and Public Facilities (Figure 11). Based upon current land use, zoning and future land use designations (Figure 11), the biggest potential for modified land use within this reach is the development of a commercial or mixed use development on the vacant property located to the northwest of the intersection of SE Bayshore Drive and SE Midway Blvd. It is also possible

that redevelopment within this reach could include modification of existing multi-family residential uses into residential offices, which are office uses such as accountants, attorneys and physicians and other similar uses that have been deemed appropriate to be located in close proximity to residential development, and the conversion of single family residences to multi-family. Existing shoreline public access points within MR4 include Flintstone Park and the waterfront trail (Figure 12). Both of these public access points are primarily view access. This reach also contains three staircase access points. Two of the staircases are public staircases and are in disrepair. The third is a private staircase in good condition. The waterfront trail, continuing for MR3, begins to travel upwards in elevation from its starting point at Flintstone Park and runs adjacent to SE Pioneer Way into the VFW Park. The waterfront trail continues into MR5. The subsection of the waterfront trail within this reach is known as the Walk of Honor and serves as a historical walk honoring the navy heritage of the area. This reach does not currently contain any shoreline dependent uses although a public access pier located at Flintstone Park for water enjoyment use may be installed at some point in the future (Municipal Pier Project). However, the City has noted in its planning documents no funding has been identified.

Hydrologic Function

This reach does not have mapped impairment to hydrologic function (e.g., 303(d) listings). However, extensive alteration to the hydrologic function is evident including shoreline modification and impervious surfaces. The majority of the upland area contains both fill and shoreline armoring (Figure 14). This reach has the largest number of stormwater outfalls (sixteen) and catch basins (sixty-three) of all of the reaches within Oak Harbor (Figure 5). This reach also has one of the largest amounts of impervious surfaces (47.95%) within the jurisdiction (Figure 7). The parcels within this reach have sanitary sewer service (Figure 6). A road runs along the majority of the reach for 5,166.2 linear feet and may serve as a source of toxins and pollutants. In addition, a sewer line is located within the right of way along Pioneer Way for the majority of the reach (Figure 6).

The narrow strip of vegetation between the shoreline and the road is unlikely to provide a substantial amount of water storage and filtration and is therefore likely to provide minimal functionality to the hydrologic function within the reach.

The primary soil type within this reach is Whidbey-Hoypus complex, 2 to 15% slope (Figure 8). This soil is rated as “moderately well drained” and so is unlikely to provide substantial water storage. In addition, there are no wetlands mapped within the reach. The majority of the reach has a low aquifer susceptibility rating (Figure 4).

In addition to the upland modification of hydrologic function, the nearshore hydrologic function has also been modified by dredge activities. Image 8, provided below, shows the location of a dredged area adjacent to the location of the proposed municipal pier.

Image 8: Dredged prism within the aquatic area adjacent to MR4. Also note evidence of extensive shoreline fill and construction activity (Photo dated March 20, 1969).

Due to the amount of alteration within this reach as detailed above, the hydrologic function of this reach is considered to be low.

Vegetation Function

The vegetation within MR4 is a thin strip of low marine bluff, approximately 25 feet in width based upon aerial photography, located between the shoreline and the adjacent roadways. This narrow strip includes small trees, shrubs, and grasses. Due to the reduced amount of vegetation, the vegetation function of this reach is considered to be low.

Habitat Function

The development and resultant lack of vegetation in MR4 greatly limit the extent of terrestrial habitat within this reach. There are no mapped wetlands within this reach.

The shoreline contains small areas of documented sand lance and surf smelt spawning, with extended areas of potential spawning habitat (refer to figure 3c). However, mapped areas are the second-most fragmented of all other reaches in the City – only exceeded by MR5 (Salmonscape queried March 2011).

Slopes in this reach are identified as modified (Coastal Zone Atlas). In addition, 77% of the reach has some form of shoreline stabilization (Figure 13). This data is generally consistent with the findings of a study of Island County Feeder Bluff and Accretion Shoreform Mapping which

identifies the area in this reach as modified (Johannessen 2005). It is unlikely that this reach provides substantial sediment materials to the shoreline. However, the reach does provide a left-to-right sediment drift along the western side of the reach and an area of no appreciable drift on the eastern side (Figure 15). As such, the drift cell may transport materials from west of the reach and deposit them into the harbor. There are two overwater structures within this reach and 50.4% of the reach is comprised of nearshore fill (Figure 13).

The habitat function rating for this reach is low.

5.5 MARINE REACH 5 (OAK HARBOR MARINA)

Marine Reach 5 (MR5) coincides largely with the Oak Harbor Marina, though a small portion of NASWI developed with urban uses is also located within the southern portion of this reach (Refer to Appendix E - Figure 16). The reach is 0.95 miles in length.

Table 16. MR5 Summary

Current Land Use	Acres	Percent of Reach[1]	Current Zoning	Acres	Percent of Reach[1]	Future Land Use	Acres	Percent of Reach[1]
Marina Parcels	4.0	44.6	Public Facilities[2]	9.0	100	Public Facilities	4	44.6
NASWI	5.0	55.4				NASWI	5	55.4
Total Acreage of Reach			9.00 acres					
Public Shoreline Access[3]			The Shoreline waterfront trail provides view access for the entire reach. Reach contains Oak Harbor marina with associated boat moorage, boat ramp, as well as pedestrian access to the shoreline.					
Habitat [4]			Reach has substantially limited habitat due to impervious surface coverage and shoreline modification including overwater structures					

[1] Data derived from analysis of City of Oak Harbor GIS data. Percentages may not total 100% due to rounding.
[2] GIS data layer attributes define current zoning as "None". The identified zoning is Public Facilities based upon guidance from City of Oak Harbor staff.
[3] Data derived from analysis of City of Oak GIS data.
[4] Data derived by aerial photograph review conducted by Grette Associates.

Current and Future Land Use

The current land use, zoning and future land use designations within this reach include public facilities (Oak Harbor Marina) and NASWI (Figures 9, 10, and 11). A private boat repair and storage yard also operates on property adjacent to the marina's south perimeter that was formerly leased by the City from the Navy. The private operator purchased the property from the Navy in 1996. These uses are not expected to change, although they are expected to intensify with planned expansion and redevelopment. For this section, the analysis of this reach will primarily focus on the Marina and private boat repair yard – an ecosystem-based analysis of the area located within the boundaries of NASWI is provided in Section 4.6 of this document.

Built in 1974, the Oak Harbor Marina is owned by the City and provides view and direct public access to the shoreline, moorage for 420 boats, with 217 open and 135 covered permanent slips. The marina is a water dependent use, which makes it a preferred shoreline use pursuant to the Shoreline Management Act, RCW 90.58. The City has plans for major improvements to the Marina, these currently include:

- Replace existing docks A-E with six new docks and utilities.
- Construct a multi-use, public access float at the Marina's south end.
- Dredge the marina basin.
- Repair or replace the boat launch and repair the boat ramp as the need arises.
- Pursue an agreement with the Navy to access the portion of their adjacent property located on the concrete apron just east of the marina.

- Improve the connections to town through shuttle service and improved walkway along Pioneer Way.
- Improve community access by improving Catalina Park.
- Redevelop the storage sheds at the end of their useful life into multi-use, marine-oriented building(s).

Hydrologic Function

Overall hydrologic function in the reach has been greatly modified. The majority of the upland land mass was created by fill, as described in Section 2.2.1. GIS analysis indicates that the majority of the land within this reach is actually shoreline fill (83.1%) covered by impervious surface (74.27%) (Figure 7 and GIS Analysis). The soil type within this reach is mapped as urban land (Figure 8). The reach extent has a moderate susceptibility to critical aquifer recharge (Figure 5). Stormwater drainage is managed within this reach through a limited system of pipes, catch basins and outfalls as show in Figure 5. Large areas of pavement appear to sheet flow to the shoreline within the upland area of the Marina.

The data gathered during the GIS analysis process indicate that no roadway exists within the shoreline jurisdiction of this reach. However, review of available aerial photographs indicates that the majority of the land is paved driving surface, parking, and/or storage.

A sanitary sewer line extends into the shoreline jurisdiction in the southern end of the reach (Figure 6).

Due to the large amount of alteration of the hydrologic function within this reach, the hydrologic function of this reach is considered to be low.

Vegetation Function

The majority of the reach has a narrow band of vegetation (20 feet or less) directly adjacent to the shoreline that is comprised of low shrubby vegetation and grasses with no overhanging or shading vegetation.

Due to the overall lack of vegetation within the reach, the vegetation function of this reach is considered to be low.

Habitat Function

A Biological Evaluation (BE) of the Oak Harbor marina and surrounding areas was completed as part of an upgrade project in 2007 (HartCrowser 2007). In the BE, use of this area by anadromous fish species was assumed. Other endangered species including Southern Resident killer whale, marbled murrelet, Stellar sea lion, humpback whale and leatherback sea turtle were deemed unlikely to be found in this reach or within Oak Harbor itself.

There are no mapped saltwater habitat areas or wetlands within this reach (Figure 3a). A potential bald eagle forage zone is included in this reach (Figure 3c), but given the lack of high-functioning habitat, it is unlikely that this reach provides optimal foraging opportunities.

There is no documented forage fish breeding within this reach. However, a small area of potential habitat for intertidal forage fish spawning is noted (Salmonscape queried March 2011, Figure 3c). In addition, existing forage fish spawning areas may have recently been increased within this reach as the result of fish mix substrate that was placed along the shoreline as part of a recent mitigation project (Spoo. Personal communication 2011).

There are seven overwater structures in this reach, with an estimated coverage of aquatic area of approximately 6 acres. 83.1% of the upland portion of this reach is comprised of nearshore fill (Figure 13). The majority of the reach (99%) has shoreline stabilization (Figure 14).

Slopes in this reach are identified as modified (Coastal Zone Atlas). MR5 is part of a drift cell with no appreciable drift (Figure 15). This data is generally consistent with the findings of a study of Island County Feeder Bluff and Accretion Shoreform Mapping which identifies the area in this reach as modified (Johannessen 2005). Sediment within this reach is likely to have been deposited by the left-to-right oriented drift cell to the west and the right-to-left oriented drift cell to the south.

Due to the minimal area of mapped habitat in conjunction with the habitat disturbance resulting from reduced hydrologic and vegetation functions, the habitat function rating for this reach is low.

5.6 MARINE REACHES 6 -11 (NAVAL AIR STATION – WHIDBEY ISLAND)[14]

Marine Reaches 6 through 11 (MR6-11) correspond to the Naval Air Station on Whidbey Island. MR6-11 begins on the southern side of Oak Harbor, follows around Maylor point and includes all of the area adjacent to Crescent Harbor that lies within the jurisdiction of Oak Harbor (Refer to Appendix E - Figure 16). The reach is approximately 10.09 miles in length.

Table 17. MR6-11 Summary.

Current Land Use	Acres	Percent of Reach[1]	Current Zoning	Acres	Percent of Reach[1]	Future Land Use	Acres	Percent of Reach[1]
NASWI	876.7	100	None[2]	876.7	100	NASWI	876.7	100
Total Acreage of Reach			876.7 acres					
Public Shoreline Access[3]			Watershed trail (Maylor point) as well as access by boat to Crescent Harbor shorelines - Access to Naval Air station property is allowed by an agreement held between the City and NASWI and could be limited or revoked in the future.					
Habitat [4]			Large areas of wetland habitat and restored areas.					

[14] Navy activities are not subject to SMA provisions when those activities are conducted within the boundaries of the station, and the City does not have permit authority on Navy land. However, non-federal actions on federal land, e.g. expansion of the City's sewer treatment plant, would be subject to the SMA and SMP. Based upon direction from DOE staff, review of reaches 6 through 11 has been combined to provide an ecosystem-scale analysis that can be used to make environmental designations, policies and regulations that can be used to address the potential for non-federal actions on federal lands.

[1] Data derived from analysis of City of Oak Harbor GIS data. Percentages may not total 100% due to rounding.
[2] "None" is an attribute defined by the GIS data layer. It is likely a result of variations within mapped locations of the GIS data layers. As such, the areas identified as "none" are actually part of the other identified land use and zoning designations
[3] Data derived from analysis of City of Oak Harbor GIS data.
[4] Data derived by aerial photograph review conducted by Grette Associates.

Current and Future Land Use

The existing land use, zoning and future land use within MR6-11 is the Seaplane Base (Figure 9, 10 and 11) and is not expected to change. The majority of the shoreline is relatively undeveloped. Future development may include both new development associated with NASWI operations and services as well as redevelopment of existing development. One example of development in the past was the conversion of the old seaplane hangar into the Naval Exchange commercial facility for base personnel. At this time, Navy representatives expect that current uses will continue without significant changes (NASWI Representative, personal communication, 2010).

View public access within this reach is provided via an extension to the waterfront trail, known as the Maylor Point extension, which was completed in 2010 (Figure 12). This portion of the waterfront trail was the result of a combined effort by the Navy and City of Oak Harbor to resume non-military personnel access to the station which was denied following the September 11, 2001 attacks. Access to this trail is provided via a contract ending in November 2011 (Manning 2010). Public use of the trail after November 2011 is subject to negotiation between the City and NASWI. In addition, access to the shoreline of Crescent Harbor is also allowed by boat. In addition, vehicular, pedestrian and bicycle access to this shoreline is available via Old E. Pioneer Way. However, this access is also subject to closure by NASWI (Figure 12).

Hydrologic Function

The reaches within MR6-11 follow from the eastern side of Oak Harbor to just beyond the peninsula that marks the eastern end of Crescent Harbor. This reach contains both marine shorelines, extensive wetland areas (approximately 44.5% of the reach is mapped as wetland), and two freshwater inputs into the marine shoreline (Crescent Creek and a small unnamed creek). Restoration activities associated with the Crescent Harbor salt marsh have restored some of the tidal interaction that was limited in the 1920s by dikes built by farmers as well as the development of Pioneer Way (also mapped as Old Polnell Road and East Polnell Road). However, the continued existence of Pioneer Way indicates that hydrologic flow is still at least somewhat modified within this reach. In addition, a wastewater treatment plant is currently located within the mapped wetland habitat adjacent to Crescent Harbor. The treatment plant is represented by the rectangular wetland feature that is part of larger wetland area within MR11 (Figure 3a and Figure 16). The portion of Crescent Creek that is located within MR11 has been ditched and channelized for much of its length with some of the flow re-directed into County ditches (KCM 1998; Johnson and Kearsley 1999). Although parts of Crescent Creek were restored during the salt marsh habitat restoration project, the remaining areas of straight channels indicate that hydrologic flow within this reach is still somewhat modified.

The *Salmon Limiting Factors Analysis* document provides information about the water quality of Crescent Creek: this waterbody has a relatively cool water temperature and low turbidity and

nutrient concentrations during storm events. However, dissolved oxygen levels violated the state standard (7.9 mg/l or greater) during one monitoring occasion and fecal coliform bacteria exceeded the state standard on two of three monitoring occasions. Despite the channel straightening and occasional exceedences to water quality standards, the overall water quality is listed as fair.

The low bank areas within this reach series are mapped as containing 100-year floodplain associated with Oak Harbor and Crescent Harbor (Figure 3). The extensive wetland areas adjacent to both harbors are likely to provide continued flood storage and stormwater attenuation within this reach. However, floodwater storage and attenuation is somewhat diminished within this reach series by the straightening of Crescent Creek; it is unclear whether the associated wetland areas can compensate for this modification.

Other factors that result in modification to hydrologic function that are found in other reaches within the City's jurisdiction are either absent within MR6-11 or are concentrated within a single reach of the series. For example, MR6-11 has no mapped stormwater outfalls or catchbasins within its shoreline jurisdiction (Figure 5), and overall impervious surface is approximately 7.9%. However, MR10 greatly exceeds this average percentage with a calculated impervious surface area of 75.39% (Figure 7). In addition, MR6-11 has a total of 17,144 linear feet of road within 200 feet of the shoreline, but the majority of this roadway (16,968 linear feet) is located in MR11.

This reach series contains 20 mapped soil types (Figure 8). The soils with the largest percentages of area within this reach include: Indianola loamy sand, Dugualla muck, Mitchellbay gravelly sandy loam, Xerothents-Endoaquents, Beach Endoaquents, and Semiahmoo Muck. Generally, known and mapped wetland areas coincide with mapped soils that are rated as being poorly to very poorly drained (Dugualla muck, MR7 and MR11). Upland areas contain soils that are rated as somewhat poorly drained (Mitchellbay gravelly sandy loam 2 to 10%, MR8, 9 and 11) to somewhat excessively drained (Indianola loamy sand, MR6) and excessively drained (Xerothents-Endoaquents, tidal association, MR8 and 9). As would be expected within an area with soils of varying rates of drainage, this reach has areas of low, moderate and high susceptibility for critical aquifer recharge (Figure 4).

MR6-11 has areas of extensive shoreline alteration. As depicted in Section 2.2.1 of this document, the shoreline within MR10 is largely composed of fill (566,273.2 square feet, 82.1% of the reach). The shoreline jurisdiction of MR7 is also largely composed of fill (1,497,484.4 square feet, 34.8% of the reach). In addition, MR6 and MR11 also contain areas of fill and stabilization. However, some portions of this reach series, including MR8 and 9 as well as the eastern portion of MR11, have no fill and only moderate amounts of shoreline armoring. Overall, the hydrologic function of this reach series is considered to be medium.

Vegetation Function

MR6-11 is characterized by multiple land uses[15] including, open space, marina, and residential use and each of these uses have resulted in varying amounts of modification to the vegetation within this reach. In general, vegetation varies from forested areas comprised primarily of Douglas Fir to emergent and scrub shrub areas of varying plant communities. Although most of the vegetation within this reach shows evidence of human modification (e.g., the influx of freshwater wetland vegetation into a previously saltwater marsh) the majority of the reach still contains areas characterized by fairly complex vegetation. It is assumed that the second growth areas located within and to the south of MR6 are most indicative of the historic vegetative structure of the reach (Figure 16).

Due to the level of alteration to the vegetation, the vegetation function of this reach is considered to be medium.

Habitat Function

The reduced level of development within MR6-11 (excluding areas such as MR8 and 10) is likely to provide a greater level of habitat function than is found within the City's core reaches MR1-5, with the possible exception of MR2. It is worth noting that habitat structure within MR11 is also somewhat fragmented by Pioneer Way and the channelization of Crescent Creek. However, restoration actions within this reach series, such as the Crescent Harbor Salt Marsh restoration described below, have restored some of the functionality to this area.

The Crescent Harbor Salt Marsh Restoration project (located in MR11) has improved the overall quality of the habitat within this reach series. Historically, this salt marsh was one of the largest on Whidbey Island. Development has fragmented portions of the marsh habitat. For example, a waste water treatment plant impacted 32 acres within the wetland area. In addition, East Pioneer Way served as a berm between the marine shoreline and the marsh preventing fish access to the marsh and limiting tidal exchange to groundwater systems. The restoration project, constructed in 2008-2009, was designed to address some of the impacts associated with NASWI development, and included the following components:

1. Creation of a notched weir at the sewer intake dike separating the southwest and northwest marsh cells to allow for tidal circulation.
2. Breach of the northeast sewer intake dike to increase tidal volume and fish access between the northwest and east salt marsh cells.
3. Replacement of the undersized culvert currently connecting the southwest and east salt marsh cells to improve fish access and tidal circulation.
4. Breaching the remaining beach berm near the existing tide gate and reconnecting the existing channel network to Crescent Harbor through Seabee Bridge.

[15] Land uses estimated from review of aerial photography. Available GIS data layers do not distinguish land use beyond NASWI.

Completion of this restoration project has increased the likelihood that this area will be used by juvenile salmonids. Salmonscape mapping resources note that Coho salmon and fall Chum are present and there is the potential of distribution/use of Crescent Creek (Salmonscape queried March 2011). The marine shoreline within MR6-11 contains documented areas of surf smelt and sand lance spawning in Crescent Harbor and the majority of the remainder of the MR6-11 shoreline is mapped as having the potential to support forage fish spawning (Salmonscape queried March 2011) (Refer to Figure 3c).

Slope stability within this reach series is highly variable. The modified slopes are mapped near Maylor Point, and unstable slopes are mapped on the eastern side of the central peninsula and to the east of Crescent Harbor. The small peninsula including the area known as Polnell Point is mapped with alternating areas of unstable and unstable recent slide (Coastal Zone Atlas). The remainder of the slopes within the reach are mapped as stable.

The amount of shoreline stabilization within this reach series is also varied (Figure 13). Although the location of shoreline stabilization has a greater coincidence with modified slopes and nearshore fill than unstable slopes, there is no direct correlation between shoreline armoring and slope stability with this reach series. Shoreline stabilization exceeds 94% for MR10 but is as low as 7-9% for reaches 8 and 11. Average shoreline stabilization coverage for the entire reach is approximately 54%.

The data regarding slope stability and shoreline stabilization as provided above is generally consistent with the findings of a study of Island County Feeder Bluff and Accretion Shoreform Mapping. This document identifies the areas in this reach series as varying from accretion shoreforms along the wetland area on the Maylor Point peninsula and along the northwestern boundary of Crescent Harbor to feeder bluffs directly north of Maylor and Forbes Point as well as along the northeastern boundary of Crescent Harbor. In addition, the shoreline area between Maylor Point and Forbes Point as well as the shoreline associated with Ponell Point are identified as Feeder Bluff exceptional, which indicates areas that have the highest volume of sediment input per lineal foot [16] (Johannessen 2005).

Terrestrial habitat within the MR6-11 reaches is also variable. For example, MR10 is contains development directly adjacent to and waterward of the ordinary high water mark line. As such, it is unlikely that terrestrial species utilize this area. However, reaches MR 6, 7 and 11 are much less developed and therefore are able to support greater levels of habitat. As shown in Figure 3c, these reaches include bald eagle foraging areas, which indicates these areas may also be likely to support other bird of prey species as well as food sources.

The expanse of MR6-11 includes seven drift cells (Figure 15). As discussed previously in Section 3.2, these drift cell push sediment into Oak and Crescent Harbors. The southern tips of each peninsula act as divergence zones where areas of left-to-right and right-to-left sediment drifts combine. Unlike Oak Harbor, Crescent Harbor does not have an area of no appreciable drift. This is likely due to the shape of the harbor, but may also be at least partially the result of the extensive shoreline armoring that is located along the internal western side of the harbor (Figure 13).

[16] An accretion shoreform is a shore area that is form by the gradual accumulation of sediment.

There are twenty-one overwater structures within this reach and nineteen are mapped within MR10 alone. The average amount of nearshore fill within this reach is 24.6%. However, nearshore fill within each reach varies widely (from 82.1% in MR10 to 0.2% in MR8) (Figure 13).

Due to the minimal locations of mapped habitat and in conjunction with the habitat disturbance presented by the reduced hydrologic and vegetation functions, the overall habitat function rating for MR6-11 is medium, with specific internal areas (such as the wetland habitat restoration areas) rated medium-high or high.

5.7 SHORELINE FUNCTION SUMMARY

Table 13 provides a summary of hydrology, vegetation, and habitat function of MR1-11 based on this assessment. As is typical in urban areas, City shoreline function is closely tied to development patterns. Existing function is generally greater in areas where land use and shoreline condition limit or entirely exclude development adjacent to shoreline areas (e.g., steep slopes in MR1 or wetlands in MR 2 and MR 6-11).

Table 18. Ecological Function Assessment Summary for City Shoreline Reaches

Marine Reach	Hydrologic	Vegetation	Habitat	Overall Function
MR1 (Scenic Heights segment)	**Medium –** Reach has no mapped direct stormwater input, relatively low impervious surface percentages, and the presence of vegetated marine bluffs. However, failing septic systems may be a source of toxins as well as nitrogen and phosphorus.	**Medium High –** The vegetated marine bluffs provide a natural setback between the shoreline and residential development.	**Medium –** The majority of the shoreline provides forage fish habitat and the upland marine bluff has approximately 50 feet of multi-storied vegetation which overhangs the shoreline.	**Medium**

Marine Reach	Hydrologic	Vegetation	Habitat	Overall Function
MR2 (Freund Marsh segment)	**Medium High –** The majority of this reach is protected wetland area, which is likely to provide necessary water storage and water quality function necessary to offset at least a portion of the surrounding development.	**High –** Vegetation within the reach is likely representative of pre-development wetland vegetation. In addition, vegetation in this area is maintained and supplemented with additional plantings by local groups.	**Medium High –** Majority of reach is vegetated open space and is likely to provide habitat for urban wildlife as well as raptor species or traveling waterfowl. Ability of reach to provide habitat may be impeded by surrounding development.	**Medium High**
MR3 (Oak Harbor Beach Segment)	**Medium low –** Reach has increased levels of impervious surface that are likely to cause impacts to water storage during rain events and may serve as a source of pollutants to the adjacent marine shoreline. Windjammer Park may serve to reduce some of these impacts.	**Low –** areas of residential development generally have minimal amounts of associated shoreline vegetation. Windjammer Park contains large expanses of maintained grass and little associated tree cover.	**Low –** The majority of this reach is developed and contains residential development adjacent to the shoreline. The grassy expanses within the park may provide rest areas to waterfowl species.	**Low**

Marine Reach	Hydrologic	Vegetation	Habitat	Overall Function
MR4 (SE Bayshore/ Pioneer Way Segment)	**Low –** The majority of this reach contains impervious surface, associated roadway and outfalls. All of these are likely to greatly alter water quality and quantity within the reach.	**Low** - The vegetation within this reach is limited to a narrow strip, approximately 25 feet in width (but as narrow as 10 feet in some locations), located between the shoreline and the adjacent roadways.	**Low –** This reach has only a small amount of mapped forage fish habitat, and terrestrial habitat is limited to the narrow strip of shoreline vegetation along the marine bluff.	**Low**
MR5 (Oak Harbor Marina)	**Low** – The majority of the landmass within this reach is composed of nearshore fill covered by impervious surfaces. This is likely to result in greatly reduced natural hydrologic function of the area.	**Low** – This reach contains only a narrow band (up to approximately 20 feet in width) of emergent and scrub/shrub type vegetation.	**Low** – This reach contains high amounts of alteration to the hydrologic and vegetation functions and much shoreline armoring (99%). In addition, this reach has very little spawning habitat suitable for forage fish.	**Low**

Marine Reach	Hydrologic	Vegetation	Habitat	Overall Function
MR 6-11 (Naval Air Station Whidbey)	**Medium –** This reach includes significant areas of alteration including the placement of a wastewater treatment plant within a tidally influenced marsh and the straightening of Crescent Creek. However, the surrounding areas are not developed, so improvement of hydrologic function in this area is possible.	**Medium -** The majority of the reach contains undeveloped, vegetated areas that may provide habitat as well as areas that are currently being restored or are being considered for restoration.	**Medium/Medium High -** Although the reach has moderate to high amounts of alteration, including shoreline armoring, roads and overwater development (varied by reach), the majority of the reach also contains undeveloped, vegetated areas that can provide habitat as well as areas that are currently being restored or are being considered for restoration.	**Medium**

6 OPPORTUNITIES FOR SHORELINE PROTECTION, RESTORATION, PUBLIC ACCESS AND USE

6.1 SHORELINE PROTECTION AND RESTORATION OPPORTUNITIES

This section of the Inventory and Characterization document describes opportunities within the City to advance the goals of shoreline protection and restoration. Pursuant to the Shoreline Guidelines provided by the Department of Ecology (WAC 173-26), "Restoration" is the reestablishment or upgrading of impaired ecological shoreline processes or functions, but does not imply a requirement for returning the shoreline area to aboriginal or pre-European settlement conditions.

Shoreline protection and restoration opportunities were identified using the baseline watershed processes and reach characterization and functions information provided in Sections 3 and 5 of this document.

Recommendations for improvement to hydrologic, vegetative and habitat functions within Oak Harbor include:

- Reduction of impervious surfaces; use of pervious pavers with adequate stormwater/runoff controls to ensure their use does not impact hydrologic function. More specifically, opportunities exist in Reaches 3, 4, and 5 along developed shorelines to apply pervious surfaces. For example, future improvements to Windjammer Park should consider using LID techniques.

- Coordinate design of landscaping and stormwater facilities on new development or re-development adjacent to Freund Marsh to include Low Impact Development features and facilities such as native landscaping, rain gardens and bioswales. Reaches 2 and 3.

- Discourage the building of new bulkheads and promote the replacement of existing bulkheads with soft armoring alternatives, specifically for Reaches 1, 4, 5, 6, 7 and 10.

- Require grating or other materials that allow increased light transmission to reduce the shading impacts of overwater structures on salmonids (including improvement projects associated with the Municipal Pier and Oak Harbor Marina), Reaches 4, 5 and 10.

- Require, as a condition of development or redevelopment, that properties with on-site septic disposal connect to sanitary sewer, if available, for Reaches 2 and 3.

- Continue to protect and maintain existing habitat within Freund Marsh, Reach 2, and NASWI, Reach 11.

- Pursue additional efforts to further improve the vegetative and habitat function of Freund Marsh as first envisioned in the Waterfront Redevelopment, Branding, and Marketing Program. Restoration projects could include: further vegetation enhancement; removal of stormwater conveyances, tide gates, catch basins and outfalls; creation of a braided channel habitat with associated large woody debris, Reach 2.

- Collaborative efforts between the City and Navy, such as the Crescent Harbor Saltwater Marsh habitat effort have provided a good foundation of restoration actions within the shoreline jurisdiction. It is recommended that the City and Navy continue to work on future habitat projects. One such project could include decommissioning of the lagoon wastewater treatment facility after construction of a new wastewater treatment facility is complete. It is believed that restoration actions in the area will be especially beneficial in providing increased habitat functionality. If advance planning is done for the decommissioning, the City may be able to obtain federal/state funding to remove the lagoon facility and repair the environment. Discussions would need to begin early with the Navy to enter into agreements to decommission the lagoon facility. Primarily Reach 11.

- Pursue the restoration of tidal influence and fish access to the marsh system associated with Crescent Harbor and Reach 11 has been identified as a priority for Chinook salmon recovery by the Skagit River System Cooperative.
  (See also: http://www.skagitcoop.org/index.php/crescent-harbor-salt-marsh-restoration/).

- Investigate the feasibility and potential positive restoration opportunities associated with the removal of historic fill from some or all of the wetland and shoreline acreage to the north of Maylor Point within reach MR7. It is recommended that functioning salt marsh habitat, even if associated with historic fill, should be maintained.

The *Salmon Habitat Limiting Factors Analysis* for WRIA 6 includes the following recommendations for improvement to hydrologic, vegetative and habitat function within Crescent Harbor, which may also be considered by the City as possible restoration projects[17]:

- Fill the ditch (immediately north) that runs parallel to East Pioneer Way.[18]

- Explore the feasibility of removing the sewage lagoon and restoring the grade to facilitate restoration of the entire estuary system by cooperation between the Navy and the City. [Refer to collaborative efforts bullet in the section above]

- Explore the possibility of removing the left creek tributary that drains from the Sleeper Road wetlands to the County drainage ditch and unmaintained agricultural channels.

- Identify and protect (through acquisition or easement) the headwaters of Crescent Creek.

[17] These recommendations were pulled directly from the text of the Limiting Factors Analysis. The recommendations within the Analysis document that were completed as a part of the Crescent Harbor Salt marsh restoration project have been removed.

[18] It is assumed by the authors of this analysis that this recommendation, as made by the authors of the Limiting Factors Analysis, is to limit the amount of straightened channelized waterways within this wetland system which, in turn, is also likely to reduce the amount of sediment and toxins introduced into marine waters from the adjacent roadway.

- Develop a plan to restore and manage Crescent Creek for the reintroduction of anadromous salmon.

- Provide protection for the riparian buffer [Crescent Creek assumed] through acquisition or conservation easements.

- Install a conspan or bridge under [east] Pioneer Way.

- Explore the option of closing and removing a portion of [east] Pioneer Way.

- Remove the existing dikes and ditches within the estuary and restore tributaries off of the main channel.

- Allow Crescent Harbor marsh to re-vegetate naturally. Design and implement a vegetation monitoring program.

6.2 SHORELINE MANAGEMENT RECOMMENDATIONS

Shoreline Environment Designation Recommendations:

In Phase 3 of the Shoreline Management Program update process, local jurisdictions are required to develop environmental designations (RCW 90.58.040 and WAC 173-26-211). These designations are similar to zoning designations for areas within the shoreline management jurisdiction and are assigned in order to address the land uses with the designation area (i.e. residential, urban, and military uses within the City of Oak harbor) as well as the associated habitat and physical character of each shoreline reach (i.e. wetlands, marine bluffs, etc.).

The state's SMP guidelines include recommendations for six designations (WAC 173-26-211). These designations are as follows:

- Natural

  The purpose of the "natural" environment is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes. Consistent with the policies of the designation, local government should include planning for restoration of degraded shorelines within this environment (WAC 173-26-211(5)(a)(i)).

- Rural Conservancy

  The purpose of the "rural conservancy" environment is to protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural flood plain processes, and provide recreational opportunities. Examples of uses that are appropriate in a "rural

conservancy" environment include low-impact outdoor recreation uses, timber harvesting on a sustained-yield basis, agricultural uses, aquaculture, low-intensity residential development and other natural resource-based low-intensity uses. (WAC 173-26-211(5)(b)(i)).

- Aquatic

  The purpose of the "aquatic" environment is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high-water mark. (WAC 173-26-211(5)(c)(i)).

- High Intensity

  The purpose of the "high-intensity" environment is to provide for high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded. (WAC 173-26-211(5)(d)(i)).

- Urban Conservancy

  The purpose of the "urban conservancy" environment is to protect and restore ecological functions of open space, flood plain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses. (WAC 173-26-211(5)(e)(i)).

- Shoreline Residential

  The purpose of the "shoreline residential" environment is to accommodate residential development and appurtenant structures that are consistent with this chapter. An additional purpose is to provide appropriate public access and recreational uses. (WAC 173-26-211(5)(f)(i)).

The local jurisdiction may choose to utilize the designations provided in the SMP guidance or generate and utilize designations to suit the specific needs of the area, provided they are consistent with the purposes and the policies of the guidelines.

The following table, Table 19, identifies the recommended shoreline environment designation for each reach based upon the results of this Inventory and Characterization document that is intended to be utilized in Phase 3, Task 3.3 of the Shoreline Master Program Update process. For some reaches within the City, an environmental designation based upon the designations provided in the Shoreline Master Program update guidance is recommended. For other reaches, City specific environmental designations are recommended.

Table 19: Shoreline Environmental Designation Recommendations[1]

Reach	Recommended Designation(s)	Supporting Information
1	Parallel designations with **Urban Conservancy** waterward of the top of the bluff, and **Shoreline Residential** upland of the bluff top is one option. Another option is to create a **locally unique designation** that combines these elements without the use of a parallel designation and call it **Residential Conservancy**, **Shoreline Residential Bluff Conservancy**, or similar.	The Urban Conservancy designation or similar is proposed in order to protect the bluff and beach areas along Scenic Heights and prevent further alteration and development of the shoreline. However, the extensive presence of single-family residences in the area and level of modification landward of the bluff top must be recognized.
2	**Urban Conservancy**	Reach 2 consists of Freund Marsh. The area may not meet the criteria for being designated as Natural, due to extensive historic modifications and future plans for improvements. Urban Conservancy would provide protection of open space and ecological resources while allowing greater flexibility for future park and open space uses and future enhancement activities.
3a	**Shoreline Residential**	This reach is platted and developed with residential uses.
3b	**Public Facility** or **Urban Park (locally unique designation)**	This reach is dominated by Windjammer Park. While open space, Windjammer is an urban park, surrounded by urban development. Rather than preservation of native vegetation and habitat, its purpose is to provide water oriented recreational opportunities and shoreline access for the public, as well as opportunities for ecological enhancement. It is recommended that the designation include policies and regulations that focuses on providing open space, water oriented recreation, and public access in developed urban areas. This designation also needs to allow for the repair, expansion, redevelopment and relocation of the existing wastewater treatment plant.
3c	**Urban Mixed Use (locally unique designation)**	This reach contains mostly multifamily residential, but is zoned and designated in the comprehensive plan as Central Business District. Over time, this area is likely to

		redevelop with a mixture of downtown uses. It is recommended that the Urban Mixed Use designation focus on mixed-use, water-oriented development.
4	Multiple Designations are recommended for this reach **Urban Park:** Flintstone Park **Urban Mixed Use:** All other areas of the reach.	This reach is extensively developed and contains a mixture of residential and commercial uses. This area should be focused on fostering water-oriented mixed-use development and providing public access to the shoreline. In contrast to the residential, commercial and transportation uses present in most of the reach, Flintstone Park provides recreational opportunities and public shoreline access and should be reserved in this capacity.
5	**High Intensity**	This reach consists of the Oak Harbor Marina, a private boat storage yard, and Navy property. The shoreline is extensively modified and contains little vegetation. Hydrologic, vegetation, and habitat functions are all low.
6-9*	**Urban Conservancy**	While the shorelines of these reaches vary in their level of modification, all are relatively undeveloped. A few of the houses near Forbes Point extend into the shoreline jurisdiction, but this area is mostly free of structures. Application of the Urban Conservancy designation will protect existing shoreline function from future development while allowing restoration and enhancement activities at Maylor Point.
10*	**High Intensity**	This reach is extensively developed and consists primarily of fill. Little vegetation remains, and hydrologic and habitat functions are low.
11*	**Urban Conservancy or Natural** **(Urban Conservancy is most likely based on existing development including Pioneer Way, Old Polnell Road, associate berms and the waste water treatment plant)**	The shoreline of Reach 11 is less developed and modified than most other areas of the City. However, Pioneer Way, Old Polnell road, the existing wastewater treatment plan and associated fill berms are present in this reach. These fill berms prevent direct interaction between uplands or wetlands and the shoreline along much of this reach. The far eastern end of the reach contains extensively vegetated areas, and the reach also contains upland associated wetlands. Because this area retains relatively high levels of ecological function and is less modified that other areas of shoreline in the City, the Urban Conservancy or Natural designation is recommended in order to protect wetland habitat and preserve natural shoreline areas. Use of this designation will also promote restoration and enhancement activities in areas where the shoreline has been altered, such as the wastewater treatment plant near Crescent

		Marsh.

[1] It is recommended that all areas within the shoreline jurisdiction waterward of the ordinary high water mark are designated aquatic.

* As noted in Chapter 5.6 of this document, Navy activities are not subject to SMA provisions when those activities are conducted within the boundaries of the station. However, non-federal actions on federal land, e.g. modification of the City's sewer treatment plant, would be subject to the SMA and SMP. Therefore, environmental designations are assigned to these areas to address these non-federal actions should they arise.

Shoreline Policy Recommendations

Phase 3, Task 3.2 requires the development of general policies for the Shoreline Master Program. For the purposes of the SMP update task a policy is identified as

> *"[A] commitment to act in a prescribed manner in the administration of the master program. Most policy statements use the verb form "should" to indicate the principal to be upheld in making a decision and that the policy direction itself will require interpretive judgment in applying it to a specific case."*[19]

Based upon the data collected during the Inventory and Characterization process, the follow recommendations are given for shoreline management policies that may be created during the update process[20]:

- Should avoid permitting shoreline uses that would prevent the establishment of the preferred shoreline uses as identified in the Shoreline Management Act.
- Should maximize water dependent and water related uses in appropriate locations.
- Should develop priorities for water-oriented and water-related recreation. This planning should recognize the wide variety of needs of the population of the City.
- Should preserve, protect, enhance and restore critical areas and shoreline functions and processes through regulatory and non-regulatory methods.
- Should develop and require performance standards that will prevent detrimental impacts to the shoreline.
- Should encourage the improvement of shoreline habitat where possible.
- Should encourage the study and monitoring of aquatic and shoreline environments in order to identify existing as well as future conditions.
- Should reduce or eliminate the need for structural shoreline armoring through such methods as land use designations, associated development standards , and public education.

[19] Quoted text obtained from the Washington State Department of Ecology's website on Shoreline Master Program updates in August 2011. http://www.ecy.wa.gov/programs/sea/shorelines/smp/toolbox/process/task3.2.html

[20] This list is intended to provide an initial list of recommendations for the generation of shoreline management policies that will be generated during Phase 3, Task 3.2. This list is not intended to identify all policies that may be included in the draft SMP.

Shoreline Regulation Recommendations

Phase 3, Task 3.2 also requires the development of regulations for the Shoreline Master Program. For the purposes of the SMP update task a regulation is identified as

> *[A]n authoritative rule dealing with the specifics of a use or physical standard. Regulations are specific, as definitive as possible, and generally use the verb form "shall" to indicate that the statement must be conformed to.*[21]

Based upon the data collected during the Inventory and Characterization process, the follow recommendations are given for shoreline management regulations that may be created during the update process[22]:

- Adopt wetland and FWHCA buffers consistent with best available science to protect and restore shoreline ecological functions.
- Create a regulation designed to conserve existing vegetation along the shoreline.
- Limit development to appropriate height restrictions on construction in order to maintain existing view corridors.
- Require new development to connect to City sewage (if available).
- Prohibit new development that would require shoreline stabilization.

6.3 PUBLIC ACCESS OPPORTUNITIES

Shoreline public access allows the general public to reach and touch the water and offers the ability to view the water and the shoreline from upland locations. Public access facilities may include public parks, boat launches, trails, improved street ends and overlooks. On Oak Harbor shorelines, public access is provided by multiple parks (including Freund Marsh, Windjammer Park, and Flintstone Park), the Oak Harbor Marina (owned and operated by the City of Oak Harbor), and the shoreline waterfront trail which provides access from the northern side of Freund Marsh, around Oak Harbor and terminates in the Seaplane Base near the wetland area of the Maylor Point peninsula (Figure 13). Access to the portion of the trail on NASWI is pursuant to a recent agreement between the City and the Navy which allows temporary access.

The relative amount of public access available within Oak Harbor appears to exceed the amount of public access found in most similar jurisdictions. Although not all of the reaches are able to provide designated public access points (e.g., MR1 has no mapped access and MR6-11 has limited public access, subject to closure by NASWI), the majority of the reaches contain public access for almost the entire extent of the reach. While future redevelopment in Subreach 3c could provide limited additional public access on private property as a result of the implementation of state SMA requirements for new development, the primary opportunities in Oak Harbor consist

[21] Quoted text obtained from the Washington State Department of Ecology's website on Shoreline Master Program updates in August 2011. http://www.ecy.wa.gov/programs/sea/shorelines/smp/toolbox/process/task3.2.html

[22] This list is intended to provide an initial list of recommendations for the generation of shoreline management regulations that will be generated during Phase 3, Task 3.2. This list is not intended to identify all policies that may be included in the draft SMP.

of improvements to existing facilities, enhanced trail connections and pursing long term agreements with NASWI to maintain and enhance public access to Maylor Point and Crescent Harbor.

The City of Oak Harbor has identified public access opportunities and planning goals in the 2009 Parks Recreation and Open Space Plan. Key planned shoreline projects include:

- Improvements to Windjammer Park, including resurfacing and drainage improvements in parking lots, upgrades to the RV parking pads, resurfacing of basketball court, replacement of the west playground and repairs to the east playground, resurfacing of the trail and replacement of the bridge and upgrading the east wading pool. Other improvements noted include aesthetic improvements to the swimming lagoon, adapting or modifying the sewer plant into a community facility and additional elements as noted in the Windjammer Plan and in the planning goals identified in the next section of this document.

- Improvements to Flintstone Park which includes demolition of an existing restroom facility, asphalt driveway and trails and replacing with a new 2,325 square foot multi-purpose room and restroom facility buildings, a 252 square foot picnic shelter, and related utilities and site improvements. The new facility includes a multi-purpose room, a storage area, a mechanical room, men's and women's restroom rooms and a detached picnic shelter. Site work includes clearing and grading, asphalt access drive with parking, curb, gutters, concrete plaza, concrete paved trails, utilities, storm drainage, landscaping and aesthetic improvements.

- Replacement and upgrading of the existing derelict municipal pier at Flintstone Park.

- Provide Beach Access at VFW Memorial Park.

- Major improvements to the Oak Harbor Marina as previously described including extending the trail through the Marina and a new multi-use float which will enhance existing overwater access to pedestrians

- Improvements to Catalina Park just north of the Oak Harbor Marina. Key needed improvements include installation of an irrigation system, upgrading the playground surface and upgrading the volleyball courts. Other possible improvements include upgrading the fence and beach improvements with ADA access.

Key planning goals related to shoreline public access identified in the 2009 Parks, Recreation and Open Space Plan include:

- Post a City parks directory map at Windjammer Park that incorporates City landmarks

- Construct a concert/performance arts pavilion at Windjammer Park.

- Provide additional public RV spaces in or around Windjammer Park.

- Provide shoreline access, campgrounds and trail linkages for kayakers and others using human powered watercrafts.

- Provide upland facilities at Flintstone Park that will support the Municipal Pier Project.

- Prepare a concessionaire policy and related ordinance for the City's shoreline and community parks.

- Provide more attractions at Oak Harbor's shoreline parks, including opportunities for community events and vendors of appropriate refreshments and rental sports equipment.

- Various goals supporting the creation of the recent Marina Master Plan, related upgrades and funding mechanisms.

6.4 SHORELINE USE ANALYSIS AND IDENTIFICATION OF POTENTIAL CONFLICTS

Planned shoreline use as identified in the adopted Comprehensive Plan (City of Oak Harbor 2010), includes developed parks, open space, single family residential, multifamily residential, mixed use, commercial development, water dependent uses (marina and boat yard) and NASWI (e.g. administrative, commercial and training facilities). These uses are consistent with adopted zoning in the Oak Harbor Municipal Code. There are relatively few undeveloped properties remaining within the shoreline jurisdiction within the core city area, so the majority of future development will likely involve the redevelopment of existing parcels.

Within Reach 3a there are a few vacant properties where single family residential development could occur under current zoning and adopted future land use. There is the potential for single family and low density multifamily properties in Reach 3c to convert to higher density multifamily or mixed use development and a limited number of single family properties in Reach 4 to convert to multifamily and residential office development. There is also the potential for some multifamily properties in Reach 3c to convert to mixed use and the potential for multifamily and single family land uses in the western portion of Reach 4 to convert to small office development.

Of particular note, there is a large vacant site within the western portion of Reach 4 just east of Flintstone Park that is zoned and designed Central Business District and would allow a sizeable new development in the SMA. Mixed use development has previously been proposed on this site. It is likely that this site will be developed for mixed use, residential or commercial development in the future.

The residential use of property as well as the development of parks is a priority use according to the SMA (RCW 90.58.020). The primary potential for shoreline use conflict within the City of Oak Harbor shoreline jurisdiction involves areas where current zoning or future land use designations may result in the development of commercial uses that are not water-dependent, water-oriented or water enjoyment. This is most likely to occur within MR3c and MR4. However, the commercially zoned parcels within MR4 are prevented from having direct access to the shoreline by Pioneer Way and as such are also prevented from providing water-dependent uses.

The City of Oak Harbor must ensure that development is consistent with the goals and policies outlined in the SMA, the Shoreline Master Program, and does not result in ecological harm. The Shoreline Master Program Guidelines provide allowances for non-water dependent commercial and mixed use development under certain conditions. WAC 173-26-241(3)(d) states:

Master programs should prohibit non-water oriented commercial uses on the shoreline unless they meet the following criteria:

> *(i) The use is part of a mixed-use project that includes water-dependent uses and provides a significant public benefit with respect to the SMA's objectives such as providing public access and ecological restoration; or*
>
> *(ii) Navigability is severely limited at the proposed side; and the commercial use provides a significant public benefit with respect to the SMA's objectives such as providing public access and ecological restoration.*

In areas designated for commercial use, non-water-oriented commercial development may be allowed if the site is physically separated from the shoreline by another property or public right of way.

While there is limited potential for new private residential development in the shoreline jurisdiction, Oak Harbor has extensive parks and open space in its shoreline area, and additional recreational development within public parks is planned as part of the Waterfront Redevelopment, Branding, and Marketing Program. Future recreational development within the shoreline area should give priority to uses and facilities that are primarily related to access to, enjoyment and use of the water and shoreline. New uses that are not related to the shoreline, such as ballfields, should be discouraged or prohibited from locating in shoreline jurisdiction.

Two market studies identifying future community need of waterfront for tourism, marina and recreational uses within the City were identified during the inventory and characterization process. One of the studies was a 1998 market assessment focused on tourism. The results of this study identified a City need for additional and more upscale lodging, including waterfront views, conference facilities, and pedestrian-oriented activities such as shopping, restaurants, and recreation (Chandler and Brooks 1998). More recently, the City commissioned a second study that focused specifically on redevelopment of the Oak Harbor Marina. The results of the 2009 study recommended that focus be placed initially on critical in water projects including: dock maintenance, construction of a public multi-use float, and repair of the existing boat launch. The study also recommended that secondary focus be placed on upland projects such as improvements to community access and the redevelopment of existing storage sheds into multi-use marine oriented buildings including a restaurant and supply store (City of Oak Harbor 2009). In addition to the findings of the two market studies above, anecdotal information collected during the characterization process indicated that existing restaurant and multi-use facilities along the shoreline, such as the Oak Harbor Yacht Club, are used extensively. Representative of the yacht club noted that their facility is utilized 3 to 4 weekends each month and that average event attendance is 120 people (Oak Harbor Yacht Club personal comm. 2011). Based upon the findings listed above, it appears that there may be substantial demand for a waterfront or view multi-use facilities including restaurants in Oak Harbor.

Additional development is also anticipated at the Oak Harbor Marina as previously noted in Section 6.2. A demand analysis prepared by BST Associates in 2006 indicated that the number of recreational boats in Washington State is anticipated to increase at a rate of approximately 1.7% per year through 2020. Based on Oak Harbor's share of the recreational boat market, the marina could attract up to 255 additional boats between 2006 and 2020. Additional moorage would be necessary to accommodate new boat traffic, with a particular emphasis on slips for larger vessels to match prevailing trends in boat ownership. In addition to new slips, recommended improvements at the marina include parking area renovations, a new dedicated fishing pier, and additional commercial development in the form of support services for boat owners. Planned improvements at the Marina also include dredging to improve navigation and moorage depth.

Oak Harbor and Crescent Harbor are not included in the DNR list of Washington State Harbor Areas. Based on a variety of factors, including water depth in the harbor, location and limited market area, the demand for water dependent shipping or industrial uses is limited. Mooring of military vessels, including visiting Coast Guard cutters, and the transport of military personnel and goods occurs at NASWI facilities in Crescent Harbor. Limited facilities still exist, including concrete ramps, but the aircraft hangar has been converted to the Navy Exchange commercial facility. The Seaplane Base Pier is approximately 550 ft (168 m) long. The west end of the pier extends approximately 50 ft (15 m) over the shoreline, so the usable portion of the pier is less than its total length (http://members.tripod.com/airfields_freeman/WA/Airfields_WA_NW.htm). The pier is structurally unsound and the Navy plans to eventually remove it (Spoo. personal communication 2011).

7 DATA GAPS

This section of the Inventory and Characterization describes data gaps or limitations identified during document development. This section is not intended to provide an exhaustive list of all of the items the City should address. However, the actions listed within this section are provided to suggest possible directions the City may wish to pursue prior to future code updates and/or amendments to the Shoreline Master Program.

Regional Information

As noted in Section 2 of this document, Island County is conducting its SMP update concurrent with the City effort, and will prepare a county-wide assessment of regional conditions including watershed processes and shoreline functions. Additionally, Ecology may provide updated information to supplement the watershed processes and/or reach analysis within this document. Any information that becomes available within the timeframe of the appropriate update task should be utilized for this update process. If information becomes available after the appropriate task has been completed, it is recommended that it be gathered for future updates.

Intertidal Wave action

Information regarding drift cells as well as information on accretion shoreforms within the City is provided in the habitat section data for each reach. However, further information regarding attenuation of wave and tidal energy needed to address shoreline update guidance within WAC 173-26-201 (3) (d) (i) (c) is not available. The City may wish to pursue obtaining city specific information on intertidal wave action within Oak and Crescent harbors for future shoreline updates.

Impervious Surfaces

As noted in Section 4.1.4 of this document, the available impervious surface data is inaccurate. The City may wish to pursue obtaining city specific information regarding impervious surface for future shoreline updates. In addition, future updates may have the benefit of impervious surface research that is directly related to marine shorelines. However, the study of this interaction is likely to occur outside of the city jurisdiction.

Land Cover

Land cover data for the City was only available at a state and federal level of data. This is the information that was utilized to generate Figure 15. As one can see by reviewing this figure, the raster data was developed for a much larger scale of analysis than would be applicable at a City level. As a result, the data resulting from GIS analysis was grossly inaccurate. For example, a large percentage of each shoreline reach was identified as barren land based upon the available information. However, these areas were clearly not barren land when compared to aerial photography. The City may wish to pursue obtaining city specific information regarding land cover for future shoreline updates.

Building Footprints

No GIS data regarding building foot prints within the shoreline jurisdiction was discovered during the inventory or analysis process. This data is often utilized to obtain an understanding of the existing setbacks of structures from the shoreline and helps to provide baseline data for future updates. The City may wish to pursue obtaining city-specific information regarding building footprints for future shoreline updates.

Site Specific Critical Area Information

As noted within Section 4 of this document, site-specific studies may yield information regarding critical areas that are currently unknown and unmapped within the shoreline.

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CITY OF OAK HARBOR
SHORELINE MASTER PROGRAM UPDATE

APPENDIX A – INVENTORY OF DATA SOURCES

CITY OF OAK HARBOR
SHORELINE MASTER PROGRAM UPDATE

TASK 2.1 – INVENTORY

PREPARED FOR:

CITY OF OAK HARBOR
DEVELOPMENT SERVICES
865 SE Barrington Drive
Oak Harbor, WA 98277

PREPARED BY:

AHBL, INC
1200 6TH AVENUE
SUITE 1620
SEATTLE, WA 98101-3117

GRETTE ASSOCIATES, LLC
2102 NORTH 30TH SUITE A
TACOMA, WASHINGTON 98403
(253) 573-9300

REVISED – APRIL 28, 2011

Table 1: Technical Resources

Report or Document Title	Author and Date	Location
Integrated reports, catalogs and online resources		
Boundaries of State-owned Aquatic Lands	Washington State Department of Natural Resources	http://www.dnr.wa.gov/Publications/aqr_aquatic_land_boundaries.pdf
Coastal Zone Atlas	Washington State Department of Ecology	http://www.ecy.wa.gov/programs/sea/sma/atlas_home.html
Crescent Bay Salt Marsh and Salmon Habitat Restoration Plan	Philip Williams & Associates and University of Washington Wetland Ecosystem Team, July 2003	AHBL, Digital copy received from City of Oak Harbor
Crescent Creek Freshwater Input Analysis	Eric Mickelson, Skagit River System Cooperative, April 2009	AHBL, Digital copy received from City of Oak Harbor
Historic Aerial Photos	Naval Air Station Whidbey Island (NASWI), 1992, 1960's (various dates), 2003; Peggy Darst Townsdin, Island County Historian (early 1940's photo), City of Oak Harbor, various dates	AHBL, Digital copies received from City of Oak Harbor
Island County Boat Launches and Marinas	Island County Tourism	http://www.whidbeycamanoislands.com/downloads/whidbey-camano_34.pdf?PHPSESSID=0a295e179e94db1fcf261c1430b57b57
Island County Water Resource Management Plan	Island County, June 20, 2005	AHBL, Digital copy received from City of Oak Harbor, also available on-line: http://www.islandcounty.net/health/Wat

		ershedPlanning/WRMPlan.htm
Guide to Local Histories: Island County, Washington (State) Records 1979-2000	Department of History, Pacific Lutheran University, 2000	Hard copy at Grette Associates
Naval Air Station Whidbey Island (NASWI) General Information	NASWI, 2010	https://www.cnic.navy.mil/Whidbey
NASWI, Seaplane Base Information	Paul Freeman, 2009	http://members.tripod.com/airfields_freeman/WA/Airfields_WA_NW.htm
Nearshore Report	Island County Marine Resources Committee, August 2009	AHBL, Digital copy received from City of Oak Harbor
Northwest Salmon Recovery Planning	NOAA/NMFS national site	http://www.nwfsc.noaa.gov/trt/index.cfm
Priority Habitats and Species	Washington State Department of Fish and Wildlife	http://wdfw.wa.gov/conservation/phs/
Public Access Information	Washington Department of Ecology BEACH Program	http://www.ecy.wa.gov/programs/eap/beach/
Public Access Regional Maps	Trust for Public Land	http://www.tpl.org/tier3_cd.cfm?content_item_id=19981&folder_id=262
Salmon Recovery Plan	Puget Sound Partnership, 2010	http://www.psp.wa.gov/SR_status.php
Salmonscape	Washington State Department of Fish and Wildlife	http://wdfw.wa.gov/mapping/salmonscape/
Section 303d Listed water body	Washington State Department of Ecology	http://apps.ecy.wa.gov/website/wq303d/viewer.htm
The Shoreline Management Act and Use of State-Owned Aquatic Lands	Washington State Department of Natural Resources	AHBL/Grette, Digital copy received from City of Oak Harbor, also available on-line: http://www.clallam.net/RealEstate/assets/applets/WDNR_SMA_Aquatic_Resources_Prog.pdf

Strategic Science Plan	Puget Sound Partnership, 2010	http://www.psp.wa.gov/downloads/SCIENCE/strategicscience_09_02_10.pdf
Third 5-Year Review for NAS Whidbey Island Ault Field & Seaplane Base	Department of the Navy Naval Facilities Engineering Command Northwest, September 2009	AHBL, digital copy received from City of Oak Harbor
Washington Department of Archaeology and Historic Preservation	Washington Department of Archaeology and Historic Preservation	http://www.dahp.wa.gov/pages/wisaardIntro.htm
Washington State Accessible Outdoor Recreation Guide - North Puget Sound Region.	Washington State Parks, 2006	http://www.parks.wa.gov/adarec/detail.asp?region=NPS#12
Washington State University Beach Watcher data on Crescent Harbor	Washington State University Beach Watchers	AHBL, Digital Copy received from City of Oak Harbor
Water Resources Inventory Area 6 (Whidbey and Camano Islands) Multi-Species Salmon Recovery Plan	Island County Water Resources Advisory Committee, May 5, 2005	AHBL, Digital copy received from City of Oak Harbor, also available on line: http://www.islandcounty.net/health/WatershedPlanning/documents/WRIA6_SalmonRecoveryPlan_2007.pdf
City of Oak Harbor Documents		
City of Oak Harbor Capital Improvement Plan	City of Oak Harbor, December 2009	AHBL, Digital copy received from City of Oak Harbor, also available on-line: http://www.oakharbor.org/uploads/documents/516942010_cip.pdf
City of Oak Harbor Comprehensive Plan	City of Oak Harbor, December 2009	AHBL, Digital copy received from City of Oak Harbor, also available on-line: http://oakharbor.howitworks.com/uploads/documents/841742010_comprehensive_plan.pdf
City of Oak Harbor, Comprehensive Sewer Plan	City of Oak Harbor, 2008	http://www.oakharbor.org/uploads/documents/807942010_comprehensive_sewer_plan.pdf

City of Oak Harbor, Comprehensive Stormwater Drainage Plan	City of Oak Harbor, 2006	http://www.oakharbor.org/uploads/documents/166642010_comprehensive_stormwater_drainage_plan.pdf
Oak Harbor Marina Redevelopment Program	City of Oak Harbor, April 2, 2009	AHBL, Digital copy received from City of Oak Harbor
City of Oak Harbor Parks, Recreation and Open Space Plan	City of Oak Harbor, 2009	AHBL, Digital copy received from City of Oak Harbor, also available on-line: http://www.oakharbor.org/uploads/documents/440442010_parks_recreation_and_open_space_plan.pdf
City of Oak Harbor Shoreline Master Program	City of Oak Harbor December, 1998	AHBL, Digital copy received from City of Oak Harbor, also available on-line: http://www.oakharbor.org/uploads/documents/200842010_shoreline_master_program.pdf
City of Oak Harbor Water Systems Plan	City of Oak Harbor, 2003	http://www.oakharbor.org/uploads/documents/901942010_water_system_plan.pdf
North Whidbey Community Diversification Action Plan	City of Oak Harbor, 1995	http://www.oakharbor.org/uploads/documents/385242010_north_whidbey_community_diversification_action_plan.pdf
Oak Harbor Critical Areas Update: Review of Comprehensive Plan and Regulations	Stewart and Associates/Perteet, Inc, May 18, 2005	AHBL, Digital copy received from City of Oak Harbor
Oak Harbor Municipal Code Titles 19 (zoning), 20 (environment), 21 (subdivisions)	City of Oak Harbor	AHBL, Digital copy received from City of Oak Harbor. Municipal code also available online in its entirety.
Transportation Element	City of Oak Harbor, 2007	http://www.oakharbor.org/uploads/documents/461242010_final_oak_harbor_transportation_plan.pdf
References for scientific texts, journal articles, technical reports, and research papers		
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pub/sxn7.pcts_upload.download?p_file=F3181/200600472_fema_nfip_09-22-2008.pdf

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Table 2: Geographic Information System (GIS) Digital Data

GIS Data Theme	Data Source	Location
Aerial Photography	USDA National Agricultural Imagery Program (NAIP), 2009 Historic photos are noted in Table 1: Technical Resources	AHBL, http://gis.ess.washington.edu/data/raster/doqs_naip.html
Archeological and Cultural Resources	Washington State Department of Archaeology and Historic Preservation, December 2010	AHBL Note: Data will be destroyed by AHBL following project completion and will only remain on file with City of Oak Harbor per the terms of the MOU.
Building Footprints	City of Oak Harbor, 2010	AHBL
City, UGA boundary	City of Oak Harbor, 2010	AHBL
Critical Aquifer Recharge Areas (CARA)	Island County Health Department, date unknown	AHBL
Drift Cells	United States Army Corps of Engineers (USACOE), Puget Sound Nearshore Ecosystem Restoration Project, (PSNERP), 2010	AHBL, ftp://ftp.usace.army.mil/pub/nws/PSNERP_CA/
Flood Hazard Areas	Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM), 2010	AHBL
Impervious layer	National Land Cover Database (NLCD) via Washington Department of Ecology (WDOE), 2005 (originally published 2001 by National Oceanic and Atmospheric Administration (NOAA))	AHBL, http://www.ecy.wa.gov/services/gis/data/data.htm#s

GIS Data Theme	Data Source	Location
Land Cover	USACOE, PSNERP, 2010	AHBL, ftp://ftp.usace.army.mil/pub/nws/PSNERP_CA/
Liquefaction Susceptibility	Washington Department of Natural Resources (WDNR), 2004	AHBL, http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html
Marina Parcel data	City of Oak Harbor, 2010	AHBL
Natural Heritage Program (garry oak, snowberry)	WDNR Natural Heritage Program, 2005 via City of Oak Harbor	AHBL
Naval Air Station Whidbey Island (NASWI) Hydrology (sloughs and ditches)	NASWI, date unknown	AHBL
Ordinary High Water Mark	WDNR Shorezone Inventory, Shoreline Shapefile, updated 2006	AHBL, http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html
Overwater Structures in Marine Waters of Washington State	WDNR, 2007	AHBL, http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html
Parcels • Zoning • Future land use • Current land use	Island County via City of Oak Harbor, 2010	AHBL
Priority Habitat and Species	Washington Department of Fish and Wildlife (WDFW), 2010 via City of Oak Harbor	AHBL
Recreation • Boardwalk • Waterfront trail • Easements	City of Oak Harbor, 2010	AHBL
Roads	City of Oak Harbor, 2010	AHBL
Saltwater habitats	WDNR Shorezone data, 2001	AHBL, http://fortress.wa.gov/dnr/app1/dataweb/dmmatrix.html
Shoreline Modifications • Armoring	USACOE, PSNERP, 2010	AHBL, ftp://ftp.usace.army.mil/pub/nws/PS

GIS Data Theme	Data Source	Location
• Breakwater • Jetties • Landfill • Overwater structures		NERP_CA/
Slopes > 15%	City of Oak Harbor, 2003 (derived from 10 meter Digital Elevation Model)	AHBL
Soils	United States Department of Agriculture, Natural Resource Conservation Service (USDA NRCS) National Soil Survey Geographic (SSURGO) database via Soil Data Mart, 2010	AHBL http://soildatamart.nrcs.usda.gov/Download.aspx?Survey=WA029&UseState=WA
Subbasins	United States Geological Survey (USGS), 1994	AHBL
Topography (2' and 10' contours)	City of Oak Harbor, 2003	AHBL
Utilities • Stormwater facilities • Sewer lines • Water lines	City of Oak Harbor, NASWI, date unknown	AHBL
Washington Rivers	City of Oak Harbor, August 2003	AHBL
Wellhead Protection Areas	WA Department of Health, retrieved, October 2010	AHBL

CITY OF OAK HARBOR
SHORELINE MASTER PROGRAM UPDATE

APPENDIX B – ASSESSMENT OF SHORELINE JURISDICTION

October 29, 2010

Ethan Spoo
City of Oak Harbor
865 SE Barrington Drive
Oak Harbor, WA 98277

Project: City of Oak Harbor Shoreline Master Program, Our File No. 210351.3
Subject: Proposed Oak Harbor Shoreline Jurisdiction

Dear Ethan:

AHBL, in collaboration with Grette Associates, has developed the attached map of the proposed minimum shoreline jurisdiction. Under the City's current Shoreline Master Program, marine shorelines and shorelands extending 200 feet from the ordinary high water mark within the municipal boundary of Oak Harbor are regulated as shorelines. Associated wetlands also fall within the existing state definition of regulated shorelines. Associated wetlands have not historically been specifically identified as shorelines in the Oak Harbor SMP or included in previous shoreline boundary mapping.

The first step in updating the map of shoreline jurisdiction was to review the precise shoreline and associated wetlands definition found in RCW 90.58.030, related guidance found in Chapter 173-22 WAC and guidance found in Chapter 5 of the Washington Department of Ecology's (Ecology) SMP Handbook (updated 6/2/2010). Key definitions and portions of these guidance documents for the City of Oak Harbor include "marine waters", "Ordinary High Water Mark" (OHWM), as well as when to consider wetlands as "associated" with the shoreline.

Marine Waters and Ordinary High Water Mark

The SMA generally applies to all marine waters of the state waterward of the OHWM. Local shoreline jurisdiction applies to the area waterward of the OHWM out to the City's in-water jurisdictional boundary. RCW 35.21.160 extends in-water jurisdictional boundaries to the middle of water bodies such as bays, sounds, lakes, and rivers.

Since there was no locally available data source complete or consistent enough for establishing the OHWM, AHBL retrieved Washington Shorezone data (last updated 2006) from the Department of Natural Resources website, and utilized the "shoreline" shapefile as the OHWM. A discussion with Tim Strickler of the Aquatic Resources Program, confirmed that this was the most accurate and up-to-date data available from the State, and that it should be used for mapping of the OHWM. Ecology does not require the SMP jurisdiction map to show precise location of the OHWM.

RCW 90.58.030(2)(f) provides a definition for Shorelines of Statewide Significance. The definition includes "those areas of Puget Sound and the Strait of Juan de Fuca and adjacent salt waters north to the Canadian line and lying seaward from the line of extreme low tide". Therefore, that portion of the Oak Harbor shoreline jurisdiction lying seaward from the line of extreme low tide is considered to be a Shoreline of Statewide Significance.

Civil Engineers
Structural Engineers
Landscape Architects
Community Planners
Land Surveyors
Neighbors

SEATTLE
1200 6th Avenue
Suite 1620
Seattle, WA 98101-3117
206.267.2425 TEL
206.267.2429 FAX

www.ahbl.com

Associated Wetlands

The City provided wetland data that included the boundaries of Freund Marsh. This data was originally generated by Fish and Wildlife Service's NWI database. The City of Oak Harbor also provided additional wetland data which was generated by an Island County wetland survey conducted in 1991 and 1998. None of the City or County data sets include wetlands within Navy Air Station Whidbey Island (NASWI) Seaplane Base properties. NASWI provided wetland data for its properties. This data was derived from the Natural Resources Management Plan prepared by the USDA Soil Conservation Service, and has been modified over the years by NASWI.

Ecology guidance states that an entire wetland is associated if any part of it lies within the area 200 feet landward of the OHWM of a State Shoreline. Further guidance states that wetlands that are hydraulically connected to a Shoreline are also considered to be associated, as well as wetlands within the 100-year floodplain. Wetlands that are separated by an obvious topographic break from the shoreline are not associated, provided they are outside the shoreland zone and provided that the break is not an artificial feature such as a berm or road. Grette Associates made the determination of which wetlands were associated based on available GIS data, analysis of aerial photography, and the criteria discussed above.

Flood Hazard Areas

Under RCW 90.58.030, minimum shoreline jurisdiction also includes the floodway and contiguous floodplain extending 200 feet landward from the floodway. There are no mapped floodways within the City. Therefore, in Oak Harbor, floodplains are only included in the minimum shoreline jurisdiction where they are located within 200 feet of the OHWM or within an associated wetland. Flood hazard data is 1996 Q3 data (FIRM) obtained from FEMA and is the latest available.

Streams/Rivers and Lakes

There are no streams or rivers in Oak Harbor that meet the 20 cubic feet per second (cfs) mean annual flow threshold for SMA regulation. WAC 173-18-190 states "Island County has no 20 cfs streams but has shorelines". There are no lakes within the City that meet the 20 acre size threshold for regulated shorelines. Department of Ecology GIS data was also reviewed to confirm that there are no streams or lakes in Oak Harbor that fall within the jurisdiction of the Shoreline Management Act (see http://www.ecy.wa.gov/services/gis/data/data.htm#m).

Revised Jurisdiction Summary

- Marine Shorelines
- Shorelands 200 feet landward of the marine shoreline OHWM
- Associated Wetlands

If you have any questions, please call me at (206) 267-2425.

Sincerely,

Gabe Snedeker, AICP
Project Manager

GS/mh
c: Cassandra Moore, Grette Associates

CITY OF OAK HARBOR
SHORELINE MASTER PROGRAM UPDATE

APPENDIX C – INFORMATION REQUEST

CITY OF
Oak Harbor
WHIDBEY ISLAND, WASHINGTON

September 10, 2010

RE: City of Oak Harbor Shoreline Inventory and Assessment, Request for Existing Information on Puget Sound Shoreline

Dear Stakeholders:

The City of Oak Harbor is in the early stages of examining the Puget Sound shorelines and associated wetlands within City limits for the purposes of updating its Shoreline Master Program (SMP) per the requirements of the Washington State Department of Ecology. We recently hired AHBL, Inc. and Grette Associates, LLC to assist with shoreline analysis and characterization, regulatory review and restoration plan development. A shoreline inventory, where we compile all pertinent and reasonably available data, plans, studies, inventories, maps and other applicable information, will be the first step. The inventory will be used to develop a map portfolio and a report characterizing ecological functions and ecosystem-wide processes, among other things.

The City is requesting your help in obtaining all existing physical and biological information for its shoreline area and associated wetlands within the City limits, and other relevant watershed or basin information. Specific locations include Oak Harbor, Maylor Point, Crescent Harbor, Freund Marsh and Crescent Marsh. We are interested in any and all inventories, assessments, water quality analyses, and/or fish and wildlife distribution and habitat information. An aerial photo with the municipal boundary of Oak Harbor is included for reference.

We hope to assemble our inventory by November 15, 2010, in order to complete the necessary characterization, analysis, and recommendations in a timely manner. A response would be appreciated by November 1, 2010. If possible, please provide hard copies or electronic files of any studies instead of a list of citations; contact the City if a copy fee is required. If you believe that another individual within your organization would be a more appropriate contact for this solicitation, please forward this letter to that individual, and notify us of the change in contact.

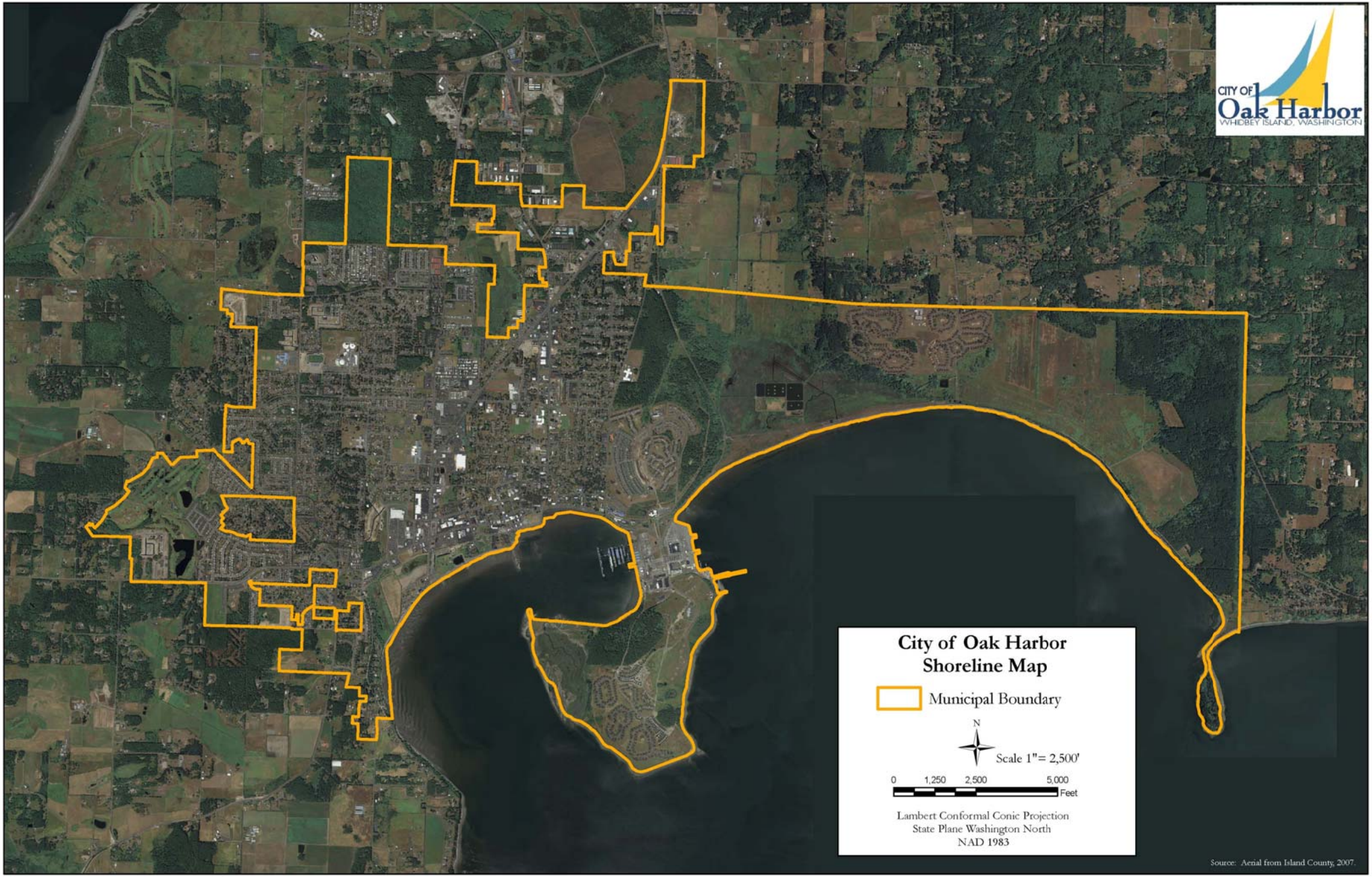
If you have any questions or need additional information, please feel free to contact Ethan Spoo, Senior Planner, at (360) 279-4513, or espoo@oakharbor.org.

Sincerely,

Ethan Spoo

Ethan Spoo
Senior Planner
Development Services Department
City of Oak Harbor

Cc: File
Encl.


City of Oak Harbor
Shoreline Map
Municipal Boundary
N
Scale 1"= 2,500'
0
1,250
2,500
5,000
Feet
Lambert Conformal Conic Projection
State Plane Washington North
NAD 1983
Source: Aerial from Island County, 2007.
CITY OF
Oak Harbor
WHIDBEY ISLAND, WASHINGTON

Dept. Natural Resources
SEPA Center
PO Box 47015
Olympia WA 98504-7015

Department of Ecology
Environmental Review Section
P.O. Box 47703
Olympia, WA 98504-7703

Attorney General
Ecology Division
1125 Washington St SE
PO Box 40100
Olympia, WA 98504-0100

Puget Sound Water Quality Authority
Environmental Review
PO Box 40900
Olympia WA 98504-0900

Doug Thompson
Area Habitat Biologist
WS Dept of Fish and Wildlife
PO Box 1100
La Conner WA 98257-1100

The Tulalip Tribes
6319 23rd Ave NE Bldg B
Tulalip WA 98271-9132

Skagit Valley Community College
Whidbey Island Campus
1900 SE Pioneer Way
Oak Harbor WA 98277

Greater Oak Harbor Chamber of Commerce
P.O. Box 883
Oak Harbor WA 98277

ABHL
Attn: Gabe Snedeker, AICP
1200 6th Avenue
Suite 1620
Seattle WA 98101-3117

Skagit River System Cooperative
P.O. Box 368
La Conner, WA 98527

WSDOT
1043 Goldenrod Rd. #101
Burlington, WA 98233

SEPA Information Officer
Island County Planning Dept.
P.O. Box 5000
Coupeville, WA 98239

Northwest Air Pollution Auth.
1600 South 2nd Street
Mount Vernon, WA 98273-5202

David Pater
Shorelands and Environmental Assistance
Dept of Ecology
3190 160th Ave SE
Bellevue WA 98008

Swinomish Indian Tribal Community
11404 Moorage Way
La Conner WA 98257

Jennifer S. Meyer
Code NAS N01A
3730 N Charles Porter Ave
NAS Whidbey Island
Oak Harbor WA 98278-5000

Island County Public Health
PO Box 5000
Coupeville WA 98239

WSU Beach Watchers
PO Box 5000
Coupeville WA 98239

Nancy Waddell
EcoNet Whidbey Coordinator
<info@whidbeywatersheds.org>

Department of Ecology
Shorelands Division
Mail Stop PV-11
Olympia, WA 98504

US Army Corps of Engineers
Regulatory Branch
PO Box 3755
Seattle WA 98124-3755

Oak Harbor School District
350 S Oak Harbor Street
Oak Harbor WA 98277

Gretchen Kaehler
Department of Archaeology & Historic Preservation
PO Box 48343
Olympia WA 98501

Lummi Indian Business Council
2616 Kwina Road
Bellingham WA 98226

City of Oak Harbor
Mack Funk, Harbormaster
865 SE Barrington Dr.
Oak Harbor WA 98277

Island County Marine Resources Committee
c/o WSU Extension
POB 5000
Coupeville, WA 98239

Island County Salmon TAG
PO Box 5000
Coupeville WA 98239

Douglas Hennick
Watershed Steward
WDFW
16018 Mill Creek Blvd
Mill Creek, WA 98012

CITY OF OAK HARBOR
SHORELINE MASTER PROGRAM UPDATE

APPENDIX D – SHORELINE PHOTOGRAPHS

Reach 1 (Scenic Heights): looking south at failing timber bulkhead

Reach 1 (Scenic Heights): looking north at shoreline armoring and unstable slopes

Reach 2 (Freund Marsh): looking northeast along dike with wetland area at the left of the photo

Reach 2 (Freund Marsh): looking north. Restored wetland areas are visible to the left of the photo with stormwater conveyance pipes visible to the right

Reach 2 (Freund Marsh): outfall and conveyance from marsh to the harbor.

Reach 2 (Freund Marsh): Freund Marsh Trail looking east.

Reach 3a (Dillard's Addition): view looking southeast.

Reach 3b (Windjammer Park): view looking west along Waterfront Trail.

Reach 3b (Windjammer Park): view of the swimming lagoon looking northwest

Reach 3c (Boardwalk): view looking west along Waterfront Trail boardwalk.

Reach 3c: view of the CityPier looking east along Reach 4

Reach 5 (Oak Harbor Marina): view looking south.

Reach 5: view of marina and adjacent lands looking north

Reach 6: view looking west along trail to Maylor Point.

Reach 7: view of large Maylor Point wetland

Reach 10: view looking south towards old Navy Seaplane Ramp and Pier