Appendix B - Shoreline Inventory and Characterization – Summary of Findings

2.1 Purpose

The Town of La Conner (Town) conducted a comprehensive Shoreline Master Program (SMP) update. This process was partially funded by a grant administered through the Washington State Department of Ecology (Ecology) (SMA Grant No. G1100003). Substitute Senate Bill (SSB) 6012, an Act passed in 2003 relating to shoreline management and amending RCW 90.58.060, 90.58.080, and 90.58.250, requires cities and counties to update their SMPs consistent with the state Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58 and its implementing guidelines, Washington Administrative Code (WAC) 173-26.

This document presents results of the Town of La Conner Shoreline Inventory and Characterization. According to Ecology, the purpose of the Shoreline Inventory and Characterization is to develop an understanding of the relationship between shoreline processes and functions and the built environment. Together, the combined Inventory and Characterization (Ecology 2010a):

- Identify ecosystem wide processes and shoreline functions.
- Set a baseline for evaluating cumulative impacts of the draft SMP and determining no net loss of shoreline ecological functions.
- Identify potential sites for protection, restoration and public access.
- Guide development of the shoreline management strategy that will lead to policies, regulations and environment designations that achieve no net loss of shoreline ecological functions.

2.2 Regulatory Overview

Washington's 1971 SMA was created in response to a growing concern among Washington residents that irrevocable damage was being done to Washington's shorelines through unplanned and unbridled use.

The SMA policy goals harbor potential for conflict as set forth in WAC 173-6-176(2):

> *"The act recognizes that the shorelines and the waters they encompass are "among the most valuable and fragile" of the state's natural resources. They are valuable for economically productive industrial and commercial uses, recreation, navigation,*

residential amenity, scientific research and education. They are fragile because they depend upon balanced physical, biological, and chemical systems that may be adversely altered by natural forces (earthquakes, volcanic eruptions, landslides, storms, droughts, floods) and human conduct (industrial, commercial, residential, recreation, navigational).”

The SMA is intended to provide a balance between shoreline development and conservation or enhancement of shoreline ecological functions and values by encouraging water-dependent, water- related, and water-enjoyment uses within shoreline jurisdiction.

The legislative findings and policy goals of the SMA are as follows (RCW 90.58.020):

"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."

"It is the policy of the state to provide for the management of the shorelines by planning for and fostering all reasonable and appropriate uses."

"Uses shall be preferred which are. . .unique to or dependent upon use of the state's shoreline."

"Alterations of the natural condition of the shorelines of the state, in those limited instances when authorized, shall be given priority for single - family residences and their appurtenant structures, ports, shoreline recreational uses including but not limited to parks, marinas, piers, and other improvements facilitating public access to shorelines of the state, industrial and commercial developments which are particularly dependent on their location on or use of the shorelines of the state and other development that will provide an opportunity for substantial numbers of the people to enjoy the shorelines of the state."

RCW 90.58.090 authorizes and directs the Department of Ecology (Ecology) to adopt:

"*…guidelines consistent with RCW 90.58.020, containing the elements specified in RCW 90.58.100" for development of local master programs for regulation of the uses of "shorelines" and "shorelines of statewide significance.*"

RCW 90.58.200 authorizes the department and local governments "*to adopt such rules as are necessary and appropriate to carry out the provisions of*" the Shoreline Management Act.

Local governments are assigned the primary responsibility for administering a regulatory program consistent with the policies and provisions of the SMA through local shoreline master programs (SMPs). The SMP guidelines (WAC 173-26), established by the Department of Ecology (Ecology), offer goals and policies (see above) to guide local jurisdictions in developing use regulations and development standards within the shoreline. Local governments are allowed substantial discretion to adopt SMPs that reflect local circumstances, and regulatory/non-regulatory programs.

The SMA thus provides the policy goals and a set of guidelines (WAC 173-26) to assist local jurisdictions in developing, adopting and amending local Shoreline Master Programs (SMPs), to provide 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).

2.3 Shoreline Jurisdiction and Definitions

The Town of La Conner shoreline jurisdiction extends from the center line of the Swinomish Channel to a line that is 200 feet landward from the Ordinary High Water Mark (OHWM) of the Swinomish Channel (Town of La Conner 2003a). The Town has seven shoreline environmental designations including Commercial, Industrial, Historic Commercial, Aquatic, Residential and Public Use (Figure 3 – Town of La Conner Shorelines Map). "Residential" is not a current established environmental designation, however it has been recognized as a pre-existing use and will be established as an environmental designation during the update of the Shoreline Master Program.

The Department of Natural Resources (DNR) and the Town of La Conner are in discussion about the location of the official Town limits along the shoreline of the Swinomish Channel, relative to the OHWM and harbor lines. Future maps of the Town will reflect any changes in the Town limits that occur as a result of these discussions.

2.4 Relationship to Other Plans and Programs

WAC 173-26-010 and RCW 90.58.080 direct local governments to develop and administer local shoreline master programs (SMPs) for regulation of uses on shorelines of the state. WAC 173-26-010 directs local governments to develop SMPs that are integrated with other local government systems for administration and enforcement of land use regulations.

2.4.1 Town Plans and Programs

Regulation of development near the Swinomish Channel and management of shoreline resources is conducted under various regulatory plans and programs that have been adopted by the Town Council and administered by the Planning Department. Some of these plans have been developed pursuant to the Washington State Growth Management Act (GMA) and Shoreline Management Act (SMA), while others have been independently established by the Town to meet the unique vision of La Conner. Town planning documents that affect activities and development within the shoreline zone include, but may not be limited to: current Shoreline Master Program, Comprehensive Plan, Parks and Recreation Plan, Parking Plan, Capital Facilities Plan, Climate Change Action Plan, Floodplain Management Program, Critical Areas Ordinance , and various other Chapters within the LCMC that establish development standards and zoning.

The Comprehensive Plan is the unifying document that outlines how the Town will direct development and retain certain desirable qualities. The Comprehensive Plan provides guidance regarding general land use and development patterns with regard to the following primary elements: economic, land use, housing, transportation, utilities, capital facilities and essential facilities. The scope of jurisdiction subject to guidance contained in the Comprehensive Plan includes the entire town, both within and beyond the extent of shoreline jurisdiction.

Other planning documents developed by the Town, including the Shoreline Master Program, should be developed to be consistent with the Comprehensive Plan to achieve a consistent use policy. The update to the Shoreline Master Program therefore should also strive to be consistent with the other planning documents listed above. A complete reference list of Town Plans & Programs is provided in the Shoreline Inventory prepared during this update process and summarized below in Section 2.5.1.

2.4.2 Regional, State and Federal Programs

Shoreline planning must also take into consideration other regional, state and federal programs and/or laws that may influence development of shorelines within the local jurisdiction. As discussed in the preceding section, several local plans and programs have been mandated at the state level under the authority of the state GMA and SMA. In addition to these programs, several other state, regional and federal programs and regulations are also relevant to the shoreline planning process. These include but are not necessarily limited to: Washington's Hydraulic Code (see RCW 77.55 and WAC 220-110), SEPA rules (see RCW 43.21C and WAC 197-11), and Aquatic Land Management (see RCW 79.105 and WAC 332-30) at the state level; National Flood Insurance Program, Clean Water Act, Endangered Species Act and Magnuson-Stevens Fisheries Management Act at the federal level; and various plans and programs developed at the regional or county level, a comprehensive list of which is included in the Shoreline Inventory document previously prepared as part of the update process and summarized below in Section 2.2.

2.5 Methods

2.5.1 Shoreline Inventory

On August 31, 2011, the Town of La Conner submitted to Ecology a Shoreline Inventory. Features identified in the Shoreline Inventory included:

- Shorelines of the State,
- General location of channel/floodplain features,
- Critical Areas,
- Shoreline and adjacent land use patterns/density and transportation and utility facilities,
- Degraded areas and sites with potential for ecological restoration,
- Areas of special interest,
- Existing and potential shoreline public access sites,
- Historical aerial photographs documenting past conditions to assist in preparing an analysis of cumulative impacts of development,
- Archaeological and historic resources in shoreline jurisdiction, and
- Policies and regulations in shoreland and adjacent areas that affect shorelines. Issues identified in the Shoreline Inventory that will be characterized in this report include:
  - Climate Change
  - Flooding
  - Eroding shorelines

- Sedimentation within Swinomish Channel

Appendix B contains the Shoreline Inventory including the list of references.

2.5.2 Characterizing Ecosystem Wide Processes and Shoreline Functions

Ecosystem wide characterization of processes and functions within the Town's shoreline environment includes a coarse scale analysis of the broader area that influences the shoreline jurisdiction. Shoreline functions within the limits of jurisdiction of the Town do not exist in isolation and are dependent on, and result from, ecosystem wide processes that operate on scales not necessarily limited to the Town boundary. According to Ecology:

> *Ecosystem wide processes refer to dynamic physical and chemical interactions that form and maintain natural landscapes, including the movement of water, sediment, nutrients, pathogens, toxins and wood as they enter into, pass through, and eventually leave, the watershed.*

These processes occur over larger landscapes that include both the shoreline and watershed features draining to the shoreline and are influenced by precipitation, geology, topography, soils, land cover and land use.

The first step needed to characterize ecosystem-wide processes and shoreline functions is to identify the contributing watersheds that may influence and interact with the shoreline environment within the Town (Section 3.0). Ecology WRIA maps and USGS topography maps were used for this purpose in addition to a shallow groundwater study of the Skagit River Delta (Ecology 2009 and 2002, Savoca et al 2009).

The second step is to identify and analyze the ecosystem-wide processes within contributing watersheds that may influence shoreline functions within the Town's jurisdiction. Guidance from Ecology identifies methods by which the influence of each ecosystem process on ecological functional groups is identified and described based on specific structures (natural resources) and biological/ecological functions.

The goal is to identify those ecosystem-wide processes that may influence shoreline functions at the site scale that will be considered at a detailed level in the reach assessment (see Section 2.4). This information is used to establish an environmental baseline at both the watershed and reach scales during the shoreline planning process and to help identify appropriate uses, modifications and/or restoration that should be recommended.

Inventory data sources used to identify ecosystem wide processes, shoreline structures, and functions are provided in Section 10 – References and in Appendix B (Shoreline Inventory). Results of the ecosystem-wide analysis are presented in Section 3 of Appendix B.

2.5.3 Inventory and Characterization Approach for Shoreline Reaches

To facilitate shoreline planning at the scale needed to make specific recommendations within the Town's jurisdiction, the shoreline environment has been divided into three "reaches". Reaches are specific segments of the shoreline that will be the basis for in depth discussion of shoreline functions. Reaches in the Town were identified using guidance from Ecology with consideration for the physical and biological changes, relative intensity and type of development along the shoreline, and adjacent land use. These patterns were identified using available resources including shoreline oblique photos obtained from Ecology (Ecology 1994; Figure 2), a reconnaissance level site visit, planning documents prepared by the Town's Planning Department and others, and discussion with local planners and experts.

Baseline conditions within each reach were assessed using methods developed by Ecology. Natural resources and ecological/biological functions within each reach were evaluated in the context of the ecosystem wide processes that have been identified for the Town's location (see Section 3.4). The functional integrity and/or relative levels of impairment of the shoreline environment were then described on a reach by reach basis and specific management recommendations were made as warranted.

Inventory and characterization of each of the three reaches identified using these methods are presented in Section 5.

2.6 Ecosystem Wide Profile

The purpose of this section is to present the results of an ecosystem wide characterization of processes and functions that affect the Town's shoreline environment at a coarse scale. To understand the processes that influence and interact with shoreline functions at the reach scale, it is important to first examine the Town's location relative to other geographical and physical features at a broader watershed scale. The information presented includes areas that extend beyond the jurisdiction of the Town's shoreline environment within the Swinomish Channel to include baseline environmental data for the Lower Skagit/Samish (WRIA 3) and Puget Sound (HUC 17110019) watersheds. Specifically, the geographic scope of this section includes the following areas: the Swinomish Channel in its entirety; the Skagit and Samish Rivers, as well as associated deltas, floodplains and tributaries; Padilla and Skagit Bays; and portions of Puget Sound within Skagit County.

Watershed Overview (WRIA 3 – Lower Skagit/Samish)

The Town of La Conner lies within the Lower Skagit/Samish Watershed (WRIA 3) in northwestern Washington. WRIA 3 contains the entirety of the Samish River basin, including Friday Creek which is the outlet to Lake Samish, and the lower reaches of the Skagit River, which includes approximately eleven major tributaries and the north and south forks of the Skagit River which together with Skagit Bay bound Fir Island. La Conner lies between the Samish River and the North Fork of the Skagit River along the eastern banks of the Swinomish Channel, an 11 mile man made channel connecting Padilla and Skagit Bays (Figure 1 – Vicinity Map).

2.6.1 Padilla Bay

Padilla Bay is an estuary (eight miles long and three miles wide) at the northern edge of the Skagit River delta. Since 1980, Padilla Bay has been part of the National Estuarine Research Reserve System, a program that protects more than 1.3 million acres of near-shore coastal and estuarine areas across 22 states and Puerto Rico for purposes of long-term research, environmental monitoring, education and stewardship (Ecology 2011a, NOAA 2000).

Padilla Bay was originally formed by sediments from the Skagit River. In the last 5,000 years, only floodwaters from Skagit River have flowed to Padilla Bay and since the late 1800s, the construction of dikes has artificially reduced input from the Skagit River. A number of sloughs deliver freshwater to the bay (e.g., Joe Leary Slough and Indian Slough), and some of these sloughs are experiencing water quality problems such as low dissolved oxygen, high levels of fecal coliform, high temperatures, and low and high pH excursions (Ecology 2008 and 2010b, Smith et al. 2009).

Currently, Padilla Bay is a shallow bay with exposed mudflats on out-going tides. Intertidal flats cover approximately 75 percent of the surface area of the bay with the other 25 percent consisting of a system of dendritic channels that distribute and drain the semi diurnal tides (Bulthuis 2003). Hat Island, on the western edge of Padilla Bay, straddles the contrasting topography with eelgrass covered intertidal flats on one side and deep waters on the other side.

Existing Land Use and Cover

Agriculture surrounds the bay to the south, east and west with a few small areas of forested areas that are bisected by single family residences, roads and agricultural uses. Habitat conditions within and adjacent to Padilla Bay mostly include non forested habitat with less than 5 percent forested area surrounding the bay (Smith et al. 2009). A coarse estimation of shoreline modifications indicated that approximately 95 percent of Padilla Bay has extensive modifications that are comprised mostly of dikes and riprap (DNR 1998a).

Water Quality

The shallow nature of Padilla Bay results in naturally warm temperatures in the summer. Warm water temperatures, as high as 23 degrees Celsius, have been documented in Padilla Bay (Bulthuis 1993). Low dissolved oxygen levels have also been recorded with 4 percent of the samples below 6mg/L in August and 6 percent below the standard in September of 1985 to 1986 (Bulthuis 1993). Because the warm water temperatures appear to be natural and low dissolved oxygen levels are few, water quality in Padilla Bay is tentatively rated “good” in the salmonid limiting factors report for the watershed (Smith et al. 2009).

Several sloughs input freshwater to Padilla Bay: Joe Leary, No Name, Big Indian, Little Indian, and Telegraph Sloughs. These sloughs have been severely impacted both in terms of access conditions (loss of habitat) and quality of habitat. Most lack shrub or tree cover and most have been ditched. These water quality problems contribute to increased turbidity, nutrients and fecal coliform levels in Padilla Bay (NOAA 2000). The sources of the water quality problems in the Padilla Bay sloughs appear to be from a combination of agricultural, urban, and industrial sources. Based on a review of aerial photographs, nearly all the riparian and marine riparian areas within the Padilla Bay area have been converted to a non-forest land use, which is unable to provide functions such as shade, bank stabilization and organic inputs.

Non-Native Invaders

Control, monitoring and research on non-native species has been part of the protection plan for Padilla Bay for long term research and education (Padilla Bay NERR 2008). One of the controversial non-native species has been smooth cordgrass (*Spartina alterniflora*) that was introduced to Padilla Bay in the 1940s as an intentional planting by the Dike Island Gun Club (Riggs 1992). Padilla Bay began a control program that has eliminated most of the smooth cordgrass from the bay. However, seedlings appear each year from infestations in surrounding bays and require annual monitoring and control.

Another non-native plant, Japanese eelgrass (*Zostera japonica*), has become well established in the bay and has received a certain level of protection from Washington State agencies (Bulthuis 2003). Padilla Bay is the location of one of the early introductions of Japanese eelgrass and recent mapping projects indicate that it is spreading into areas that had been covered by the native species of eelgrass (Padilla Bay NERR 2008). Little research has been done regarding the interaction of the two species.

A non-native species that has been moving north up the west coast is the European Green Crab, (*Carcinus maenus*) (Yamada and Randall 2006, Bulthuis 2003). Padilla Bay has joined several other National Estuarine Research Reserves, including South Slough in Oregon and Elkhorn Slough in California in a pilot invasive crab monitoring project (Bulthuis 2003). Replicate trays with appropriate habitat for crabs are set out and collected every three months, and sizes and numbers of native and non-native crabs determined. The project is still in progress, but the European Green Crab has not reached Padilla Bay yet although it has been found in Oregon and California (Yamada and Randall 2006, Bulthuis 2003).

2.6.2 The Skagit River & Skagit Bay

The Skagit River is the largest Puget Sound river system and enters Puget Sound near Whidbey and Camano Islands. The Skagit River produces the most salmonid and salmonid stocks in Puget Sound including all five species of Pacific salmon (e.g., Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye (*O. nerka*) salmon) as well as other salmonids and char such as cutthroat (*O. clarkii*), steelhead (*O. mykiss*), and bull trout (PWA and Skagit Systems Cooperative 2004). The Skagit River discharges approximately 39% of total sediment and 20% of freshwater input into Puget Sound (Downing 1983).

Skagit Bay is located at the southern edge of the Skagit River delta and is a ten mile long by four mile wide shallow estuary, with most depths ranging 0 to 5 feet below Mean Sea Level (MSL). The main stem of the Skagit River splits at Fir Island (river mile 9.5) into the North and South Forks of the Skagit River before entering Skagit Bay. The construction of dikes around the perimeter of Fir Island has altered wildlife habitat and disconnected pathways of freshwater and sediment delivery to Skagit Bay mudflats and intertidal areas.

Existing Land Use and Cover

Agriculture is the dominant land use surrounding Skagit Bay along with some single unit residential areas on Whidbey and Camano Islands to the west and a Washington Department of Fish and Wildlife (WDFW) wildlife refuge at the mouth of the South Fork of the Skagit (Ecology 2002). Commercial and recreational shellfish harvests are also conducted in Skagit Bay. Agricultural areas are primarily drained by slough and ditches with tide gates and pump stations to prevent flooding from high tides and high surface water flow. Based on a review of aerial photographs, the majority of marine riparian areas adjacent to Skagit Bay have been converted to non-forested cover, with associated decreases in functions such as shade, bank stabilization and organic inputs.

Water Quality

Water quality within the lower Skagit River and Skagit Bay has been degraded by development, agriculture and wastewater impacts. Elevated levels of nutrients and chronic levels of lead and copper have been documented in the lower main stem Skagit River. Most of the lower Skagit tributaries have very warm water temperatures in the summer months in addition to elevated nutrients, low dissolved oxygen levels, and increased turbidity. Skagit Bay and several freshwater tributaries exceed Washington State's surface water quality criteria for dissolved oxygen and fecal coliform and are listed on the 2008 303 (d) impaired water body list (Ecology 2008).

Non-Native Invaders

Smooth cordgrass (*Spartina alterniflora*) was introduced to north Puget Sound in the 1940s and again in the 1960s to control eroding shorelines and to serve as cattle forage (Riggs 1992; Dept. Agriculture 2000). Removal efforts have occurred throughout Skagit Bay with particular focus on a large colony at the southern end of Skagit Bay (Dept. of Agriculture 2000). However continued monitoring and effort is needed to control the spread of smooth cordgrass (Smith et al. 2009).

2.6.3 The Swinomish Channel

The Swinomish Channel is a navigable man-made cut through what was once a complex of mud flats, salt marshes and shallow tidal sloughs referred to as the "Swinomish Slough" (Hood 2004). A proposed U.S. Army Corps of Engineers (Corps) dredging and diking project, to make the Swinomish Slough into an inland passage, was approved by Congress in 1892. The project was completed in 1937.

The 11 mile long channel connecting Padilla Bay on the north with Skagit Bay on the south provides an alternate route to Rosario Strait for fishing boats, tugs, recreational craft, and shallow draught freight vessels heading north from Saratoga Passage or south from Bellingham Bay or Padilla Bay. The new channel separated the area now known as Fidalgo Island from the mainland. Historically, funded through the Corps' annual budget, the channel has been dredged every three to four years to an authorized depth of 12 feet below mean lower low water to keep the channel open for vessels and prevent boats from running aground (Bach 2010).

Prior to 2012, the channel was last dredged in 2008. A Swinomish Channel sedimentation study commissioned by the Port of Skagit County determined that the channel would reach depths of minus 2 feet by 2015 in Padilla Bay and by 2019 in Skagit Bay (Coastal Geologic Services 2010a, 2010b). The Army Corps of Engineers received funding to dredge the Channel to 12 feet in 2012 and successfully completed the dredging.

2.7 Existing Land Use and Cover

Existing land use for a majority of the channel is mapped as agricultural in the northern and eastern areas and as urban commercial for the Swinomish Tribe in also in the northeastern end of the channel, and (Town of La Conner) in the south end (Ecology 2002). A small area of the western shore is mapped as mixed forested. However, from a review of aerial photographs, the forested area is bisected with roads and cleared areas.

Water Quality

Swinomish Channel is listed on the 2008 Water Quality Assessment as a Category 5 – Polluted Waters/303d List impaired water body for tissue level exceedances for Benzo(a)anthracene and Chrysene. The area mapped as impaired is adjacent to the agricultural areas north of the Town of La Conner (Ecology 2009 and 2008). Shellfish in the Swinomish Channel were sampled for metals and organic compounds, and elevated levels of tributyltin and Polycyclic Aromatic Hydrocarbons (PAHs) were found (Johnson 2000). Potential sources of pollutants are runoff from adjacent agricultural areas as well as marinas and boat traffic.

The Town holds a National Pollutant Discharge Elimination System (NPDES) permit for their publicly owned treatment works (POTWs) (i.e., wastewater treatment plant) which discharges to the Swinomish channel at the Morris Street end, after harmful organisms and other contaminants have been removed from the wastewater.

Non-Native Invaders

Smooth cordgrass (*Spartina alterniflora*) was introduced to north Puget Sound in the 1940s and again in the 1960s to control eroding shorelines and to serve as cattle forage (Riggs 1992, Dept. Agriculture 2000). Removal efforts have occurred throughout the watershed including approximately 2.75 acres of the Swinomish Channel in 2000 (Dept. of Agriculture 2000). However continued monitoring and effort is needed to control the spread of smooth cordgrass (Smith et al. 2009).

See Appendix B, Sections 4.0 and 5.0, for detailed discussions of physical and biological features and processes within the Swinomish Channel.

2.8 Physical and Biological Features in the Vicinity of the Swinomish Channel

Climate

The climate in the vicinity of the Town of La Conner is generally mild with approximately 33 inches of annual rainfall and average monthly temperatures ranging from 40 degrees Fahrenheit (°F) in January to 63 °F in August with the frost free season beginning in late April and the first frost occurring around mid to late October (NOAA 2002).

Geology

The project area is located within the northern portion of the Puget Lowland Physiographic Province. The Puget Lowland physiographic province consists of a broad, low lying region of subdued topography situated between the Cascade Range to the east and the Olympic Mountains to the west.

Geology in the project vicinity is mapped on the 7.5 minute Utsalady Quadrangle (Dragovich et al 2004) and the 7.5 minute La Conner Quadrangle (Dragovich et al 2000).

The surficial geologic units within the project vicinity consist of near-shore deposits, Skagit River alluvium, beach deposits, marsh deposits, Vashon age glacial till, Vashon age advance glacial outwash, Glaciomarine drift, sedimentary conglomerate bedrock, and Metasedimentary bedrock.

Nearshore deposits (Qn) are Holocene in age and include estuarine or tidal flat deposits composed of fine sand silt and clay and locally includes flood deposits marsh or peat deposits. Beach deposits (Qb) are Holocene in age and characterized as loose poorly graded sand and gravel along shorelines typically well rounded, locally include shell fragments. Marsh deposits (Qm) are Holocene in age and characterized as soft to stiff gray silt and silty clay, commonly with lenses and layers of peat, muck and other organic material. Locally includes up to 5-inch thick layers of white to cream colored volcanic ash. Poorly graded sand and gravel observed along shorelines are typically well rounded and locally include shell fragments.

Skagit River Alluvial deposits (Qas) within the project area are Holocene in age and generally consist of stratified poorly graded fluvial deposits of sand, with silt and clay and contain lesser sandy gravel, cobbles and/or gravel.

Glacial till (Qgt) deposits mapped in the project vicinity are Pleistocene in age and consists of dense to very dense, non-sorted mixture of clay, silt, sand, gravel, cobbles and boulders. The upper 2 to 5 feet is often weathered, and the consistency can range from medium dense to dense. The till was deposited and consolidated by several thousand feet of ice.

Advance outwash (Qga) deposits mapped in the project vicinity are Pleistocene in age and generally consist of dense to very dense, stratified, clean to silty sand with variable quantities of gravel and occasional layers or lenses of clay and silt. The Vashon advance outwash was deposited by meltwater streams flowing from the advancing Vashon lobe of the Fraser glaciation. The advance outwash subsequently was overridden consolidated by several thousand feet of ice. Typically, the advance outwash is highly permeable and susceptible to erosion.

Glaciomarine drift deposits (Qgdmec) mapped in the project vicinity are Pleistocene in age and characterized as a silt and clay-rich unit with few or no dropstones. Glaciomarine drift is light yellow-brown and blocky and stiff when dry and dark brown to grayish blue and soft when moist or wet. It locally has vertical jointing or desiccation cracks.

Conglomerate bedrock (Ecb) mapped in the project vicinity is Oligocene to Eocene in age and characterized as yellowish brown, subangular to subrounded, moderately spherical to elongate, pebble and cobble conglomerate; typically massive to locally very thickly bedded. The unit contains lesser interbeds of brownish gray or yellowish brown pebbly sandstone to sandstone, reddish gray siltstone, and minor diamictite and coal; reddish brown to yellowish brown color due to iron oxide staining.

Metasedimentary rocks (KJmsg) mapped in the project vicinity are Cretaceous to Jurassic in age and characterized as non-foliated to foliated or cleaved metamorphosed sandstone with lesser greywacke, siltstone or argillite, conglomerate, minor chert, and rare marble pods and very poorly sorted conglomerate/breccia.

Fish and Wildlife Habitats

Marine Beaches and Tidal Areas

Approximately 72 percent of intertidal habitat within the Skagit delta has been lost and dikes have isolated much of the historic delta habitat (Smith et al. 2009, Ecology 2011b). Further impacts that have resulted in loss of beach and tidal areas include ditching, channelization and filling (Smith et al. 2009). The loss of estuarine habitat has been extensive throughout the Skagit, Samish and Padilla shorelines, mostly due to diking, which has isolated former estuarine habitat (Smith et al. 2009). Further losses have occurred as the isolated habitat is ditched, drained, or filled to convert estuarine habitat into agricultural land.

The Swinomish Channel is a manmade channel and therefore has been greatly impacted by shoreline modifications. More than 30 percent of the segments along the channel have an extensive level of modifications, with most comprised of riprap followed by landfill (dikes) and bulkhead impacts (Smith et al. 2009). The Swinomish Channel also has large numbers of overwater structures, including two road crossings (three bridges), a railroad trestle, boat ramps, marinas, piers, and slops (Smith et al. 2009).

Eelgrass and Kelp Beds

Due to site and topography conditions Padilla Bay has one of Washington's largest area of eelgrass (*Zostera marina*), estimated to be approximately 8,000 acres in size (Ecology's Padilla Bay website). Padilla Bay eelgrass beds may have increased in area due to the diversion of freshwater (Skagit River) away from the bay, as eelgrass prefers saltier water (Smith et al. 2009). Eelgrass meadows are important because they provide food and shelter for a variety of species including: Dungeness crab, juvenile salmonids and hundreds of thousands of waterfowl and marine birds (Padilla Bay NERR 2008). Within Swinomish Channel, patchy eelgrass beds have been documented, particularly along the west bank (Smith et al. 2009). The historic extent of eelgrass within the Swinomish Channel is not known but dredging activities, and the presence of numerous overwater structures have likely impacted historic eelgrass beds in this area.

Wetlands

A significant loss of both estuarine and freshwater wetland habitat has occurred in the lower Skagit basin (including Skagit and Padilla Bays). Diking, draining, and filling have obliterated nearly all of the salt marsh that was once associated with Padilla and Skagit Bays. Only a small fraction of salt marsh, riverine and tidal wetlands remain. An estimated 454 wetlands have been identified in the Padilla Bay watershed, but most of these no longer have contact with streams that either provide or directly connect to salmonid habitat, and of those on Port of Skagit County property most are small at less than 1-acre (Smith et al. 2009). Currently, wetlands comprise 5 percent of the Padilla Bay/Bay View watershed, but hydric soils, potential for historic wetland areas, account for 64 percent of the watershed (Smith et al. 2009). The dredging of the Swinomish Channel through what was once a series of wetland habitat that consisted of salt marshes and shallow tidal sloughs has significantly altered wetland habitat.

Fish and Wildlife Species

Table 4-1 presents United States Fish and Wildlife Services (USFWS) and National Marine Fisheries Services (NMFS) Marine and Aquatic Listed Species in Skagit County.

Table 4-1. USFWS AND NMFS Marine and Aquatic Listed Species in Skagit County

Species	Status
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened
Bull Trout (*Salvelinus confluentus*)	Threatened
Chinook Salmon (*Oncorhynchus tshawytscha*)	Threatened
Steelhead (*O. mykiss*)	Threatened
Southern Resident killer whale (*Orcinus orca*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Steller sea lion (*Eumetopias jubatus*)	Threatened
Bocaccio (*Sebastes paucispinis*)	Endangered
Canary rockfish (*Sebastes pinniger*)	Threatened
Yelloweye rockfish (*Sebastes ruberrimus*)	Threatened

Marine Mammals

Adjacent to the Swinomish Channel in Skagit and Padilla Bays observed marine mammals include the harbor seal (*Phoca vitulina*) and the river otter (*Lutra canadnsis*) (Padilla Bay NERR 2008, Jeffries, 2000). Harbor seals use isolated sand and mud flats along tidal channels as haul - out sites for resting, grooming and sunning (Jeffries 2000). In deeper water, killer whales (*Orcinus orca*) have been observed regularly, and harbor porpoise (*Phocoena phocoena*) and Dall's porpoise (P*hocoenoides dalli*) are occasionally found in the deeper waters as well (Padilla Bay NERR 2008). It is assumed these mammal species are outside the waters of the Swinomish Channel (Padilla Bay NERR, 2008). Although, there are no harbor seal haul out sites located within the channel, haul out sites are located to the north (Padilla Bay) and south (Skagit Bay) (Jeffries 2000) and it is assumed that harbor seals may use the Swinomish channel.

Seabirds and Waterfowl

Padilla Bay

Waterfowl have been and continue to be an important component of the Padilla Bay food web (Bulthuis 2003). It is estimated that Padilla Bay contains an average of 50,000 ducks of 26 species during the winter (Padilla Bay NERR 2008). Widgeon, pintail, mallard, green-winged teal, and scoters are particularly abundant during autumn and spring migrations, as well as a large number that over winter in the bay. The herbivorous brant (*Branta bernicla*) feed directly on the eelgrasses, with some evidence that most of one race, the High Arctic Brant, over winter in Padilla Bay rather than in Mexico as do most other brant (Bulthuis 2003 and Padilla Bay NERR 2008).

In addition to the waterfowl, two great blue heron (*Ardea herodias*) rookeries have been identified on the shores of Padilla Bay and it is estimated that more than 240 species of birds can be found at Padilla Bay (Padilla Bay NERR 2008).

Swinomish Channel

Due to the location of the Swinomish Channel, between Padilla Bay and Skagit Bay, many species of birds likely use the channel as a migration and resting area. The channel itself does not provide high quality habitat due to boat traffic, lack of food and development along the shores. However Padilla Bay is known to be an important area for seabirds and other waterfowl.

Shorebirds

Common shorebirds found in the vicinity of the Swinomish Channel include greater yellowlegs (*Tringa melanoleuca*), black-bellied plover (*Pluvialis squatarola*), dunlin (*Calidris alpine*), and western sandpiper (*Calidris mauri*).

Forage Fish

Pacific herring (*Clupea pallasi*) are a common forage fish using Padilla and Skagit Bay near-shore areas. They typically use eelgrass as a spawning substrate although this has not been observed. Surf smelt (*Hypomesus pretiosus*) and sand lance (*Ammodytes hexapterus*) also use near-shore areas of both bays for spawning. Forage fish species occupy marine and estuarine near-shore habitat and because of their role of critical prey species, including salmonids, recent attention has been paid to their conservation and protection (Penttila 2007). There are data gaps and it is not known to the extent of which forage fish may utilize Swinomish Channel (Smith et al. 2009).

Salmonids

Padilla Bay is an important migration route for juvenile Chinook, coho, pink and chum salmon (Padilla Bay NERR 2008). Skagit Bay and the Skagit River are highly productive salmonid system producing the most salmonids and salmonid stocks in Puget Sound including all five species of Pacific salmon (Chinook, chum, coho, pink, sockeye), in addition to cutthroat, steelhead and bull trout (PWA and Skagit Systems Cooperative 2004). Migrating juvenile salmon spend varying lengths of time in estuaries and eelgrass beds before moving to the North Pacific. In addition, once juvenile salmon migrate out of rivers and into estuaries, they spend time in brackish water searching out areas of appropriate salinity as they adapt to the marine environment. They use the near-shore and shallow areas to obtain food before they venture to deeper water. While there is no spawning habitat within Swinomish Channel, adult and juvenile salmonids migrate and rear throughout Puget Sound and the Strait of Georgia, which are adjacent to the Swinomish Channel (WDFW 2003).

Before construction of the McGlinn Island Causeway and Jetty, mixing of marine water from Padilla and Skagit Bays with freshwater from the North Fork Skagit River likely created a salinity gradient in the Swinomish Channel that allowed juvenile salmon opportunity to seek out appropriate habitat while transitioning from freshwater to saltwater physiology. With construction of the McGlinn Island jetty freshwater from the Skagit River was prevented from flowing north up the Swinomish Channel so that a sharp salinity contrast has been created between the Swinomish channel and the Skagit River approximately 3000 feet south of the southern La Conner Town limits at the north end of McGlinn Island.

For migrating juvenile salmon, this salinity contrast acts as a physiological barrier, especially for Chinook salmon that are more physiologically sensitive (Hinton et al 2008, Yates 2001). Fish catch data indicate that abundance of juvenile salmonids is very low in the Swinomish Channel relative to other areas in the Skagit River delta (Yates 2001). Juvenile Chinook catch data show a steady decline from the southern end of the Swinomish Channel to zero on a northward gradient (Hinton et al 2008, Yates 2001).

Marine Invertebrates

Mussels (*Mytilus trossulus)*, oysters (e.g., Pacific oyster introduced species (*Crassostrea gigas*) and Olympia oyster – native species (*Ostrea conchaphila*)) and barnacles (*Belanus glandulus*) are common invertebrates found on hard surfaces in marine intertidal/sub-tidal areas in this part of Puget Sound. Other marine invertebrates found abundantly in mud and sand habitats of Padilla and Skagit Bays include but are not limited to: polychaete worms such as the lugworm (*Abarenicola sp*.) and Capitella, clams include the bent-nose clam (*Macoma nasuta*), the mud clam (*Mya species*) and Transenella species. Many other organisms, shrimp and crab being the most common, live on the surface probing the sediment for food or discarded material (Bulthuis 2003 and Padilla Bay NERR 2008).

Ecosystem Processes

Near-shore Marine Ecosystem Processes

The purpose of this section is to characterize near-shore marine ecosystem process that are likely to influence shoreline function within the limits of the Town's shoreline jurisdiction and to provide a framework for further analysis of impairments to these processes and possible management solutions, including restoration opportunities. To accomplish this goal, information in this section is presented primarily within a tabular format as suggested in Chapter 7 of Ecology's Shoreline Master Program (SMP) Handbook (Ecology, 2010). Organization of ecosystem processes and shoreline functions within the following tabular format generally follows guidance provided in Stanley et al. (2005) and WAC 173.26.201.

According to Ecology (2010), ecosystem processes are "dynamic physical and chemical interactions that form and maintain natural landscapes." Ecosystem processes include the movement of water, sediment, nutrients, pathogens, toxins, and organic/woody debris.

Shoreline functions, on the other hand, are the ecological services provided by the physical, chemical and biological ecosystem processes. Specific ecological functions are lumped into three general categories of functions including Water Quality, Water Quantity, and Habitat.

In the following table, each ecosystem process likely to influence shoreline function within the limits of the Town’s shoreline jurisdiction is identified, as well as the specific physical structure(s) and ecological function(s) influenced by the process. Physical structures are the physical location within the landscape where these processes and functions take place and/or interact with the environment. Potential threats to these functions that may result from anthropogenic landscape alteration are also included.

Table 5-1. Nearshore Marine Ecosystem Processes and Functions

Ecosystem Process	Physical Structure(s)	Ecological Function(s)	Potential Threats
Movement of Water: • Surface water runoff • Tidal fluctuations • Currents • River flow • Precipitation • Groundwater exchange • Evaporation/ Transpiration	Swinomish channel Marine riparian Intertidal zone Subtidal zone • Slough • Wetlands* • Skagit estuary* • Padilla Bay* • Adjacent uplands	<u>Water Quantity:</u> • Input, retention and release of water to aquatic locations through time <u>Water Quality:</u> • Appropriate salinity in estuarine and brackish areas <u>Habitat:</u> • Habitat for aquatic species (fish, seabirds/waterfowl, marine mammals, invertebrates, submergent/emergent plants) • Habitat for aquatic prey and forage species (fish, invertebrates, plants)	• Shoreline armoring • Floodplain development • Impervious surfaces • Climate change/sea level rise • Construction of jetties and/or causeways
<u>Movement of Sediment, Nutrients, Pathogens and Toxins:</u> • Surface water runoff • Marine riparian vegetation • Coastal erosion • Alluvial deposition • Currents/drift cells • Beach erosion/accretion	• Marine riparian areas • Banks of the • Swinomish channel • Skagit estuary* • Padilla Bay* • Adjacent uplands	<u>Water Quality:</u> • Removal of excess nutrients, sediments, pathogens and toxins <u>Habitat:</u> • Feeder bluffs as sediment source • Marine habitats receive contributions of organic material and insects from marine riparian vegetation • Redistribution of sediments and formation of beaches • Appropriate substrates for forage fish spawning habitat • Appropriate substrates for benthic invertebrate habitat	• Dredging and filling • Agricultural runoff • Marinas and vessel traffic • Shoreline development & impervious surfaces • Shoreline armoring • Construction of jetties and/or causeways
<u>Movement of Woody Debris:</u> • Marine riparian vegetation • River flow • Currents/drift cells	• Marine riparian areas • Banks of the Swinomish channel • Skagit river and estuary* • Adjacent uplands	<u>Water Quality:</u> • Organic nutrient inputs into marine environments <u>Habitat:</u> • Creating and maintaining aquatic habitat for a variety of species • Natural buffering of effects from wave action on shoreline	• Removal of marine riparian vegetation • Shoreline development & overwater structures • Construction of jetties and/or causeways

Alterations to Near-shore Processes

The preceding section outlines ecosystem processes, shoreline structures and functions, and potential activities that may threaten the integrity of these functions through anthropogenic alteration. The following list of past, current and a potential future alteration to near-shore processes that may affect shoreline functions within the Town is based on the information presented above:

- Shoreline armoring
- Shoreline development, including new impervious surfaces and overwater structures
- Floodplain development
- Dredging and filling
- Levies, jetties and causeways
- Agricultural runoff
- Marinas and vessel traffic
- Climate change/sea level rise

The extent that these alterations have already affected or have the potential to affect shoreline ecological function within the Town's jurisdiction are discussed in the following sections.

Shoreline Armoring

Shorelines in La Conner have already been armored with riprap and wooden bulkheads, resulting in a modification of more than 80 percent of the total shoreline across the Town's jurisdiction, with extensive reaches of 100 percent modification (DNR 2000a, USACE 1996). Shoreline armoring can have negative effects on hydrologic and other ecological processes by limiting groundwater exchange with the marine environment, altering movement patterns of water associated with tidal currents, and altering transport of sediment, nutrients, and large woody debris (Shipman et al. 2010). These alterations ultimately affect the distribution of beaches and other important habitat structures and can indirectly affect water quality. There is currently a very limited distribution of natural sandy beaches within the Town, with most shoreline areas consisting of steep man-made banks instead (DNR 2000a).

Shoreline Development

Shoreline development refers to the collective alteration of the shoreline environment through construction of structures at or near the land water interface. This includes development activities that displace marine riparian vegetation communities, increase impervious surfaces and/or contribute to new overwater or in-water structures. Most of the shoreline within the Town has experienced a high level of historical and on-going development (DNR 2000a and 2000b, Doyle 2011, GeoEngineers 2011, Town of La Conner 2005b, 2007a, 2009b, 2010c, 2011a). Shoreline development can negatively affect ecological functions as a result of an increase in impervious surfaces, which increases surface water runoff including pollutants that may be transported in this runoff, limiting groundwater exchange, and altering drift processes that can influence the distribution of sediment, nutrients, pathogens, toxins and woody debris and therefore may affect water quality and habitat functions.

Floodplain Development

Floodplain development has the potential to alter movement of water, which can directly affect water quantity and indirectly affect water quality. Sixty-eight percent of the Town is mapped within the 100-year floodplain, but the accuracy of this mapping is currently undergoing review and on-going discussion with FEMA (GeoEngineers 2011, Town of La Conner 2009a, FEMA 2009, 2010). Consequently, all development within the town has the potential to impact shoreline ecological functions by affecting the retention and release of water during times of high river flow and precipitation (water quantity) and through absorption, uptake and removal of pollutants (water quality) that naturally occurs in undeveloped floodplains.

Dredging and Filling

The Swinomish Channel itself is a man-made cut that has been maintained through dredging activities every three to four years since it was originally completed in 1937 (Bach 2010, Grossman et al. 2007, Hood 2004). The Channel was last dredged in 2008 and the Town has expressed strong support to the USACE for ongoing dredging (Bach 2010, Town of La Conner 2010c, 2010c, 2010e), which has important economic benefits to the Town (BST Associates 2010). The effects of dredging on the natural environment are evident in the limited and patchy distribution of aquatic vegetation within the channel (DNR 2000b) as well as dominance of artificial, mixed course and mixed fine substrates in intertidal areas within the channel (DNR 1998a, 1998b). Dredging activities have the potential to artificially redistribute sediments, nutrients, pathogens and toxins, which can affect water quality and habitat conditions. In 2012, the Army Corps of Engineers receive Congressional funding to dredge the channel to a 12-foot depth.

Jetties and Causeways

The following history of construction activities associated with jetty and causeway development to maintain the Swinomish Channel is summarized from Grossman et al. (2007). A causeway was constructed between the southern end of La Conner and McGlinn Island to the south during the 1930s to protect channel navigation from flooding impacts and to block sediment input into the channel from the Skagit River. Shortly thereafter, in 1938, a jetty was built from McGlinn Island out to Goat Island and beyond to further restrict sediment input from the river into the channel.

Alteration of alluvial deposition, currents and drift patterns associated with these jetty/causeway features has altered movement of water, sediment and nutrients and has reduced connectivity between habitats. Alteration of mixing processes has impacted suitable habitat for salmon fry through impacts to salinity in the estuarine environment. As a result of salinity barriers, salmon fry leaving the Skagit River may be discouraged from accessing and using available habitat further north within the Swinomish Channel and beyond into Padilla Bay (Hinton et al 2008). This occurs in spite of the fish passage structure present in the jetty. The net drift pattern within the Swinomish Channel is from south to north. However, alteration of drift patterns resulting from jetty/causeway construction may further limit salmon and, more likely, forage fish spawning habitat within the channel due to the restriction of sediment drift into the channel and deposition that would otherwise form sandy beaches.

Agricultural Runoff

Most of the land area to the north and east of the Town is dominated by agricultural use (Ecology,2002). There is a drainage slough, located just south of Dunlap Way and North Basin Street and just north of the South Basin marina area, flowing through the Town from the east and discharging into the Swinomish Channel. This slough drains agricultural areas to the east and may be a significant source of nutrient and pollutant inputs into the channel. These inputs likely have an adverse effect on water quality. There are known elevated levels of tributyltin and various polycyclic aromatic hydrocarbons (PAHs) in the Swinomish Channel and/or organisms inhabiting the channel (Ecology 2008, Johnson 2000). These compounds, which are known to be toxic to a variety of organisms, likely, originate from adjacent agricultural activity and/or as a result of marinas and vessel traffic (see below).

Marinas and Vessel Traffic

There are two marinas within the Town (the North and South Basins), as well as numerous docks and boat moorage structures lining the Swinomish Channel. There is also extensive boot moorage at Shelter Bay to the southwest from Town. It is clear that vessel traffic and other marine boating activity dominate the shoreline and channel through town. These activities contribute generally to shoreline modifications and contribute to degradation of water quality (see above) and habitat as a result of vessel noise and pollutants.

Climate Change/Sea Level Rise

The principal effect of climate change on shoreline environments is anticipated to result from sea level rise (SITC 2010 and 2009, Skagit County 2010 and 2008, and Town of La Conner 2010a). Other effects, such as a general increase in local average high temperatures and/or changes in precipitation patterns are either too poorly understood at this point or are unlikely to have significant effects on shoreline environments at a scale and within a timeframe that can be estimated with any degree of certainty. Sea level rise may play a role in ongoing development of shorelines as existing structures may need to be modified and/or new structures constructed to meet current uses in light of a changing environment. Storm surge events are currently increasing. The intensity and frequency of storm events are likely under the current climate change modeling.

Additionally, change in average tidal elevations over time will affect both the spatial and temporal distribution of water in vertical and lateral planes at the land-water interface. This may have dramatic effects on the distribution of appropriate fish, wildlife and plant habitats, particularly in the current intertidal/littoral and supratidal/supralittoral zones. These effects could compound throughout trophic hierarchies. Areas most at risk from sea level rise include sensitive shoreline areas currently experiencing tidal inundation that could become permanently inundated as well as those areas in or above the spray zone that may at a future point experience regular tidal inundation(SITC 2010 and 2009, Skagit County 2010 and 2008).

Conditions by Reach

This section describes features and processes within each of the three reaches identified within the Town of La Conner's Shoreline Jurisdiction (Figure 2). Appendix B presents shoreline photographs.

Reach 1 – Marine Harbors, Industrial and Commercial, North of Downtown

Shoreline Reach 1 (Reach 1) is the northern most segment of the Town extending from the northern Town limits, at North Pearle Jensen Way, south for approximately 3,000 feet (0.6 miles) along the Swinomish Channel to South Basin Street. There is approximately 6000 feet of shoreline along this reach associated with the La Conner Marina's North and South Basins (owned and operated by the Port of Skagit) and the Drainage Slough outlet immediately south of Dunlap Street that drains adjacent farm fields.

Three shoreline environmental designations exist within this reach including Urban Industrial, Urban Commercial (Environment A) and Public Use (Figure 3, Town of La Conner Shorelines Map). There are no public shoreline access points along this reach. The Drainage Slough is listed as Public Use, however the slopes of the slough are steep and there are no docks or beaches along the Drainage Slough.

The direction of net shoreline drift is from south to north along all shoreline reaches; however tidal currents go both directions in the Swinomish channel. Sediments released from the Skagit River and the Drainage Slough are swept north, deposited in the navigation channel or deposited on the sandy beaches on the western shore on the Swinomish Reservation.

Along the Swinomish Channel in this reach, the upper shoreline is steep and armored with riprap from approximately the OHWM down to approximately the Mean Lower Low Water (MLLW). Below MLLW the shoreline is generally more gradually sloped and consists of soft sediments, gravel and smaller barnacle-encrusted rock (6" minus). The shorelines in the north and south basin marinas have more gradual slopes than those along the Swinomish Channel and they are composed of soft sediments. Apart from the areas immediately adjacent to the channel the shorelines are not armored with riprap.

The Port of Skagit implemented an eelgrass habitat mitigation project along the shoreline immediately north of the north basin along the Swinomish Channel. This area is identified as eelgrass habitat by the DNR Shoreline Inventory (DNR 2000a) and as green algae and salt marsh habitat by the Skagit County Intertidal Habitat Inventory (DNR 1998a). In addition, the DNR Shoreline Inventory identified eelgrass habitats within the Drainage Slough and immediately north and south of the Drainage Slough along the Swinomish Channel (DNR 2000a). These areas have not been surveyed since 2000.

The Skagit County Intertidal Habitat Inventory identified areas of salt marsh habitat in the following locations: patches along the north and south shores of the north basin marina; patches along of the north shore of the Drainage Slough, a small patch along the shoreline between the north basin marina and the Drainage Slough and along the east and south shores of the South Basin Marina (DNR 1998a). In addition, a small patch of shoreline between the North Basin Marina and the Drainage Slough was identified as supporting green algae and mixed algae were identified immediately south of the Drainage Slough (DNR 1998a).

Marine riparian vegetation in the form of a thin line of landscaped trees is present along the eastern and southern banks of the north basin marina and along the eastern bank of the south basin marina. Other marine riparian vegetation consists of various grasses and herbaceous species. At lower tidal elevations (+5 to 7 feet) the rock or rip rap is covered in rockweed (*Fucus* sp.). Above this are American glasswort (*Salicornia virginica*), sea plantain (*Plantago maritima* ssp *juncoides*), Puget Sound gumweed (*Grindelia integrifolia*), and red goosefoot (*Chenopodium rubrum*). At the upper shoreline adjacent to the road there are grasses and weeds present.

No forage fish habitats have been documented along this shoreline reach (WDFW 2011). Listed salmonid species may use this reach of the Swinomish Channel, however due to salinity barriers, salmon fry leaving the Skagit River may be discouraged from accessing and using available habitat further north within the Swinomish Channel and beyond into Padilla Bay (Grossman et al. 2007).

Shoreline structures along Reach 1 consist of docks, piers and marina slips. Along the Swinomish shoreline there are 6 structures that consist of piers that connect to floating docks. The floating docks are located approximately 50-110 feet from the OHWM and are oriented parallel to the shoreline. The La Conner Marina has 366 covered moorage slips, 131 open moorage slips and 2,400 lineal feet of dock space for overnight moorage.

Recommendations

Biological and physical features and processes are highly altered within Reach 1. Armored or altered banks, over-water structures, and a fully developed marine riparian area (all owned by Port of Skagit) are all key features of this reach. Along this reach, sediments are not forming sandy beaches, drainage from upland areas does not create dendritic channels and pocket estuaries, and marine riparian vegetation is not providing shade and a source of organic debris to the marine environment. This reach of the Town of La Conner is operated and managed as a commercial/industrial waterway and a marina and thus opportunities for restoration or conservation are limited. Opportunities for restoration include removal of old derelict isolated creosote piles and improvements as over-water structures are maintained. This could include replacement of creosote piles with concrete or steel piles, adding transparency on decking, and decreasing lighting impacts to the marine and shoreline environment.

Reach 2 – Downtown La Conner South to Sherman Boat Launch

Shoreline Reach 2 (Reach 2) is the central segment of the Town extending from South Basin Street, immediately south of the Port of Skagit marina properties, south to the Sherman Avenue boat launch (Figure 2). Reach 2 extends for approximately 3,300 feet (0.6 miles) along the Swinomish Channel.

Five shoreline environmental designations exist within this reach including Urban Commercial (Environments A and B), Historic Commercial, Residential and Public Use (Figure 3). The Historic Commercial environment is within Town of La Conner Historic District "…whose significance is related to the preserved nature of the commercial buildings primarily along the waterfront that reflect the development of this town as a 19th century center of commerce, government, transportation, agriculture and fishing" (Town of La Conner 2011b). See Section 7.0 for more discussion of the Town of La Conner Historic District. There are seven public shoreline access points along this reach including public floats at the Benton Street, Washington Street and Morris Street ends, a public boat launch at the Sherman Avenue end, and shoreline access at the Commercial and Jordan Street ends (Figure 3). Land use within Reach 2 is primarily commercial with water-enjoyment uses. The Upper Skagit Indian Tribe owns a parcel of land just north of Sherman Avenue where they dock their fishing fleet, a water-dependent use. The Upper Skagit Indian Tribe hopes to use the property for fish processing in the future, another water-dependent use.

The direction of net shoreline drift is from south to north along all shoreline reaches; however tidal currents go both directions in the Swinomish channel. Sediments released from the Skagit River and swept north through the Swinomish Channel are deposited in the navigation channel or on the sandy beaches on the western shore on the Swinomish Reservation. These sediments accumulate at a rate of 2 feet per year at the southern end of the Swinomish Channel and 1 foot per year at the northern end of the Swinomish Channel (Coastal Geologic Services 2010a, 2010b).

Along the Swinomish Channel in this reach, the shoreline is armored with riprap from as high as 15 feet above MLLW to 15 feet below MLLW (USACE 1996). During the late summer and fall of 1993, the United States Army Corps of Engineers (USACE) installed approximately 1500 feet of bank protect along the eastern shore of the Swinomish Channel from the end of Commercial Street to the end of Center Street, excluding the area under Dunlap Dock at the end of Commercial Street. The materials used consisted of 12 inch minus graded riprap, 11/4 inch minus crushed rock and pea gravel. North of Morris Street, where resource agencies wanted to preserve fine grained mud substrate for habitat purposes, an L-shaped wood pile bulkhead, approximately 150 feet long, was constructed instead of an armored bank.

Since its installation, the bulkhead has been partially covered by a wood pile boardwalk constructed by the owner. To address fish habitat concerns, patches of flat benched areas were created along the shoreline at elevations between Mean Higher Water (MHW) and MLLW. These shallow benches provide a safe migratory path for migrating juvenile salmonids as the shallow waters are ideal for avoiding predation from below and also create habitat for prey items for young fish (e.g., copepods and amphipods).

The DNR Shoreline Inventory does not identify seagrass, kelp, sargassum or dunegrass occurring along Reach 2, however it does identify the entire reach as having patchy salt marsh vegetation, except for the last 150 feet, immediately north of the Sherman Avenue boat launch (DNR 2000a). The Skagit County Intertidal Habitat Inventory identified areas of salt marsh habitat at the end of Morris Street, areas of mixed algae south of Caledonia Street and between State and Morris Street, and areas of green algae between Morris and Washington Streets and between Douglas and Caledonia Streets (DNR 1998a). WDFW priority habitats and species maps identify turf algae occurring between State and Washington Streets and between Douglas and Sherman Avenue (WDFW 2011). “Turf Algae” refers to *Vegetated Marine/Estuarine* habitats consisting of non-emergent green, red, and/or brown algae plants growing on solid substrates (rocks, shell, hardpan) (WDFW 1999). Turf algae is not a priority habitat, but appears on PHS maps because they provide for comparatively high fish and wildlife density, high fish and wildlife species diversity, and important fish and wildlife seasonal ranges (WDFW 2008, 1999). During a kayak survey in February 2011, patches of turf algae were observed growing on rocks and other hard surfaces throughout Reach 2 (GeoEngineers 2011b).

Marine riparian vegetation is sparse along Reach 2. An area on the shoreward side of the La Conner Channel Lodge, between State Street and Center Street, (approximately 25 by 200 feet) was developed as a mitigation site. At the south end of the property a 30-foot tall conifer tree marks the location of a permit-mandated public access stairway to the shoreline. The area above the OHWM has been planted with shrubs and the shoreline below the OHWM consists of barnacle encrusted riprap and large rock (with some turf algae) with patches of muddy fine grained substrate. There are patches of shoreline along Reach 2 where over-water structures are not present and thin patches of upland are undeveloped. The upland portions of these areas make up thin vegetated marine riparian zones consisting of grasses and weeds. Below the OHWM along these reaches rock or rip rap is covered in rockweed at lower tidal elevations (+5 to 7 feet). Above this are American glasswort, sea plantain, Puget Sound gumweed, and red goosefoot.

No forage fish habitats have been documented along this shoreline reach (WDFW 2011). Listed salmonid species may use this reach of the Swinomish Channel, however because of salinity barriers, salmon fry leaving the Skagit River may be discouraged from accessing and using available habitat further north within the Swinomish Channel and beyond into Padilla Bay (Grossman et al. 2007).

Shoreline structures along Reach 2 consist of 15 piers with associated floating docks. The floating docks are located approximately 30-130 feet from the OHWM and are oriented parallel to the shoreline. Approximately a third of Reach 2 has over-water structures right at the shoreline edge, usually consisting of buildings constructed on pilings.

Recommendations

Biological and physical features and processes are highly altered within Reach 2. Armored or altered banks, over-water structures, and a fully developed marine riparian area are all key features of this reach. Along this reach, sediments are not forming sandy beaches, drainage from upland areas does not create dendritic channels and pocket estuaries, and marine riparian vegetation is not providing shade and a source of organic debris to the marine environment. This reach of the Town of La Conner is operated and managed as a commercial/industrial waterway and thus opportunities for restoration or conservation are limited. Opportunities for restoration include removal of old derelict isolated creosote piles and improvements as over-water structures are maintained. This could include replacement of creosote piles with concrete or steel piles, adding transparency on decking, and decreasing lighting impacts to the marine and shoreline environment. Some specific locations have been identified for future nearshore and upland habitat restoration and enhanced public access including the Jordan Street end. Section 10 presents a summary of recommendations.

Reach 3 – Pioneer Point to South of Sherman Boat Launch

Shoreline Reach 3 (Reach 3) is the southern segment of the Town extending from the Sherman Avenue boat launch south to the southern Town limits (Figure 2). Reach 3 extends for approximately 1,200 feet (0.23 miles) along the Swinomish Channel.

Two shoreline environmental designations exist within this reach including Industrial and Public Use (Figure 3). The Sherman Avenue boat launch serves as a public access point to the shoreline. The area south of Sherman Avenue and east of Conner Way is also an access point for the public, not for direct physical shoreline access but for view enjoyment. Land use within Reach 3 is currently commercial (Pioneer Point Marina) with both water-enjoyment and water-dependent uses.

The direction of net shoreline drift is from south to north along all shoreline reaches; however tidal currents go both directions in the Swinomish channel. Sediments released from the Skagit River and swept north through the Swinomish Channel are deposited in the navigation channel or on the sandy beaches on the western shore on the Swinomish Reservation. These sediments accumulate at a rate of 2 feet per year at the southern end of the Swinomish Channel and 1 foot per year at the northern end of the Swinomish Channel (Coastal Geologic Services 2010a, 2010b). Within Reach 3 sediments are deposited primarily in the middle of the channel at the bend in the channel just southwest of the Rainbow Bridge and on the western shore on the Swinomish reservation. With the orientation of the Pioneer Point Marina dock, debris drifting up the Swinomish Channel builds up between the dock and the shoreline.

Along the Swinomish Channel in this reach, the shoreline is armored with riprap from near the OHWM down to approximately 3 feet above MLLW. Below the riprap the shoreline slopes gradually and the substrate consists of fine muddy sediments with scattered rock. These gradually sloping areas, with a mixture of fine sediments and rock substrate have the potential to be serving as fish benches. These shallow benches can provide a safe migratory path for migrating juvenile salmonids as the shallow waters are idea for avoiding predation from below and also create habitat for prey items for young fish (e.g., copepods and amphipods).

The DNR Shoreline Inventory does not identify any near-shore vegetation occurring along Reach 3 (DNR 2000a). The Skagit County Intertidal Habitat Inventory and WDFW priority habitats and species maps identified a patch of mixed algae/turf algae at the south end of the reach immediately south of the Pioneer Point Marina Buildings, another patch at the north end immediately south of the Sherman Avenue boat launch, and two patches of green algae/turf algae between the Rainbow Bridge and the Pioneer Point Marina (DNR 1998a, WDFW 2011). During a kayak survey in February 2011, small patches of turf algae were observed growing on rocks and other hard surfaces throughout Reach 3 (GeoEngineers 2011b).

Marine riparian vegetation at the shoreline edge is sparse along Reach 3. There is a small patch of trees (approximately 5 trees) southwest of the Rainbow Bridge. On the southeast side of Connor Way the hillside is forested, however this patch of forest does not provide shade or water quality improvement functions for the Swinomish Channel. Other marine riparian vegetation on the immediate shoreline edge consists of a thin strip of grasses and weeds. Below the OHWM along this reach rock or rip rap is covered in rockweed at lower tidal elevations (+5 to 7 feet). Above this are American glasswort, sea plantain, Puget Sound gumweed, and red goosefoot.

No forage fish habitats have been documented along Reach 3 (WDFW 2011). Listed salmonid species may use this reach of the Swinomish Channel, however because of salinity barriers, salmon fry leaving the Skagit River may be discouraged from accessing and using available habitat further north within the Swinomish Channel and beyond into Padilla Bay (Grossman et al. 2007).

Shoreline structures along Reach 3 consist of 1 pier/platform with an associated floating dock. The floating dock is located approximately 120 feet from the OHWM and oriented parallel to the shoreline. Approximately one half of Reach 3 has over-water structures.

Some buildings and pier/dock structures associated with the Pioneer Point Marina have been demolished in the past two years (Figure 2). The Pioneer Point Marina owner, who leases the land from the Town, was planning to rebuild immediately but replacement structures have yet to be built.

Recommendations

Biological and physical features and processes are less altered within Reach 3 compared to the other Reaches. Altered natural features of Reach 3 include armored banks, over-water structures, and a developed marine riparian area however the forested hill south of the Rainbow Bridge and the presence of fish benches immediately south of the Sherman Avenue boat launch provide valuable habitat for fish and wildlife. Due to bank armoring and past human cut and fill actions along this reach, sediments are not forming sandy beaches, drainage from upland areas is not creating dendritic channels or pocket estuaries, and marine riparian vegetation is not providing shade and a source of organic debris to the marine environment. This reach of the Town is operated and managed as a commercial waterway (marina), however there are some opportunities for restoration/conservation. Opportunities for restoration cited in Appendix B include the same creosote pile replacements and maintenance upgrades listed in Sections 6.1 and 6.2. In addition, the fish benches south of the Sherman Avenue boat launch could be enhanced to provide more habitat for migrating fish, and marine riparian vegetation in the form of shade producing trees and shrubs could be planted along this portion of Conner Way. Section 9 presents a summary of recommendations.

LAND USE WITHIN SHORELINE PLANNING AREA

Historic Land Use

Prior to the arrival of settlers in the mid-1850s, the area around the site of present day La Conner was inhabited the southern Northwest Coast Salish peoples. Several villages were known to be located on the west side of the Slough (ERCI 2011). La Conner was established by settlers as a trading post in 1867, and became the first county seat for Skagit County in 1883. While it was the largest community in the county, Mount Vernon was designated the county seat in 1884. La Conner's location on the Swinomish Slough made it an important hub of shipping and transport, supporting the numerous agricultural activities in the area. The slough was navigable at high tide to shallow draft steamers, and provided a safer route for vessels to travel between Whatcom County to the north and Seattle to the south.

The Corps of Engineers began diking and dredging the Swinomish Slough in 1892 in order to provide a waterway between Skagit and Padilla Bays that would accommodate commercial and recreational vessels without having to depend on tides for access. The dredging project was completed in 1935. To this day the Swinomish channel provides a generally quieter route for vessels traveling to or from the San Juan Islands and regions north to Everett, Seattle and regions south. The presence of the channel has led to the development of a marine - based infrastructure including marinas, docks for transient moorage, marine repair, fish processing and other businesses.

In the late 1800's and early 1900's, La Conner flourished as a town due to its location, which provided means of transport for agricultural products from the fertile Skagit Valley and supplies to support these activities. The development of railroads and highways eventually led to a decrease in the local importance of the Town as Mount Vernon and Burlington gained population and prominence in the county.

Current Land Use

Today, La Conner continues to support marine uses, including marinas, commercial and recreational boating, fishing vessels, and public enjoyment of water views from retail businesses and restaurants. Tourism is an important contributor to the Town economy, with average daily visitation estimated at 1,400 people. The latter is very important to supporting tourism in the Town. Most of the Town's tourist area is located in La Conner Historic District 45DT12, which is bound by the Swinomish Channel to the west, Commercial Street on the South, Whatcom Street on the east and Morris Street on the north. The Historic District is characterized by many preserved buildings that reflect the commercial, transportation and agricultural roots of the Town (ERCI 2011).

La Conner shoreline zoning designations are listed and mapped on Figure 3. Public open space and access to the waterfront is provided at several street ends along First Street. In addition, several restaurants and businesses and a hotel along First Street have shoreline decks and/or views of the channel that are open to the public. There is an existing boardwalk along the channel on private land with public easements that is privately maintained. Section 6.0 above provides detailed description of the shoreline uses and structures located along the channel reaches.

Public access and public lands are present throughout the shoreline jurisdiction, and are described in Table 7.1 below.

Table 7.1. Current and Proposed Public Shoreline Parks Access Points

Park	Features	Proposed Future Improvements
Sherman Street End	Public boat launch, trailer parking	
Caledonia Street End	Undeveloped, DNR waterfront lease	
Commercial Street End	Undeveloped. View of Rainbow Bridge	Boardwalk connection to Street-end parks
Calhoun Street End	Public Moorage, Dirty Biter Waterfront Park	Boardwalk connection to Street-end parks
Benton Street End	Public moorage, waterfront viewing	Boardwalk connection to Street-end parks
Washington Ave End	Public moorage, information kiosk, waterfront viewing	Boardwalk connection to Street-end parks
Gilkey Square/Morris Street End	Waterfront viewing, open space	Boardwalk connection to Street-end parks
Kirsch Building	Overwater platform adjacent to Jordan Street End	Develop a facility and use plan for the Kirsch building for waterfront boardwalk connection and boating (2012)
Jordan Street End	Undeveloped waterfront lot	Develop a usage plan for the site as a recreation facility, picnic, parking and water access (2012).
1st Street ROW	Between Commercial and Caledonia, undeveloped being used for parking	
Conner Way	Open space waterfront beneath Rainbow Bridge	
Waterfront Boardwalk		Engineering and planning for connecting the street-end parks and Pioneer Park with a waterfront boardwalk (2012)

Source: Town of La Conner Six-Year Capital Facilities Plan 2011-2016 (Town of La Conner 2010b)

Transportation

Major roads and transportation facilities in the La Conner shoreline jurisdiction include First Street through the Town, Conner Way adjacent to the Swinomish Channel to the south, and marine traffic in the Swinomish Channel itself. Morris Street is the main arterial into town, and connects to First Street, which is the primary destination for most tourists visiting La Conner's shops, businesses and restaurants. The street network in the Town is comprised of arterial street, collector streets and local access streets.

Wastewater and Stormwater Utilities

La Conner owns, operates, and maintains a domestic wastewater collection and treatment system, and most of the Town has sanitary sewer service. The Wastewater Treatment Plant is located east of La Conner, on the south side of Chilberg Road and discharges into Sullivan Slough.

Most of La Conner is at sea level and has for many years experienced localized flooding during modest storm events. The flooding is due to the town's geography, its proximity to the Swinomish Channel, its high water table and the configuration of the existing stormwater system (Town of La Conner 2011 Capital Facilities Plan). Currently stormwater from the Morris Street area in the shoreline jurisdiction is collected and routed to the water treatment facility on Chilberg Road. The treatment facility consists of a settling pond and infiltration pond.

NATURAL RESOURCE LANDS AND CRITICAL AREAS WITHIN SHORELINE PLANNING AREA

In Puget Sound, the Growth Management Act (GMA) requires local governments to designate natural resource lands and critical areas (RCW 36.70A.170), and to adopt regulations to conserve natural resources areas and protect critical areas (RCW 36.70A.060). The Town has employed provisions of the State Environmental Policy Act (SEPA) and *Title 15, Division III - Critical Areas and Natural Resource Lands Protection* (LCMC 15.60 to 15.70) to protect natural resource lands and critical areas during development review processes.

The GMA defines three types of non-critical area natural resource lands, as follows (RCW 36.70A.170):

1) Agricultural lands that are not already characterized by urban growth and that have long-term significance for the commercial production of food or other agricultural products;
2) Forest lands that are not already characterized by urban growth and that have long-term significance for the commercial production of timber;
3) Mineral resource lands that are not already characterized by urban growth and that have long-term significance for the extraction of minerals; and

The Town of La Conner does not contain agriculture, forest or mineral resource lands; however there are adjacent agricultural lands, defined as "All lands inside town boundaries that are within 25 feet of agricultural resource lands." (Appendix D 15.65.020(3)). "The environmentally sensitive area overlay district is a mechanism by which the town of La Conner recognizes the existence of natural conditions which affect the use and development of property. The regulations are to protect environmentally sensitive areas…(and) to prevent encroachment on any adjacent agricultural lands of long - term significance." (Appendix D 15.65.010)

The GMA (RCW 36.70A.030(5)) and Appendix D define five types of Critical Areas, as follows:

(1) Wetlands,

(2) Critical Aquifer Recharge Areas (CARAs) defined as areas with a critical recharging effect on aquifers used for potable water),

(3) Fish and wildlife habitat conservation areas,

(4) Frequently flooded areas, and

(5) Geologically hazardous areas.

Wetlands

?

Two freshwater Palustrine emergent semi-permanently flooded wetlands (PEMC) have been identified by the National Wetlands Inventory (NWI) in the southeast corner of the Town (Figure 4) (USFWS 1998). These wetlands are outside of the shoreline management area.

NWI identifies the north and south basins of the La Conner Marina as estuarine, sub-tidal, unconsolidated bottom, excavated wetlands (E1UBLx) (USFWS 1998) (Figure 4).

Critical Aquifer Recharge Areas

No CARAs have been identified within the Town.

Fish and Wildlife Habitat Conservation Areas

WDFW provides guidelines for designating Fish and Wildlife Habitat Conservation Areas as follows:

- Habitat associated with endangered, threatened, and sensitive species
- Habitats and species of local importance
- Commercial and recreational shellfish areas
- Kelp and eelgrass beds; herring and smelt spawning areas
- Ponds, waters of the state, and those planted with game fish
- Naturally occurring ponds smaller than 20 acres and their submerged aquatic beds
- Natural area preserves and resource conservation areas
- Land essential for preserving habitat connections

Within Reach 1, the Port of Skagit implemented an eelgrass habitat mitigation project along the shoreline immediately north of the north basin along the Swinomish Channel. This area is identified as eelgrass habitat by the DNR Shoreline Inventory (DNR 2000a) and as green algae and salt marsh habitat by the Skagit County Intertidal Habitat Inventory (DNR 1998a).

As stated in Section 6, no forage fish habitats have been documented along the La Conner shoreline (WDFW 2011). Listed salmonid species may use the La Conner shoreline, however because of salinity barriers, salmon fry leaving the Skagit River may be discouraged from accessing and using available habitat within the Swinomish Channel (Grossman et al. 2007). The presence of fish benches at various locations along the Town's shoreline provide potential valuable habitat for fish and other marine biota.

There are no recorded priority species or habitats within the La Conner Town Limits (WDFW 2011).

Frequently Flooded Areas

The Town of La Conner is within the Skagit River 100-year floodplain, however no parts of the Town experience flooding from the Skagit River (FEMA 2010, 2009). There are three relatively low elevation areas within the Town that do experience localized tidal storm surges, including the Sherman Avenue boat launch, and Caledonia and Washington Street ends. The Town currently deploys sandbags and containment materials at these locations from January to April, the period when these winter storm surges occur (Town of La Conner 2003b).

FEMA is currently developing a coastal risk assessment for shorelines, in an attempt to assess and inventory risks associated with sea level rise and tidal/storm surges (FEMA 2011).

Geologically Hazardous Areas

There are regulated slopes within Reach 2 in downtown La Conner and within Reach 3 adjacent to the Rainbow Bridge (Figure 4) in Pioneer Park.

La Conner is located within the Lahar zone for Mount Baker (Dragovich et al 2000). Low elevation/flat parts of the Town are situated on top of Holocene nearshore deposits composed of fine salt, silt and clay (Dragovich et al 2000). In addition, these loose and soft nearshore deposit soils are often saturated because within the Town groundwater levels are directly related to tidal elevations, making them an area of liquefaction risk.

2.9 Conclusions and Recommendations

2.9.1 Future Development Potential and Impacts

The Town's shoreline management area is already heavily developed as a commercial/industrial waterfront. Some buildings, piers and docks associated with the Pioneer Point Marina were demolished in the last two years and there is future potential for proposals to redevelop the marina in those locations (Figure 2). There is a current proposal for expansion of the Town's waterfront boardwalk from Commercial Street to Jordan Street (La Conner 2011a). The Upper Skagit Indian Tribe recently conducted improvements on their pier and floating docks at the La Conner Pier facility just north of the Sherman Avenue boat launch. The Tribe hopes to expand operations at that location to a full fish processing facility. Potential negative impacts to the environment from the above projects may include an increase in over-water structures (or replacement of previously demolished structures) and increased boat traffic (affecting noise and water quality).

2.9.2 Opportunities for Restoration of Impaired Processes/Habitats

The following table presents threats or impact caused by physical structures or actions and lists potential remedies for these issues.

Table 9-1. Shoreline Zone Habitats and Ecosystem Processes with Potential for Restoration

Physical Structure or Action Causing Threat/ Impact	Ecological Process/ Function Interrupted	Potential Threats	Potential Remedy
Shoreline Armoring	Currents reduced hydraulic complexity Natural bank erosion and sloughing (sediment source) Sediment accretion (deposition) along the shoreline	Loss of fast and slow moving micro-habitats that support a more diverse array of marine biota Loss of soft sediment shallows with a potential for eelgrass colonization Loss of beaches and pocket estuaries	Not feasible to remove armoring with structures located immediately adjacent to the shoreline Implement softened bank treatments in areas where structures are not at immediate risk (e.g., immediately south of Sherman Avenue boat launch) Create fish benches below armoring and above MLLW
Creosote Piles or Structures	Reduces surface area of benthic nearshore marine habitat	Water quality and sediment contamination	Remove old structures that are no longer serving a purpose Replace structures made of creosote with concrete or steel as maintenance occurs

Physical Structure or Action Causing Threat/ Impact	**Ecological Process/ Function Interrupted**	**Potential Threats**	**Potential Remedy**
Over-water structures	Reduces sunlight and potential photosynthesis (base of food chain)	Shading	Make all new overwater components at least 50% grated, with at least 60% functional open space for the grating
	Physical interruption of currents, sediment transport and fish migration	Benthic habitat impacts from piles	Use fewer piles (steel or concrete) or cantilever out from existing structures
		Light impacts (at night)	Reduce light impacts by using LED lights for ankle or waist height lighting, fully shielding overhead lights with shades that avoid illumination of the surrounding environment, and focus night lighting on the dock surfaces only, not on the water.
Channel Dredging	Deeper channel (12 feet) has impact on currents, shoreline sediment transport and fish migration.	Deeper water harbors fish predators – risk to young migrating fish	Create fish benches below armoring and above MLLW

Physical Structure or Action Causing Threat/	Ecological Process/ Function Interrupted	Potential Threats	Potential Remedy
Removal of marine riparian vegetation	Loss of over-hanging vegetation and recruitment of large woody debris (LWD) Loss of shading	Loss of habitat from roots, branches, and shade regimes. Loss of small organic material and LWD inputs Increased temperatures and lower dissolved oxygen levels	Plant shrubs and trees where possible along shoreline

2.9.3 Opportunities for Increased Recreation/Public Access

As mentioned in Section 6, the Town has at least 9 existing public access points, both for direct access to the shoreline (beach access) or water (public float), and for public viewing of the shoreline (access to areas immediately adjacent to the shoreline with a view). Public access points with potential for future improvement include the Jordan Street end and along the northwest side of Connor Way (under the Rainbow Bridge).