

SHORELINE ANALYSIS REPORT

for Shorelines in the City of Ilwaco: Columbia River, Wallacut River, Black Lake, and Pacific Ocean

City of Ilwaco

Prepared Sept. 2014 by

The Watershed Company

DRAFT GRANT NO.G1400373

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Prepared with funding from:

WASHINGTON STATE DEPARTMENT OF ECOLOGY

September 2014

The Watershed Company Reference Number:
130515

Cite this document as:
The Watershed Company. September 2014. DRAFT Shoreline Analysis Report for Shorelines in the City of Ilwaco: Columbia River, Wallacut River, Black Lake, and Pacific Ocean. Prepared for the City of Ilwaco, WA.

READER'S GUIDE

The main purpose of this report is to provide information about shorelines in Ilwaco.

As the City works to update its Shoreline Master Program, the broad-scale overview of shoreline conditions provided in this report should help the City to make decisions about how to manage its shorelines in the years to come. This report should help provide the City with answers to questions such as:

- What kind of land use do we have along our shorelines? What kind of land use might we have in the future?
- Where can City residents and visitors access shorelines? Are more locations for public access needed?
- What issues threaten the environmental quality of our shorelines? What actions can be taken to protect and improve their environmental quality?

It is also important to mention what this report is not intended to do. This report is not intended to provide an assessment of shoreline conditions on specific properties. This report is also not intended to be used in the future to generate numerical figures of shoreline improvements or losses.

This report is organized as follows:

- **Chapter 1** provides more detail about the purpose of this report and discusses the basics of how the City manages its shorelines under the Shoreline Management Act;
- **Chapter 2** reviews what laws and agencies are particularly important in shoreline areas;
- **Chapter 3** steps back and takes a big-picture look at conditions affecting City shorelines;
- **Chapter 4** zooms in and takes a more detailed look at the City's shorelines, including both ecological and land use conditions; and, finally
- **Chapter 5** makes recommendations for shoreline management based on the contents of the previous chapters.

TABLE OF CONTENTS

LIST OF FIGURES

Page #

LIST OF TABLES

Page #

SHORELINE ANALYSIS REPORT

FOR SHORELINES IN THE CITY OF ILWACO

1 INTRODUCTION

1.1 Background and Purpose

The City of Ilwaco (City) is located in southwestern Pacific County (County), Washington State (State). In 2013, the City obtained a grant from the State Department of Ecology (Ecology) to complete a comprehensive update of its Shoreline Master Program (SMP), as required by the State Legislature. One of the first steps of the SMP update process is for the City to inventory and characterize its "Shorelines of the State," as defined by Washington's Shoreline Management Act (SMA) (Revised Code of Washington [RCW] 90.58).

This Shoreline Analysis Report presents the results of the inventory and characterization of Ilwaco's Shorelines of the State. This report was prepared in accordance with the SMP Guidelines (Guidelines) (Washington Administrative Code [WAC] 173-26) and the SMP update scope of work promulgated by Ecology. Under the Guidelines, the City must identify and assemble the most current, applicable, accurate and complete scientific and technical information available.

1.2 Shoreline Jurisdiction

As defined by the SMA, Shorelines of the State include certain waters plus their associated "shorelands." At a minimum, waters designated as Shorelines of the State are rivers and streams whose mean annual flow is 20 cubic feet per second (cfs) or greater; lakes whose area is greater than 20 acres; and marine waters. Shorelands are defined as:

> Those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of this chapter…Any county or city may determine that portion of a one-hundred-year-floodplain to be included in its master program as long as such portion includes, as a minimum, the floodway and the adjacent land extending landward two hundred feet therefrom… Any city or county may also include in its

> master program land necessary for buffers for critical areas (RCW 90.58.030).

The ordinary high water mark (OHWM) is:

> That mark that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation as that condition exists on June 1, 1971, as it may naturally change thereafter, or as it may change thereafter in accordance with permits issued by a local government or the department: Provided, that in any area where the OHWM cannot be found, the OHWM adjoining salt water shall be the line of mean higher high tide and the OHWM adjoining fresh water shall be the line of mean high water (RCW 90.58.030(2)(b)).

In Ilwaco, the Columbia River, Wallacut River, Black Lake, and Pacific Ocean qualify as Shorelines of the State. A detailed discussion of how shoreline jurisdiction was developed for the City is included in Appendix A. The geographic extent of the City's shoreline jurisdiction can be seen on any of the maps in Appendix B.

1.3 Study Area

The study area for this report includes all land within the City's proposed shoreline jurisdiction. In total, the City's proposed shoreline jurisdiction covers approximately 291 acres of uplands spread across approximately 8.2 miles of shoreline. Further, the study area includes relevant discussion of the contributing watersheds.

2 CURRENT SHORELINE REGULATORY FRAMEWORK

This chapter reviews the current regulatory framework for development activities along the City's shorelines. During the SMP update, the City will consider local, State, and federal regulations to ensure consistency as appropriate and feasible, with the goal of streamlining the shoreline permitting process.

2.1 City Regulatory Framework

Shoreline development activities are subject to the City's existing SMP, comprehensive plan, zoning regulations, critical areas regulations, and other City regulations. The existing SMP and critical areas regulations are discussed below.

2.1.1 Existing SMP

According to Ecology's records, Ecology first approved Ilwaco's SMP on May 2, 1975. Ecology records do not indicate that the City's SMP has been amended since that time.

The City's SMP-related provisions are included in Chapter 15.14 of the Ilwaco Municipal Code (IMC). Per IMC 15.14.010, the City currently adopts by reference Pacific County's SMP, as amended.

2.1.2 Critical Areas

Per Growth Management Act (GMA) requirements, the City is required to designate and protect critical areas. Critical areas, as defined by the GMA (RCW 36.70A.030(5)), include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.

The City's existing critical areas regulations are contained in Ordinance Number 614. This ordinance was approved by the City in 1998 and is currently in the process of being updated. The update of the critical areas ordinance is expected to be completed by the end of 2014.

The critical areas ordinance—the existing and eventually the updated version—will continue to apply in shoreline jurisdiction until the City adopts its updated SMP. Once the City adopts its updated SMP, only the critical areas regulations contained in the SMP will apply in shoreline jurisdiction.

The critical areas regulations contained in the updated SMP are expected to be very similar to those of the updated critical areas ordinance. Because the critical areas ordinance is being updated to include the best available science, minimal changes are expected to be needed to adapt the updated critical areas regulations for inclusion into the SMP. However, some changes will be required due to technical differences between the GMA and SMA.

2.2 State Regulatory Framework

Key components of the State regulatory framework that may be pertinent to development in the City's shorelines include the SMA, the Hydraulic Code, and Section 401 of the Clean Water Act, Water Quality Certification. Other components that may be relevant include the GMA, State Environmental Policy Act, Watershed Planning Act, Water Resources Act, and the Salmon Recovery Act.

Several State agencies (e.g. Ecology, Department of Fish and Wildlife [WDFW], Department of Natural Resources [DNR]) are involved in implementing these laws or own shoreline areas. Ecology reviews all shoreline projects that require a shoreline permit, but has specific regulatory authority over shoreline conditional use permits and shoreline variances. DNR is charged with protecting and managing the use of State-owned aquatic lands. Projects waterward of the OHWM require review by DNR to establish whether the project is on State-owned aquatic lands (DNR recommends that all proponents of a project waterward of the OHWM contact DNR to determine jurisdiction and requirements). Other agency reviews of shoreline developments are typically triggered by in- or over-water work, discharges of fill or pollutants into the water, or substantial land clearing. State laws can play an important role in the design and implementation of a shoreline project, ensuring that impacts to shoreline functions and values are avoided, minimized, and/or mitigated.

Summaries of key components of the State regulatory framework follow.

2.2.1 Shoreline Management Act

The SMA promotes planning along shorelines and coordination among governments. The legislative findings of the SMA state:

> The legislature finds that the Shorelines of the State are among the most valuable and fragile of its natural resources and that there is great concern throughout the state relating to their utilization, protection, restoration, and preservation. In addition it finds that ever increasing pressures of additional uses are being placed on the shorelines necessitating increased coordination in the management and development of the Shorelines of the State. The legislature further finds that much of the Shorelines of the State and the uplands adjacent thereto are in private ownership; that unrestricted construction on the privately owned or publicly owned Shorelines of the State is not in the best public interest; and therefore, coordinated planning is necessary in order to protect the public interest associated with the Shorelines of the State while, at the same time, recognizing and protecting private property

> rights consistent with the public interest. There is, therefore, a clear and urgent demand for a planned, rational, and concerted effort, jointly performed by federal, State, and local governments, to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines (RCW 90.58.020).

While protecting shoreline natural resources by regulating development, the SMA also aims to plan for and foster "all reasonable and appropriate uses" (RCW 90.58.020). Under the SMA, single-family residences are a preferred use of shorelines.

The SMA is implemented by locally adopted SMPs. While an SMP must comply with the Guidelines, the Guidelines offer considerable flexibility for a jurisdiction to tailor its SMP to address the specific conditions and needs of the local community.

2.2.2 Hydraulic Code

RCW 77.55, the Hydraulic Code, gives WDFW the authority to review, condition, and approve or deny "any construction activity that will use, divert, obstruct, or change the bed or flow of State waters." These activities may include stream alteration, culvert installation or replacement, among others. Through a permit called a Hydraulic Project Approval, WDFW can condition projects to avoid, minimize, restore, and compensate for adverse impacts.

2.2.3 Clean Water Act – Section 401

Section 401 of the federal Clean Water Act allows states to review, condition, and approve or deny certain federally permitted actions that result in discharges to state waters, including wetlands. In Washington, Ecology is the State agency responsible for administering Section 401. Ecology's primary aim is to ensure that State water quality standards and other aquatic resource protections standards are met. Actions within watercourses or wetlands within the shoreline zone that require a Section 404 permit (see Subsection 2.3.2 below) also need Section 401 Water Quality Certification.

2.3 Federal Regulatory Framework

Key components of the federal regulatory framework that may be pertinent to development in the City's shorelines include the Rivers and Harbors Act, Sections 402 and 404 of the Clean Water Act, and the Endangered Species Act (ESA). Other components that may be relevant include the National Environmental Policy Act,

Anadromous Fish Conservation Act, Clean Air Act, Coastal Zone Management Act, National Historic Preservation Act, Marine Mammal Protection Act, and the Migratory Bird Treaty Act.

A variety of agencies (e.g. U.S. Army Corps of Engineers [Corps], National Marine Fisheries Service [NMFS], U.S. Fish and Wildlife Service [USFWS]) are involved in implementing these laws. Review by these agencies of shoreline development in most cases is triggered by in- or over-water work, or discharges of fill or pollutants into the water. Federal regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts to shoreline functions and values are avoided, minimized, and/or mitigated.

Summaries of key components of the federal regulatory framework follow.

2.3.1 Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 provides the Corps with authority to regulate activities that may affect navigation of "navigable" waters. Designated "navigable" waters in Ilwaco include Baker Bay, 0.5 mile of the Wallacut River, and the Pacific Ocean. Proposals to construct new or modify existing over-water structures (including bridges), to excavate or fill, or to "alter or modify the course, location, condition, or capacity of" navigable waters must be reviewed and approved by the Corps.

2.3.2 Clean Water Act – Section 402 and Section 404

Major components of the Clean Water Act include Section 402 and Section 404.

Section 402 of the Clean Water Act required the establishment of the National Pollutant Discharge Elimination System (NPDES). The NPDES is similar to Section 401 (discussed above in Subsection 2.2.3), and applies to ongoing point-source discharge. Examples of discharges requiring NPDES permits include municipal stormwater discharge, construction-related stormwater discharge, wastewater treatment effluent, and discharges related to industrial activities. Permits include limits on what can be discharged, monitoring and reporting requirements, and other provisions designed to protect water quality.

Section 404 of the Clean Water Act provides the Corps, under the oversight of the U.S. Environmental Protection Agency (EPA), with the authority to regulate discharge of dredged or fill material into waters of the U.S., including wetlands. The

extent of the Corps' authority and the definition of fill have been the subject of considerable legal activity. As applicable to the City's shoreline jurisdiction, however, it generally means that the Corps must review and approve most activities in water and wetlands. These activities may include wetland fills, in-water and wetland restoration, and culvert installation or replacement, among others. The Corps requires projects to avoid, minimize, and compensate for impacts.

2.3.3 Endangered Species Act

Section 9 of the ESA prohibits "take" of listed species. Take has been defined in Section 3 as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The take prohibitions of the ESA apply to everyone, so any action that results in a take of listed fish or wildlife would be a violation of the ESA and is strictly prohibited. Per Section 7 of the ESA, activities with potential to affect federally listed or proposed species and that require federal approval, receive federal funding, or occur on federal land must be reviewed by the NMFS and/or USFWS via a process called "consultation." For example, activities requiring a Section 404 permit require such consultation if these activities occur in waters with listed species.

2.4 Regulatory Framework for Dredging

Dredging projects typically involve multiple agencies. The following discussion assumes that new permits are required for a dredging project (as opposed to performing dredging under an existing permit). Permits are required to be obtained from the Corps, Ecology, WDFW, and the City. Before applying for a permit, an applicant must obtain a Suitability Determination or other decision document from the Dredged Material Management Program that evaluates the proposed project. As part of the Corps process, ESA consultation with the USFWS and the NMFS will be conducted. If in-water disposal is proposed, a Site Use Authorization from DNR is also required.

3 ECOSYSTEM CONDITIONS

This chapter reviews broader-scale ecosystem conditions that may influence the Ilwaco's shorelines. The City's shorelines themselves are reviewed in Chapter 4.

3.1 Climate

Ilwaco is located in a temperate maritime climate. Average annual rainfall in the City is approximately 80 inches and is concentrated in the winter months.

3.2 Geology

Ilwaco is located in the Willapa Hills physiographic region (Figure 3-1), which is part of the Coast Range, bounded by the Columbia River to the south and the Olympic Mountains to the north. The following description of the geologic setting is derived from Lasmanis' "The Geology of Washington" (1991) and Wiedemann's description of coastal geology in "The Ecology of Pacific Coastal Sand Dunes" (1984).

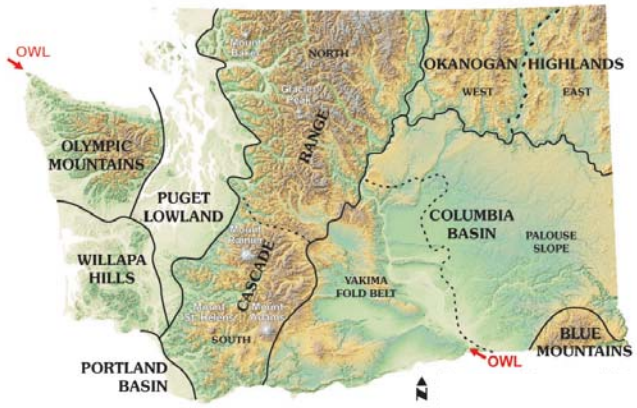

Figure 3-1. Physiographic provinces of Washington, including the Willapa Hills.

Sequences of exposed tertiary igneous and sedimentary rocks of Eocene through Miocene age are present in the Willapa Hills. During the middle and late Miocene, Columbia River basalt flowed down the Columbia River to the Pacific Ocean, Willapa Bay, and Grays Harbor. These flows formed many of the basaltic intrusions and headlands that remain today. The Willapa Hills were not subject to subduction or metamorphism. Erosional weathering of the sedimentary beds in the Willapa Hills began in the Pliocene and continued rapidly, resulting in the rounded topography and deep weathering profiles apparent today.

The Columbia River estuary was formed by the forces of glaciation, volcanism, hydrology, and erosion and accretion of sediments. The Cascade Range was formed 50 to 35 million years ago, at which time uplift of the Rocky Mountains combined with subduction of the oceanic plates of the Pacific Ocean, creating the flow path for the Columbia River. Subsequent glaciation restructured and expanded the extent of the Columbia River basin. Near the end of the last glacial period, the Missoula

Floods resulted in the deposition of silt, sand, and gravel that now form much of the landscape in the Columbia River basin. Volcanism, lava flows, and lahars occurring in the Holocene period have contributed much of the bedload of the lower Columbia River (Simenstad et al. 2011). Sea level rise since the late Pleistocene period has submerged river channels and caused deposition of coarse and fine sands (Marriott 2002), which shape today's shallow estuarine habitats.

3.3 Geography, Topography, and Drainage Patterns

Ilwaco is located in Baker Bay, near the mouth of the Columbia River at the southern end of the Long Beach Peninsula. According to maps of Water Resource Inventory Areas (WRIAs), the City falls within the Willapa WRIA (24) (Figure 3-1); however, practically, the City is located outside of the Willapa Watershed and immediately along the Columbia River estuary. The lead entity responsible for management and restoration of salmon habitat in the Columbia River estuary is the Lower Columbia Fish Recovery Board.

Figure 3-2. Map of WRIA boundaries in Pacific County.

3.3.1 Columbia River Estuary

The Columbia River is the largest river on the West Coast of the U.S., draining about 260,000 square miles and extending from British Columbia to the Pacific Ocean between Oregon and Washington. The hydrology of the Columbia River basin reflects the interaction of topography, geology, and climate. Precipitation in most of the drainage falls as snow in the Rocky Mountains and in the Cascade Range. Annual peak discharges occur in the spring (April to June), and generally result from snowmelt in the interior sub-basin. Historically, flood flows peaked at 1.2 million cfs (Simenstad et al. 2011). Today, as a result of dam regulation, the highest flows occur from April to June, with discharge at the mouth of the river ranging from 100,000 to 500,000 cfs (Marriott et al. 2002). The lower basin, where precipitation generally occurs as rain, contributes to peak winter discharges (Simenstad et al. 2011). The average annual discharge is about 52 cubic miles per year, more than twice the average annual discharge of all other rivers in Washington, Oregon, and California combined.

The Columbia River estuary in Pacific County experiences extensive mixing, depending on river flows, winds, waves, and tides. Currents through the Columbia River estuary can be heavily influenced by fluvial forcing. Velocities at the entrance to mouth of the Columbia River in the tidal channels can reach over 8.4 feet per second on the ebb, but seldom exceed 6.7 feet per second on the flood, and on average reach about 5.9 feet per second. Tidal range at the mouth is about 8 feet, and decreases moving upstream. Extreme tidal ranges reach up to about 13 feet. Extreme fluvial forcing, however, can dampen the flood tide so much that little tidal influence can be felt upstream of the mouth. During low flow periods, tidal forcing can be strong enough to reverse flow through the river up to river mile 87 (Beaver Army Terminal) (Kukulka and Jay 2003).

3.3.2 Tsunamis

Shorelines of along the Columbia River estuary and Pacific Coast are vulnerable to tsunami inundation. Tsunamis can occur from either local sources like the Cascadia Subduction Zone (CSZ) or from far-field sources such as Alaska or Chile. The recurrence interval of tsunamis is estimated at 500 to 1,000 years for a megathrust event (Jacoby et al. 1997; Satake et al. 1996). Apparently, the last known CSZ event to produce significant inundation and run-up in southwest Washington was in 1700, for which numerous proxies exist, such as inland marine deposits in Willapa Bay and records of sudden land subsidence indicative of convergent subduction zone inter-plate stress release (Satake et al. 1996). Far-field tsunamis have produced

substantial observed run-ups in Pacific County, as well. The 1964 Alaska-Aleutian earthquake and tsunami produced recorded tsunami wave heights at Seaview of 12.5 feet above tide and 4.5 feet above tide at Ilwaco (Washington 2013).

DNR has worked with the National Tsunami Hazard Mitigation Program and local officials to develop tsunami evacuation maps for Washington. In addition to the delineation of tsunami evacuation limits for the State, the U.S. Geological Survey (USGS) and the Washington Military Department Emergency Management Division recently assessed variation in exposure of 24 communities along Washington's outer coast to tsunami hazard. The report finds that 43 percent of Ilwaco's developed land is in the inundation zone. This area includes the majority of businesses and 40 percent of its residents.

3.4 Key Species and Habitats

Ilwaco includes estuarine, marine, and freshwater shorelines and their associated shorelands. Most species within the City are predominantly associated with one of these habitats, although several species (including salmonids) bridge multiple habitats.

3.4.1 Estuarine and Marine Habitats

An estuary is a semi-enclosed coastal body of water that extends to the effective limit of tidal influence, within which sea water entering from one or more free connections with the open sea, or any other saline coastal body of water, is significantly diluted with fresh water derived from land drainage, and can sustain euryhaline biological species from either part or the whole of their life cycle (Perillo 1995).

Key estuarine and nearshore marine habitats in Ilwaco include mud flats, seabird/waterfowl concentration areas, intertidal wetlands/marshes, and nearshore riparian habitats. Cobble to fine sand beaches and tidal sand and mudflats are important habitats for primary production, nutrient cycling, fish habitat, detrital sinks, prey production, wave attenuation, and shellfish production. Salt marshes, beaches, and mudflats are used as roosting and foraging grounds by shorebirds. Tidal wetlands that are fed by freshwater seeps or streams provide localized freshwater input and support species that include native shellfish and shorebirds (Schlenger et al. 2011).

Shallow water estuarine ecosystems, such as the tidal marshes of Baker Bay and the wetland complex on the southern side of the Wallacut River, are particularly important habitats for the rearing of small, subyearling ocean-type Chinook salmon during estuarine residency (Levings et al. 1991; Levings et al. 1995; Bottom et al. 2005). Shallow water estuarine habitats may provide spatial separation from aquatic predators that reside in deeper waters, improved protection from predators through higher turbidity levels (Gregory and Levings 1998), as well improved foraging capacity (Levings et al. 1991).

Tidal marshes are among the most susceptible ecosystems to accelerated sea-level rise associated with climate change (USFWS 2010). Rising water may result in tidal marsh submergence and habitat transition as salt marshes replace freshwater wetlands. Changes in tidal marsh area and habitat type due to sea-level rise were modeled for the nearby Willapa National Wildlife Refuge under five scenarios ranging from 0.39 to 2 meters of sea-level rise by the year 2100 (USFWS 2010). Results of the model indicate that swamps and tidal swamps are particularly vulnerable, losing as much as 95 percent of their extent. Inland fresh marsh habitats showed consistent losses under all scenarios, and tidal flats were reduced by approximately one-third above the 0.39-meter scenario (USFWS 2010).

Intact nearshore riparian habitats provide a variety of essential ecological functions, including water quality protection, sediment control, wildlife habitat, nutrient control, insect food sources for juvenile fish, shaded cover, and woody debris to help build complex habitat and stabilize beach substrate (Brennan and Culverwell 2005). Riparian vegetation also helps stabilize slopes and protect against landslides and other erosion hazards.

3.4.2 Freshwater Habitats

Key habitats associated with freshwater shorelines, such as Black Lake, include wetlands, riparian habitats, and upland forests.

Wetlands provide habitat for fish and wildlife, moderation of flood impacts, and filtration and assimilation of nutrients and contaminants (Mitsch and Gosselink 2000). The relative value of wetland functions varies based on landscape position; location relative to streams, rivers, and lakes; and surrounding development.

Interdunal wetlands are a common feature near coastal areas in Pacific County, including Ilwaco. They frequently occur behind stabilized foredunes, either in small depressions or as larger deflation plains. Wiedemann (1984) listed 168 species of

birds, 31 species of mammals, 10 species of amphibians, and 3 species of reptiles occurring in association with the Pacific Northwest coastal dune ecosystem. In addition to supporting a wide diversity of wildlife, interdunal wetlands are frequently associated with many rare and endangered plant species and their associated fauna (Crawford 2011).

Riparian areas provide a broad range of critical functions for water quality and habitat. Water quality functions include filtration of nutrients, bacteria, sediment, and other contaminants (Naiman and Decamps 1997; Mayer et al. 2007). Functions important to fish and wildlife habitats include microclimate regulation, invertebrate and detrital food sources for juvenile fish, shaded cover, and woody debris recruitment (Naiman and Decamps 1997).

Upland forests provide foraging and breeding habitats, as well as migratory corridors for a variety of mammals and birds.

3.4.3 Priority Habitats and Species

Table 3-1 includes a list of priority habitats and species (PHS) identified by WDFW (2013) as occurring in Ilwaco.

Table 3-1. Priority habitats and species within the shoreline areas of Ilwaco.

Category	Species/Habitats	State Status	Federal Status
Fish	Bull Trout	Candidate	Threatened
	Chinook Salmon	Candidate	Threatened
	Chum Salmon	Candidate	Threatened
	Coastal Res./ Searun Cutthroat	--	Species of Concern
	Coho Salmon	--	Threatened – Lower Columbia
	Eulochan	Candidate	Threatened
	Green Sturgeon	--	Threatened
	Pink Salmon	--	--
	Sockeye Salmon	Candidate	Endangered – Snake River
	Steelhead Trout	Candidate	Threatened
Mammals	Roosevelt Elk	--	--
Birds	Shorebird Concentrations	--	--
	Waterfowl Concentrations	--	--
	Bald Eagle	Sensitive	Species of Concern
	Marbled Murrelet	Threatened	Threatened

Category	Species/Habitats	State Status	Federal Status
Wetlands	Marine Intertidal	--	--
	Estuarine Intertidal	--	--
	Palustrine	--	--

3.4.4 Non-Native, Invasive Species

Non-native, invasive vegetation often forms dense monocultures that preclude native vegetation and alter the ecosystem. Potential effects of invasive plant species in riparian and instream habitats include increased instream water temperatures, lowered dissolved oxygen, changes in pH, reduced bank stability, altered flow conditions and increased localized flooding.

Brazilian elodea (*Egeria densa*) is a submersed, freshwater plant that forms dense monospecific stands that can outcompete native aquatic plants and impact swimming, fishing, and boating opportunities. Since the mid-1990s, the aquatic plant community of Black Lake has become dominated by elodea (Mueller and Downen 2000). The City has explored using grass carp to control the errant vegetation and now receives support from Ecology's Aquatic Weeds Management Fund to help pay for herbicide, dredging, and other eradication methods.

New Zealand mudsnails were first discovered in the lower Columbia River in 1996, and today they can be found throughout the Columbia River estuary (including peripheral bays, lakes and tributaries) (USFWS, electronic reference). Experimental results indicate that large populations of New Zealand mudsnails could potentially limit the availability of other, more nutritious food sources for native rainbow trout (Vinson and Baker 2008).

Marine debris associated with the 2011 Japanese tsunami has recently washed ashore in Pacific County. This debris brings with it the potential to transport new non-native, invasive marine species. WDFW is the lead State agency for responding to reports of marine debris with respect to potential invasive species.

3.5 Land Use and Demographics

The first non-native settlers arrived in what would become Ilwaco in the late 1840s. First platted in 1876, Ilwaco became a port for Columbia River salmon fishermen and a transportation hub for Pacific County. Ilwaco formally incorporated in 1890.

Land to the west and Sand Island protected Baker Bay from ocean conditions, but siltation proved to be a problem for ships approaching Ilwaco's docks. In 1928 voters approved the formation of the Port of Ilwaco (Port) as a means to improve access to the harbor and to provide a public dock on Baker Bay. The Port prepared, and voters approved, a comprehensive plan calling for seawalls, jetties, piers, quays, slips, gridirons, railroad track spurs, water and electrical services, fire protection, and streets (History Link, electronic reference).

Fishing and seafood processing have served as primary industries in Ilwaco over the years, and commercial agriculture operations including cranberry, strawberry, and peat harvesting have also been established. Since the 1970s, salmon populations have remained low due to a variety of factors, including overharvest, upstream habitat loss, and climatic disruptions such as El Niño. In the 1980s, Port commissioners realized Ilwaco's future prosperity would not be based solely on fishing. The Port began to develop its onshore properties to encourage tourism. Over the next 30 years the Port transformed its onshore lands from a primarily industrial waterfront to a working fishing port that is also integrated with the local community (History Link, electronic reference).

3.5.1 Demographics

According to the State Office of Financial Management's most recent estimate, in April 2014 Ilwaco had a population of 948. Decennial census population figures for Ilwaco since its incorporation in 1890 are shown in Table 3-2. Reviewing the most recent two decades, during the 1990s the City added on average added approximately 11 persons per year. However, the City's population declined slightly in the following decade.

Table 3-2. City of Ilwaco population by year.

Year	Population
2010	936
2000	950
1990	838
1980	604
1970	506
1960	518
1950	628
1940	656
1930	750
1920	787
1910	664
1900	584

3.5.2 Building Permit Activity

Consistent with its comparatively small size, development activity in Ilwaco is relatively limited. Table 3-3 identifies the number of building permit applications in the City for the most recent five years for which complete data were available. These data include all types of building permits (e.g. from the installation of wood stoves to the construction of new houses). Thus, the data provide a general indicator of the level of recent development activity in Ilwaco. The data suggest that the recent recession (that officially began in December 2007 and ended in June 2009) had a substantial dampening effect on development activity in the City. Development activity appears not to have yet returned to pre-recession levels.

Table 3-3. Building permit applications by year.

Year	Building Permit Applications
2013	18
2008	7
2007	34
2006	41
2005	40

3.5.3 Dredging

Regular maintenance dredging in Baker Bay is required to maintain a navigation channel to the Port of Chinook Marina, the Coast Guard training facility, the Port of Ilwaco, and the public boatyard at Cape Disappointment. The Corps maintains a 17-foot-deep federal navigation channel from the main channel in the Columbia River through Baker Bay and to the Port of Ilwaco. The Port conducts regular maintenance dredging work at the marina and approaches. Dredged material from the marina that is too contaminated for in-water release has been placed at an upland disposal site; however, the capacity of this upland disposal site has been exhausted. Therefore, alternatives under consideration include extension of the existing site and/or developing a new flow lane placement site to accommodate maintenance dredging needs and to return accumulated sediment into the natural littoral drift system.

Dredging operations have the potential to adversely affect recruitment of marine species that support commercially and recreationally significant fisheries, notably Dungeness crab. Because of potential conflicts between dredging and fisheries, in 2002 the governors of Oregon and Washington convened the Lower Columbia Solutions Group. The group is comprised of key government, fishing industry, and environmental stakeholders, and charged with cooperatively planning dredging projects to achieve economic and environmental objectives. In 2011, the group signed a Regional Sediment Management Plan for the Mouth of the Columbia River. The plan includes implementation of dredging projects along with funding for research and monitoring from the Corps, the EPA, WDFW, the Columbia River Crab Fisherman's Association, the Oregon Dungeness Crab Commodities Commission, and the Oregon Department of Fish and Wildlife.

4 SHORELINE INVENTORY & ANALYSIS

This chapter discusses the inventory and analysis of Ilwaco's shorelines, and consists of three sections. Section 4.1, Shoreline Inventory and Analysis Methodology, goes over how the inventory and analysis was conducted. Section 4.2, Shoreline Inventory and Analysis Overview, provides a summary of shoreline conditions, which are reviewed in greater detail in Section 4.3, Shoreline Inventory and Analysis Results by Reach.

4.1 Shoreline Inventory & Analysis Methodology

4.1.1 Inventory Data

The shoreline inventory is intended to document the existing conditions in the City's shorelines. At a minimum, local jurisdictions must gather the inventory elements listed in the Guidelines (at WAC 173-26-201(3)(c)), to the extent that information is relevant and readily available.

Information collected for Ilwaco's shoreline inventory principally included watershed and other basin documents, regional studies, scientific literature, aerial photographs, and geographic information systems (GIS) data from a variety of providers.

Table 4-1 lists relevant inventory elements for which spatial data were available. The table also describes the spatial information gathered for each of the required inventory elements, and identifies data limitations and assumptions. Maps provided in the Inventory Mapfolio (Appendix B) depict the various inventory elements listed in the table. Some of the inventory data is summarized in the reach summary data tables in Section 4.3.

Table 4-1. Shoreline inventory elements.

Inventory Element	Information Gathered, Inventory Map	Data Source	Limitations/Assumptions/Notes
Floodplains	100-year Floodplain (Maps 1,14)	Federal Emergency Management Agency, 2013	• Digital Flood Insurance Rate Map data are preliminary. • Floodplain based on models, and may contain some inaccuracies.

Inventory Element	Information Gathered, Inventory Map	Data Source	Limitations/Assumptions/Notes
Wetlands	Potentially Associated Wetland (all maps)	National Wetland Inventory (NWI) (edited by The Watershed Company), 2011	• Many wetlands are not identified by NWI mapping; mapped wetlands may not meet wetland criteria. • Wetland data have not been field verified.
	Other Wetland (Map 14)	NWI (edited by The Watershed Company), 2011	• See above.
	Salt Marsh (Map 14)	The Nature Conservancy, 2005	
Land Use Patterns	Current Land Use (Map 4)	Pacific County, 2013	• Based on Pacific County parcel data. Current land use for tax-exempt properties based on land ownership.
	Land Parcel Ownership (Map 5)	Pacific County, 2013	• Based on Pacific County parcel data.
	Aquatic Land Parcels (Map 5)	DNR, 2014	
	Existing Environmental Designations (Map 3)	University of Washington Olympic Natural Resources Center, 2013	• Not official City dataset.
	Zoning (Map 2)	City of Ilwaco, 2013	
Land Cover	Land Cover (Map 11)	National Oceanic and Atmospheric Administration, 2011	• Based on interpretation of multispectral imagery at 30 by 30 meter cell resolution. • Useful for broad-scale assessment of vegetation coverage and extent of existing development. • Not useful for accurate characterization of fine scale data (e.g. parcel level). • May overestimate or underestimate impervious surface coverage. • Data may not be up-to-date, released every five to ten years.
	Percent Impervious (Map 9)	National Land Cover Database, 2006	• See above.

Inventory Element	Information Gathered, Inventory Map	Data Source	Limitations/Assumptions/Notes
Recreation	Boat Launch (Map 6)	Washington State Recreation and Conservation Office, 2009	• Does not include Black Lake boat launch.
	City Park (Map 6)	The Watershed Company, 2014	• Based on the City of Ilwaco Parks, Trails & Natural Areas Plan (2014).
	Trail (Map 6)	Pacific County, 2013	• Includes Discovery Trail and Black Lake Trail.
	Washington State Park (Map 6)	Washington State Parks, 2014	
	Shellfish Recreational Beach (Map 6)	Ecology, 2011	
	Shoreline Public Access (Map 6)	Ecology, 2011	• May not capture informal public access locations in the City.
Geology	Soil Title (Map 10)	DNR	• Based on broad-scale soil mapping. • Not to be used in place of site-specific studies.
Habitats and Species	Priority Habitats and Species Regions (Map 15)	WDFW, 2013	• WDFW maps do not capture every priority species location or habitat, particularly for rare species or species that use shoreline habitats seasonally or intermittently. • Absence of mapping information does not indicate absence of a particular species. • The number of documented species may reflect the relative amount of past survey efforts.
	Salmon Stock Inventory (Map 15)	WDFW, 2013	• See above.
	Marbled Murrelet Presence (Map 15)	WDFW, 2013	• See above.
	Bald Eagle 1/8 Mile Nest Buffer (Map 15)	WDFW, 2013	• See above.
	Shellfish Resources (Map 15)	WDFW, 2013	• See above.
Surface Water System	Hydrology (Water Type) (Map 8)	DNR, 2006 (edited by Pacific County in 2014)	• Small, intermittent or ephemeral streams may not be identified.
Water Resources	Individual Water Well (Map 12)	Pacific County	
	Pacific Northwest Basin-fill Aquifers (Map 12)	USGS, 1998	

Inventory Element	Information Gathered, Inventory Map	Data Source	Limitations/Assumptions/Notes
Geologically Hazardous Areas	Faults (Map 13)	DNR	• Requires site-specific review to verify presence/absence of geologic hazards.
	Slope Stability (Map 13)	DNR	• See above.
	Tsunami Inundation (Map 13)	DNR, 2010	• See above.
Sewer and Septic	Ecology Permitted Sewage Site (Map 7)	Ecology	
	NPDES Permitted Location (Map 7)	Ecology	
	Ilwaco Sewer Line (Map 7)	Pacific County	
	Wastewater Facilities (Map 7)	Pacific County	
Shoreline Processes	Net Shore Drift (Map 18)	Ecology	
Ecology Permitted Sites	Ecology-permitted Sites (Map 17)	Ecology	• Dataset shows the locations of Ecology's regulated facilities and provides basic information about their operation and/or business characteristics.
Water Quality	Water Quality 305b List (Map 16)	Pacific County	• Category 4 represents segments impaired by causes that cannot be addressed through a total maximum daily load (TMDL). Category 5 represents polluted waters that require a TMDL. Category 5 represents the 303(d) list, the traditional list of impaired water bodies.
Shoreline Modifications	Fill (Map 16)	USGS, 2010	
	Jetty/Groin (Map 16)	USGS, 2010	
	Levee (Map 16)	Lower Columbia Estuary Partnership, 2006, 2012	
	Piling (Map 16)	Lower Columbia Estuary Partnership, 2006, 2012	
	Overwater Structure (Map 16)	DNR, 2007	• Includes boat ramps, buildlings, docks, marinas, piers/landings, railings. • Does not capture all overwater structures within the City.

4.1.2 Inventory Data Gaps

Table 4-2 identifies notable data gaps in the shoreline inventory. While the data identified in the table would be beneficial, a substantial quantity of information about Ilwaco's shorelines was available to aid in the development of this report.

Table 4-2. Inventory data gaps.

Data Gap	Comment
Channel migration zone (CMZ)	CMZ data was not available. The 100-year floodplain may be used as a proxy for the CMZ except where areas are separated from the channel by a legally existing artificial structure.
Shoreline stabilization	Citywide data were not available for shoreline stabilization, such as riprap. To address this data gap, a visual assessment of shoreline stabilization using aerial photography was incorporated into the analysis of ecological functions. However, visual assessment may underestimate the extent of armoring.

4.1.3 Reach Delineation

For purposes of the shoreline inventory and analysis, the City's Shorelines of the State were broken down into 12 segments or "reaches." These reaches are shown below in Figure 4-1. In determining reach break locations, existing and planned land use figured prominently, in recognition that the intensity and type of land use affect shoreline ecological conditions.

In order to evaluate marine vegetation that occurs below the OHWM, reach boundaries were extended waterward using the GIS Euclidean Allocation tool. This tool divided the area waterward of the OHWM into zones based on proximity to the shoreline reach.

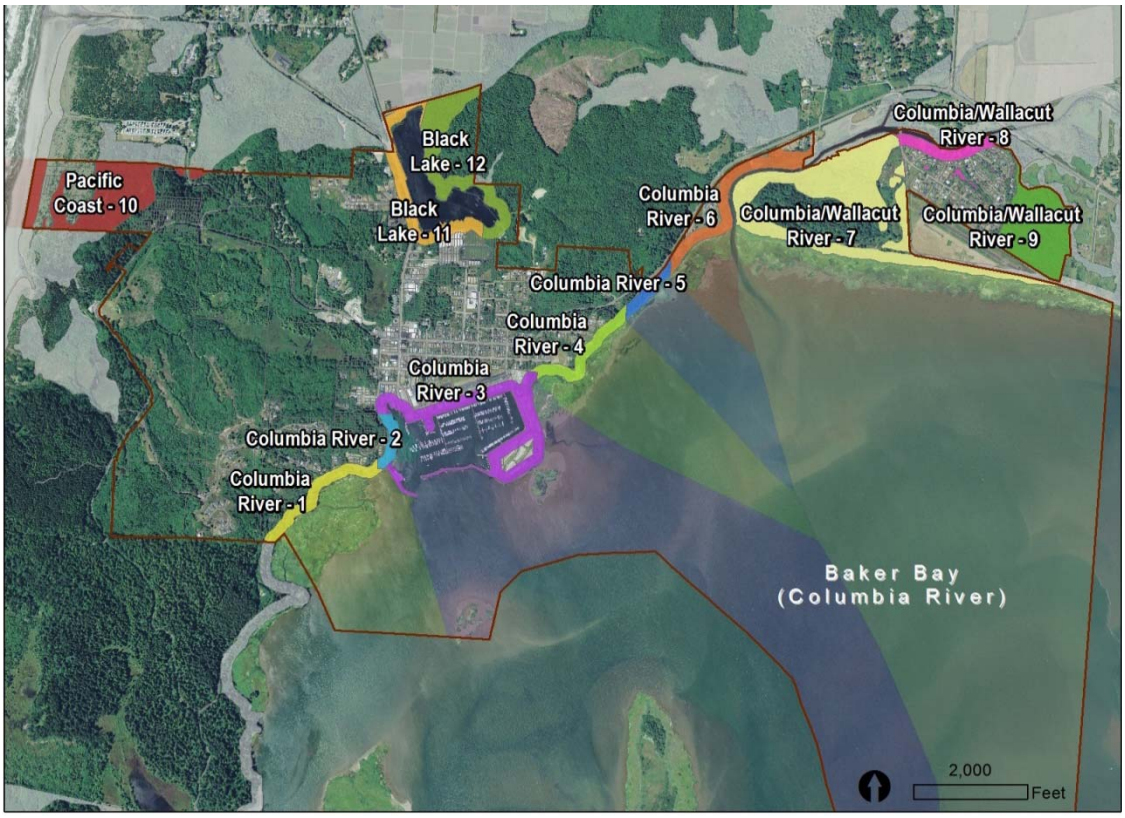

Figure 4-1. Shoreline reaches.

4.1.4 Analysis of Ecological Functions

Building upon the ecosystem conditions information presented in Chapter 3, Section 4.2, Shoreline Inventory and Analysis Overview, provides a summary of shoreline conditions including ecological functions, while ecological functions are reviewed in greater detail in Section 4.3, Shoreline Inventory and Analysis Results by Reach. The analysis of ecological functions in Section 4.3 was structured according to the four major function categories identified in the Guidelines: hydrologic, hyporheic, shoreline vegetation, and habitat. These four primary functional categories were further broken down into relevant functions identified in WAC 173-26-201(3)(d)(i). Table 4-3 outlines the ecological functions that apply to the City's proposed shoreline jurisdiction.

Table 4-3. Framework for analysis of shoreline ecological functions.

Hydrologic Functions	Transport and/or storage of water and sediment[1]
	Energy attenuation[2]
	Development of complex habitats
	Recruitment and transport of large woody debris (LWD) and organic material
	Removal through wetland filtration of excess nutrients and toxic compounds

Vegetative Functions	Temperature regulation
	Provision of LWD and other organic matter[3]
	Filtering excess nutrients, fine sediment, and toxic substances
	Energy attenuation
	Bank stabilization
Habitat Functions	Physical space and conditions supporting fish and wildlife
	Food production and delivery
Hyporheic Functions	Removal of excess nutrients and toxic compounds
	Water and sediment storage
	Support of vegetation

[1] In Ilwaco, water and sediment transport processes are primarily affected by river flows and tides. Sediment accretion and localized erosion are key processes responsible for the formation of complex tidal marshes. Off-channel areas and large wetland complexes help moderate peak flow velocities.
[2] Vegetated uplands help to desynchronize flooding impacts downstream. Broad, vegetated floodplain wetlands and tidal marshes help slow and disperse flood flows. Vegetative root structure stabilizes shoreline soils and limits excessive erosion.
[3] Salt marsh productivity is among the highest reported for an ecosystem. Riparian forested vegetation provides a source of LWD recruitment, and provides organic matter in the form of leaves, branches, and terrestrial insects.

4.1.5 Analysis of Land Use

Building upon the more general land use information presented in Section 3.5, Land Use and Demographics, Section 4.2, Shoreline Inventory and Analysis Overview, provides a summary of shoreline conditions including land use, while shoreline land use is reviewed in greater detail in Section 4.3, Shoreline Inventory and Analysis Results by Reach.

A requirement of the Guidelines is an analysis of shoreline use (WAC 173-26-201(3)(d)(ii)). A major reason for this is to ensure uses consistent with WAC 173-26-201(2)(d), which states that local governments, when determining allowable uses and resolving use conflicts within shoreline jurisdiction, must apply, in order, the following preferences and priorities:

1. Reserve appropriate areas for protecting and restoring ecological functions to control pollution and prevent damage to the natural environment and public health. In reserving areas, local governments should consider areas that are ecologically intact from the uplands through the aquatic zone of the area, aquatic areas that adjoin permanently protected uplands, and tidelands in public ownership. Local governments should ensure that these areas are reserved consistent with constitutional limits.

2. Reserve shoreline areas for water-dependent and associated water-related uses. Harbor areas, established pursuant to Article XV of the state

Constitution, and other areas that have reasonable commercial navigational accessibility and necessary support facilities, such as transportation and utilities, should be reserved for water-dependent and water-related uses that are associated with commercial navigation unless the local governments can demonstrate that adequate shoreline is reserved for future water-dependent and water-related uses and unless protection of the existing natural resource values of such areas preclude such uses. Local governments may prepare master program provisions to allow mixed-use developments that include and support water-dependent uses and address specific conditions that affect water-dependent uses.

3. Reserve shoreline areas for other water-related and water-enjoyment uses that are compatible with ecological protection and restoration objectives.

4. Locate single-family residential uses where they are appropriate and can be developed without significant impact to ecological functions or displacement of water-dependent uses.

5. Limit nonwater-oriented uses to those locations where the above described uses are inappropriate or where nonwater-oriented uses demonstrably contribute to the objectives of the SMA.

In preparing the analysis of land use, a variety of factors were reviewed and considered, including the following:

- Existing land use
- Future land use
- Land ownership
- Water-oriented uses
- Public access locations
- Historical or archaeological sites
- Use conflicts

Data from the Pacific County Assessor (Assessor) figured prominently in the analysis of land use, particularly in identifying existing land use and ownership. For existing land use, the Assessor designates a land use code, as established in WAC 458-53-030, for each parcel in the County. These two-digit codes were aggregated into the following broad categories for purposes of the land use analysis:

- Agriculture
- Commercial
- Fishing
- Forestry

- Manufacturing/Industrial
- Residential
- Recreation
- Utilities
- Vacant/Undeveloped
- Others
- Not Coded

Use of the Assessor's data requires a certain level of interpretation when using it for describing and analyzing land use. Because the primary purpose of Assessors' data is to assess property taxes, the Assessor does not collect data on publicly owned and non-profit uses that are tax exempt. These uses and lands are coded as "exempt." For this analysis, ownership data was used to help identify the land use. Therefore, the following land use categories, in addition to those listed above, were used to differentiate exempt lands:

- Government/Institutional refers to lands that are owned by Port of Ilwaco, Columbia Land Trust, City, County, or State; and

- Quasi-Public refers to lands that were identified as churches, cemeteries, or fraternities.

4.2 Shoreline Inventory and Analysis Overview

Ilwaco's shoreline jurisdiction includes shorelines along the Columbia River, the Wallacut River, Pacific Coast, and Black Lake. In total, the City's shoreline jurisdiction covers nearly 8.2 miles of shoreline and encompasses approximately 290 acres of uplands. Much of the shoreline is undeveloped or has limited development, with well-vegetated riparian and wetland habitats, as well as productive salt marsh areas within Baker Bay. In total, jurisdiction includes 173.5 acres of wetlands and 134 acres of associated salt marsh. The area supports concentrations of shorebirds and waterfowl, bald eagles and marbled murrelets, as well as numerous anadromous and resident fish species (see Table 3-1).

Major land uses in the City's shoreline jurisdiction include government/institutional (34%), vacant/undeveloped (23%), residential (14%), and recreation (4%). Agriculture, fishing, commercial, and forestry uses each represent less than one percent of shoreline jurisdiction. The City features multiple shoreline public access opportunities, in addition to those afforded by the adjacent 1,882-acre Cape Disappointment State Park. The Port of Ilwaco features a variety of water-

dependent and water-related uses. No potential for land use conflicts was identified in the analysis.

4.3 Shoreline Inventory and Analysis by Reach

Subsections 4.3.1 through 4.3.12 present an inventory and analysis of Ilwaco's shorelines by reach.

4.3.1 Columbia River Reach 1

Table 4-4 provides summary data for Reach 1.

Columbia River Reach 1 shorelands are well vegetated with minimal development. Deciduous and evergreen riparian forest and tidal wetlands provide productive shoreline habitats for waterfowl, salmonids, and other wildlife species. Highway 100 (Robert Gray Drive) parallels the shoreline for most of the reach, but is at an elevation that does not impede tidal inundation. Table 4-5 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 1 is residential (18.3%). This residential use includes a guest retreat house. The data suggest a relatively similar level of government/institutional use (18.9%); however, the data are based on land ownership, and in a review of aerial imagery the government/institutional parcels appeared undeveloped. The data also classify another 14.6 percent of the reach as vacant/undeveloped. No formal public access sites were identified in this reach; however, guests at the retreat house can access the property's shoreline.

The entire reach is zoned residential (including Single Family Residential [R-1] and Resort Residential [R-3]). However, any future development waterward of Highway 100 would be expected to be minimal. As indicated above, many of the parcels landward of Highway 100 are publicly owned. Additionally, lots in R-1 and R-3 zones typically have a minimum lot size of 6,000 square feet, which many of the existing lots do not meet. Finally, steep slopes in this area present difficulties for development.

Table 4-4. Columbia River Reach 1 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 12.2 AC • Length 2,596 LF *Critical Areas* • Floodplain 1.2 AC / 9.5% • Freshwater Wetlands 0.5 AC / 3.9% • Salt Marsh 41.5 AC *Modifications* • Roads 2,563 LF	*Current Land Use* • Government/Institutional 2.3 AC / 18.9% • Residential 2.2 AC / 18.3% • Vacant/Undeveloped 1.8 AC / 14.6% • Not Classified 5.9 AC / 48.1% *Zoning* • Resort Residential (R-3) 3.1 AC / 25.6% • Single Family Residential (R-1) 2.9 AC / 23.5% • Not Zoned 6.2 AC / 50.9% *Current Shoreline Designation* • Rural	*Development* • Medium-intensity developed 0.2 AC / 1.3% • Low-intensity developed 0.8 AC / 6.3% • Developed open space 0.1 AC / <1% *Vegetation* • Scrub/Shrub 3.6 AC / 29.8% • Deciduous Forest 3.3 AC / 27.0% • Unconsolidated Shore 1.7 AC / 13.7% • Grassland 1.6 AC / 12.9% • Estuarine Emergent Wetland 0.3 AC / 2.7% • Evergreen Forest 0.3 AC / 2.1% • Mixed Forest 0.2 AC / 1.7% • Palustrine Forested Wetland 0.2 AC / 1.7% • Palustrine Scrub/Shrub Wetland 0.1 AC / <1%

Table 4-5. Columbia River Reach 1 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	Dendritic tidal channels are present throughout the intertidal marsh. Highway 100 roughly parallels the shoreline, affecting upland connectivity, but does not limit floodplain or tidal influence. Although not picked up in the inventory data, one overwater structure is visible in aerial imagery. No armoring appears to be present.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Outside of roads, this reach is well vegetated with mixed evergreen and deciduous riparian forest and scrub/shrub habitat. An extensive tidal wetland, comprising over 40 acres of emergent vegetation, is located waterward of the OHWM.
	Filtration of upland inputs	
	Bank stabilization	

Process	Function	Notes
Habitat	Space and conditions supporting fish and wildlife, including PHS species	Riparian forested vegetation and tidal wetlands provide diverse habitat opportunities for waterfowl, salmonids, and other wildlife species.
	Food production and delivery	
Hyporheic	Water and sediment storage	Tidal wetlands provide water storage and vegetative support.
	Support of vegetation	

Figure 4-2. Baker Bay salt marsh and tidal channels west of the Port of Ilwaco. (Source: Washington State Department of Ecology)

4.3.2 Columbia River Reach 2

Table 4-6 provides summary data for Reach 2.

Columbia River Reach 2 is located along the western edge of the Port of Ilwaco. It is primarily a rocky shoreline with mixed forest and scrub-shrub vegetation. While the reach does not contain any overwater structures, proximity to the marina and activities associated with the Port, such as maintenance dredging, likely limit the habitat value of this reach. Highway 100 runs parallel to the shoreline. Table 4-7 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 2 is vacant/undeveloped (25.4%). Vacant/undeveloped land is owned by the Keystone

Packing Company and other private owners. Property of Ilwaco Landing, a seafood offloading and handling company, is also partially located within this reach. The data indicate that another 14.6 percent of the reach area is government/institutional, based on Port ownership. With the exception of the western portion of the reach, most of the reach waterward of Highway 100 is undeveloped.

Under current zoning, the area of this reach waterward of Highway 100 is predominantly zoned Light Industrial. Future development in this area would face challenges including steep slopes and floodplains. Areas landward of Highway 100 are zoned residential.

Table 4-6. Columbia River Reach 2 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 5.0 AC • Length 878 LF *Critical Areas* • Floodplains 0.8 AC / 15.5% • Wetlands 0.0 AC / <1% *Modifications* • Roads 914 LF • Fill 0.9 AC	*Current Land Use* • Vacant/Undeveloped 1.3 AC / 25.4% • Government/Institutional 0.7 AC / 14.6% • Fishing 0.4 AC / 7.5% • Residential 0.2 AC / 3.5% • Not Classified 2.4 AC / 49.0% *Zoning* • Light Industrial (M-1) 2.4 AC / 48.3% • Single Family Residential (R-1) 0.4 AC / 8.9% • Not Zoned 2.1 AC / 42.7% *Current Shoreline Designation* • Urban	*Development* • Low-intensity developed 1.0 AC / 20.6% • Developed open space 0.1 AC / 2.2% *Vegetation* • Unconsolidated Shore 2.2 AC / 44.7% • Scrub/Shrub 1.0 AC / 20.6% • Deciduous Forest 0.2 AC / 4.5% • Evergreen Forest 0.2 AC / 4.4% • Grassland 0.2 AC / 3.1 %

Table 4-7. Columbia River Reach 2 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	The jetties at the entrance to the marina, while located outside the boundaries of this reach, inhibit tidal exchange and create poorly flushed areas associated with the reach. Dredging in the marina increases water depth and reduces current velocity, adding to a lower flushing rate.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Riparian forested and scrub/shrub vegetation occurs within a roughly 100- to 150-foot wide area between Highway 100 and the shoreline.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	Proximity to the marina, runoff from impervious surfaces, and the lack of upland connectivity likely limits the habitat value of this reach. Dredging activities in the marina negatively affect benthic macroinvertebrate production through direct reduction in numbers and habitat disturbance.
	Food production and delivery	
Hyporheic	Water and sediment storage	The lack of intertidal wetlands in this reach suggests minimal hyporheic function.
	Support of vegetation	

Figure 4-3. Western edge of the Port of Ilwaco.
(Source: Washington State Department of Ecology)

4.3.3 Columbia River Reach 3

Table 4-8 provides summary data for Reach 3.

Columbia River Reach 3 encompasses active industrial and commercial land uses associated with the Port of Ilwaco. Multiple shoreline modifications and water quality issues limit habitat value within the marina. The area has 14.6 acres of overwater structures. Two jetties at the entrance to the marina that inhibit tidal exchange and create poorly flushed areas. Dredging in the marina increases water depth and reduces current velocity, adding to a lower flushing rate. Water quality in the harbor is classified as Category 5 under Ecology's 305(b) listing, requiring a TMDL to address bacteria pollution in the water body. Table 4-9 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 3 is government/institutional (83%), associated primarily with the Port of Ilwaco. Several water-dependent uses and public access facilities are located in this reach. The 800-slip marina is used by both recreational boaters and commercial fishermen, and includes a boatyard, two fuel docks, a boat launch, and two small boat hoists. A stretch of the Discovery Trail is also located in this reach.

Under current zoning, the reach is divided between Low-Density Commercial and Light Industrial.

Table 4-8. Columbia River Reach 3 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 34.9 AC • Length 12,019 LF *Critical Areas* • Floodplain 6.6 AC / 18.9% • Wetlands 2.1 AC / 6.2% • Salt Marsh 10.2 AC *Modifications* • Roads 4,682 LF • Fill 27.8 AC • Jetty 1.9 AC • Overwater Structures 14.6 AC	*Current Land Use* • Government/Institutional 28.9 AC / 83.0% • Fishing 0.5 AC / 1.5% • Residential 0.0 AC / <1% • Not Classified 5.3 AC / 15.3% *Zoning* • Low-Density Commercial (C-2) 19.0 AC / 54.4% • Light Industrial (M-1) 7.9 AC / 22.6% • Not Zoned 8.0 AC / 23.0% *Current Shoreline Designation* • Urban • Conservancy	*Development* • High-Intensity Developed 8.5 AC / 24.4% • Medium-intensity developed 5.0 AC / 14.4% • Low-intensity developed 1.3 AC / 3.9% *Vegetation* • Unconsolidated Shore 9.8 AC / 28.1% • Grassland 6.2 AC / 17.9% • Estuarine Emergent Wetland 2.0 AC / 5.7% • Bare Land 0.9 AC / 2.7% • Scrub/Shrub 0.8 AC / 2.2% • Palustrine Forested Wetland 0.2 AC / <1%

Table 4-9. Columbia River Reach 3 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	This reach covers the Port of Ilwaco, an active commercial and recreational marina protected by two armored jetties. The majority of the shoreline is composed of nearshore fill and the marina includes 14.6 acres of overwater structures. The jetties at the entrance to the marina inhibit tidal exchange and create poorly flushed areas. Dredging in the marina increases water depth and reduces current velocity, adding to a lower flushing rate. A wetland marsh is located east of the OHWM, outside of the marina.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	While a thin strip of herbaceous vegetation exists within the reach, there is no forested vegetation and nearly one-quarter of the area is classified as high-intensity development. The tidal marsh on the eastern edge of the reach may provide functional benefits, such as filtering excess nutrients, fine sediment, and toxic substances, and attenuating energy.
	Filtration of upland inputs	
	Bank stabilization	

Process	Function	Notes
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The overwater structures, combined with a hardened shoreline, runoff from impervious surfaces, channel dredging, and water quality issues, limit the habitat value of the reach for fish. Upland habitat has been replaced by industrial and commercial uses.
	Food production and delivery	
Hyporheic	Water and sediment storage	Armoring and nearshore fill in this reach limits potential hyporheic functions.
	Support of vegetation	

Figure 4-4. Port of Ilwaco area.
(Source: Washington State Department of Ecology)

4.3.4 Columbia River Reach 4

Table 4-10 provides summary data for Reach 4.

Columbia River Reach 4 is located northeast of the Port of Ilwaco and includes primarily residential properties and undeveloped land. Over 20 percent of the reach is wetland, and a tidal marsh extends over 20 acres waterward of the shoreline. The area likely supports a rich benthic invertebrate community and provides foraging and wintering habitat for waterfowl and shorebirds. Table 4-11 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 4 is residential (32.7%), followed by government/institutional (20.8%), and undeveloped/vacant

(14.9%). The government/institutional land use is based on Port and City ownership and appears to represent undeveloped land. No existing formal public access sites were identified; however, road ends in this reach represent locations where shoreline access could potentially be developed.

Under current zoning, the reach is predominantly zoned Single Family Residential. Challenges for future development include wetlands, floodplains, and steep slopes.

Table 4-10. Columbia River Reach 4 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 10.5 AC • Length 2,233 LF *Critical Areas* • Floodplain 3.0 AC / 28.2% • Wetlands 2.3 AC / 21.9% • Salt Marsh 20.4 AC *Modifications* • Roads 543 LF	*Current Land Use* • Residential 3.4 AC / 32.7% • Government/Institutional 2.2 AC / 20.8% • Vacant/Undeveloped 1.6 AC / 14.9% • Water 0.1 AC / 1.2% • Not Classified 3.2 AC / 30.4% *Zoning* • Single Family Residential (R-1) 6.8 AC / 65.0% • Low-Density Commercial (C-2) 0.2 AC / 2.1% • Park (P) 0.1 AC / 1.1% • Not Zoned 3.3 AC / 31.8% *Current Shoreline Designation* • Urban • Rural • Conservancy	*Development* • Low-intensity developed 0.8 AC / 7.4% • Developed open space 0.9 AC / 8.6% *Vegetation* • Scrub/Shrub 2.8 AC / 26.9% • Unconsolidated Shore 1.5 AC / 14.4% • Deciduous Forest 1.3 AC / 12.2% • Estuarine Emergent Wetland 1.3 AC / 12.1% • Grassland 0.9 AC / 8.1% • Palustrine Scrub/Shrub Wetland 0.3 AC / 3.3% • Evergreen Forest 0.3 AC / 3.0% • Palustrine Forested Wetland 0.3 AC / 2.6% • Mixed Forest 0.2 AC / 1.5%

Table 4-11. Columbia River Reach 4 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	A tidal marsh located below the OHWM supports hydrologic functions in the reach. No armoring or overwater structures are present.
	Energy attenuation	
	Development of complex habitats	

Process	Function	Notes
Vegetation	Provision of LWD and other organic matter	A generally 200-foot-wide vegetated area is primarily herbaceous wetland at the western end, and scrub/shrub and deciduous forest at the eastern end.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The tidal marsh area likely supports a rich benthic invertebrate community and provides export of organic detritus and nutrient filtration functions. The area also provides foraging and wintering habitat for waterfowl and shorebirds.
	Food production and delivery	
Hyporheic	Water and sediment storage	Tidal wetlands provide water storage and vegetative support.
	Support of vegetation	

Figure 4-5. Baker Bay salt marsh east of Port of Ilwaco.
(Source: Washington State Department of Ecology)

4.3.5 Columbia River Reach 5

Table 4-12 provides summary data for Reach 5.

Columbia River Reach 5 is comprised of undeveloped uplands and intertidal marsh areas, providing habitat for fish, waterfowl, and shorebirds, among other wildlife species. Highway 101 runs parallel to the upper extent of the reach limiting upland connectivity. Table 4-13 provides an analysis of ecological functions.

Based on Assessor data, the land use in Reach 5 is vacant/undeveloped (70.2%) and government/institutional (29.7%). As previously stated, government/institutional land use is based on public ownership, and consists here of State-owned undeveloped riparian lands and tidelands.

Under current zoning, the reach is entirely zoned Recreation Residential. While development opportunities appear to exist in this reach, steep slopes may present difficulties for development.

Table 4-12. Columbia River Reach 5 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 5.1 AC • Length 1,153 LF *Critical Areas* • Floodplain 1.1 AC / 21.3% • Wetlands 0.9 AC / 17.8% • Salt Marsh 2.3 AC	*Current Land Use* • Vacant/Undeveloped 3.6 AC / 70.2% • Government/Institutional 1.5 AC / 29.7% *Zoning* • Recreation Residential (R-4) 5.1 AC / 99.8% *Current Shoreline Designation* • Rural • Conservancy	*Development* • Low-intensity developed 0.2 AC / 3.2% *Vegetation* • Estuarine Emergent Wetland 1.5 AC / 30.4% • Scrub/Shrub 1.1 AC / 22.1% • Evergreen Forest 0.8 AC / 16.6% • Deciduous Forest 0.5 AC / 10.4% • Unconsolidated Shore 0.5 AC / 9.0% • Mixed Forest 0.4 AC / 8.2%

Table 4-13. Columbia River Reach 5 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	This reach is largely undeveloped with forested riparian vegetation and marsh wetland along the OHWM that act to support hydrologic functions.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Nearshore vegetation is extensive in this reach, consisting of mixed evergreen and deciduous forest with a fringing tidal wetland.
	Filtration of upland inputs	
	Bank stabilization	

Process	Function	Notes
Habitat	Space and conditions supporting fish and wildlife, including PHS species	Tidal wetland and mudflats, combined with intact forested riparian vegetation, provide habitat functions for fish, waterfowl, shorebirds, and other wildlife species.
	Food production and delivery	
Hyporheic	Water and sediment storage	Hyporheic functions are not limited by any anthropogenic modifications along this reach.
	Support of vegetation	

Figure 4-6. Salt marsh and forested uplands including State-owned lands. (Source: Washington State Department of Ecology)

4.3.6 Columbia River Reach 6

Table 4-14 provides summary data for Reach 6.

Columbia River Reach 6 comprises the right bank of the lower Wallacut River where it enters Baker Bay, and represents important backwater habitat in the lower Columbia River. Based on NWI data, nearly half of the reach is comprised of freshwater wetland vegetation (forested/shrub and emergent), with an additional 11 acres of salt marsh located below the OHWM. Table 4-15 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 6 is residential (53.6%), followed by vacant/undeveloped (27.3%). This undeveloped land includes much of the freshwater forested and emergent wetlands within the reach.

Under current zoning, the entire reach is zoned Recreation Residential. Floodplains, which constitute 58.1 percent of the reach, as well as wetlands pose challenges for new development.

Table 4-14. Columbia River Reach 6 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 18.5 AC • Length 3,607 LF *Critical Areas* • Floodplain 10.7 AC / 58.1% • Wetlands 8.7 AC / 47.3% • Salt Marsh 11.3 AC	*Current Land Use* • Residential 9.9 AC / 53.6% • Vacant/Undeveloped 5.1 AC / 27.3% • Government/Institutional 2.6 AC / 13.9% • Recreation 1.0 AC / 5.2% *Zoning* • Recreation Residential (R-4) 18.5 AC / 100% *Current Shoreline Designation* • Rural	*Development* • Medium-intensity developed 0.5 AC / 2.4% • Low-intensity developed 2.7 AC / 14.8% V*egetation* • Palustrine Emergent Wetland 4.4 AC / 23.7% • Scrub/Shrub 3.5 AC / 19.0% • Estuarine Emergent Wetland 2.3 AC / 12.4% • Grassland 2.1 AC / 11.5% • Deciduous Forest 1.7 AC / 9.0% • Unconsolidated Shore 0.5 AC / 2.8% • Evergreen Forest 0.5 AC / 2.5% • Palustrine Scrub/Shrub Wetland 0.4 AC / 1.9%

Table 4-15. Columbia River Reach 6 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	Tidal marsh at the mouth of the Wallacut River and freshwater wetlands throughout the reach support hydrologic functions.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Nearly half of the reach is comprised of freshwater wetland vegetation (forested/shrub and emergent) with an additional 11 acres of salt marsh located below the OHWM. Riparian vegetation associated with residential properties is predominantly herbaceous and scrub-shrub, backed by mowed lawn.
	Filtration of upland inputs	
	Bank stabilization	

Process	Function	Notes
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The Wallacut River represents important backwater habitat for salmonids in the lower Columbia River. In addition, wetland marsh at the mouth of the tributary likely supports a rich benthic invertebrate community and provides export of organic detritus and nutrient filtration functions. The area also offers foraging and wintering habitat for waterfowl and shorebirds.
	Food production and delivery	
Hyporheic	Water and sediment storage	Tidal marsh and freshwater wetlands provide water storage and vegetative support.
	Support of vegetation	

Figure 4-7. Salt marsh and residential development at the mouth of the Wallacut River. (Source: Washington State Department of Ecology)

4.3.7 Columbia/Wallacut River Reach 7

Table 4-16 provides summary data for Reach 7.

Columbia/Wallacut River Reach 7 comprises over 70 acres of wetland habitat, representing the majority of the Columbia Land Trust's Wallacut River Acquisition and Restoration Project. This project protects a total of 113 acres of forested wetland habitat, including tidal channels and sloughs, at the tributary's confluence with Baker Bay. Backwater habitats, like the Wallacut River, are important areas for juvenile salmon rearing in the lower Columbia River estuary. Tidal influence in the reach is bounded by a levee that runs north-south, with the Ilwaco airport and a residential development situated immediately to the east. Table 4-17 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 7 is government/institutional (94.7%). In this case, government/institutional land use is based on land ownership by the Columbia Land Trust organization; no actual development is apparent in aerial imagery.

Under current zoning, the entire reach is zoned Recreation Residential. Development in the reach is not expected given the restoration and protection goals of the Columbia Land Trust's project.

Table 4-16. Columbia/Wallacut River Reach 7 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Length 75.1 AC • Area 9,087 LF *Critical Areas* • Floodplain 55.6 AC / 74.0% • Wetlands 70.2 AC / 93.5% • Salt Marsh 48.3 AC *Modifications* • Levees 757 LF	*Current Land Use* • Government/Institutional 71.1 AC / 94.7% • Residential 2.8 AC / 3.7% • Vacant/Undeveloped 0.7 AC / <1% • Not Classified 0.5 AC / <1% *Zoning* • Recreation Residential (R-4) 46.7 AC / 62.2% • Not Zoned 28.4 AC / 37.8% *Current Shoreline Designation* • Rural • Conservancy	*Development* • Medium-intensity developed 1.2 AC / 13.0% • Low-intensity developed 3.3 AC / 35.2% • Developed open space 1.8 AC / 19.7% *Vegetation* • Palustrine Forested Wetland 18.6 AC / 24.8% • Palustrine Scrub/Shrub Wetland 13.2 AC / 17.6% • Deciduous Forest 8.7 AC / 11.6% • Estuarine Emergent Wetland 8.0 AC / 10.7% • Scrub/Shrub 6.7 AC / 9.0% • Mixed Forest 1.9 AC / 2.6% • Unconsolidated Shore 1.2 AC / 1.6% • Grassland 0.8 AC / 1.0% • Pasture/Hay 0.5 AC / <1%

Table 4-17. Columbia/Wallacut River Reach 7 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	Complex forested and emergent wetland habitats are present throughout this reach, which encompasses the most floodplain acreage of the reaches in this report. Tidal influence in the reach is bounded by a levee to the east.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	This reach is comprised of a large forested/shrub wetland complex and fringing emergent marsh along the left bank of the lower Wallacut River. Shorelines east of the confluence in Baker Bay are also forested, with wetland marsh below the OHWM.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The Wallacut River and tidal channels present in the reach represent important backwater habitat for salmonids in the lower Columbia River. In addition, wetland marsh at the mouth of the tributary likely supports a rich benthic invertebrate community and provides export of organic detritus and nutrient filtration functions. The area also offers foraging and wintering habitat for waterfowl and shorebirds.
	Food production and delivery	
Hyporheic	Water and sediment storage	Tidal marsh and freshwater wetlands provide water storage and vegetative support.
	Support of vegetation	

Figure 4-8. Extensive freshwater emergent and forested/scrub-shrub wetlands protected by the Columbia Land Trust's Wallacut River Acquisition and Restoration Project.
(Source: Washington State Department of Ecology)

4.3.8 Columbia/Wallacut River Reach 8

Table 4-18 provides summary data for Reach 8.

Columbia/Wallacut River Reach 8 includes residential properties along the left bank of the Wallacut River. The reach is located above the tide gate at the Stringtown Road crossing, isolating the channel from tidal influence and preventing salmonid access. A small, forested and scrub-shrub wetland area just east of Stringtown Road presumably provides some water storage and filtration of upland inputs. Table 4-19 provides an analysis of ecological functions.

Based on Assessor data, the most prominent land use in Reach 8 is residential (44.1%). The data also suggest that some land is in government/institutional use (25.5%); however, this data is based on ownership and reflects undeveloped City-owned property situated along the shoreline waterward of residential parcels.

The reach is zoned Single Family Residential - Manufactured (44.7%); the rest of the reach is not zoned. Nearly the entire reach is located within the floodplain, which will impact future development.

Table 4-18. Columbia/Wallacut River Reach 8 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 9.3 AC • Length 2,194 LF *Critical Areas* • Floodplain 9.1 AC / 98.2% • Wetlands 1.8 AC / 19.8% *Modifications* • Roads 1,111 LF • Levees 1,886 LF	*Current Land Use* • Residential 4.1 AC / 44.1% • Government/Institutional 2.4 AC / 25.5% • Vacant/Undeveloped 1.3 AC / 13.4% • Not Classified 1.6 AC / 17.0% *Zoning* • Single Family Residential - Manufactured (R-1S) 4.2 AC / 44.7% • Single Family Residential (R-1) 0.0 AC / <1% • Recreation Residential (R-4) 0.0 AC / <1% • Not Zoned 5.1 AC / 55.2% *Current Shoreline Designation* • Conservancy • Rural	*Development* • Medium-intensity developed 1.2 AC / 13.0% • Low-intensity developed 3.3 AC / 35.2% • Developed open space 1.8 AC / 19.7% *Vegetation* • Palustrine Emergent Wetland 1.0 AC / 11.1% • Deciduous Forest 0.7 AC / 7.7% • Palustrine Forested Wetland 0.4 AC / 4.3% • Palustrine Scrub/Shrub Wetland 0.4 AC / 4.2% • Scrub/Shrub 0.2 AC / 2.7% • Mixed Forest 0.2 AC / 2.2%

Table 4-19. Columbia/Wallacut River Reach 8 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	A tide gate at the Stringtown Road crossing restricts tidal influence and hydraulic connectivity in the Wallacut River. No armoring or overwater structures appear to be present in this reach.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Riparian vegetation consists of patchy trees and shrubs, frequently backed by mowed lawn.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The presence of the tide gate prevents channel access by salmonids and residential development limits floodplain habitat value.
	Food production and delivery	

Process	Function	Notes
Hyporheic	Water and sediment storage	Hyporheic functions are expected to be limited in this reach as a result of the lack of natural tidal connectivity.
	Support of vegetation	

Figure 4-9. Residential development along the left bank of the Wallacut River. (Source: Washington State Department of Ecology)

4.3.9 Columbia/Wallacut River Reach 9

Table 4-20 provides summary data for Reach 9.

Columbia/Wallacut River Reach 9 comprises a privately owned, undeveloped freshwater wetland complex. The wetland is densely vegetated with forest and scrub-shrub. This area connects to the Wallacut River upstream of the tide gate at Stringtown Road, through a small floodplain channel. The functional value of the wetlands could potentially be quite high if tidal influence and hydraulic connectivity to the Columbia River were restored. Table 4-21 provides an analysis of ecological functions.

Based on Assessor data, the land use in Reach 9 is almost exclusively vacant/undeveloped (93.8%). The nearly 37-acre reach is made up primarily of one privately owned parcel. The Columbia Land Trust has acquired a narrow band that encompasses around half of the floodplain channel connecting the wetland to the Wallacut River.

Under current zoning, the reach is zoned Single Family Residential - Manufactured (93.5%). The land under Columbia Land Trust ownership is not zoned.

Table 4-20. Columbia/Wallacut River Reach 9 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 36.9 AC • Length 0 LF *Critical Areas* • Floodplain 29.1 AC / 78.7% • Wetlands 36.9 AC / 99.9%	*Current Land Use* • Vacant/Undeveloped 34.5 AC / 93.5% • Government/Institutional 2.3 AC / 6.1% • Residential 0.0 AC / <1% *Zoning* • Single Family Residential (R-1) 34.5 AC / 93.5% • Not Zoned 2.4 AC / 6.4% *Current Shoreline Designation* • Rural	*Development* • Low-intensity developed 0.1 AC / <1% *Vegetation* • Palustrine Scrub/Shrub Wetland 22.5 AC / 61.1% • Palustrine Forested Wetland 12.4 AC / 33.5% • Palustrine Emergent Wetland 1.0 AC / 2.8% • Scrub/Shrub 0.7 AC / 2.0% • Deciduous Forest 0.1 AC / <1%

Table 4-21. Columbia/Wallacut River Reach 9 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	This reach is entirely composed of a freshwater wetland complex that connects to the Wallacut River through a small floodplain channel. The wetlands are expected to provide water storage and nutrient filtration.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Approximately 35 acres of forested/shrub wetland provide vegetative functions.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	Without hydraulic connectivity to the Columbia River, this reach is limited in providing habitat value to salmonids. The area is expected to provide habitat for birds and small mammals and is at the western edge of the Roosevelt elk herd's large winter range
	Food production and delivery	

Process	Function	Notes
Hyporheic	Water and sediment storage	The wetlands provide water storage and vegetative support.
	Support of vegetation	

Figure 4-10. Undeveloped, privately owned area of freshwater forested/scrub-shrub wetland at the east edge of Ilwaco.
(Source: Washington State Department of Ecology)

4.3.10 Pacific Coast Reach 10

Table 4-22 provides summary data for Reach 10.

Pacific Coast Reach 10 comprises the only marine environment within Ilwaco's shoreline jurisdiction. This reach includes emergent and scrub/shrub interdunal wetlands that provide bank stabilization and upland nutrient filtration. The undeveloped shoreline supports shorebird concentrations and shellfish resources. The beach is part of the Columbia River littoral cell (CRLC). The CRLC has been experiencing high rates of coastal erosion along sections that historically saw consistent beach accretion from sand transported out of the Columbia River. The Southwest Washington Coastal Erosion Study has been researching the causes and implications of the regional coastal erosion crises that have threatened the long-term viability of coastal communities. Table 4-23 provides an analysis of ecological functions.

Virtually all of the land in this reach is owned by Washington State Parks and is within the northern extent of Cape Disappointment State Park. The Discovery Trail runs the length of the reach's marine shoreline. The reach is predominantly zoned Resort Residential (97%).

Table 4-22. Pacific Coast Reach 10 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 40.5 AC • Length 1,263 LF *Critical Areas* • Floodplain 0 AC • Wetlands 34.7 AC / 85.8%	*Current Land Use* • Recreation 40.2 AC / 99.2% • Residential 0.1 AC / <1% • Government/Institutional 0.0 AC / <1% *Zoning* • Resort Residential (R-3) 39.3 AC / 97.0% • Recreation (R-5) 1.0 AC / 2.5% *Current Shoreline Designation* • Urban • Natural	*Development* • Low-intensity developed 0.3 AC / <1% • Developed open space 0.4 AC / 1.1% *Vegetation* • Grassland 10.0 AC / 24.6% • Scrub/Shrub 6.6 AC / 16.3% • Palustrine Scrub/Shrub Wetland 5.9 AC / 14.6% • Palustrine Forested Wetland 5.3 AC / 13.1% • Palustrine Emergent Wetland 5.2 AC / 12.9% • Deciduous Forest 4.9 AC / 12.0% • Bare Land 1.1 AC / 2.6% • Evergreen Forest 0.7 AC / 1.6% • Mixed Forest 0.2 AC / <1%

Table 4-23. Pacific Coast Reach 10 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	This marine reach does not include any overwater structures or shoreline armoring that would impact hydrologic functions. Jetty construction at the mouth of the Columbia River, wave conditions, sediment budget characteristics, and the influence of El Niño are all factors influencing beach morphology along the littoral cell.
	Energy attenuation	
	Development of complex habitats	

Process	Function	Notes
Vegetation	Provision of LWD and other organic matter	This reach includes emergent and scrub/shrub wetland vegetation that provides bank stabilization, nutrient filtration and other vegetative functions.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The nearshore supports regular concentrations of shorebird populations as well as razor clams and other shellfish resources.
	Food production and delivery	
Hyporheic	Water and sediment storage	Hyporheic functions are generally dependent on directional flow, and therefore, are less applicable in marine environments.
	Support of vegetation	

Figure 4-11. Shoreline public access via the Discovery Trail along this stretch of Washington State Parks land.
(Source: Washington State Department of Ecology)

4.3.11 Black Lake Reach 11

Table 4-24 provides summary data for Reach 11.

Black Lake Reach 11 is located along the west side of Black Lake, a shallow body of water fed by precipitation and groundwater. Highway 101 and development at the south and north ends of the lake restrict upland connectivity and limit functional values associated with the reach. The City has been combatting the invasive aquatic

plant Brazilian elodea (*Egeria densa*), which has formed dense stands within the lake. Table 4-25 provides an analysis of ecological functions.

Based on Assessor data, the land use in Reach 11 is a mixture of government/institutional (16.6%), which includes City properties along the shoreline and part of Ilwaco High School at the south end of the lake; agriculture (11.1%), associated with the cranberry growers Cran Mac Farms; vacant/undeveloped (10.4%), comprised of three privately owned parcels; and residential (5.8%), covering houses west of Highway 101. Shoreline jurisdiction also includes right-of-way for the highway, which runs adjacent to the west bank. A pier provides access to the lake at the south end, and an overlook is located across from Lakeview Avenue. A public walking trail encircles most of the lake.

Under current zoning, the reach is zoned Park (23.5%), corresponding to City land; Single Family Residential (20.4%), associated with the agricultural land; and Low-Density Commercial (13.5%) west of Highway 101, which includes residential, undeveloped, recreational, and commercial properties. A vacant parcel next to Ilwaco High School, along the south shore, is zoned Multi-Family Residential.

Table 4-24. Black Lake Reach 11 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 17.1 AC • Length 4,677 LF *Critical Areas* • Floodplain 0.2 AC / 1.3% • Freshwater Wetlands 0.6 AC / 3.9% *Modifications* • Roads 1,831 LF	*Current Land Use* • Government/Institutional 2.8 AC / 16.6% • Agriculture 1.9 AC / 11.1% • Vacant/Undeveloped 1.8 AC / 10.4% • Residential 1.0 AC / 5.8% • Recreation 0.5 AC / 2.8% • Commercial 0.3 AC / 1.8% • Not Classified 8.8 AC / 51.6% *Zoning* • Park (P) 4.3 AC / 25.3% • Single Family Residential (R-1) 3.5 AC / 20.4% • Low Density Commercial (C-2) 2.3 AC / 13.5% • Multi-Family Residential (R-2) 1.3 AC / 7.3% • Not Zoned 5.7 AC / 33.4% *Current Shoreline Designation* • Rural • Conservancy	*Development* • High-Intensity Developed 0.6 AC / 3.8% • Medium-intensity developed 2.6 AC / 15.6% • Low-intensity developed 4.9 AC / 30.0% • Developed open space 1.3 AC / 7.7% *Vegetation* • Evergreen Forest 2.0 AC / 12.3% • Scrub/Shrub 1.6 AC / 9.8% • Palustrine Emergent Wetland 0.9 AC / 5.7% • Deciduous Forest 0.7 AC / 4.0% • Mixed Forest 0.6 AC / 3.5% • Palustrine Forested Wetland 0.5 AC / 2.8% • Palustrine Scrub/Shrub Wetland 0.3 AC / 1.8% • Unconsolidated Shore 0.3 AC / 1.6% • Grassland 0.2 AC / 1.3%

Table 4-25. Black Lake Reach 11 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	Highway 101 runs parallel to the west shore of Black Lake, and a cranberry farm and Ilwaco High School are located to north and south of the lake, respectively. Surface water flows out a drainage channel at the north end of the lake, through Tarlett Slough.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Riparian vegetation ranges from 100 to 200 feet wide along the lake's south shore, to a narrow band with patchy trees between the west shore and Highway 101.
	Filtration of upland inputs	
	Bank stabilization	

Process	Function	Notes
Habitat	Space and conditions supporting fish and wildlife, including PHS species	The lake and existing riparian vegetation support habitat for resident fish species, but the lack of vegetated corridors limits upland habitat in the reach.
	Food production and delivery	
Hyporheic	Water and sediment storage	Hyporheic functions are generally dependent on directional flow, and therefore were not evaluated for this lake system.
	Support of vegetation	
	Maintenance of base flows	

4.3.12 Black Lake Reach 12

Table 4-26 provides summary data for Reach 12.

Black Lake Reach 12 is located along the undeveloped, east side of Black Lake, a shallow body of water, fed by precipitation and groundwater. Forested riparian and wetland vegetation is extensive and well connected to uplands along much of the reach. The lake and surrounding vegetation is expected to provide habitat for resident fish species, amphibians, birds, and mammals. Table 4-27 provides an analysis of ecological functions.

Based on Assessor data, the land use in Reach 12 is primarily government/institutional (82.3%). As previously stated, institutional land use is based on City ownership and consists here of undeveloped parkland. A primitive boat launch and trail system allows public access to the lake. Under current zoning, the reach is zoned Park (90.2%).

Table 4-26. Black Lake Reach 12 – Summary data.

Dimensions, Critical Areas & Modifications	Land Use Patterns	Development & Vegetation
Dimensions • Area 25.7 AC • Length 3,505 LF *Critical Areas* • Floodplain 0.4 AC / 1.7% • Freshwater Wetlands 14.6 AC / 56.6%	*Current Land Use* • Government/Institutional 21.2 AC / 82.3% • Agriculture 0.0 AC / 1.0% • Forestry 0.0 AC / <1% • Not Classified 4.5 AC / 17.5% *Zoning* • Park (P) 23.2 AC / 90.2% • Not Zoned 2.5 AC / 9.8% *Current Shoreline Designation* • Rural • Conservancy	*Development* • Medium-intensity developed 0.1 AC / <1% • Low-intensity developed 0.2 AC / <1% • Developed open space 0.4 AC / 1.5% *Vegetation* • Evergreen Forest 11.9 AC / 46.7% • Palustrine Forested Wetland 9.2 AC / 36.2% • Mixed Forest 1.0 AC / 4.1% • Deciduous Forest 0.9 AC / 3.6% • Palustrine Scrub/Shrub Wetland 0.8 AC / 3.2% • Palustrine Emergent Wetland 0.7 AC / 2.8% • Scrub/Shrub 0.1 AC / <1%

Table 4-27. Black Lake Reach 12 – Analysis of ecological functions.

Process	Function	Notes
Hydrologic	Transport and/or storage of water and sediment	Though not mapped, a road runs across the north shore of the lake to the east side, providing access to a primitive boat launch and dock.
	Energy attenuation	
	Development of complex habitats	
Vegetation	Provision of LWD and other organic matter	Riparian and wetland vegetation is extensive in the reach. Evergreen forest and palustrine forested wetland dominate the composition.
	Filtration of upland inputs	
	Bank stabilization	
Habitat	Space and conditions supporting fish and wildlife, including PHS species	Riparian and surrounding habitats are well vegetated providing full upland connectivity along most of the reach. The lake and surrounding vegetation is expected to provide habitat for resident fish species, amphibians, birds, and mammals.
	Food production and delivery	

Process	Function	Notes
Hyporheic	Water and sediment storage	Hyporheic functions are generally dependent on directional flow, and therefore were not evaluated for this lake system.
	Support of vegetation	
	Maintenance of base flows	

Figure 4-12. View from across the lake of Black Lake Reach 12.

5 SHORELINE MANAGEMENT RECOMMENDATIONS

This chapter sets forth recommendations for translating the inventory and analysis information presented in the previous chapters of this report into SMP environment designations, policies, and regulations. In addition to these recommendations, the updated SMP should meet all applicable requirements of the SMA and the Guidelines.

The inventory and analysis information presented in this report will also inform the forthcoming Shoreline Restoration Plan, a required component of the SMP update process. As directed by WAC 173-26-201(2)(f), the Shoreline Restoration Plan will

include "goals, policies and actions for restoration of impaired shoreline ecological functions."

5.1 Environment Designations

As outlined in the Guidelines (WAC 173-26-191(1)(d)) "shoreline management must address a wide range of physical conditions and development settings along shoreline areas. Effective shoreline management requires that the shoreline master program prescribe different sets of environmental protection measures, allowable use provisions, and development standards for each of these shoreline segments."

Under the SMA, different shoreline segments are regulated through the assignment of various "environment designations." Environment designations can be thought of as system of shoreline zoning (though the standard underlying zoning still applies as well). The Guidelines recommend a classification system with six basic environment designations. These six environment designations are: Natural, Rural Conservancy, Aquatic, High-intensity, Urban Conservancy, and Shoreline Residential. However, the Rural Conservancy designation is not intended for cities. Jurisdictions may use these environment designations as applicable, or develop their own unique environment designations (provided they meet certain requirements).

There is substantial flexibility in the development and assignment of environment designations to a shoreline area; however, the Guidelines (WAC 173-26-211(2)(a)) direct that the development and assignment of environment designations be based on "existing use pattern, the biological and physical character of the shoreline, and the goals and aspirations of the community as expressed through comprehensive plans…" While current and future land use provide basic context for a given segment of land, environment designations should not be expected to always correlate strongly with these parameters, particularly in shoreline areas that are currently undeveloped, feature existing development located away from shoreline jurisdiction (especially on larger parcels), or have extensive critical areas (e.g. wetlands and floodplains/floodways).

5.1.1 Recommendations

The following recommendations are provided for the development and assignment of environment designations for Ilwaco's shorelines:

- Use the classification system recommended in the Guidelines when assigning environment designations.

- Based on the findings of this report, the potential environment designations identified in Table 5-1 may be appropriate.

Table 5-1. Potential environment designations.

Area	Potential Environment Designations
West of Ilwaco Harbor	Urban Conservancy
Ilwaco Harbor	High-intensity
East of Ilwaco Harbor to Wallacut River	Urban Conservancy/Shoreline Residential
East of Wallacut River confluence	Urban Conservancy/Natural
Wallacut River	Urban Conservancy/Natural/Shoreline Residential
Pacific Coast	Urban Conservancy/Natural
West shore of Black Lake	Shoreline Residential/Urban Conservancy
East shore of Black Lake	Urban Conservancy
Below the OHWM	Aquatic

5.2 Policies and Regulations

Policies and regulations form the core of the SMP. The Guidelines address policies and regulations for three distinct topic areas: General Master Program Provisions (WAC 173-26-221), Shoreline Modifications (WAC 173-26-231), and Shoreline Uses (WAC 173-26-241). The following subsections discuss policy and regulation recommendations for each of these topic areas in turn.

5.2.1 General Provisions

Archaeological and Historic Resources

- Based on the contents of this report, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

Critical Areas

- The City's critical areas ordinance is currently being updated. Incorporate the updated critical areas ordinance into the SMP. Consider whether the updated critical areas ordinance should be incorporated into the SMP by direct inclusion, as an appendix, or by reference. Either of the first two methods is recommended. Adopting critical areas protections by reference would require that future changes to the City-wide critical areas ordinance be formally approved by Ecology as an SMP amendment.

- Recognize that some interdunal wetlands may be hydrologically associated with the shoreline and may be considered as shoreline jurisdictional wetlands, even when they are well beyond 200 feet from the shoreline's OHWM. Interdunal wetlands are frequently associated with many rare and endangered plant species, and their associated fauna and should be given careful consideration for protection.

Flood Hazard Reduction

- Based on the contents of this report and local conditions, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

Public Access

- Use the shoreline visioning process to foster community dialogue about shoreline public access opportunities in and around the City. Opportunities may exist for new shoreline access points along the Columbia River.

Shoreline Vegetation Conservation

- In addition to guidance or requirements specified by the Guidelines, ensure that vegetation standards allow adequate provisions to allow for treatment and removal of invasive vegetation that poses a threat to shoreline ecological functions.

- Ensure that vegetation standards for coastal dunes acknowledge the habitat value of sparsely vegetated dune communities.

Water Quality, Stormwater, and Nonpoint Pollution

- Based on the contents of this report and local conditions, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

5.2.2 Shoreline Modification Provisions

Shoreline Stabilization

- Consider requiring a Shoreline Conditional Use Permit for any new hard shoreline stabilization.

Piers and Docks

- Regulations for piers and docks should be developed to provide applicants with as much predictability as possible, while still allowing for an

appropriate amount of flexibility based on site-specific conditions and use-specific needs.

Breakwaters, Jetties, Groins and Weirs

- Consider prohibiting new breakwaters, jetties, groins, or weirs in the SMP, except where they are essential to restoration or maintenance of existing water-dependent uses.

Dredging and Dredge Material Disposal

- Establish provisions to allow for continued dredging while addressing long-term ecological issues.

- Continue to prohibit dredging and fill in tidal wetlands.

Shoreline Habitat and Natural Systems Enhancement Projects

- Based on the contents of this report and local conditions, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

5.2.3 Shoreline Use Provisions

Agriculture

- Based on the contents of this report and local conditions, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

Aquaculture

- Consider where and what types of aquaculture would be appropriate in the City.

Boating Facilities

- Ilwaco includes commercial and public boating facilities, including a marina, port uses, and community launching facilities. Regulations for the over-water components should be developed to provide applicants with as much predictability as possible, while still allowing for an appropriate amount of flexibility based on site-specific conditions and use-specific needs.

- Public access should be included as components of marina expansions, where feasible.

Commercial Development

- Incorporate clear dimensional criteria for commercial development, such as setbacks/buffers.

- Recognize commercial uses and provide for a clear priority for water-dependent, water-related and water-oriented uses.

- Ensure water-dependent uses are not restricted by other regulatory setbacks/buffers.

Forest Practices

- Per the Guidelines, the City's SMP should rely on the Forest Practices Act and its implementing rules, as well as the *Forest and Fish Report* for adequate management of commercial forest uses within shoreline jurisdiction. However, the City's SMP will apply to Class IV-General forest practices where shorelines are being converted or are expected to be converted to non-forest uses.

Industry

- Incorporate clear dimensional criteria for industrial development, such as setbacks/buffers.

In-stream Structural Uses

- Based on the contents of this report and local conditions, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

Mining

- Consistent with the Seashore Conservation Area of Washington State Parks, prohibit the mining of sand along the ocean beaches.

- Consider whether mining should be allowed or prohibited in shoreline jurisdiction. If mining is allowed, clearly differentiate between upland and aquatic mining. And if upland mining is allowed, consider including policies that emphasize mining as far as practicable from shorelines, floodplains, and streams.

Recreational Development

- Based on the contents of this report and local conditions, no recommendations are set forth beyond the guidance or requirements specified by the Guidelines.

Residential Development

- Incorporate clear dimensional criteria for residential development, such as setbacks/buffers.

Transportation and Parking

- Allow for maintenance and improvements to existing roads, parking areas, or other transportation facilities.

Utilities

- Allow for maintenance and improvements to existing utility facilities.

ACRONYMS & ABBREVIATIONS

AC ..... Acres
Assessor ..... Pacific County Assessor's Office
Cfs ..... Cubic feet per second
City ..... City of Ilwaco
CMZ..... Channel migration zone
CSZ ..... Cascadia Subduction Zone
Corps ..... U.S. Army Corps of Engineers
County..... Pacific County
CRLC ..... Columbia River littoral cell
DNR..... Washington Department of Natural Resources
Ecology..... Washington State Department of Ecology
EPA ..... Environmental Protection Agency
ESA ..... Endangered Species Act
GIS ..... Geographic information systems
GMA ..... Growth Management Act
Guidelines..... Shoreline Master Program Guidelines
IMC ..... Ilwaco Municipal Code
LF ..... Linear feet
LWD ..... Large woody debris
OHWM..... Ordinary high water mark
NMFS..... National Marine Fisheries Service
NPDES..... National Pollutant Discharge Elimination System
NWI ..... National Wetlands Inventory
PHS ..... Priority habitats and species
Port ..... Port of Ilwaco
RCW ..... Revised Code of Washington
SMA ..... Shoreline Management Act
SMP..... Shoreline Master Program
State ..... Washington State
USFWS ..... U.S. Fish and Wildlife Service
USGS..... U.S. Geological Survey
WAC ..... Washington Administrative Code
WDFW..... Washington Department of Fish and Wildlife
WRIA..... Water Resource Inventory Area

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APPENDIX A

Assessment of Shoreline Jurisdiction

APPENDIX B

Shoreline Inventory Map Folio