City of Langley
Shoreline Master Program Update
Final Shoreline Inventory and Characterization Report

Ecology Grant No. G1100124
Deliverable for Task 2.3
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CHAPTER 1 INTRODUCTION

1.1 Background and Purpose

The City of Langley (City) is conducting a comprehensive Shoreline Master Program (SMP). The City’s SMP was last updated in 2001. It was based on the Island County SMP also updated in 2001. In recent years, several species that depend on shorelines have been listed as threatened or endangered species, concern about public access to shorelines has grown, and there have been economic and demographic changes that were not foreseen in the late 1990s, all of which contribute to the need to update the SMP. This update is funded by a grant from Washington State through the Department of Ecology (Ecology) (SMA Grant No.G1100124). Per the requirements of the grant, the City is required to amend their local SMP consistent with the State Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58 and its implementing guidelines, Washington Administrative Code (WAC) 173-26. The City is scheduled to adopt their updated SMP by December 2012.

This report is one of the early steps in the comprehensive update process: an inventory and characterization of shoreline conditions. The inventory and characterization provides a basis for updating shoreline management goals, policies, and regulations (including critical areas); applying shoreline environment designations; and identifying public access and shoreline restoration opportunities.

This report includes a discussion of the ecosystem processes at a landscape scale that influence the Puget Sound shorelines and provides more detailed descriptions of the ecological functions and land use patterns along the shoreline. Accompanying this report, in Appendix A, is a series of maps depicting shoreline features and conditions (see Table 2-1 for a list of maps in Appendix A).

Based on the findings of this report, the City will begin the next steps in the SMP update process, which includes public involvement, updating shoreline environment designations and goals, policies, and regulations. The City will also prepare a separate restoration plan to more fully describe restoration goals and opportunities.

1.2 Shoreline Management Act

Washington’s Shoreline Management Act was passed by the State Legislature in 1971 and adopted by the public in a referendum. The SMA was created in response to growing concerns about the effects of unplanned and unregulated development on the state’s shoreline resources. A central goal of the SMA is “to prevent the inherent harm in an uncoordinated and piecemeal development of the state’s shorelines.”

The term ‘shorelines’ in the Act and in this report refers to areas that meet the criteria for ‘shorelines of the state’. In Langley, the only shoreline of the state is the Puget Sound as shown in Map 1 (Appendix A). The Puget Sound seaward from the line of extreme low tide is also classified as a ‘shoreline of statewide significance’ (RCW 90.58.030(2)(e).
Ecology administers the Act, but the Act gives primary permitting authority for shoreline development to local governments. Local governments are also charged with developing SMPs in accordance with the State Guidelines developed by Ecology. The Guidelines give local governments some discretion to adopt SMPs that reflect local circumstances and to develop other local regulatory and non-regulatory programs related to the goals of shoreline management as provided in the policy statements of RCW 90.58.020, WAC 173-26-176, and WAC 173-26-181.

The City of Langley adopted the Island County Shoreline Master program in 1975. In 2001 the County adopted an updated SMP. At that time the City Council determined that the City should develop its own SMP specific to the City. The development of the City’s SMP incorporated appropriate policies and regulations contained in the adopted, but not yet approved, County SMP.

1.3 Shoreline Jurisdiction

SMA jurisdiction includes all “shorelines of the state” as defined in RCW 90.58.030. Shorelines of the state include all of the water areas of the state and their associated “shorelands,” together with the lands underlying them, except:

- Shorelines on segments of streams upstream of a point where the mean annual flow is 20 cubic feet per second (cfs) or less and the wetlands associated with such upstream segments; and
- Shorelines on lakes less than 20 acres in size and the wetlands associated with such small lakes.

The SMA further designates some shorelines as “shorelines of statewide significance”. These “shorelines of statewide significance” include Puget Sound waters seaward of the extreme low tide. Consistent with RCW 90.58.020 and .090, the SMA raises the status of “shoreline of statewide significance” by establishing specific preferences for uses and calling for a higher level of effort in implementing the objectives of the SMA. Associated wastelands are those wetlands which have a two way hydrologic connection to tidal waters.

“Shorelands” or “shoreland areas” means those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark (OHWM); floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with such streams, lakes, and tidal waters. In this context, “associated” wetlands means wetlands that are in proximity to shorelines or that influence or are influenced by waters subject to the SMA (WAC 173-22-030 (1)). These typically include wetlands that physically extend into the shoreline jurisdiction, and wetlands that are functionally related to the shoreline, such as through a hydrologic connection or other factors.

Shoreline jurisdiction also applies to the area waterward of the OHWM to the middle of Puget Sound, as RCW 35.21.160 extends jurisdiction to the middle of water bodies, such as bays, sounds, lakes and rivers.
1.3.1 Shorelines of the State

In the City of Langley, the shoreline area to be regulated by the SMP includes:

- The Puget Sound shore within the City’s municipal boundary (Map 1, Appendix A).
- The open water and tidelands extending to the middle of the Saratoga Passage;
- The upland area landward 200 feet of the OHWM; and
- Any associated wetlands (none have been identified).

1.3.2 Shorelines of Statewide Significance

The SMA designates some shorelines as “shorelines of statewide significance”. These “shorelines of statewide significance” include portions of Puget Sound and other marine water bodies, rivers with mean annual flow of 1,000 cfs or greater, and freshwater lakes 1,000 acres or larger. Consistent with RCW 90.58.020 and .090, the SMA raises the status of “shoreline of statewide significance” by establishing specific preferences for uses and calling for a higher level of effort in implementing the objectives of the SMA.

In the City of Langley, shorelines of statewide significance include the open water areas of Puget Sound lying seaward from the line of extreme low tide. The shorelands landward of extreme low tide do not meet the criteria of RCW 90.58.030(2)(e) for designation as a shoreline of statewide significance, and are considered shorelines of the state. Figure 1 demonstrates this division:

![Figure 1. Shoreline of Statewide Significance](image)

1.4 Shoreline Environment Designations

SMPs are required to have a system for classifying shoreline areas based on their biological and physical characteristics, their existing and planned land use patterns, and the goals of the community. This system of shoreline environment designations (SED) groups areas that share similar characteristics so they can be managed in a uniform and consistent manner. In a regulatory context, shoreline environment designations function similarly to zoning overlays. That is, they do not change the underlying zoning or other applicable land use regulations, but provide an additional layer of policy and regulations that can be tailored to the designation. The City’s current SMP includes three environment designations and one sub-designation. The purposes of the designations are outlined below in Table 1-1.
Table 1. Current Shoreline Environment Designations

<table>
<thead>
<tr>
<th>Environment</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Urban/High Intensity</strong></td>
<td>The purpose of the Urban/High Intensity Environment designation is to ensure optimum use of the shorelines in areas characterized by high-intensity land uses or planned for future high-intensity development. The Urban/High Intensity Environment should be managed to maintain the shoreline for a variety of more intense developments including water dependent, water related or water enjoyment uses and to protect shoreline resources.</td>
</tr>
<tr>
<td><strong>Shoreline Residential</strong></td>
<td>The purpose of the Shoreline Residential environment is to recognize areas where the predominant land use is residential and to accommodate future residential development consistent with the Langley Comprehensive Plan while protecting shoreline resources.</td>
</tr>
<tr>
<td><strong>Aquatic</strong></td>
<td>The purpose of the Aquatic Environment is to protect the marine environment and critical biological resource areas, to protect the public’s right to navigation and where appropriate, allow for water dependent and water related uses.</td>
</tr>
<tr>
<td><strong>Sub-Designation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Urban Aquatic</strong></td>
<td>Consistent with the purpose of the Aquatic Environment, this subordinate designation is to provide an area for the water dependent and water related uses adjacent to the Urban/High Intensity Environment and to assure compatibility with adjacent upland uses.</td>
</tr>
</tbody>
</table>

1.5 Relationship to Other Plans and Programs

1.5.1 City Plans and Programs

The City’s SMP works in concert with the Comprehensive Plan and a variety of other regulatory plans and programs to manage shoreline resources and regulate development near the shoreline. The Comprehensive Plan establishes the general land use pattern and provides an overall vision for growth and development for areas inside and outside shoreline jurisdiction. Various sections of the Langley Municipal Code (LMC) also play a major role in how shorelines are managed. These include:

**LMC Title 18 – Zoning.** Establishes zoning districts and regulates land use in the City including the shorelines.

**LMC 16.04 – Environmental Policy.** Establishes procedures and policies to implement the state environmental policy act (SEPA). All non-exempt City actions require environmental review under SEPA.
LMC 16.20 – Resource Lands and Environmentally Sensitive (Critical) Areas Management. Establishes policies, regulations and land use controls to protect critical areas, including wetlands, streams and other fish and wildlife habitats, geologically hazardous areas, and aquifer recharge and wellhead protection areas. Once adopted, critical areas within shoreline jurisdiction will be regulated through the City’s Shoreline Master program and not LMC 16.20.

LMC 15.24 - Flood Hazard Areas. Establishes procedures for the planning official and/or building official to ensure that new development plan adequately when in flood-prone areas.

LMC 15.01.420 through 455. Building and Construction (Stormwater). Includes erosion prevention and stormwater management requirements for all development proposals.

2009 Comprehensive Stormwater Management Plan. This plan guides management of surface water runoff to protect people and property and meet water quality and resource protection goals, including development of an adequate stormwater system for the City of Langley. The plan identifies deficiencies in the City’s stormwater systems and recommends improvements.

The SMA requires local governments and state agencies to review their plans, regulations, and ordinances that apply to areas adjacent to shoreline jurisdiction and modify those plans, regulations, and ordinances so they “achieve a consistent use policy” in conformance with the Act and the SMP\(^1\). This means that the City’s comprehensive plan and development regulations must be consistent with the SMP overall.

One of the most important areas for consistency is between the SMP and the City’s development standards and use regulations for environmentally critical areas. Although critical areas in shoreline jurisdiction are to be identified and designated under the Growth Management Act (GMA), they must also be protected under SMA. According to Engrossed Senate Bill 1651 passed in 2010, once the City updates its SMP critical areas within shoreline jurisdiction are protected under the SMA and are no longer subject to the procedural and substantive requirements of the GMA. The SMP must protect critical areas such that there is “no net loss of shoreline ecological functions [including feeder bluff retreat] necessary to sustain shoreline natural resources” as defined by the SMP Guidelines.

1.5.2 State and Federal Programs

As stated in WAC 173-27, it is the intent of the SMA to provide for integration of the shoreline permit into a consolidated environmental review and permit process. In achieving this goal, the shoreline policies and regulations contained in the updated SMP will also have to work in concert with several state and federal laws and regulations that relate to shorelines. The major state and federal regulations include:

Hydraulic Project Approval (HPA). Under the State Hydraulic Code (RCW 75.20), an HPA is required for any construction activity in or near the waters of the state, including Puget Sound.

\(^1\) RCW 90.58.340
The program is administered by the Washington State Department of Fish and Wildlife (WDFW). All applicable projects are required to submit permit applications to show that construction is done in a manner to prevent damage to the state's fish, and shellfish, and their habitats.

**Clean Water Act Section 404 Dredge and Fill Requirements.** Section 404 of the Federal Clean Water Act (33 USC 1344) regulates the discharge of dredged or fill material into waters of the U.S. Any project that proposes discharging dredged or fill material into the waters of the United States, including special aquatic sites such as wetlands (non-isolated), must get a Section 404 permit. The U.S. Army Corps of Engineers (Corps) can authorize activities by a standard individual permit, letter-of-permission, nationwide permit, or regional permit.

**State Water Pollution Control Act.** The Washington State Department of Ecology regulates state water quality standards through the State Water Quality Pollution Control Act (RCW 90.48). State regulations include wetlands considered to be isolated under the Clean Water Act.

**Clean Water Act Section 401 Water Quality Certification.** Applicants receiving a section 404 permit from the U.S. Army Corp of Engineers, a Coast Guard permit or license from the Federal Energy Regulatory Commission (FERC), are required to obtain a section 401 water quality certification from the Washington Department of Ecology (Ecology). Issuance of a certification means that Ecology anticipates that the applicant’s project will comply with state water quality standards, including the state’s Water Pollution Control Act (RCW 90.48), and other aquatic resource protection requirements under Ecology's authority.

**Federal Endangered Species Act (ESA).** All federally funded projects or projects that require federal permits, must comply with the federal Endangered Species Act (7 USC 136). Projects that have the potential to directly or indirectly impact species listed as endangered or threatened (including several species in Puget Sound) are subject to approval by the U.S. Fish and Wildlife Service (USFWS) or the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries).

**Section 10 Rivers and Harbors Act (Permit for Work in Navigable Waters).** Under the Rivers and Harbors Act, the Corps has jurisdiction in all navigable waters of the U.S (33 USC 403). Any work in, over, or under navigable waters must apply for a Section 10 permit, which prohibits the obstruction or alteration of navigable waters.
CHAPTER 2    METHODS

2.1 Determining Shoreline Planning Area Boundaries

The approximate extent of shoreline jurisdiction within the municipal limits of the City of Langley is shown in Map 1 (Appendix A) and referred to as the shoreline planning area (SPA). In general this extent represents:

- Lands within 200 feet of the OHWM of Puget Sound within the municipal limits of the City;
- Any wetlands that lie adjacent and contiguous to the areas above; and
- The open water and tidelands waterward of the OHWM to the middle of Saratoga Passage consistent with RCW 90.58.030(2)(e).

The shoreline planning area is intended for planning purposes only. As a result, the actual regulated boundaries of the shoreline jurisdiction may differ from the area shown on Map 1 (Appendix A) depending on information gathered on the ground at any specific location.

2.2 Inventory Data Sources

The shoreline master program guidelines state that shoreline inventory and characterizations should use existing sources of information that are both relevant and reasonably available (WAC 173-26-201(3)(c)). No new field-based data collection efforts were performed to develop the summaries and characterization included in this document. The State’s guidelines establish minimum requirements for the collection and use of scientific and technical information in developing the SMP updates. WAC 173-26-201(2) provides the following standard for collection and use of scientific information:

“First, identify and assemble the most current, accurate, and complete scientific and technical information available that is applicable to the issues of concern... At a minimum, make use of and, where applicable, incorporate all available scientific information, aerial photography, inventory data, technical assistance materials, manuals and services from reliable sources of science. Local governments should also contact relevant state agencies, universities, affected Indian tribes, port districts and private parties for available information. While adequate scientific information and methodology necessary for development of a master program should be available, if any person, including local government chooses to initiate scientific research with the expectation that it will be used as a basis for master program provisions, that research shall use accepted scientific methods, research procedures and review protocols.”

This report incorporates and builds on past work the City and County have undertaken relevant to the SMP. Key sources of information include County planning documents and technical studies (including comprehensive plan), and the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) publications. Mapping information and other studies from City, local, regional, state, federal, and tribal agencies (including Washington Department of Fish and Wildlife,
Department of Ecology, and Department of Natural Resources) were also used. Chapter 6 contains a list of the primary technical and scientific references used to prepare this report. A complete list of GIS/mapping data sources is included in Appendix B. A series of maps depicting shoreline data accompanies this report as Appendix A. A list of the Appendix A map themes is shown in Table 2.

<table>
<thead>
<tr>
<th>Map Title</th>
<th>Map No.</th>
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<tbody>
<tr>
<td>Shoreline Planning Area</td>
<td>1</td>
</tr>
<tr>
<td>Vicinity</td>
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<tr>
<td>Topography</td>
<td>3</td>
</tr>
<tr>
<td>Hydrology</td>
<td>4</td>
</tr>
<tr>
<td>Priority Habitats and Species</td>
<td>5</td>
</tr>
<tr>
<td>Marine Shellfish, Forage Fish, and Eelgrass</td>
<td>6</td>
</tr>
<tr>
<td>Drift Cell &amp; Shoreform</td>
<td>7</td>
</tr>
<tr>
<td>Shoretype</td>
<td>8</td>
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<td>Zoning</td>
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<td>Land Use</td>
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<td>Public Access</td>
<td>13</td>
</tr>
<tr>
<td>Utilities</td>
<td>14</td>
</tr>
</tbody>
</table>

### 2.3 Analysis and Characterization

SMA guidelines require local jurisdictions to evaluate ecosystem-wide processes during SMP updates. Analyzing conditions and processes at the watershed scale informs local planning by providing a broad understanding of the influences on shoreline conditions and functions. Natural processes, and alterations to those processes, are described, generally at the watershed scale based on existing reports and readily available mapping information.

Because Whidbey Island and the City of Langley are located within a group of islands surrounded by marine waters, ecosystem-wide processes (or landscape processes) are described primarily with respect to marine coastal and nearshore processes.

In this document, the term ecosystem-wide processes refer to the dynamic physical, biological and chemical interactions that form and maintain the landscape. Information on nearshore geomorphic processes was derived in large measure from PSNERP, with refinements from more detailed studies prepared for the Island County Marine Resources Committee. The focus of PSNERP has been to identify significant regional ecosystem problems along Puget Sound marine shorelines arising from degradation of geomorphic processes due to human activity, and to prioritize a suite of protection and restoration strategies and projects to help address the
problems identified. Because of the regional intent of PSNERP’s effort, PSNERP data and resources are at a regional scale. This data was supplemented with more detailed local information on geology, climate, hydrology, biology, land use, public access, and other topics relevant to shoreline planning in the City of Langley.

Data were compiled and analyzed at the landscape and reach scale. The report describes the relative condition of ecological functions of the shorelines. The City’s shorelines have been divided into three shoreline “reaches”. The reach scale assessment provides an analysis and assessment of conditions, identifies key management issues and provides conceptual restoration opportunities for each reach. This analysis helps to identify potential use conflicts and issues.
CHAPTER 3  ECOSYSTEM-WIDE CHARACTERIZATION

3.1  Introduction and Overview

This chapter, referred to as the Ecosystem Profile, describes how landscape processes affect the shorelines of Whidbey Island and the City of Langley in a landscape context. It includes a description of Whidbey Island’s physical and biological processes, such as climate, geology, and landforms and how they affect shoreline functions, such as wildlife habitat, in Langley.

Multiple factors influence nearshore character and conditions, such as nearshore morphology, species composition and water quality. These factors are primarily large scale phenomena that occur over broad areas much larger than the City. The variables include climate, geology, oceanographic conditions, wave energy (exposure), topography/bathymetry, littoral drift (net shore-drift), freshwater/fluvial systems and shoreline development. These processes and characteristics are fundamental defining factors that form local shoreline functions. This chapter will discuss these larger processes while Chapter 4 will link them to the discreet shoreline functions of Langley.

The City of Langley occupies approximately 1.73 miles of shoreline on the southeast coast of Whidbey Island in Island County. Whidbey Island is the largest island in the Puget Sound. It is 45 miles long and 235 square miles with approximately 159 miles of marine shoreline. The City of Langley comprises roughly 1 percent of that shoreline.

Climate and geology have combined to make Whidbey Island an important habitat element for the many species that depend on Puget Sound. Situated at the north end of Puget Sound, Whidbey Island has a relatively cool and moist climate that is conducive to development of dense coniferous forests on land, and a rich and diverse sea life. Many beaches on the island are backed by bluffs that erode and feed the beach below. These beaches are important habitat for birds, shellfish, and small fish that larger fish species forage on.

Humans have inhabited the islands in northern Puget Sound for 10,000 to 12,000 years. However, European-American settlers arriving in the 19th century significant changed the landscape of Whidbey Island. All but a small fraction of the forest was logged off during the 19th and 20th centuries. Farming depleted soils and introduced a number of invasive weeds that persist to this day (White, 1980).

In modern times, residential and commercial uses inhabit the shorelines along East Whidbey Island and the City of Langley. Urban uses have resulted in further clearing of vegetation along the shorelines for various types of residential, commercial, and recreational development. In many places in Whidbey Island and Langley, bulkheads have been constructed to protect development from coastal erosion.

As a result of these changes, together with other changes throughout the region, many of the fish, marine mammal, bird, shellfish, and native plant populations of Whidbey Island have been substantially reduced.
3.2 Relationship of Process to Function in Langley

The specific characteristics of Langley’s shoreline are influenced by nearshore processes that extend along the eastern side of Whidbey Island. This area typically consists of high bluffs with beach and mudflats extending into Puget Sound. The bluffs, beaches, and mudflats are interrelated landforms driven by tidal and wave energy. The riparian and intertidal landforms created at the toe of the bluffs provide key aquatic habitats and other shoreline functions that are discussed in greater detail in Chapter 4. Development along Langley’s shorelines has directly modified portions of these landforms and also influenced the processes that drive the formation and maintenance of shoreline functions.

The generation and movement of sediments in the nearshore is key to maintaining shoreline functions in Langley. Bluffs west of the city limits as well as unarmored bluffs within the city contribute sediment that is transported along the shore toward Sandy Point, southeast of the city. Some of the sediment is diverted by the docks in Langley’s harbor area, where it accumulates along an accretion shoreform shown in Map 8 and discussed in greater detail in section 4.3.1.

Bluff erosion rates are influenced by the combined effect of shore orientation and fetch as well as bluff stratigraphy and land use. South facing shores with considerable fetch are the most vulnerable to wave-induced erosion, while the most protected, lower energy shores are most often east or west facing shores within sheltered harbors and embayments. Langley’s shorelines are typically more sheltered than other parts of Whidbey Island, although drift remains an active process through the city.

Sediments are also delivered to the city’s nearshore by the three small streams that flow through the city. Saratoga, Brookhaven and Noble Creeks are small contributors of sediments. Although the area is characterized by lower wave energy, enough sediment is deposited via the streams and drift to create adequate substrate to support eel grass and forage fish habitat, both are discussed in detail in section 4.4.3 and 4.4.4 and mapped in Map 6.

Shoreline development is another major factor affecting physical and biological processes that form shoreline functions. East Whidbey Island includes the most densely populated shorelines on the island, and more of the shoreline is armored. This is particularly true of Langley, which is one of only three incorporated municipalities on Whidbey. The effect of shoreline development has influenced existing condition of shoreline functions and is described in detail in Chapter 4. Development has resulted in shoreline armoring (section 4.3.3), loss of marine riparian vegetation (section 4.4.2), a lowered capacity to slow and filter runoff (section 4.5.5) and additional overwater coverage (section 4.3.3). All of these changes have resulted in adverse changes to nearshore habitats and are discussed in greater detail in Chapter 4.

A Puget Sound Nearshore Environmental Restoration Project (PSNERP) analysis completed in 2010 as part of the Strategic Needs Assessment Report (SNAR) rated the level of degradation of geomorphic processes in the Puget Sound. The analysis was an evaluation of the overall level of degradation (ranging from “most degraded” to “least degraded”) for each the following
nearshore processes: sediment input, sediment transport, erosion/accretion, tidal flow, distributary channel formation, tidal channel formation, detritus import/export (detritus is material produced by erosion), freshwater input, physical disturbance, and solar incidence and then aggregated them into a single classification. The process unit from roughly Baby Point to Sandy Point, which includes Langley, was classified as “Least Degraded.” While local sediment transport processes in Langley, have been altered by shoreline armoring and overwater structures (as described in Chapter 4), it is important to note that the City lies in a processes unit that has some of the least degraded geomorphic processes in the Puget Sound.

The remainder of this chapter focuses, in more detail, on the ecosystem processes that operate within the marine shorelines of Eastern Whidbey Island, where Langley is located. Chapter 4 then describes how these broader landscape-scale processes interact with shoreline development and form shoreline functions in Langley.

### 3.3 Climate, Geology, and Landforms

#### 3.3.1 Climate

Local mountain ranges cause precipitation levels to vary widely across the Whidbey Basin. The Olympic Mountains reduce precipitation (rain shadow effect) over Island County. Precipitation levels increase with elevation. The topography adjacent to Puget Sound constrains the wind within channels, which are primarily oriented north-south, except near the Strait of Juan de Fuca. From October through March the flow is predominantly from the south-southwest. Through the spring, this flow gradually reverses direction until it is predominantly from the north. Highest monthly wind speeds are in the range of 6 to 9 m/sec and are from the south between September and May. Highest net wind speeds from the north are of lower velocity and are in the range of 5 to 7 m/sec. The winds do not show a significant sea breeze effect as is evident in the Strait of Juan de Fuca and along the open coast (Williams et al. 2001, Coomes et al. 1984).

Climate change predictions suggest that the intensity of storms will increase while overall precipitation in the northern Puget Sound area will remain about the same. Higher precipitation rates during storm events could result in more runoff and lower infiltration of water, which could reduce the available fresh groundwater supply as well as the extent of freshwater wetlands. Predicted sea level rise also has the potential to accelerate bluff erosion along Puget Sound shorelines.

#### 3.3.2 Geology

Coastal bluffs are the primary source of sediment for most Puget Sound beaches (Keuler 1988, Downing 1983). Mass wasting (landslides) and erosion of these bluffs deliver sediment to the beach in large quantities. Feeder bluff presence or absence was inventoried by Coastal Geologic Services (CGS) in 2005 for the Island County Marine Resources Committee. Results of that mapping effort documented bluffs (mapped as feeder bluff and feeder bluff exceptional units) actively supplying sediment to the nearshore across over 38% of the study area shore length (Johannessen and Chase 2005). Active toe erosion and recent landslides were also mapped by
CGS. The distribution of these areas of erosion can inform where active erosion supports adjacent down-drift character and composition of critical habitats, such as spits and beaches. Toe erosion and recent landslides are mapped along the City of Langley’s high bluff areas to the east and west of downtown (Map 8).

Landslides along coastal bluffs are the cumulative result of numerous interacting variables, including factors of climate and sea level rise as well as site-specific factors (Bray and Hooke 1997). Site-specific factors include: the characteristics of the bluff (cliff) material – its composition, resistance, permeability, the structure of the slope, the bluff’s weaknesses, and local topography, including the slope’s landslide history (Emery and Kuhn 1982). Other site-specific factors include hydrodynamics and the protection offered by the beach and management practices. These factors produce variability in the processes and forms that characterize eroding bluffs (Bray and Hooke 1997). Site specific drivers of erosion are commonly grouped as of marine, subaerial (referring to upland geology) or human-induced erosion. Each driver may be occurring independently or simultaneously upon the bluff over time. In Puget Sound, bluff erosion is typically driven by a combination of all of these factors; for example, seasonal drivers such as storms interact with locally variable bluff geology, toe (basal) protection and other factors including management practices (Shipman 2004).

According to a city geotechnical report (Shannon and Wilson, 1986), slopes in Langley are covered with a “rind” of loose or soft soil (coluvium). Creep of the upper few feet of soil on the slopes causes soils to move slowly downhill and to accumulate at the toe of the slope. Before the bulkheads, seawall and docks were built in the city and harbor area, the bluffs were attacked, as they are in the east and west of the central city, directly by waves and currents. All of the downtown bluff area is now protected from marine toe erosion; however, minor erosion and sloughing are still active on the steep slopes, due to groundwater seepage, freeze-thaw and direct precipitation.

Coastal landslides typically occur during periods of high precipitation on bluffs with a combination of characteristics making the bluff more vulnerable to slope failure (Tubbs 1974). These characteristics include the underlying geology of a bluff or bank, its level of exposure (fetch), and the local hydrology (groundwater and surface water). Landslides are more likely to occur in areas where there is a history of landslides or where the lower bluff strata is comprised of an unconsolidated, permeable layer (sand), overlain by a (more) consolidated impermeable layer (such as dense silt or clay) (Gerstel et al. 1997). As water seeps through the permeable layer and collects above the impermeable layer a zone of weakness or “slip-plane” is created. This stratigraphic pattern is a typical initiator of mass movement (landslides) throughout the Puget Sound and in Whidbey Island.

Undercutting of the toe of the bluff is the long-term “driver” of bluff recession (Keuler 1988). Windstorms that create significant wave attack of the bluff toe also trigger bluff failures. Bluffs that are exposed to greater fetch are subject to higher wave energy during storms, resulting in greater toe erosion and bluff undercutting, thus more frequent landslides (Shipman 2004). Bulkheads reduce wave attack to bluff toes but can accelerate erosion of the beach.
Surface water volumes often increase and become more concentrated as a result of
development of housing, roads, and septic drain fields. This is due to decreased infiltration and
interception of water. Concentrated surface and subsurface water can locally erode bluff crests
while also saturating soils, which exacerbates “natural” slope stability problems along coastal
bluffs and can trigger landslides (Shipman 2004). Runoff flowing down a driveway and rapidly
across a lawn (which can absorb little water when wet) as sheet flow to the bluff face is an
example of this process. A broken drainage pipe (often called a “tightline” and typically a low-
strength, flexible, corrugated pipe) on a bluff face is another form of development triggering
slides; failed tightlines have often contributed to initiating coastal landslides; and septic system
drainfields or irrigation systems located close to the edge of a bluff can exacerbate slope
instability.

Removal or lack of bluff vegetation can result in low root strength (of scattered ornamental
plants and grass) and increased likelihood of future landslides (Schmidt et al. 2001, Zimmer and
Swanson 1977, Bishop and Stevens 1964). Bluffs with significant modifications to both the
natural drainage regime and vegetation are particularly susceptible to landslides.

Reestablishment and maintenance of native vegetation cover or installation of a fibrous-rooted
vegetation cover along with some type of drainage control can reduce the likelihood of the bank

3.3.3 Landforms

Coastal landforms (also referred to as shoreforms) in Whidbey Island have been characterized in
previous efforts by Shipman (2008) in the Technical Report: A Geomorphic Classification of
Puget Sound Nearshore Landforms. Bluff back beaches comprise nearly 58 percent of the
shoreline, and barrier beaches comprise another 25 percent.

There are 77 miles of marine shoreline along East Whidbey Island. Approximately 70 percent of
the shoreline has been classified as bluff back beaches. The East Whidbey shoreline also has a
relatively large proportion of barrier beaches with 19 percent. Artificial landforms were mapped
along 1.4 percent of the shore along this geographic area.

In general, the north facing beaches in the City of Langley are identified as bluff-backed beaches.
The east facing beach, site of the marina, is identified as a barrier beach. Bluff-backed beaches
are defined as erosional areas and barrier beaches are generally depositional in nature. Because
they are so prevalent and so essential to the formation and maintenance of other shoreforms,
the management of bluff back beaches affects almost all shoreforms.

3.4 Surface and Ground Water

There are numerous small streams that reach the shoreline throughout Whidbey Island. The fact
that the streams are so small owes to the limited land area in each drainage, as well as to soil
permeability and rainfall rates. Surface waters also include wetland areas these are discussed in
the fish and wildlife section below. Three small stream, Saratoga Creek, Brookhaven Creek, and
Noble Creek, drain to and through the City’s shoreline.
Groundwater is Island County’s main water source for human consumption. Seventy-two percent of Island County residents rely on groundwater. Groundwater is the sole source of potable water in the City of Langley. Furthermore, the quality and quantity of groundwater reaching the shoreline can impact shoreline habitat, human health, and aquacultural uses. As such, groundwater quantity and quality are of critical importance to Whidbey Island and the City of Langley, and were the focus of a document prepared by Island County in 2005 entitled: *Island County Water Resource Management Plan* (Island County, 2005).

### 3.5 Fish and Wildlife Habitats

This section describes some of the key habitats on Whidbey Island and the ecological functions they provide.

#### 3.5.1 Beaches

Beaches are generally defined as areas with unconsolidated sediments that are moved, sorted, and reworked by waves and currents. The beach area generally includes the upper intertidal zone, beach face, low-tide terraces, and offshore zone to the limit of wave action. Sand beaches occur at scattered locations throughout Whidbey Island’s and the city’s marine shorelines. Ecological functions of beaches include (Williams and Thom 2001; Williams et al. 2004; WDFW 2004; NWF, 2007):

- Forage fish spawning substrate;
- Habitat and refuge for intertidal fish and wildlife;
- Habitat/substrate for intertidal vegetation;
- Nutrient cycling;
- Primary production; and
- Shellfish habitat.

#### 3.5.2 Eelgrass and Kelp Beds

Eelgrass (*Zostera marina*) is a native marine rooted seagrass that forms extensive meadows or beds on gravel, fine sands or mud substrates in the lower intertidal and shallow subtidal zones of protected or semi-protected shorelines (Bulthuis 1994; Thom et al. 1998; Shaffer, 2003; Mumford, 2007). The eelgrass zone in Puget Sound is typically confined to areas between tidal elevations of +1 meter to -2 meters relative to mean lower water (MLLW) (Thom et al. 2001, Simenstad 2000; Shaffer, 2003; Mumford, 2007).

Eelgrass ecosystems are highly productive, providing a source of organic matter to intertidal and shallow subtidal food webs. Eelgrass plants produce large amounts of organic carbon that is consumed directly by grazers, as well as forming the basis for complex detrital food webs (Williams and Thom, 2001; Mumford, 2007). Juvenile salmon, as well as a number of other animals depend on eelgrass habitat structure for refuge from predators. Eelgrass leaves provide physical structure that absorbs and dampens the energy of waves and currents, providing some
buffering for adjacent habitats. Pacific herring use eelgrass for spawning substrate and for protection while eggs and juveniles mature (Williams and Thom, 2001; Mumford, 2007).

Kelp and other macrophytic brown algae can form dense, highly productive undersea forests that support many species of fish and marine mammals. Juvenile salmon and forage fish may preferentially use kelp stands in nearshore habitats (Shaffer 2003; Mumford, 2007). Dense kelp forests also dissipate wave energy and provide sheltered habitat for resting/rafting seabirds and other animals within the kelp forest or adjacent surface waters. Kelp forests are comprised primarily of bull kelp (Nereocystis luetkeana) and other large brown algae, including the introduced Sargassum (Sargassum muticum). These plants are attached to the marine bottom with holdfasts and require rocky or coarse substrates. Distribution is limited to areas with appropriate substrates, light penetration to the bottom and moderate wave/current energy.

Along Whidbey Island, eelgrass beds are found in numerous locations, with the most extensive beds being found on the east shore of Whidbey Island (Island Co., 2010; WDNR, 2010). Kelp beds are located primarily on the west shore of Whidbey Island (Mumford, 2007; Island Co., 2010; WDNR, 2010). Consistent with the overall pattern Eelgrass, either continuous or patchy, is mapped along the entire City shoreline. Kelp beds are not mapped in the Langley vicinity.

3.5.3 Freshwater Wetlands

The state of Washington (WAC 173-22-030) defines wetlands as “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 typically adapted for life in saturated soil conditions.” Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands play an important role in the landscape, performing:

- Biogeochemical functions related to trapping and transforming chemicals and improving water quality in the watershed;
- Hydrologic functions related to maintaining the water regime in a watershed and reducing flooding; and
- Food web and habitat functions (Granger et al., 2005; Adamus et. al, 2006).

3.5.4 Marine Riparian Vegetation

Marine riparian zones occur at the interface between upland and marine aquatic systems (Culverwell and Brennan 2003; Brennan and Culverwell 2004; Brennan, 2007). Marine riparian zones occur landward from tidal inundation, but may be in the area influenced by salt spray or storm waves. The type of marine riparian vegetation that occurs along the shoreline is influenced by a number of factors, including: geology (shoreform), type of soil, steepness and height of the shoreline or bluff, annual precipitation, adjacent land uses, and surface runoff processes.

Healthy marine riparian areas provide a range of important functions, including water quality protection, sediment stabilization and control, wildlife habitat, nutrient retention, microclimate
regulation, food sources for juvenile fish, shade/cover, and woody debris to provide complex habitat structure and stabilize beaches (Brennan and Culverwell 2004; Brennan, 2007).

Areas with intact riparian vegetation can also help protect slopes and bluffs from erosion hazards, mitigate storm damage, and stabilize slopes. Plant root masses provide stability by holding the soil in place. In addition, evapotranspiration removes moisture from the soil and can prevent high soil moisture or saturated soil conditions, which can lead to landslides or erosion hazards (Brennan and Culverwell 2004). The extent to which riparian zones perform these functions is dependent on vegetation composition, vegetation density, and the area continuously covered with vegetation (e.g., width of buffer and length of shoreline with buffer) (Knutson and Naef 1997).

Brennan and Culverwell (2004) note the following characteristics of healthy nearshore riparian systems:

- Long linear shapes;
- High edge-to-area ratios;
- Microclimates distinct from those of adjacent uplands;
- Standing or flowing water present all or much of the year, or a capacity to convey or retain water;
- Periodic flooding, which results in greater natural diversity;
- Composition of native vegetation differing from upland (inland) systems (e.g., different species composition, abundance, diversity, and structure), and
- Support systems for terrestrial and aquatic biota.

Many areas of marine shoreline on Whidbey Island have relatively intact marine riparian vegetation, with the potential to provide water quality, shoreline stabilization, and LWD functions to the nearshore. Most of downtown Langley’s shoreline, from Park Avenue to the marina, lack native shoreline vegetation. The area is characterized by shoreline armoring and lawn. Riparian vegetation is more prominent along the high bluff areas.

### 3.6 Fish and Wildlife Species

Numerous fish and wildlife species use the shorelines in the East Whidbey area of Puget Sound for habitat. Habitat and species found within Langley are typical of those found throughout the area. More detailed discussion of these habitats and species are found in Chapter 4.

### 3.6.1 Marine Mammals

A number of marine mammals occur in the nearshore and marine waters of Whidbey Island, including harbor seals (Phoca vitulina), California sea lions (Zalophus californianus), Steller sea lions (Eumetopias jubatus) and Southern Resident killer whales, or Orcas (Orcinus orca). Humpback whales (Megaptera novaeangliae) may also occasionally occur occasionally in Puget Sound. From six to ten Grays return most years to northwestern Whidbey Island or southeastern
Whidbey Island and Port Susan, Camano Island, feeding on ghost shrimp and tubeworms for several months. In recent years (2008-2009) more gray whales have been reported feeding in more areas around Whidbey Island, including Holmes Harbor and along Whidbey Naval Air Station and Joseph Whidbey State Park near Oak Harbor. They also appear to be arriving earlier - some in January - and staying later - some not leaving until July (http://www.orcanetwork.org/nathist/graywhales.html) (WDFW, 2009).

3.6.2 Forage Fish

In Puget Sound, forage fish species constitute a significant part of the marine food web, being particularly important as prey for wildlife including salmonid fish, marine mammals, and seabirds (Fresh et al. 1981; Pentilla 1995; Bargmann 1998; Buchanan, 2006; Kriete, 2007). Three species comprise the main forage fish species: surf smelt (Hypomesus pretiosus), Pacific herring (Clupea harengus pallasi), and Pacific sand lance (Ammodytes hexapterus). Forage fish species use a range of nearshore and estuarine habitats for feeding, rearing, and spawning.

Surf smelt and Pacific sand lance both spawn within a limited range of tidal elevations in the upper intertidal zones of beaches, and have specific habitat requirements including substrate size and type (Pentilla 1978, 1995). Eelgrass beds are important spawning substrate for Pacific herring; adhesive eggs are deposited on leaf blades of eelgrass and to a lesser extent on a variety of marine algae (Lemberg et al. 1997; Pentilla 1995; Mumford, 2007). Due to the spawning requirements of these species, suitable spawning habitat for forage fish is limited, and these species are particularly vulnerable to changes in beach morphology (relative depth, exposure), beach sediment characteristics (substrate size - sediment sources, transport, or deposition), and nearshore riparian vegetation cover (WDFW 2000, 2004). Documented sand lance spawning beaches are mapped along Langley’s shorelines (Map 6).

3.6.3 Waterfowl and Marine Birds

Both resident and migratory seabirds and waterfowl are associated with Whidbey Island shorelines. Commonly occurring seabirds or waterfowl include loons (Gavia spp.), cormorants (Phalacrocorax spp.), mergansers (Mergus spp.), grebes (Aechmophorus spp.), herons and egrets (Ardeidae), geese (Branta), brants (Branta bernicla), gulls (Larinae), sandpipers (Scolopacidae), and ducks (dabbling and diving) (Buchanan 2006). In addition, a number of bird species identified as state priority wildlife species are associated with and forage along shorelines of Whidbey Island, including bald eagles (Haliaeetus leucocephalus), osprey (Pandion haliaetus), and great blue heron (Ardea herodias) (WDFW, 2008; Buchanan, 2006).

3.6.4 Shellfish

Cobble to fine sand beaches and sand and mud flats are important habitat for many shellfish species. Intertidal and subtidal areas that support the native Dungeness crab (Cancer magister) occur abundant in the northern portions of Puget Sound, often associated with estuaries and eelgrass beds (Stevens and Armstrong 1984). Geoducks (Panopea abrupta) occur in offshore areas (including Langley) in fine substrates of mud or soft sand, and typically burrow up to 2-3 feet deep into the substrate. A number of hardshell clams, including butter clams (Saxidomus
gigantean), native littleneck (Protothaca staminea), manila clams (Venerupis philippinaram), and horse clams (Tresus capax and T. nutillii) also inhabit the intertidal shorelines. Olympia oyster (Ostreola conchaphila) and non-native Pacific oysters (Crassostrea gigas) are common. Other nearshore shellfish include a number of filter feeders that remove plankton from the water column - cockles (Clinocardium nutillii), softshell clams (Mya arenaria) and detritivores that feed on organic detritus on the surface of sediments – clams (Macoma spp.).

Shellfish beds perform a number of important ecological functions including nutrient cycling, stabilizing substrate, enhancing water quality (filtering and retention), creating and maintaining habitat structure (e.g., oyster reefs), and providing food for a wide variety of marine invertebrates, birds, fish and mammals. As filter feeders, shellfish consume large quantities of plankton and particulate organic matter, cleaning the water column of organic matter (and any pathogens or pollutants that are present). Shellfish species occupy a range of substrate types from mud to gravels, with each species having a preferred or optimal substrate size for larval settling and adult growth (Dethier 2006).

3.7 Land Use and Land Cover

The ecosystems of Island County have been heavily modified by human activity. In the unincorporated areas, land uses remain largely rural in character. In the Cities and towns, development is more concentrated. For comparison, land uses on Whidbey Island and the City are tabulated in Table 2.

Forest cover, ubiquitous before European-American settlers arrived, has been diminished but remains a major component of land cover within the County. Almost all forested land has been logged at least once in the past century, and much forest land is occupied by relatively young forest stands. Agriculture is also a predominant land use. The majority of agricultural uses are pasture and hay, but there are also row crops grown in some areas. Residential uses are the most common use throughout Whidbey Island, and also in shoreline areas.

Table 3. Land Uses in Whidbey Island and the City of Langley

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Whidbey Island</th>
<th>City of Langley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>8.4%</td>
<td>&gt; 1%</td>
</tr>
<tr>
<td>Commercial</td>
<td>2.0%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Cultural, Entertainment, and Recreational</td>
<td>0.4%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Forest or Timber</td>
<td>11.2%</td>
<td>0.0</td>
</tr>
<tr>
<td>Mining</td>
<td>1.1%</td>
<td>0.0</td>
</tr>
<tr>
<td>NA</td>
<td>3.3%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Parks and Open Space</td>
<td>1.4%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Residential</td>
<td>41.2%</td>
<td>51.9%</td>
</tr>
<tr>
<td>Tidelands</td>
<td>0.8%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Transportation, Communication, and Utilities</td>
<td>0.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Vacant</td>
<td>30.0%</td>
<td>26.1%</td>
</tr>
</tbody>
</table>

Source: Island County, 2010
As expected, urban uses are more prevalent in the City of Langley than the County as a whole. More than have the City is in residential use. Commercial uses comprise slightly less than 10 percent and parks make up a largely share of the area. Subsequent sections will discuss the land use of the shorelines in more detail, however because the potential impacts urban development has on shoreline (i.e. increased runoff, pollutants, armoring...), it is important to note the differences in land use as compared to the broader setting.

### 3.8 Implications of Sea Level Rise

Sea level rise is expected to affect many of the habitat areas described above. Sea level rise will result in landward migration of the shoreline due to wave action attacking the toe of the bluffs and the addition of sediment from associated bluffs (Johannessen and MacLennan, 2007). Sand beaches associated with estuaries are particularly vulnerable to sea-level rise, and losses of 50 percent could occur in this century (NWF, 2007). Sea level rise is expected to affect tidal sand and mud flats (NWS, 2007).
CHAPTER 4    REACH SCALE ANALYSIS

4.1 Overview

The purpose of this chapter is to characterize conditions within the city’s shorelines in greater detail and in the context of the larger landscape. The general intent is to identify and assess the conditions of shoreline functions in the context of the ecosystem processes described in chapter 3. This is accomplished through reach-scale summaries and analysis for each of three shoreline reaches (Langley West, Central and East (Map1)).

The reach scale analysis is primarily presented in reach information sheets referred to as “reach sheets”. Reach sheets for each of the three shoreline reaches follow as Figures 2, 3, and 4. The reach sheets summarize and characterize the inventory data presented in the inventory maps (Appendix A). Pertinent reach characteristics are detailed and presented with a reach map (2009 aerial photography) and illustrative shoreline photos. Reach inventory and characterization information is grouped into three broad categories: 1) physical resources; 2) habitats and species; 3) shoreline use patterns.

In addition, key alterations and impairments and identified restoration opportunities are identified within each reach sheet. Key alterations and impairments are summarized from existing data sources. Identified reach-specific restoration opportunities were identified by PSNERP Puget Sound Restoration Planning Activities as well as review of city documents and shoreline conditions.

The text of this chapter augments the contents of the reach sheets. It presents contextual information, adds explanation and detail and highlight key issues. The text is also grouped into three categories.

The reach scale assessment establishes a baseline of conditions along the city’s shorelines and begins to plot a course forward to updating shoreline designations as well as policies and regulations aimed at achieving no net loss of shoreline functions.
REACH SUMMARY

Langley West is located immediately west of downtown Langley. Geomorphic shoreline processes are characterized by an E/SE-trending drift cell moving through Langley to Sandy Point. The reach is a mix of feeder bluff shoretype with areas of shoreline modification, which likely affect the littoral drift. Saratoga Creek flows via pipe under a beach front home and exits to an outfall within a concrete bulkhead (Photo A).

There are no wetlands mapped in the reach. Saratoga Creek drains through the reach and a significant portion of the reach contains steep slopes. Marine aquatic areas provide sandlance, geoduck, and Dungeness crab habitat, including areas of patchy and contiguous eelgrass habitat. WDFW designates gray whale habitat throughout Saratoga Passage.

Approximately half of the reach is mapped as feeder bluff. The other half is mapped as modified. The high slopes of the west end are moderately or well vegetated with mixed forest and shrub communities. Evidence of recent sloughing is apparent. In lower bluff areas to the east (Photo B), the shoreline slopes and uplands are less vegetated and native marine riparian vegetation decreases. Shoreline uses consist of single-family residences on medium and large lots, primarily landward of the shoreline. A bulkhead west of Saratoga Creek supports three single-family homes and extends waterward of OHWM. Vegetation on top of the bulkhead is primarily lawn.
KEY MANAGEMENT ISSUES

- Continued degradation of shoreline processes due to armoring (bulkheads).
- Disconnection of feeder bluff areas from shoreline due to toe armoring and/or development fronting bluff areas leading to greater down-drift erosion rates (issue is related to short portions of reach Saratoga Creek Mouth). The presence of the bulkhead also alters littoral drift.
- Piping of Saratoga Creek creates a fish barrier, alters the hydrologic processes of the creek and disrupts transport of organic debris to shoreline.
- Potential implications of sea level rise (SLR) and coastal flooding on development within or near coastal floodplain areas (shoreline residential development).
- Slope / bluff stability for existing and future land uses at the top or toes of slopes (considering land uses and modifications such as clearing, creation of impervious surfaces, modified surface/groundwater dynamics).
- Subdivision and intensified use – additional modification of feeder bluff / steep slope areas and water quality implications due to greater intensity of use.

HABITATS & SPECIES

Significance & Unique Features
Orca and Dungeness Crab habitat are present throughout Saratoga Passage. Geoduck habitat extends across the reach as part of a larger habitat that extends along the majority of the southeast coast of Whidbey Island. Patchy eelgrass extends along shoreline west of Saratoga Creek while continuous eelgrass extends along the shoreline east of Saratoga Creek. Clam beds are identified across the entirety of the reach.

Coastal Stream Mouths
Saratoga Creek. The mouth of the creek is a 24-inch RCP culvert that discharges onto the beach.

Forage Fish
Sandlance
30% None mapped

Recruitment and Distribution of Large Woody Debris (LWD)
A moderate amount of large woody debris (LWD) is present on the high bluff, unarmored portions of the reach. Wood is largely absent from the armored portions of the reach. Wood deposited below armored shorelines is removed during high tides. Recruitment potential is moderate. The bluff slopes in this reach are moderately or well vegetated serving as sources of LWD. Significant areas on the top of the bluffs are cleared, removing sources of LWD.

Shellfish & Aquaculture
Shellfish growing is approved west of Saratoga Creek and prohibited east of Saratoga Creek due to a sewer outfall located waterward of Anthes Avenue.

RESTORATION OPPORTUNITIES

- Soften bulkhead particularly around the mouth of Saratoga Creek.

GEOMORPHIC KEY INFORMATION

<table>
<thead>
<tr>
<th>Steep Slopes</th>
<th>Geomorphic Shoretype</th>
</tr>
</thead>
<tbody>
<tr>
<td>32%</td>
<td>Feeder Bluff (61%); Modified (39%)</td>
</tr>
</tbody>
</table>

Shoreform Current
100% Bluff-backed beach

Coastal Floodplain
4% Floodplain

Lagoons

Net Shore Drift
Eastward/southeastward drift along entire reach. Drift cell originates two miles north of city and continues to Sandy Point. An area in the reach has been bulkheaded and backfilled, extending waterward of the OHWM, likely altering littoral drift.

Coastal Landslides & Toe Erosion
To immediate east of Saratoga Creek along shoreline and at far western shore of reach

LAND & SHORELINE USE

Shoreline Modifications
Approximately 550 feet of concrete bulkhead east of Saratoga Creek associated with residential development. Bulkhead covers mouth of Saratoga Creek.

Current Land Use
Number of Parcels: 30

Average Parcel Size: 0.63 acres

Residential (93%); Vacant (5%); Tidelands (2%). Nearly all low-density residential development landward of the bluffs along the shoreline. Three single family homes are at the toe of the bluff near the mouth of Saratoga Creek supported by a concrete bulkhead.

Zoning
Residential: 100%; (RS15000: 57%, RS 7200: 32%, RS 5000: 11%)

Public Access
Public access is limited. There are two public rights-of-way that terminate at the shoreline (Debruyn Right-of-way and Park Right-of-way). There are county owned tidelands. Visual access is provided from adjacent roadways. The City has mapped a conceptual trail along Saratoga Creek, but it has not been developed.

Overwater Structures
No overwater structures

HABITATS & SPECIES

Significance & Unique Features
Orca and Dungeness Crab habitat are present throughout Saratoga Passage. Geoduck habitat extends across the reach as part of a larger habitat that extends along the majority of the southeast coast of Whidbey Island. Patchy eelgrass extends along shoreline west of Saratoga Creek while continuous eelgrass extends along the shoreline east of Saratoga Creek. Clam beds are identified across the entirety of the reach.

Coastal Stream Mouths
Saratoga Creek. The mouth of the creek is a 24-inch RCP culvert that discharges onto the beach.

Forage Fish
Sandlance
30% None mapped

Recruitment and Distribution of Large Woody Debris (LWD)
A moderate amount of large woody debris (LWD) is present on the high bluff, unarmored portions of the reach. Wood is largely absent from the armored portions of the reach. Wood deposited below armored shorelines is removed during high tides. Recruitment potential is moderate. The bluff slopes in this reach are moderately or well vegetated serving as sources of LWD. Significant areas on the top of the bluffs are cleared, removing sources of LWD.

Shellfish & Aquaculture
Shellfish growing is approved west of Saratoga Creek and prohibited east of Saratoga Creek due to a sewer outfall located waterward of Anthes Avenue.

RESTORATION OPPORTUNITIES

- Soften bulkhead particularly around the mouth of Saratoga Creek.
REACH SUMMARY

Langley Central extends from a point east of Park Avenue through Langley's downtown core and the harbor area to the east end of Wharf Street. Geomorphic shoreline processes are characterized by an E/SE-trending drift cell continuing through Langley to Sandy Point. There is evidence of net shore-drift being diverted to the shallow nearshore area by structures at the Nichols Brothers boatyard. The breakwater at the marina and the boat ramp also alter the movement of sediment. There are two mapped geomorphic shoretypes: modified and accretion. The modified shoreline includes Seawall Park. The accretion shoreline extends through the boat harbor area.

There are no wetlands mapped in the reach. Brookhaven Creek flows through the reach in a pipe to an outfall at the north end of Anthes Ave. Portions of the reach are mapped as steep slopes. Marine aquatic areas provide sand lance, geoduck, and Dungeness crab habitat. The entire reach is mapped as containing contiguous eelgrass habitat. WDFW designates gray whale habitat throughout Saratoga Passage. The reach is also closed to aquaculture because of the presence of the City's wastewater outfall. Marina riparian vegetation is generally lacking as a result of shoreline armoring and modification.

The reach is developed more intensely than adjacent areas. The shoreline is completely armored (and backfilled) through Seawall Park (Photo A), from the reach's western extent through the Langley Boat Harbor. The western portion of the shoreline is characterized by residential and commercial uses and development, including hotels and retail businesses along 1st Street. The eastern portion contains the Langley Marina and boat launch, Nichols Brothers boatyard, the Boatyard Inn and several private residences (Photo B). Public access is provided at Seawall Park, the marina, Phil Simon Park, and several other parks and view points. Access is nearly continuous between Seawall Park and the Marina. It is interrupted by private development and tideland ownership.
KEY MANAGEMENT ISSUES

- Continued degradation of shoreline processes due to armoring (bulkheads).
- Docks degrade nearshore habitat, alter sediment transport, and pose potential water quality threat if not managed properly.
- Potential implications of sea level rise (SLR) and coastal flooding on development within or near coastal floodplain areas (commercial uses and shoreline residential development).
- Piping of Brookhaven Creek creates a fish barrier, alters the hydrologic processes of the Creek and disrupts transport of organic debris to shoreline.
- Loss of native shoreline vegetation due to commercial and residential development.
- Sediment accretion in the harbor area currently necessitates maintenance dredging, specifically at the boat ramp at Phil Simon Park.
- The city is reviewing alternatives for redeveloping the marina. Such a project would include public access improvements and mitigation actions.

RESTORATION OPPORTUNITIES

- Soften bulkhead including Seawall Park bulkhead face.
- Remove derelict dock, sunken marina, piles and bulkhead.
- Restore marine riparian vegetation along seawall park and in harbor area.
- Other restoration may occur associated with private shoreline armoring (including potential for use of soft shore protection as an alternative to existing low bank bulkheads).
- Coordinate with Port of South Whidbey on developing mitigation for proposed harbor redevelopment project.

LAND & SHORELINE USE (CONTINUED)

Overwater Structures
Harbor area includes Nichols Brothers Boatyard dock, an old derelict dock and marina. The three docks total approximately 20,841 square feet (0.5 acres) of over water coverage. The abandoned/derelict dock and sunken marina are planned to be removed as part of the planned marina expansion. Additional remnant pilings are located near existing docks.

Shellfish & Aquaculture
Shellfish growing is prohibited throughout reach due to a sewer outfall located along Anthes Avenue extended.

HABITATS & SPECIES

Significance & Unique Features
Orca and Dungeness Crab habitat are present thoughout Saratoga Passage. Geoduck habitat extends across reach as part larger habitat that extends along the majority of the southeast coast of Whidbey Island. Continuous eelgrass and clam bed habitat extends across entirety of reach.

Coastal Stream Mouths
Brookhaven Creek (piped)

Forage Fish
Sandlance 82% Smelt None mapped Herring None mapped

Recruitment and Distribution of Large Woody Debris (LWD)
There is very little large woody debris (LWD) present within this reach. Nearly all of the reach is armored. There is an accumulation of wood at the unarmored eastern end of the reach past the marina. Recruitment of LWD is extremely limited. Marine riparian vegetation is largely lacking. Vegetation on top of the shoreline armoring is largely lawn and ornamental shrubs and trees.

Shoreland Priority Habitats & Species
Bald Eagle buffer

Marine Priority Habitats & Species
Gray Whale extends seaward along reach and throughout the larger Saratoga Passage.

Salmonid Fish Use
Resident Cutthroat Trout identified within Brookhaven Creek. The last 1/4 mile of the creek flows through an 18-inch storm drain along Second Street and Anthes Avenue. Nearshore areas are designated ESA critical habitat for Chinook (Puget Sound ESU) and bull trout.
REACH SUMMARY

Langley East includes the high bank portion of the city east of the harbor. It extends from the eastern city limit westerly to the shoreline bends northward. Geomorphic shoreline processes are characterized by an E/SE-trending drift cell continuing through Langley to Sandy Point. The reach is largely a feeder bluff shoretype with two small areas noted as modified because of abandoned/derelict timber shore protection structures. The beach is categorized as bluff-backed (Photo A).

There are no wetlands mapped in the reach. Noble Creek drains through the reach and a significant portion of the reach is mapped as steep slopes. Marine aquatic areas provide sand lance, geoduck, and Dungeness crab habitat. WDNR mapped the entire shoreline as patchy eelgrass habitat. The City’s data indicate an area east of Noble Creek of continuous eelgrass habitat. WDFW designates gray whale habitat throughout Saratoga Passage.

Most of the reach feeder bluff; shoreline slopes are steep and well vegetated with mixed forest and shrub communities. There are areas where recent sloughing is evident. Shoreline uses in this reach consist of residences on large lots landward of the shoreline (Photo B). Some residences are located within close proximity of the edge of the bluff. Substantial clearing on top of the coastal bluff has occurred, marine riparian vegetation on the face and toe of the slopes remains relatively intact in the reach.
KEY MANAGEMENT ISSUES

• Potential increases in coastal flooding and rates of bluff erosion due to sea level rise (SLR) or other factors

• Slope / bluff stability for existing and future land uses at the top or toes of slopes, (considering land uses and modifications such as clearing, creation of impervious surfaces, modified surface/groundwater dynamics)

• Subdivision and intensified use – additional modification of feeder bluff / steep slope areas and water quality implications (septic systems and road runoff) due to greater intensity of use

• Potential increases in coastal flooding and rates of bluff erosion due to sea level rise (SLR) or other factors

• Residential structures are close to the edge of bluffs. Retreat of the bluffs due to natural erosive processes my result in requests for bank stabilization structures.

RESTORATION OPPORTUNITIES

• Remove derelict and abandoned wood bulhead and piles (CGS, 2004)

HABITATS & SPECIES

Significance & Unique Features
Orca and Dungeness Crab habitat are present throughout Saratoga Passage. Geoduck habitat extends across reach as part larger habitat that includes the majority of the southeast coast of Whidbey Island. Patchy eelgrass extends along the entirety of the reach. Clam bed habitat extends across the western three quarters of the reach. Burrowing sand shrimp are present across nearly the entirety of the reach. Soft shell crab have also been identified along the western half of the reach.

Coastal Stream Mouths
Noble Creek

Forage Fish
Sandlance
65%
Smelt
None mapped
Herring
None mapped

Recruitment and Distribution of Large Woody Debris (LWD)
A moderate amount of large woody debris (LWD) is present within the reach. Recruitment potential is moderate or high. The bluff slopes in this reach are moderately or well vegetated serving as sources of LWD. Significant areas on the top of the bluffs are cleared, removing sources of LWD.

Shoreland Priority Habitats & Species
Bald Eagle buffer

Marine Priority Habitats & Species
Gray Whale extends seaward along reach and throughout the larger Saratoga Passage.

Salmonid Fish Use
None identified along Noble Creek. Nearshore areas are designated ESA critical habitat for Chinook (Puget Sound ESU) and bull trout.

GEOMORPHIC KEY INFORMATION

<table>
<thead>
<tr>
<th>Steep Slopes</th>
<th>Geomorphic Shoretype</th>
</tr>
</thead>
<tbody>
<tr>
<td>29%</td>
<td>Feeder Bluff (90%); Modified (9%); Accretion Shoreform (1%)</td>
</tr>
</tbody>
</table>

Shoreform Current
100% Bluff-backed beach

Coastal Floodplain
4% Floodplain

Net Shore Drift
Eastward/southeastward drift along entire reach. Drift cell originates two miles north of city and continues southeast to Sandy Point.

Coastal Landslides & Toe Erosion
Several slides are evident along bluff east of Furman Avenue.

LAND & SHORELINE USE

Shoreline Modifications
Reach is mostly unarmored. Small patches of abandoned wood pilings and derelict timber armoring.

Current Land Use
Number of Parcels: 48
Average Parcel Size: 0.72 acres
Residential (93%); Vacant (5%); Tidelands (2%). Nearly all low-density residential landward of the bluffs along the shoreline.

Zoning
Residential: 97% (RS 15000: 78%, RS 7200: 19%), Neighborhood Business: 2%, Commercial Business: 1%

Public Access
Undeveloped lands around Noble Creek (referred to as Noble Greenway) are the only mapped public uplands. Tidelands from east of Noble Creek are public. Limited visual access from adjacent roadways because of residential development and forest cover.

Overwater Structures
No overwater structures

Shellfish & Aquaculture
Although shellfish growing is approved starting approximately 300 ft. east of Noble Creek, the shellfish beach is closed per DOH (2010). Shellfish growing is prohibited in the western portion of the reach due to a sewer outfall.

FIGURE 4
4.2 Shoreline Reaches

The extent of the reach scale analysis within the City includes the open water areas of the Sound and the adjacent shorelands (generally 200 feet landward of the OHWM). The landward portion of the shoreline jurisdiction within the city consists of residential development at the toe and on top of steep bluffs, Seawall Park, the harbor area and portions of the downtown commercial core. The total length of shoreline within the municipal boundary of the City is 1.73 miles.

The reach scale analysis divides the city’s shorelines into three marine reaches referred to Langley East, Langley Central, and Langley West. The boundaries of the reaches are described in Table 4. All shorelines inventoried in this chapter are “shorelines of statewide significance” (Puget Sound).

<table>
<thead>
<tr>
<th>Reach Label</th>
<th>Reach Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langley East</td>
<td>Extends from the western municipal boundary to a the property line approximately 185 feet east of Park Ave.</td>
</tr>
<tr>
<td>Langley Central</td>
<td>Extends from a point east of Park Avenue through Langley’s downtown core and the harbor area to the east end of Warf Street.</td>
</tr>
<tr>
<td>Langley West</td>
<td>Extends from the eastern city limit westerly to the shoreline bends northward.</td>
</tr>
</tbody>
</table>

4.3 Physical Characterization

4.3.1 Nearshore Processes

The nearshore is the area of marine and estuarine shoreline extending from the top of shoreline bluffs to the depth offshore where insufficient light penetrates the water to support plant growth. In the City of Langley, the nearshore area includes bluffs, beaches, eelgrass beds, and overwater structures.

The composition of biological communities in nearshore environments is largely a function of the physical and chemical processes that transport and transform materials and energy to, within, and among individual organisms. The biological processes and communities that feed into and are supported by the nearshore are also very complex and play an important role in its structure and functions. Changes within the physical processes in the nearshore can negatively affect habitats by limiting food and nutrient sources for marine life, deteriorating beach sediment movement, and accelerating erosion.

Beaches in the Puget Sound are supplied with sediment through erosion and mass wasting (landslides) of coastal bluffs. Sediments from bluff erosion account for 90 percent of beach material. On Whidbey Island, this percentage is likely higher due to the lack of streams and rivers (CGS, 2002). Beach morphology and composition are primarily influenced by exposure to wave energy, wind storms, and available sediment sources. Beaches are shaped by wind-
generated waves. Wave energy is controlled by fetch, the open water distance over which winds blow without interference from land. The unprotected shores around Langley are exposed to a fetch of approximately 18 miles from the NW and approximately 7 miles from the east (CGS, 2002).

The area of shoreline in which sediment is released, transported and deposited is known as a drift cell and the process is known as net shore-drift. Once in the nearshore, sediment is available for transport by net shore-drift. Drift cells represent a sediment transport sector from source to deposition along a portion of the shoreline. Each drift cell acts as a system consisting of three components: a sediment source; a transport zone, where materials are moved; and a deposition site where sediment is deposited.

The net shore-drift along the shore of Langley is in an east/southeast direction. Langley is part of a larger drift cell that extends from a feeder bluff area located 2 miles northwest of downtown to Sandy Point, southeast of the city limits.

Coastal Geologic Services (2002) performed field reconnaissance and reported that the net shore drift was being diverted into the shallow nearshore area by structures at the Nichols Brothers boatyard. It was also noted that the timber breakwater along the marina pier appeared to significantly dampen wave energy reaching the beach on both sides of the existing marina and had caused accretion of sandy sediment around the boat ramp. The report found that the majority of the drift cell that Langley lies in was not armored and therefore contributed sediment to natural transport processes. However, the armored or bulkheaded areas along the City’s shorelines (particularly downtown) cause a reduction in natural bluff sediment input to the littoral system and also cause a partial interruption of the net shore-drift (CGS, 2002).

4.3.2 Soils and Geologically Hazardous Areas

Soils

According to the Soil Survey of Island County (1953), most of the Langley shoreline is classified as rough broken land. This classification includes many kinds of material. Its most important characteristic is the steepness of its slope, which ranges from 50 to 70 percent. Generally, rough broken land occupies long narrow strips along the perimeter of the islands, consisting of steep broken bluffs. Rough broken land has developed from glacial materials that are extremely variable in texture and consistence. Normally the materials are coarse textured and very loose, particularly along the lower slopes. Other areas consist of strongly cemented till and have slopes that are nearly perpendicular. As a rule, deep soils occur at the bases of slopes and in small pockets where colluvial and local alluvial deposits have accumulated.

Soils landward of the shoreline (partially within shoreline jurisdiction) are classified as keystone. These soils have slopes from 0 to 15 percent. They are characterized as somewhat excessively drained soils and are one of the most extensive of the upland soils. It has developed from sandy drift. It is sandy, open and porous and is comparatively free of gravel. Because of the open porous texture, water is absorbed readily and drains very rapidly through the soil. Consequently, surface runoff is very slow.
Geologically Hazardous Areas

Regulated geologically hazardous areas within the city (16.20.045) include erosion hazards and landslide hazards. Both of these areas are concentrated along the steep bluffs east and west of the downtown core and harbor area (Map 1). While most of these high bluffs are largely unarmored, there are areas within the west and central reaches in which the toe of the slopes are armored.

Over time, bluff armoring alters the morphology and behavior of coastal bluffs. Erosion changes from a relatively constant shallow sloughing and spalling of steep cliffs, to less frequent but more massive slides. Armoring of slopes prevents wave action from eroding the sea bluffs, essentially fixing the toe of the slopes. As a result, the tops of bluffs gradually regress backward and slopes flatten. Loose soils accumulate on these flatter slopes until their mass becomes excessive or it becomes saturated from heavy rainfall and/or ground water seepage. The accumulation of these loosened, soils on the lower portion of the bluffs impedes subsurface drainage creating increased hydrostatic pressure in the hillside and instability (HWA GeoSciences, 1999).

A geotechnical study conducted in the city after a slide in 1991 indicated that recent landslides in the central city have been limited to the upper two or three feet of the soil profile. The slides appear to originate from fill placed on the top of the crest of the slopes above the harbor area. This situation was assumed to cover the entire length of Cascade Avenue. It was further noted that other portions of that slope were only marginally stable and additional failures could occur (particularly during periods of intense or prolonged precipitation). The report indicated that native soils had a high shear strength and low compressibility rendering deep seated landslides unlikely in the city (Shannon and Wilson, 1991).

The higher bluffs in the east and west reaches are subject to more natural erosive processes driven by waves, tides and currents. Those bluffs show signs of sloughing in several locations. The examples in Figure 5 show evidence of recent bluff movement at several locations within the Langley East and West reaches.
Figure 5. Evidence of Recent Coastal Landslides in Langley

Langley East

Langley East

Langley West
4.3.3 Shoreline Modifications

Shoreline modifications refer to any structural modification to the shoreline. These include shoreline armoring, overwater structures (piers, docks), breakwaters or fill. They also include actions that structurally modify the shoreline such as clearing, grading or vegetation removal. Construction of shoreline armoring may cover or destroy intertidal habitats including eelgrass meadows, and overwater structures may deprive intertidal habitats of light and cause other impacts. Dredging can excavate intertidal habitats or cause excessive turbidity and permanent filling of eelgrass meadows (KCDNR, 2001).

**Shoreline Armoring**

Shoreline armoring is generally installed to prevent erosion and is the most common type of modification in Puget Sound. Shoreline armoring has adverse effects on the nearshore physical processes necessary to maintain native species habitats and shoreline functions. These effects include the loss of beach areas, impoundment of sediment, modification of groundwater regimes, lowering of beach elevations, concentration and redirection of wave energy to adjacent areas, alteration of substrate, and loss of riparian vegetation and associated functions (KCDNR WTD 2003).

Typical results of these effects include changes in nearshore substrates from sand or mud to coarse sand, gravel and finally hardpan; decreased eelgrass abundance and forage fish spawning habitat and increased kelp abundance. As noted above, armoring also alters natural process dynamics by blocking or delaying the erosion of upland areas and bluffs that replenish the spawning substrate (i.e., beaches). Beach narrowing and lowering and decreased driftwood abundance also result from shoreline armoring (Johannessen and MacLennan, 2007).

As shown in the reach sheets (and Map 11), armoring varies in the City of Langley. Langley West is minimally armored with a roughly 500-foot bulkhead west of Saratoga Creek. Langley Central is heavily armored with the concrete and wood bulkhead along Seawall Park (Figure 6) and armoring in the harbor area. Langley East is relatively unarmored with the exception of two sections of an abandoned and rotting timber bulkheads.

**Figure 6. Shoreline Armoring along Seawall Park in Langley Central**

Source: Microsoft Co. 2011
Docks, Piers and Over-water Structures

Overwater structures, such as docks and piers can have several impacts to nearshore processes. They change the levels of light, shoreline energy regimes, substrate type and stability, and water quality (Nightingale and Simenstad 2001). These changes result in altered abundance and diversity of species in nearshore marine ecosystems. Light levels may be reduced to levels below those necessary for plant growth, fish feeding, predator avoidance, schooling, and migration. Overwater structures can alter wave energy and sediment dynamics, affecting substrate size, type and stability, plant propagation, fish foraging, spawning and migration, and shellfish settlement and rearing. Overwater structures can affect the seabed, disturbing or destroying benthic organisms and vegetative growth. Construction materials can leach contaminants into the environment (KCDNR, 2001).

As noted in the Langley Central reach sheet and shown in Figure 7, there are three overwater structures in the City. These include (from north to south) the approximately 260-foot Nichol’s Brothers dock, an approximately 185-foot privately owned dock that is not in use, and the approximately 450-foot C-shaped marina. The total overwater coverage in the City is approximately 21,000 square feet (0.5 acres).

There is also the future potential for new construction of overwater structures. In 2004, the City and the Port of South Whidbey Island developed a master plan for the harbor and vicinity that included several alternatives for expanding the existing marina facilities. To date, projects associated with the master plan have not commenced.

Figure 7. Overwater Structures in Langley Harbor

Source: Microsoft Co. 2011
4.4 Biological Characterization

4.4.1 Wetlands and streams

There are no wetlands mapped within the city’s shoreline planning area. Wetlands associated with the city’s three creeks are mapped upland of the shoreline. There are three small creeks that accumulate groundwater and storm runoff and discharge into Puget Sound within the city’s shoreline. As noted in the reach sheets, only Noble Creek enters the Puget Sound via an unaltered stream bed. Saratoga Creek flows through a culvert and exits through a bulkhead to Puget Sound and Brookhaven Creek is piped through the shoreline (Map 4).

4.4.2 Marine Riparian Vegetation

Marine riparian vegetation is defined as vegetation overhanging the intertidal zone (KCDNR, 2001). Marine riparian zones function by protecting water quality; providing wildlife habitat; regulating microclimate; providing shade, nutrient and prey; stabilizing banks; and providing large woody debris (Anchor Environmental and People for Puget Sound, 2002).

Shoreline armoring along the central reach and development in the harbor area have impacted the marine riparian zones of the city’s shoreline. Along the seawall and through the harbor, marine riparian vegetation has been severely altered. Vegetation in these areas primarily consists of lawn and ornamental trees. There are some native conifers in the area and very little overhanging vegetation. Remnant disconnected vegetation including a mix of native and non-native vegetation is located on the landward side of the sea wall and shoreline development. The habitat functions typically associated with riparian vegetation, such as water quality, soil and bluff stability, shade creation, habitat structure, large woody debris, organic litter and wave energy dissipation, are heavily altered in this area.

A review of aerial photographs indicates the high bluff areas in the west and east of town have relatively intact shoreline vegetation comprised of a mixed forest community including deciduous tress such as big leaf maple, madrone and alder and coniferous trees including douglas fir and hemlock. Above the bluffs, vegetation is patchy and includes forested areas along with cleared lawn and buildings. In general, the riparian vegetation in the east and west reaches is approximately 100 to 150 feet wide, which roughly corresponds to the width of the bluffs. As noted above, riparian vegetation provides bank stabilization, nearshore habitat, detrital inputs, sources for LWD, and slows and filters runoff.

4.4.3 Eelgrass Meadows

As noted in the reach sheets (and Map 6), eelgrass beds have been documented as continuous or patchy by WDNR along the entire city shoreline. In a separate effort, the City has mapped more limited eelgrass beds between Anthes Avenue and Park Avenue and east of Noble Creek. Shoreline activities that may impact eelgrass (KCDNR, 2001) include:

- Clam harvesting and other direct alteration by humans;
- Propeller scour and wash;
- Physical disturbances from shoreline armoring;
- Shading from overwater structures; and
- Physical disturbances from dredging and filling.

4.4.4 Priority Habitats and Species

The Washington Department of Fish and Wildlife (WDFW) maintain priority habitat and species information for Washington State, including the status of species as threatened or endangered. As documented in the reach sheets and Maps 5 and 6, Geoduck clams and Dungeness crabs are documented in subtidal areas adjacent to all of the city’s shorelines. According to the WDFW Priority Habitats and Species data (2010), the only PHS salmonid fish species documented in Langley streams are Resident Cutthroat Trout, which are mapped in all three of the city’s creeks. Because the streams are relatively small and piped in various sections, trout may not exist in the City. This has been corroborated by anecdotal information furnished by city staff.

Nearshore habitat is an important environment for juvenile salmonids, where the shallow water depth obstructs the presence of larger, predator species (Kerwin, 2001). Juvenile salmon rely on the nearshore and estuarine marine habitats for food, migration corridors, protection from predators, and a transitional environment that supports the physiological changes that occur as they transition from a freshwater to a marine environment (Fresh, 2006). Spawn and migration timing, and the use of different marine habitats vary widely between salmonid species as well as stocks or subpopulations of the same species. Juvenile Chinook, Coho, Chum, Pink, and Sockeye Salmon are presumed to use the entire nearshore habitat of Whidbey Island Including Langley. Chinook and Coho have been documented immediately south of the city to Sandy point. Chum and Pink have been documented in the city south of the seawall and harbor area (Washington Conservation Commission, 2000).

Forage fish are key components of the marine food web and have important commercial and recreational value. They are generally characterized as small, schooling fish that prey upon zooplankton and are in turn preyed upon by larger predatory fish, birds and marine mammals (Penttila, 2007). The forage fish species typical of the area are surf smelt, sand lance, Pacific herring, longfin smelt, and eulachon (Kerwin, 2001 and King County DNR, 2001). Sand lance are the only forage fish mapped in the nearshore habitat of Langley.

4.4.5 Other Important Habitat Types and Species

A 2008 report on best available science for the Island County marine nearshore (ESA 2008), reported on the importance of ghost shrimp within the nearshore of Whidbey Island and, likely, Langley. The Island County Marine Resource Committee (MRC) identified ghost shrimp stock areas as a potential important habitat because of their association with gray whales. Ghost shrimp occur in the sand flats of the intertidal zone and their spawning areas are likely are concordant with surf smelt and sand lance spawning areas. Sand lance spawning habitat is
mapped in Langley’s nearshore as shown in Map 6. Ghost shrimp are an important food source to marine mammals including migrating gray whales that occur annually in the waters of Saratoga Passage. The gray whale was once federally and state listed as endangered, but its listing status was removed in 1994 as populations recovered. This species is still protected under Marine Mammal Protection Act.

4.4.6 Marine Water Quality

Marine water quality is a key shoreline function that is integral to the formation of nearshore habitats and species assemblages. There is limited site specific water quality data for the City of Langley. The Washington State Department of Ecology monitors key pollutants as part of its 303(d) requirements under the Federal Clean Water Act. Ecology maintains a 303(d) list of waterbodies where tested pollutants have exceeded thresholds established by the state surface water quality standards (WAC 173-201A). The 2008 303(d) list was the last one submitted to and approved by EPA. Saratoga passage was identified on the 303(d) list as category 5 for low dissolved oxygen. Category 5 means that Ecology has data showing that a water quality standard has been violated for one or more pollutants, and there is no Total Maximum Daily Load (TMDL) or pollution control plan. A draft 2010 303(d) list has been completed. Its results are scheduled to be submitted to the EPA in fall of 2011, but were not available at the time this report was completed.

4.5 Land and Shoreline Uses

4.5.1 Land Use Patterns

Originally platted in 1891, the City of Langley has a variety of residential, commercial, cultural, recreational, and educational uses and activities. The City’s Comprehensive Plan describes the general land use pattern of the City in the following manner:

“There is the concentrated commercially-oriented downtown with strong waterfront connections established a century ago. There is the ring of medium and higher density housing just outside the downtown with a development pattern dictated by the lot and block grid of the original 1891 Plat of Langley. There is the modest post-war expansion of residential areas in small- to medium-sized subdivisions, interspersed with historic homes that were once associated with small farms. Finally, there is newer infill development that reflects current trends such as mixed-use housing in downtown and cottage development around common social spaces.” (City of Langley, 2010)

The City is marked by a strong retail center in the downtown area, catering to both residents and tourists. The general pattern of use in the downtown includes the commercial and cultural downtown core fronting the shoreline and surrounded by a mix of moderate and low density residential development. The downtown fronts the shoreline, which is characterized by public parks, pathways, marine-related industry and the major marina on South Whidbey Island, serving both residents and visitors.
According to the City’s Comprehensive Plan (2010), the city consists of 644 acres of which approximately 42 acres are in SMA jurisdiction. Approximately 40 percent of the city is in residential uses; 21 percent is in institutional use (schools, fairgrounds, and wastewater treatment plant); 18 percent is vacant; and approximately 3 percent is commercial use. At the time the comprehensive plan was being developed (2007), roughly 10 percent of land in the city was in some active state of development review and/or implementation. These numbers differ from table 2 because those data were derived from 2010 Island County assessors data, which uses different category definitions (particularly for “vacant”) and was compiled more recently. That said, the general patterns are consistent. Use in the city is largely residential and institutional with a smaller amount of commercial.

The followings section describes the land use pattern within the city’s shoreline in the context of existing land use, as well as planned or future land uses that are established by Comprehensive Plan and zoning designations. The reach sheets contain relevant information of shoreline use, zoning and public access. That information is summarized for the entire city in this section.

4.5.2 Existing Shoreline Uses

Existing land use was assessed based on an analysis of the City’s land use map, zoning, County parcel data and a review aerial photography. As noted in the reach sheets, the shoreline planning area in Langley West and East are dominated by single family residential development (93 percent in each). Langley Central includes a more diverse land use inventory that includes residential uses, commercial uses, vacant lands and a significant amount of rights-of-way. Figure 8 below shows a comparison of shoreline land uses in each of the three shoreline reaches.

Figure 8. Current Shoreline Uses by Percent in each of the City’s Shoreline Reaches

Langley East and West

As shown in the reach sheets, shoreline use in the Langley West and East are dominated by single family development. Nearly all of these parcels are developed with single family homes.
As shown in Map 10, there are less than 10 parcels identified as vacant. Additionally, most of these homes are located on top of the coastal bluff to the west and east of downtown. In general the homes are set back from the edge of the bluff protecting them in the event of sloughing. However, as shown in Figure 9 below, there are areas where homes are located closer to the bluff, sometimes less than 20 feet. The proximity of these homes to the bluff edge is likely to create pressure to install structural bluff stabilization over time, even though in the long-term it is impossible to stabilize these types of bluffs.

Figure 9. Homes Near the Edge of the Coastal Bluffs in the City of Langley

Source: Microsoft Co. 2011

Langley Central

Uses in the Langley Central shoreline are more diverse. As shown in Figure 10, uses directly along the water include hotels and inns, residences, Seawall Park and the harbor area. The uses along 1st Street are oriented both to the street and, for some, the water as well. These uses include retail shops, restaurants and other commercial services. Most of these structures are set up above a moderate slope overlooking Seawall Park. Robert L. Smith Park located along 1st Street provides access via a stairway to Seawall Park.
The City’s harbor is located below 1st Street and Cascade Avenue. The harbor area is a mix of publicly and privately owned properties. Public recreational facilities at the Langley Boat Harbor include the marina, boat ramp/launch area, Phil Simon Park with restroom and shower, fishing area/pier, picnic/day use area, a swimming beach, and waterfront/beach access (City of Langley, 2004).

The Langley Marina was first constructed in 1979 and rebuilt to its current form in 1986. The marina was transferred from the City to the Port of South Whidbey in 2009. The marina consists of a timber pile breakwater, concrete floats, and access trestle with 38 slips. The boat launch is tightly situated between the marina and the parking area. According the Langley Boat Harbor and Environs Plan (2004), the ramp is deteriorated and inefficient. The slope of the concrete ramp is too gentle to remain free of drifting sand and wood, which is cleared periodically. The City has also recognized a need for parking and access from Cascade Avenue to the marina. The City recently submitted a grant application to the Island County Subregional Regional Transportation Planning Organization to support the development of a funicular that would connect Wharf Street and the marina to Cascade Avenue.

Private uses in the harbor area include an abandoned dock north of the marina. Owners of this property have expressed interest in developing it into lodging, food service and a marine supply provider. Adjacent to this property is the Boatyard Inn. The Nichols Brothers Boatyard and dock
is located immediately to the north and supports final commissioning for vessels built in Freeland. Nichols Brothers owns seven parcels of waterfront property, which include parking, a building, the dock, and dock facilities. The remaining parcels along the water north of Nichols Brothers are residences.

In 2004, the City developed the Langley Boat Harbor and Environ Master Plan, a master plan for redeveloping the harbor area. The plan identified the current demand (as of 2004) for marina services. It found that there were 3,130 boats ranging from 16 to 60 feet currently registered to Island County residents and that total rental moorage available in Island County was approximately 523 slips.

Developed along with the Port District of South Whidbey, the plan’s intent was to draw more recreational boat users to the City. The plan included rebuilding the marina with more and larger slips (either 245 or 117), increased public access and removal of the derelict dock and sunken marina. The plan would also consolidate the marina and Nichols Brothers operation into one structure. The plan would also includes a fueling option, either floating or upland, a small boat center, and updated boat launch and float plane facility. Development described in the plan would have adverse impacts to the nearshore environment. Impacts to eel grass beds, forage fish spawning areas and juvenile salmon forage areas would have to be addressed. As of the date of this report, master plan implementation has not begun.

4.5.3 Comprehensive Plan

According to the City’s Comprehensive Plan (2010), the City’s population grew from 650 residents in 1980 to 1,060 in 2007. The 2010 population is 1,037. Population is projected to reach 1,319 by 2020. This is based on an intermediate growth assumption from the State Office of Financial Management. The Comprehensive Plan also notes that new residents have been attracted to the bluffs above Saratoga passage for residential development.

Recent growth in Island County has taken place largely in unincorporated areas (Island County, 1998). This is due to the desire to live along shorelines. The County predicted that 70 percent of the population increase through 2020 would be located in unincorporated areas (Island County, 1998). This prediction has been roughly true from 2000 to 2010, during which time 65 percent of the population growth has occurred in the unincorporated areas of the County. In Langley, most of the residential shorelines are developed. Therefore, while redevelopment of residential properties is likely, very little new residential development will take place within the shorelines.

4.5.4 Zoning

The land use designations planned for in the City’s Comprehensive Plan have been largely implemented through complementary zoning. As noted above and shown in Map 9, Langley West and East are predominantly zoned and planned for low density single family residential development. Langley Central has a greater diversity of zoning within the downtown and harbor areas. Figure 11 below shows zoning as a percentage of total land area for each of the three reaches analyzed.
4.5.5 **Roads, Infrastructure, Utilities, and Stormwater**

Roads and transportation infrastructure near or adjacent to waterbodies can create adverse impacts to those natural systems by blocking flow or creating impervious surfaces. Roadways represent a significant source of impervious surface in urban areas. High levels of impervious surfaces in the uplands have had a significant effect on the Puget Sound. Auto-related pollutants including petroleum products, hydrocarbons, and heavy metals accumulate on road surfaces and are carried to nearby waterbodies during storm events through sheet runoff or stormwater collection systems.

As shown in Figure 12 and Map 14, rights-of-way comprise a significant portion of the Langley Central reach. Roadways make up a much smaller proportion of the landscape in the other two reaches. Water, sewer lines and the sewer force main are located within the shoreline. Periodic repairs of these will likely require ground disturbance in the shoreline.

The City of Langley has a stormwater conveyance system that is limited to the central portion of the City. Most of the stormwater runoff converges at the storm drains along Anthes and Park Avenue. The system consists of open ditches, storm drains along some major arterials, and mainly privately owned detention and infiltration systems. The drainage system also includes the city’s three small creeks. Much of the City’s storm drainage system was installed in the 1960’s.

The City’s surface water discharges to Saratoga Passage through four outfall locations in addition to Noble and Saratoga Creeks. All stormwater runoff within the central part of town are routed to the Anthes Avenue (which receives flows from Brookhaven Creek) and Park Avenue storm drain systems. The other major outfall is located on Camano Avenue. Flow to this outfall is collected from Camano Avenue and a small section of East Sixth Street. A portion of Edgecliff Drive is collected and discharged to Saratoga Passage near the east end of Edgecliff Drive. More
detailed descriptions of the outfalls, drainage problems and conceptual solutions and funding options are available in the City’s Comprehensive Stormwater Management Plan (City of Langley, 2009).

Island County was designated as a sole source aquifer since it is the sole source for drinking water and is vulnerable to contamination. Water flowing to streams from urban areas often contains a wide variety of pollutants. Highest pollutant concentrations generally occur in runoff from impervious surfaces, especially roads and parking lots. There is presently no water quality treatment of stormwater flows at existing outfalls. This is a concern in the central, more heavily developed areas of the City.

4.5.6 Existing and Potential Public Access Sites

Public access to the shoreline is one of the three main goals described in the Shoreline Management Act (SMA). The State defines public access to the shoreline as follows:

“the ability of the general public to reach, touch, and enjoy the water’s edge, to travel on the waters of the state, and to view the water and the shoreline from adjacent locations” (WAC 173-26-221(4)(a)).

The principles listed within (WAC 173-26-221(4)(a)) include considerations for public safety and navigational needs when developing a public access plan to the shoreline. Public access to the shoreline is one of the three main goals described in the Shoreline Management Act (SMA). The State defines public access to the shoreline as follows:

“the ability of the general public to reach, touch, and enjoy the water’s edge, to travel on the waters of the state, and to view the water and the shoreline from adjacent locations” (WAC 173-26-221(4)(a)).

The City also has an established policy framework for maintaining and improving public access to the shorelines. One of the City’s guiding principles in developing its vision for land use in the city is:

“Reorientation of the city to its historical waterfront character, including expansion of marina services and improved access to and along the waterfront and beach in conjunction with the Port of South Whidbey.”(City of Langley, 2010)

In addition, the Parks, Open Space, and Trails Element of the Comprehensive Plan includes the following goal and policy related to access and recreational use of the shoreline:

**Goal 10: Preserve, protect and expand, when possible, opportunities for the public to have access to and enjoyment of the waterfront area of the city.**
Policy 10.1: Work cooperatively with the Port District of South Whidbey with the objective of expanding boat moorage, improving the boat ramp and the associated Phil Simon Park, and facilitating public access to the waterfront area. (City of Langley, 2010).

The City of Langley has ample access to its shorelines (Map 13). Nearly all of the access is provided in Langley Central below downtown and in the harbor area. Approximately 0.25 miles, representing 14 percent of the total shoreline length and 52 percent of Langley Central is physically accessible to the public.

Access in Langley East and West is limited. Both reaches are comprised primarily by private, high bank property. There are two exceptions. The Park Avenue right-of-way is publically owned and is a potential public access site, if developed. Tidelands in Langley West and East are also accessible at low tide. Table 5 below lists the shoreline access sites and their amenities (from west to east).

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Type of Access</th>
<th>Size (acres)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debruyrn Right-of-way</td>
<td>Physical / Visual</td>
<td>0.52</td>
<td>City-owned potential mini-park locations; undeveloped tax titled tidelands</td>
</tr>
<tr>
<td>Park Ave Right-of-way</td>
<td>Physical / Visual</td>
<td>0.50</td>
<td>City-owned potential mini-park locations; undeveloped tax titled tidelands</td>
</tr>
<tr>
<td>Seawall Park</td>
<td>Physical / Visual</td>
<td>1.44</td>
<td>Created in 1975 when the seawall was constructed. Amenities include 1,140 feet of saltwater beach access; a walking trail, beach access, benches and picnic tables. The park abuts private property on its southern side, and this neighboring undeveloped property makes the park area appear larger than its actual size.</td>
</tr>
<tr>
<td>Thomas Hladkey Memorial Park</td>
<td>Physical / Visual</td>
<td>0.25</td>
<td>Devoted to public use since the creation of the 1890 Plat of Langley; originally provided access to the first marina in Langley; includes three benches, a whale bell, landscaping and interpretive signage.</td>
</tr>
<tr>
<td>Robert L. Smith Park</td>
<td>Physical / Visual</td>
<td>0.15</td>
<td>Community mini-park located in the middle of the First Street business core; contains several benches, a landscaped areas and stairs providing access to Seawall Park.</td>
</tr>
<tr>
<td>Cascade Walkway</td>
<td>Visual</td>
<td>1.28</td>
<td>Community mini-park located in downtown Langley; includes the flat area east of Cascade Avenue, as well as a large portion of the bluff east of the walkway. Upland portion provides interpretive signage, benches and views of the marina; sloped portion is vegetated and contains no human use areas</td>
</tr>
<tr>
<td>Phil Simon Park</td>
<td>Physical / Visual</td>
<td>0.46</td>
<td>Community mini-park acquired by City in 1975 and transferred to the Port of South Whidbey in 2009. The park is located south of the marina; it consists of restroom and shower building, boat launch, parking and lawn. It was redeveloped in 2009.</td>
</tr>
</tbody>
</table>

The City is currently seeking a connection between Seawall Park and the marina as well as access from Cascade Avenue via a funicular. The proposed marina expansion would likely be
coupled with additional Phil Simon Park improvements that support fishing, kayaking, diving, crabbing, beach walking, picnicking, and view platforms.

The City is also planning to interconnect the marina waterfront with the Seawall Park by a non-motorized pedestrian trail. Enhancing public access to the Seawall Park and improving its recreation function and attractiveness are also contemplated. Because of the height and steepness of the bluff outside of the core business district, public access to the privately owned tidelands is problematic with one exception. The City is exploring the feasibility of utilizing the natural corridor of Noble Creek between Edgecliff Drive down to the waterfront, which would terminate at the beach east of the Phil Simmon Park.

4.5.7 Historical/Cultural Resources

Langley was originallyplatted in 1890 and many of its buildings and homes are 50 years old or older. Langley has one nationally designated historic building, the Dog House Tavern on 1st Street in the central business district. This building is within shorelines jurisdiction. Other buildings may qualify. The City has established a comprehensive plan goal for the protection of historical resources. It reads as follows:

**Goal 9:** Encourage the protection of special historic, architectural, aesthetic, or cultural resources through the designation of historic landmarks and districts and the adoption of appropriate incentives, and ensure that new development contributes aesthetically to the overall village character. (City of Langley, 2010)

According to consultation with the Washington State Department of Archeological and Historic Preservation, there are no know archeological sites within the incorporated boundary of Langley (Kwsarsick, personal communication, 2011). This does not mean that such resources do not exist in Langley and appropriate provisions for discovery and protection will continue to apply.

4.5.8 Data Gaps

This shoreline inventory and characterization report relies on data described in each technical section. In some cases, data identified as needed for the analysis and characterization were not available for incorporation in this report. The 2003 Ecology Guidelines require that data gaps or missing information be identified during the preparation of the shoreline inventory and analysis. The following are considered data gaps at this time:

- Impervious surface information was not available for the city. Additional information may exist that needs to be explored.

The shorelines of Island County, in general, and Langley in particular are well documented. In general, the information that is available is more than adequate for an understanding of the conditions of physical processes, species occurrences and habitat conditions. The data gaps noted above will not impede the City’s ability to update existing SMP goals and policies.
CHAPTER 5 KEY MANAGEMENT ISSUES

5.1 Key Management Issues for Langley discussed in this section include:

- Construction of bulkheads in Langley West and along th Seawall Park have disconnected the shoreline from the coastal bluffs and uplands. As a result the natural erosive processes that erode the bluffs over time nourishing beaches and supporting wildlife habitats have been altered.

- The three docks in the harbor area partially intercept the transport of sediment along the drift cell. As a result sediment builds up within the harbor and at the boat launch. That sediment is not available for beach nourishment further along the cell.

- The docks create overwater coverage of portions of the nearshore. Overwater coverage creates uniform shade altering the predator prey dynamic and nearshore vegetation communities. Expansion of the facilities could exacerbate these issues.

- The mouth of Saratoga Creek is completely modified. Natural stream mouth provides important inputs to intact habitats, such as wood and other nutrients.

- Marine riparian vegetation has been greatly altered by installation of the seawall; commercial development on 1st Street, Wharf Street and Sunrise Lane; shoreline modification; and landscaping with lawn. Natural inputs of wood and detrital debris as well as shade in the near shore are diminished.

- Several primary residential structures are located close to the bluff edge, particularly in Langley East. As the bluff retreats due to erosive processes, homeowners may request permits for bank stabilization. Shoreline modification updrift of these shorelines could accelerate erosion, as could sea level rise. Lack of stormwater facilities may also increase soil saturation and accelerate bluff erosion.

- There is abundant public access in Langley. Approximately 14 percent of the shoreline is physically accessible. The City also provides a boat launch and numerous locations where visual access of Saratoga Passage and Camano Island are visible. A connection between the City center and the marina is lacking. The City is planning to provide access from Cascade Ave t the marina via a funicular.

5.2 Assessment of Ecological Conditions and Opportunities for Ecological Restoration/Conservation

Table 6 provides a summary of shoreline ecological functions for the City of Langley. Causes of impairment are identified. General or programmatic restoration opportunities to address impairments are described along with management recommendations.
Table 6. Summary of Shoreline Functions and Programmatic Restoration and Management Opportunities

<table>
<thead>
<tr>
<th>Conditions and Causes of Impairment</th>
<th>Shoreline Ecological Function Affected</th>
<th>Programmatic Restoration and management Opportunities</th>
<th>Management Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkheads on the shoreline deflect wave action and disrupt natural coastal processes. Bulkheads disrupt natural delivery of sediment to coastal areas, as well as increase beach scouring.</td>
<td>Hydraulic Sediment transport and deposition</td>
<td>Low probability of removing or softening shoreline armoring in Langley West because of the presence of homes and in the harbor area because of the presence of vertical structures and the fact that the entire Langley waterfront is developed over what would have been the backshore area.</td>
<td>Prohibit development that would require future armoring except for limited instances to support water dependent uses.</td>
</tr>
<tr>
<td>Alteration to and development near feeder bluffs can reduce the potential of these areas to provide sediment delivery to coastal zones, disrupting natural coastal beach accretion. The seawall and other bulkheads have separated coastal bluffs from the shoreline.</td>
<td>Sediment delivery and beach creation</td>
<td>Protecting unarmored bluffs should be priority. Streams can also be a source of sediment to the nearshore. Moderate probability of ensuring that existing culverts are large enough and fish-friendly.</td>
<td>Include geologic hazard development standards from CAO in SMP. Prohibit new development that would result in an increase risk of slope failure, pose a safety risk, or require bank or bluff stabilization in the future.</td>
</tr>
<tr>
<td>Marina riparian vegetation is generally absent due to development of the seawall and harbor area. Input of wood and other organic materials is lacking. The absence of a back beach reduces the changes to accumulate large wood.</td>
<td>Riparian Habitat structure</td>
<td>Explore potential to remove or soften portions of the seawall. Revegetate area above seawall with native vegetation. Redevelopment of the marina could be an opportunity to enhance shoreline riparian vegetation</td>
<td>Include provisions to ensure no net loss of habitat with new development, Limit removal of native riparian vegetation as part of development proposals. Prioritize re-vegetation of shorelines with native species when considering mitigation options and/or restoration efforts.</td>
</tr>
<tr>
<td>Man-made debris and remnant structures, including the derelict dock in the harbor area and pile and wood structures along Langley East, potentially disrupt nearshore habitats and sediment transport and accretion processes.</td>
<td>Nearshore habitat Water quality</td>
<td>Target removal of abandoned and dilapidated man-made structures in the shoreline. Determine if remnant pilings are creosote and prioritize removal.</td>
<td>Prioritize removal of derelict structures and creosote coated pilings as mitigation for future development or restoration activities.</td>
</tr>
<tr>
<td>Conditions and Causes of Impairment</td>
<td>Shoreline Ecological Function Affected</td>
<td>Programmatic Restoration and management Opportunities</td>
<td>Management Recommendations</td>
</tr>
<tr>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Overwater structures created by the docks in the harbor area create uniform shade altering the predator-prey dynamic the marine vegetation communities.</td>
<td>Nearshore habitat</td>
<td>Decreasing total overwater coverage is unlikely. However, in the event that the marina is redeveloped, grating can be used to increase light penetration through the docks and piers.</td>
<td>Consider prohibiting new overwater structures. Include provisions to ensure no net loss of shoreline functions when permitting reairs or expansions of existing structures. Require that expanded structures do not increase coverage through the use of graded materials.</td>
</tr>
<tr>
<td>Conveyance and treatment problems within the stormwater infrastructure in Langley contributes to water quality issues and adds to the instability of bluffs.</td>
<td>Water quality Bluff Stability</td>
<td>Implement recommendations of the 2009 Comprehensive Stormwater Management plan including the use of LID tools, such as rain gardens, pervious pavement and other methods described in the LID Manual.</td>
<td>Limit impervious surface in the shoreline. Ensure that new development complies with stormwater regulations.</td>
</tr>
</tbody>
</table>
CHAPTER 6    REFERENCES


King County Department of Natural Resources (KCDNR). 2001. Reconnaissance Assessment of the State of the Nearshore Report: Including Vashon and Maury Islands (WRIAs 8 and 9). Seattle, WA.


Kwarsick, Larry. 2011. City of Langley Director of Community Planning, Personal communication regarding City coordination with DAHP.


APPENDIX A SHORELINE MAPFOLIO
This map is intended for planning purposes only. Inaccuracies may exist. This map depicts the approximate location and extent of areas subject to the City of Langley SMP. The actual extent of the shoreline planning area requires a site-specific evaluation to identify the location of the ordinary high water mark and any associated wetlands.

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SOURCE: City of Langley, 2011; Island County, 2010; Puget Sound LiDAR Consortium, 2008

Department of Ecology Grant G1001024/Task 2.3
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SOURCE: City of Langley, 2011; FEMA, 2010; Island County, 2010; Puget Sound LiDAR Consortium, 2008

Department of Ecology Grant G1100124/Task 2.3

Legend
- Shoreline Planning Area
- Roads
- City Limits
- Streams
- Piped Streams

Wetlands

Soil Symbol, Description
- Kb, Keystone loamy sand, 0 to 5 percent slopes
- Kc, Keystone loamy sand, 5 to 15 percent slopes
- Kd, Keystone loamy sand, 15 to 30 percent slopes
- Na, Norma loam, 0 to 3 percent slopes
- Nc, Norma silt loam, 0 to 2 percent slopes
- Rb, Rifle peat, shallow, 0 to 2 percent slopes
- Rc, Rough broken land
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SOURCE: City of Langley, 2011; Island County, 2010; Puget Sound LiDAR Consortium, 2008
Department of Ecology Grant G1101024/Task 2.3
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Legend:
- Shoreline Planning Area
- Sand Lance
- Eelgrass (City)
- Eelgrass (Continuous) (WDNR)
- Eelgrass (Patchy) (WDNR)
- Dungeness Crab
- Geoduck
- City Limits

Department of Ecology Grant G1102124/Task 2.3
This map is intended for planning purposes only. Inaccuracies may exist. This map depicts the approximate location and extent of areas subject to the City of Langley Shoreline Master Program. The actual extent of the shoreline planning area requires a site-specific evaluation to identify the location of the ordinary high water mark and any associated wetlands.

SOURCE: City of Langley, 2011; Island County, 2010; PSNERP, 2010

Department of Ecology Grant G1100124/Task 2.3

Legend
- Shoreline Planning Area
- Direction of Drift
- Streams
- Barrier Beach
- Piped Stream
- Bluff-backed Beach
- City Limits
This map is intended for planning purposes only. Inaccuracies may exist. This map depicts the approximate location and extent of areas subject to the City of Langley SMP. The actual extent of the shoreline planning area requires a site-specific evaluation to identify the location of the ordinary high water mark and any associated wetlands.

SOURCE: City of Langley, 2011; Coastal Geologies Services, 2005; Island County, 2010
Department of Ecology Grant G110124/Task 2.3
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SOURCE: City of Langley, 2011; Island County, 2010
Department of Ecology Grant G110124/Task 2.3
*Note: Converts to RS 7200 with Availability of Sewers

Legend
- Shoreline Planning Area
- Streams
- Piped Stream
- City Limits

Zoning
- CB, Commercial Business
- NB, Neighborhood Business
- P-I, Public Use
- RM, Mixed Residential
- RS5000, High
- RS7200, Medium
- RS7200-WS*
- Rural
- SF15000, Low
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SOURCE: City of Langley, 2011; Island County, 2010
Department of Ecology Grant G1100124/Task 2.3
Map 11: Shoreline Modifications

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Legend
- Shoreline Planning Area
  - Streams
  - Piped Stream
  - City Limits
- Stormwater Outfalls
- Sewer Outfall
- Overwater Structures
- Overwater Structures (Off-Site)
- Bulkhead/Seawall
- Other Structures
- Boat Ramp
- Armoring

Map 11: Shoreline Modifications

City of Langley: Shoreline Master Program Update
This map is intended for planning purposes only. Inaccuracies may exist. This map depicts the approximate location and extent of areas subject to the City of Langley SMP. The actual extent of the shoreline planning area requires a site-specific evaluation to identify the location of the ordinary high water mark and any associated wetlands.


Department of Ecology Grant G110124/Task 2.3
This map is intended for planning purposes only. Inaccuracies may exist. This map depicts the approximate location and extent of areas subject to the City of Langley Shoreline Master Program. Determining the exact location of the shoreline planning area requires a site-specific evaluation to identify the location of the ordinary high water mark and any associated wetlands.


Legend
- Shoreline Planning Area
- Streams
- Piped Stream
- City Limits
- Marine Access (Existing)
- Marine Access (Potential)
- Boat Ramp
- Existing Paths
- Conceptual Trails

Public Access
- Public Lands
- Public Tidelands
- Parks/Publicly Owned Open Space

Map 13: Public Access
This map is intended for planning purposes only; inaccuracies may exist. This map depicts the approximate location and extent of areas subject to the City of Langley SMP. The actual extent of the shoreline planning area requires a site-specific evaluation to identify the location of the ordinary high water mark and any associated wetlands.

SOURCE: City of Langley, 2011; Island County, 2010; Bing Maps, 2009 (Aerial). Department of Ecology Grant G1100124/Task 2.3

Legend
- Shoreline Planning Area
- Force Main
- Stormwater Lines
- Piped Stream
- Water Lines
- City Limits
- Stormwater Outfalls
- Sewer Outfall
- Water Facilities
APPENDIX B GIS DATA SOURCES
<table>
<thead>
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<th>Dataset</th>
<th>Source (Date)</th>
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<td>Armoring</td>
<td>PSNERP (2008)</td>
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<td>Bald Eagle Buffer</td>
<td>WDFW (2010)</td>
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<td>Boat Ramp</td>
<td>County (2010)</td>
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<td>Bulkhead/Seawall</td>
<td>County (2010), Langley (2011)</td>
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<td>City Limits</td>
<td>Langley (2011)</td>
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<td>Contour Lines (5', 10', 50')</td>
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