



MASON COUNTY FINAL DRAFT SHORELINE INVENTORY AND CHARACTERIZATION REPORT

EXECUTIVE SUMMARY

Background

Mason County is updating its Shoreline Master Program (SMP). The SMP is an existing County planning document that contains goal and policy statements, development regulations, and permit procedures for *shores of the state*. Shores of the state are rivers, streams, lakes, and marine waters that meet a minimum size or water flow threshold. Cities and counties are required to update their SMPs to be consistent with the *Shoreline Management Act* and State guidelines. The Shoreline Management Act is a state act that was adopted in a 1972 voter referendum to prevent harm to the state's shores.

Shores in Mason County are important regional and statewide resources and their management is of interest to Mason County residents and Native American Tribes, and Washington residents as well. Because of this statewide importance, funding for the SMP update has been provided by a Washington Department of Ecology state grant. SMP updates are required to meet the 2003 shoreline guidelines outlined in the Washington Administrative Code (WAC) 173-26. Mason County has developed a web site for the SMP update process where citizens can track the progress of the update process:

http://www.co.mason.wa.us/community_dev/shoreline_master_program/index.php.



EXECUTIVE SUMMARY (CONTINUED)

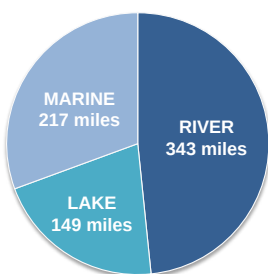
Shoreline Inventory and Characterization Report

The Final Draft Shoreline Inventory and Characterization report (dated October 2012) is a technical document that describes the existing conditions of shorelines of the state in Mason County. The report is a required step in the SMP update process.

A total of 109 waterbodies in Mason County are considered to be *shorelines of the state*. These include:

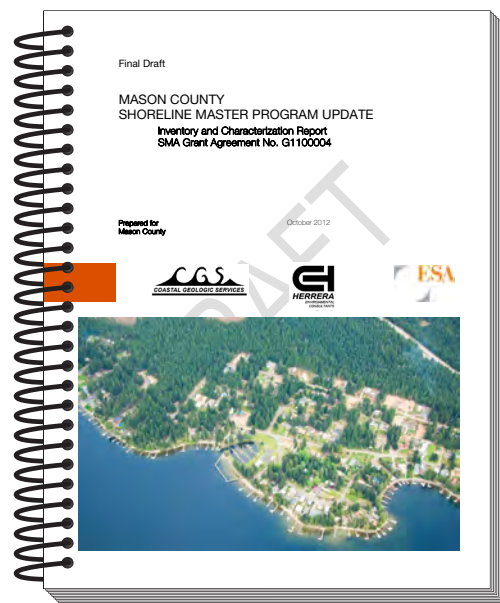
- 2 marine waterbodies (Hood Canal and South Puget Sound)
- 64 rivers and streams
- 44 lakes

709 Total Shoreline Miles



Nearly 709 linear miles of shoreline were identified within the County. In addition to studying the waterbodies themselves, adjacent *shorelands* were studied as well. *Shorelands* include lands extending landward of the waterbody for 200 feet, floodways and floodplain areas, river deltas, and wetlands considered to be associated with the shoreline. One of the important areas of the marine waterbodies is the “nearshore” environment which includes shallow marine waters, mudflats, tidal areas, and beaches.

This inventory and characterization report describes existing conditions within the Mason County shorelines and provides a map folio based upon Geographic Information System (GIS) data. The report describes existing land uses, such as residential uses, parks, development and water-dependent industries. It also evaluates existing natural shoreline processes and functions, such as forested riparian areas, wetlands, wildlife habitat and fish present. The inventory report identifies areas suitable for restoration and additional public access. The report will provide a foundation for revising the goals, policies, and regulations in the County’s SMP. It will help the County make informed decisions about incorporating the communities’ vision for the shorelines, accommodating growth, and addressing other shoreline policy objectives like promoting water-dependent uses. It will also help the County explore opportunities for conservation and restoration of natural areas.



EXECUTIVE SUMMARY (CONTINUED)

Some of the findings of the inventory report are summarized in the following table:

CHARACTERISTIC	SUMMARY
LAND USE	
	Existing land uses in freshwater shoreline areas are mostly in residential uses and forestry. Vacant lands and agriculture land uses make up most of the remaining area. Residential land uses are concentrated around lakes and each house typically has an individual dock or pier. Existing land uses in the marine shoreline areas are mostly residential. Vacant and forestry land uses are also common. Docks and piers are scattered throughout the marine environment with private marinas concentrated along Hood Canal. The only major industrial area in the County is located on Oakland Bay in the City of Shelton.
WATER-DEPENDENT USES	
	Ports, log booming and storage, shipping, marinas, docks, piers, boating facilities, outfalls, and aquaculture are typically considered to be water-dependent uses. Water-dependent uses in Mason County include docks, piers, boat launches, marinas, commercial aquaculture, and bridges. Single family residential docks are the most common water-dependent use on the county's shorelines. Commercial aquaculture is an important and growing water-dependent industry.
PARKS AND PUBLIC ACCESS	
	Many of the shorelines within Mason County have public access. Marine shorelines are accessible through Washington State or County parks or through informal access to public tidelands and beaches from public roads. Most shoreline lakes, although fully developed with private residential homes, are accessible through a Washington Department of Fish and Wildlife boat launch. Public access is encouraged on public lands that lie within the shoreline jurisdiction.
FISH AND WILDLIFE HABITAT	
	County rivers and streams support numerous species of native salmon and trout, several of which are listed under the Endangered Species Act. Native shellfish beds and forage fish (i.e. sand lance, smelt and herring) are found in the nearshore areas of Hood Canal and South Puget Sound. Many other wildlife species, including marine mammals, shorebirds, and waterfowl, use Mason County shorelines as habitat. Eelgrass and kelp beds, mudflats, estuaries and bays are important habitats in the County. Wetlands provide valuable habitat and water quality benefits to most County shorelines.

EXECUTIVE SUMMARY (CONTINUED)

CHARACTERISTIC	SUMMARY
WATER QUALITY	
	Water quality in Mason County is impaired or degraded. In South Puget Sound, water quality issues include toxic pollutants, elevated water temperatures, fecal coliform bacteria, nutrient loads, and low dissolved oxygen concentrations. In Hood Canal, the main water quality issues are low dissolved oxygen and high summer temperatures. Water quality issues for rivers and streams are sedimentation and high temperature. These issues are caused by stormwater runoff, timber harvest, culverts, and highways and railroads that cross shorelines. The increase in impervious surfaces, installation of septic systems, and human activities along the marine shoreline are all potential sources of water quality degradation. Shellfish closures result from increased nutrients, fecal coliform and corresponding algae blooms.
NEARSHORE FUNCTIONS AND COASTAL PROCESSES	
	The marine nearshore character varies considerably across Mason County. There are numerous types of shores along Hood Canal and South Puget Sound. Waves generated by wind are the dominant driver of coastal processes. Nearshore sediment supply is typically derived from eroding bluffs where sediment is transported down-drift by waves to form the varieties of shoreforms found in the County. These coastal processes dictate the many shoretypes of Hood Canal. South Puget Sound contains more sheltered, low-energy shores that form highly complex coast lines with many small bays and inlets. Erosion and sediment transport rates are very low in these environments. Numerous artificial shoreforms exist along the shores of Mason County. These shorelines no longer resemble or function like their historic types and have resulted in the degradation of coastal processes, particularly along the shores of Hood Canal. Modifications to the natural shoreline include bulkheads, riprap, and fill for bridges or structures. Fewer modifications and changes to nearshore processes have occurred along the shores of South Puget Sound.
SURFACE WATER AND GROUNDWATER	
	Mason County has a significant amount of natural surface water and groundwater resources. However, many of the rivers and creeks in Mason County fall below the Washington State minimum instream flow requirements during some months of the year. Certain streams have been closed to further diversions for some or all of the year. Tacoma Power operates Cushman Dam and has increased minimum flows through the dams to improve flow conditions for salmonid recovery in the North Fork Skokomish River.
RESTORATION	
	Restoration is currently underway in Mason County by a variety of organizations including the Squaxin Island Tribe, Skokomish Tribe, Mason Conservation District, Hood Canal Coordinating Council, Hood Canal Salmon Enhancement Group, South Puget Sound Salmon Enhancement Group, and Puget Sound Nearshore Ecosystem Restoration Project. Future opportunities for restoration are also included in the report. (Photo credit: Mason Conservation District website, 2011)

The report is available for public review online at the Mason County SMP update web site at:
http://www.co.mason.wa.us/community_dev/shoreline_master_program/index.php.

Final Draft

MASON COUNTY SHORELINE MASTER PROGRAM UPDATE

Inventory and Characterization Report
SMA Grant Agreement No. G1100004

Prepared for
Mason County

October 2012



Cover Photo Credit: Mason Lake, Coastal Atlas, Washington State Department of Ecology, 2006

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ACRONYMS

Acronym	Description
AC	Acres
CARA	Critical Aquifer Recharge Areas
CCAP	Coastal Community Action Program
cfs	Cubic Feet per Second
CGS	Coastal Geologic Services, Inc.
CIG	Climate Impacts Groups
CMZ	Channel Migration Zone
CPPA	Climate Prediction Program for the Americas
DAHP	Washington State Department of Archaeology and Historic Preservation
DNR	Department of Natural Resources
DO	Dissolved oxygen
DOH	Department of Health
DPS	Distinct Population Segment
DPU	Delta Process Unit
Ecology	Washington State Department of Ecology
EDT	Ecosystem Diagnosis and Treatment
ENSO	El Nino-Southern Oscillation
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Maps
GAP	Gap Analysis Program
GIS	Geographic Information Systems
GMA	Growth Management Act
GSU	Geographic Shoreform Unit
HCCC	Hood Canal Salmon Enhancement Group
HCSEG	Hood Canal Salmon Enhancement Group
HPA	Hydraulic Project Approval
IAVMP	Integrated Aquatic Vegetation Management Plan
IPCC	International Panel on Climate Change
JTAC	Joint Technical Advisory Committee
km	kilometer
LWD	Large Woody Debris

Acronym	Description
LHCWC	Lower Hood Canal Watershed Council
mg/L	milligrams per liter
MHHW	Mean Higher High Water
MI	Miles
MLLW	Mean Lower Low Water
MR	Marine Reach
MSL	Mean Sea Level
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Agency
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	U.S. Fish and Wildlife Service's National Wetland Inventory
OHWM	Ordinary High Water Mark
PAHs	polychlorinated aromatic hydrocarbons
PCB	Polychlorinated Biphenyl
PDO	Pacific Decadal Oscillation
PHS	Priority Habitat and Species
PNPTC	Point No Point Treaty Council
PSNERP	Puget Sound Nearshore Ecosystem Restoration Program
QAPP	Quality Assurance Project Plan
RCO	Washington State Recreation and Conservation Office
RCW	Revised Code of Washington
RM	River Mile
RMZ	Riparian Management Zone
ROS	rain-on-snow
RV	Recreational Vehicle
SaSI	Salmonid Stock Inventory
SASSI	Salmon and Steelhead Inventory
SCS	Soil Conservation Service
SEA	Washington State Department of Ecology Shorelines and Environmental Assistance Program
SED	Shoreline Environment Designation
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMP	Shoreline Master Plan
SPSSRG	South Puget Sound Salmon Recovery Group
SPU	Shoreline Process Unit
SSB	Substitute Senate Bill
SR	State Route
SRFB	Salmon Recovery Funding Board

Acronym	Description
TAG	Technical Advisory Group
TMDL	Total Maximum Daily Load
UGA	Urban Growth Area
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WDOH	Washington Department of Health
WDNR	Washington State Department of Natural Resources
WDNR NHP	Washington Department of Natural Resources Natural Heritage Program
WDOH	Washington State Department of Health
WFPB	Washington Forest Practices Board
WISAARD	Washington Information System for Architectural and Archaeological Records Data
WNHP	Washington State Natural Heritage Program
WRIA	Water Resource Inventory Area

CHAPTER 1. INTRODUCTION

1.1 Background and Purpose

Mason County is updating its Shoreline Master Program (SMP). According to Substitute Senate Bill (SSB) 6012, passed by the 2003 Washington State Legislature, cities and counties are required to amend their local SMPs consistent with the Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and its implementing guidelines, Washington Administrative Code (WAC) 173-26.

Mason County is required to complete the SMP amendment process by December 2013. Funding for the SMP update has been provided by the Washington State Department of Ecology (Ecology) through an SMA grant (Agreement No. G1100004). The state grant funds are provided by Washington State Biennia's General Fund for Shoreline Implementation, §302; and the Local Toxics Control Account, §302, Subsection 7. As per the requirements of the grant, Mason County is scheduled to complete its draft SMP by June 30, 2013.

The County is conducting the comprehensive SMP update in two phases over the next few years. The first phase is the development of an inventory and characterization of the shorelines within Mason County. This report provides the inventory and characterization study. In the second phase, the County will update its shoreline management policies and regulations.

This inventory and characterization documents baseline shoreline conditions and provides a basis for revising SMP goals, policies, and regulations for the County. This characterization will help to evaluate existing functions and values of shoreline resources, and explore opportunities for conservation and restoration of ecological functions.

This study also characterizes ecosystem-wide processes and how these processes relate to shoreline functions. Processes and functions are evaluated at two different scales: (1) a watershed or landscape scale, and (2) a shoreline reach scale. The purpose of the watershed or landscape scale characterization is to identify ecosystem processes that shape shoreline conditions and to determine which processes have been altered or impaired. The intent of the shoreline reach scale inventory and characterization is to: (1) identify how existing conditions in or near the shoreline have responded to process alterations; and (2) determine the effects of the alteration on shoreline ecological functions. The findings will help provide a

framework for future updates to the shoreline management policies and regulations.

This study and analysis was prepared by ESA in collaboration with Coastal Geologic Services and Herrera Environmental Consultants. The work was completed in partnership with Mason County Planning and GIS staff and City of Shelton staff, along with review and comment by the Joint Technical Advisory Committee (JTAC).

1.2 Report Organization

The information in this report is divided into 12 Chapters. Chapter 1, the Introduction, discusses the purpose of this report and describes the regulatory context for shoreline planning. Chapter 2 describes the methods, approach, and primary data sources used for this inventory and characterization. Chapter 3 provides a profile of the ecosystems within the County. This ecosystem profile discusses regional overview, process controls (e.g., climate, geology), fish and wildlife, and key ecosystem-wide processes and landscape analysis.

Chapters 4 and 5 provide the shoreline inventory for the marine water bodies in Mason County: Hood Canal and South Puget Sound (including Case, Skookum, and Totten Inlets, and Oakland Bay). Chapters 6 through 9 focus on the freshwater shoreline rivers and lakes and are organized around the four main Water Resource Inventory Areas (WRIAs) within Mason County. These WRIAs are designated by Washington Department of Ecology as administrative units for watershed planning in the state. Shorelines in the following watersheds are addressed in Chapters 6 through 9: WRIA 14a (Kennedy-Goldsborough), WRIA 15 (Kitsap [Tahuya Peninsula]), WRIA 16/14b (Skokomish-Dosewallips), and WRIA 22 (Lower Chehalis). The WRIA 16 planning area includes all of the Hood Canal drainages along the south shore of the lower canal (this area is referred to as WRIA 14b).

A small portion of the northwest corner of Mason County is located within WRIA 21 (Queets-Quinault). However, this area lies entirely within federal lands (Olympic National Park), and no water bodies regulated by the SMA are located in the County's portion of WRIA 21. Therefore, WRIA 21 is not discussed further in this report.

The inventory provides physical and biological characterizations of conditions in the vicinity of the shoreline regulatory zones of the County. The chapters also provide assessments of shoreline use patterns, describe the built environment, and identify potential opportunity areas for protection, enhancement, restoration and public access.

Chapter 10 is an analysis of trends and future demand of shoreline uses, and potential land use conflicts. Chapter 11 is the shoreline analysis summary. Chapter 12 provides the reference list for this document.

Appendix A is a map folio that illustrates the shoreline planning areas within Mason County and documents various biological, land uses, and physical elements at the landscape analysis scale. Appendix B identifies the GIS data sources used in development of the map folio. Appendix C provides a glossary of technical terms used in this report. Appendix D is a reach sheet guide that explains the information displayed on the reach sheets and the data sources for that information. Appendix E provides a comparison of GAP land cover analysis with Point No Point Treaty Council riparian vegetation data. Appendix F contains a list of birds associated with the marine and freshwater environments in Mason County.

1.3 Regulatory Overview

Washington's Shoreline Management Act (SMA) was passed by the State Legislature in 1971 and adopted by the public in a referendum. The goal of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." While protecting shoreline resources by regulating development, the SMA is also intended to provide for appropriate shoreline use. The SMA encourages public access and use of the shoreline and provision of water-dependent uses, as well as land uses that enhance and conserve shoreline functions and values.

The primary responsibility for administering the SMA is assigned to local governments through the mechanism of local shoreline master programs, adopted under guidelines established by Ecology. The guidelines (WAC 173-26) establish goals and policies that provide a framework for development standards and use regulations in the shoreline. The SMP is based on state guidelines but tailored to the specific conditions and needs of individual communities. The SMP is also meant to be a comprehensive vision of how the County's shoreline area will be managed over time.

1.4 Shoreline Jurisdiction and Study Area Boundary

SMA jurisdiction includes all *shorelines of the state* as defined in RCW 90.58.030. Shorelines of the state include the total of all *shorelines* and *shorelines of statewide significance*. "Shorelines" means all of the water areas of the state, including

reservoirs, and their associated *shorelands*, together with the lands underlying them, *except*:

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

“Shorelines of statewide significance” include rivers that have a mean annual flow of 1,000 cubic feet per second (cfs) or greater, freshwater lakes with a surface area of 1,000 acres or more, and portions of certain marine waters (RCW 90.58.030).

The shoreline area to be regulated under the Mason County SMP must include all shorelines of statewide significance, shorelines of the state, and their adjacent “shorelands,” defined as the upland area within 200 feet of the OHWM, as well as any “associated wetlands” (RCW 90.58.030). “Associated wetlands” means those wetlands that are in proximity to and either influence or are influenced by tidal waters or a lake or stream subject to the SMA (WAC 173-22-030 (1)). These are wetlands that physically extend into the shoreline jurisdiction, or wetlands that are functionally related to the shoreline jurisdiction through surface water connection and/or other factors.

Local jurisdictions can choose to regulate development under their SMPs for all areas within the 100-year floodplain or a smaller area as defined above (RCW 90.58.030(2)(f)(i)). For the purposes of this report, the entire 100-year floodplain is included in the study area or herein referred to as the shoreline planning area.

Numerous streams and lakes within Mason County are regulated as “shorelines of the state” under the SMA. Shorelines of statewide significance include all marine waters and shorelands of Hood Canal and marine waters of South Puget Sound seaward from extreme low tide. Lake Cushman (4,000 acres) and the main stem of the Skokomish River (greater than 1,000 cfs) downstream from the confluence of the North and South Forks, as well as their shorelands, are also shorelines of statewide significance.

1.5 Existing Plans, Programs and Regulations

1.5.1 Mason County Shoreline Master Program

Mason County adopted its first master program on August 12, 1975. In 2006, the county integrated the master program into the county's comprehensive plan and development regulations as follows:

- *Chapter IX, Shoreline Management Program* of the Mason County Comprehensive Plan includes definitions and policies for shoreline use activities (e.g., aquaculture, marinas) (Mason County, 2005);
- *Title 17.50 Zoning – Shoreline Master Program Use Regulations* includes regulations for shoreline uses, criteria for approving conditional use permits and variances, and assigns shoreline environment designations to shorelines of the state (see Map 21) (Mason County, 2006b);
- *Title 15.09.055* of the County code includes application, review, enforcement and approval processes for shoreline development (Mason County, 2006a).

1.5.2 Comprehensive Plan

The Mason County Comprehensive Plan, adopted in 1996 and revised in 2005, contains goals and policies to guide land use decisions and the management of critical areas (Mason County, 2005). Fourteen “land use categories” are described in the plan. These categories serve as the basis for more detailed zoning code designations. Land use categories include:

- Rural Lands: Rural Activity Centers, Hamlets, Rural Commercial/Industrial Areas, Rural Tourist/Recreational Areas, Fully Contained Community, Master Planned Resource, and Rural Area
- Resource Lands: Long-Term Commercial Forest Lands, Agricultural Resource Lands, and Mineral Resource Lands of long-term commercial significance, and In-holding Lands
- Urban Growth Areas: City of Shelton and surrounding area, Allyn, and Belfair

Land use designations are relevant to this shoreline characterization report as they establish the general land use patterns and vision of growth the County has adopted for areas both inside and outside the shoreline planning area.

1.5.3 Zoning Code

Title 17 – Zoning of the Mason County Code establishes zoning districts in the County (see Map 21) (Mason County, 2011). These districts, which follow land use designations established in the Mason County Comprehensive Plan, include five rural residential zones, five rural commercial zones, one rural industrial zone, one rural natural resource zone, two rural tourist zones, one rural master planned resort zone, seven zoning districts for Shelton UGA, eleven zoning districts for Allyn UGA, and eight zoning districts for Belfair UGA.

1.5.4 Critical Areas Regulations

Mason County regulates activities in or adjacent to environmentally sensitive areas under Mason County Resource Ordinance, adopted in 2009 (Mason County, 2009). Critical areas protected by this code include wetlands, critical aquifer recharge areas, frequently flooded areas, landslide hazard areas, seismic hazard areas, erosion hazard areas, and fish and wildlife habitat conservation areas. The Mason County Resource Ordinance also establishes protections for long term commercial forest lands, agricultural resource lands, in-holding lands, agriculture and forest management non-designated lands, and mineral resource lands.

1.5.5 Flood Damage Prevention Ordinance

Mason County's flood damage prevention ordinance implements comprehensive flood damage reduction measures that are necessary for public health safety and welfare and that allow property owners to protect their property (Ordinance No. 87-08). The ordinance includes minimum requirements of the National Flood Insurance Program regulation and establishes a Special Flood Risk Zone for the floodplains of the Skokomish River, Vance Creek and tributaries.

CHAPTER 2.

METHODS AND DATA INVENTORY

2.1 Data Sources

The Ecology 2003 shoreline master program (SMP) guidelines state that shoreline inventory and characterizations that support local SMP amendments should be based on best available technical information. Inventories should use existing sources of information that are both relevant and reasonably available (WAC 173-26-201(3)(c)). Aside from reconnaissance-level field visits, no new field-based data collection efforts were performed to develop the summaries and characterization included in this document.

This report incorporates and builds on past work Mason County has undertaken relevant to its SMP. Key sources of information include County planning documents and technical studies (including comprehensive plans and basin plans) and watershed planning documents for Hood Canal and Water Resource Inventory Areas (WRIA) 14a and 14b, 15, 16 and 22. Mapping information and other studies from state agencies (including Washington Department of Fish and Wildlife, Department of Ecology and Department of Natural Resources) were also used. To analyze spatial patterns and visually display data, numerous cartographic resources were consulted and used in ArcGIS (ArcMap 10).

A complete list of technical and scientific references is included in Chapter 12 of this report. The Geographic Information System (GIS) map folio prepared for this SMP update is provided in Appendix A. In addition, a complete list of GIS/mapping data sources is included in Appendix B.

2.2 Establishing Shoreline Planning Area

Mason County contains approximately 492 miles of freshwater shoreline and 217 miles of marine shoreline. The total number of miles of potential shoreline jurisdiction within the county is based upon perimeter data for lakes, centerline distance for rivers and streams (not counting each river bank separately) and miles of marine shoreline as measured along the ordinary high water mark. A total of 709 miles of shoreline are considered “Shorelines of the state” within Mason County.

Except as it pertains to characterizing ecosystem-wide processes, this inventory and characterization does not directly address waterbodies outside the County jurisdiction. Waterbodies within Olympic National Park, Mount Skokomish Wilderness, Wonder Mountain Wilderness, the Skokomish Indian Reservation, the Squaxin Island Indian Reservation and Shelton city limits are not included in this report.

2.2.1 Potential Shorelines Not Designated by WAC 173-18 or 173-20

Following the passage of the Shoreline Management Act (SMA) in 1971, Ecology developed a list of all known streams and lakes meeting the criteria for shorelines of the state. The lists, which were codified in WAC 173-18 and 173-20, have not been updated since their initial development. Streams identified as “shorelines of the state” in Mason County are listed in WAC 173-18-270. Lakes identified as shorelines in Mason County are listed in WAC 173-20-480 and 490. This inventory and update will serve to revise the list of shoreline streams and lakes and incorporate new and current data.

Ecology revised the list of shoreline streams using data from several regional flow studies conducted by the U.S. Geological Survey (Kresch, 1998). The results of the USGS study and flow model showed that numerous streams that are not currently designated as shorelines of the state meet the 20 cubic feet per second (cfs) mean annual flow criterion and should be regulated as state shorelines. In other cases, the USGS study relocated the upstream boundary of the 20 cfs point further upstream or downstream from its WAC-designated location. The streams and rivers addressed in this inventory and characterization include all those identified by the USGS study, which are located outside federal or Tribal lands.

Bahls et al. (2006) conducted a study to assess potential errors in state shoreline designation for lakes in Washington. The study attempted to estimate the error rate in current lake designation and develop a reliable and cost-effective method for local governments to use in identifying lakes that meet the 20-acre size threshold. The investigators used a three-phased approach to identify lakes equal to or greater than 20 acres throughout the state. The first phase of the Bahls study involved GIS analysis, the second phase involved aerial photo interpretation and the third phase included field assessment of a small subset of the lakes analyzed.

An Ecology GIS data layer based on the Bahls study identified several lakes in Mason County that appear to meet the criteria for shorelines of the state but are currently undesignated. Ecology staff conducted further GIS review and field investigations to make final determinations on which lakes meet the 20-acre threshold. As a result, several new lakes were added to the list of “shorelines of the state” for Mason

County based upon this analysis. For example, Coon Lake and Lake Anderson were lakes identified to meet the 20-acre or greater threshold and were added to the shoreline lakes.

2.2.3 Lateral Extent of Shoreline Planning Area

The approximate extent of shoreline jurisdiction within Mason County is shown on Map 2a and referred to throughout this report as the “shoreline planning area.” In general, the shoreline planning area includes:

- The regulated waterbody;
- 200 feet of adjacent “shorelands” extending landward from the mapped edge of the approximate Ordinary High Water Mark (OHWM);
- an area having 1 percent chance of flooding in any given year (also referred to as the 100-year floodplain); and
- any bordering, neighboring, or contiguous mapped wetlands.

This approximate extent of shoreline jurisdiction should be considered useful for planning purposes only since its resolution is based on relatively coarse-scale mapping. Site-specific delineation of wetlands, floodplains and/or OHWM is always necessary to determine the actual extent of regulated shoreline areas. It is likely that wetlands are present in some portions of the shoreline planning area but have not yet been mapped. As described in Chapter 1 (Section 1.3, Shoreline Jurisdiction) local governments can choose to regulate the entire floodplain under its SMP, or a smaller area. For this study, the entire mapped floodplain was included as it represents the maximum potential shoreline jurisdiction.

2.3 Approach to Characterizing Ecosystem-wide Process and Shoreline Functions

For purposes of this report, ecosystem-wide processes (or landscape processes) are described at the watershed scale according to WRIA boundaries. In this document, the term ecosystem-wide processes refer to the dynamic physical and chemical interactions that form and maintain the landscape at the geographic scales of watersheds to basins (hundreds to thousands of square miles). These processes include the movement of water, sediment, nutrients, pathogens, toxins and wood as they enter into, pass through and eventually leave the watershed.

2.4 Approach to Inventory and Characterization of Regulated Shorelines

The inventory of shorelines of the state in Mason County is intended to characterize conditions in and adjacent to each shoreline waterbody within the County's jurisdiction. The shoreline planning area roughly approximates the regulatory limits of the County's SMP as described above. GIS data were used to inventory and characterize conditions at the reach scale (discussed in more detail below). In addition, aerial photography and review of existing reports were used to qualitatively describe conditions in the shoreline planning area.

2.4.1 GIS Analysis and Mapping

GIS data, analysis and mapping were used to characterize shoreline conditions at the waterbody and reach scale. GIS overlay analysis was used to quantify certain conditions (e.g., spatial extent of wetlands, land use designations) in the shoreline planning areas. GIS mapping was used to develop the Working Map Folio that is found in Appendix A. Over 140 data layers were analyzed as part of this shoreline inventory and characterization. A list of GIS data and sources used for the inventory is included in Appendix B.

2.4.2 Determining Reach Breaks

To facilitate this shoreline characterization, shoreline planning areas were divided into reaches based on shoreline type (marine, river/stream, or lake system). The overall goal of this approach is to select reach breaks that primarily capture the hydro-geomorphic conditions or biophysical criteria in the landscape that will impact shoreline form and function. The reach breaks also form a basis for the scale of inventory and provide a mechanism for developing and applying shoreline environment designations in later phases. Reach breaks can also be used to calculate linear shoreline lengths and areas (e.g., area of associated wetlands, floodplains, etc.).

The number of reaches by shoreline type is summarized below in Table 2-2.

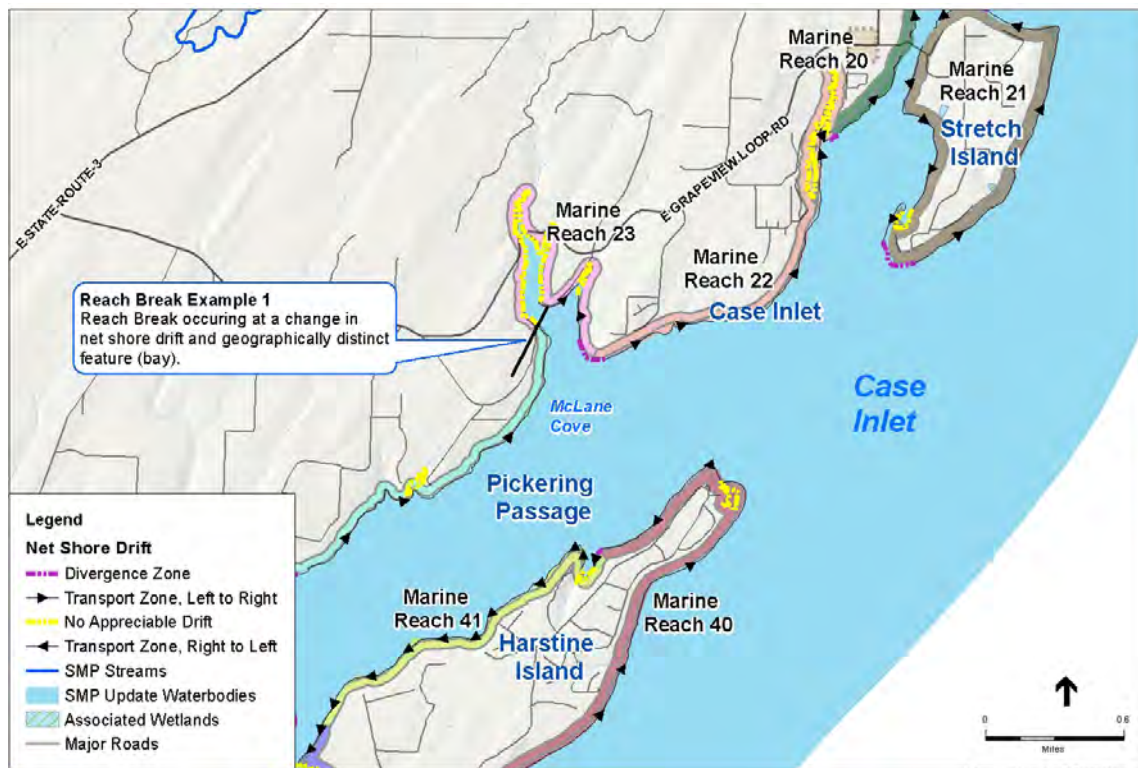
Table 2-1. Shoreline Summary by Type - Mason County, Washington

Waterbody Type	Number of Waterbodies	Number of Reaches	Total Miles
Marine	2 (Hood Canal, Puget Sound)	48	217
Rivers and Streams	64	100	343
Lakes	44	45	149
TOTAL	110	193	709

Nearshore Marine Reach Breaks

For purposes of inventorying marine shorelines, the shoreline planning area was delineated for unincorporated portions of Mason County using GIS. The area included marine waters extending 200 feet offshore; 200 feet of adjacent upland; and any bordering, neighboring, or contiguous mapped wetlands. The source data depicting the marine “shoreline” was developed by the Washington State Department of Natural Resources (DNR) ShoreZone line file approximating the OHWM.

In addition to the analysis described above, GIS analysis and mapping were used to characterize conditions at the reach scale. Reach breaks along the marine shoreline of Mason County were developed, considering changes in predominant drift direction, wave and tidal current exposure, nearshore geology, geomorphic shoreform type (e.g., Shipman typology mapping from Change Analysis: bluffs, embayments, bedrock shores); and in some cases where there were substantial changes in predominant upland or nearshore development patterns. In many cases shorter, converging drift cells were grouped to form one longer shoreline reach that supports/maintains a larger shoreform, such as an embayment. All groupings occurred within a geographically distinct feature (bay, cove) where significant land cover variations do not suggest maintaining ungrouped reaches. Consideration of land cover for reach breaks focused on broad patterns (not at a parcel scale) and occurred only where broad patterns associated with physical processes are less apparent. In addition, discussion of marine shorelines is organized around larger management units, representing different watershed areas of Hood Canal and South Puget Sound. There are 48 unique marine reaches totaling approximately 217 miles of marine shoreline in Mason County. An example marine reach break is shown in Figure 2.1.

Figure 2-1. Marine Reach Break Example

Freshwater Reach Breaks

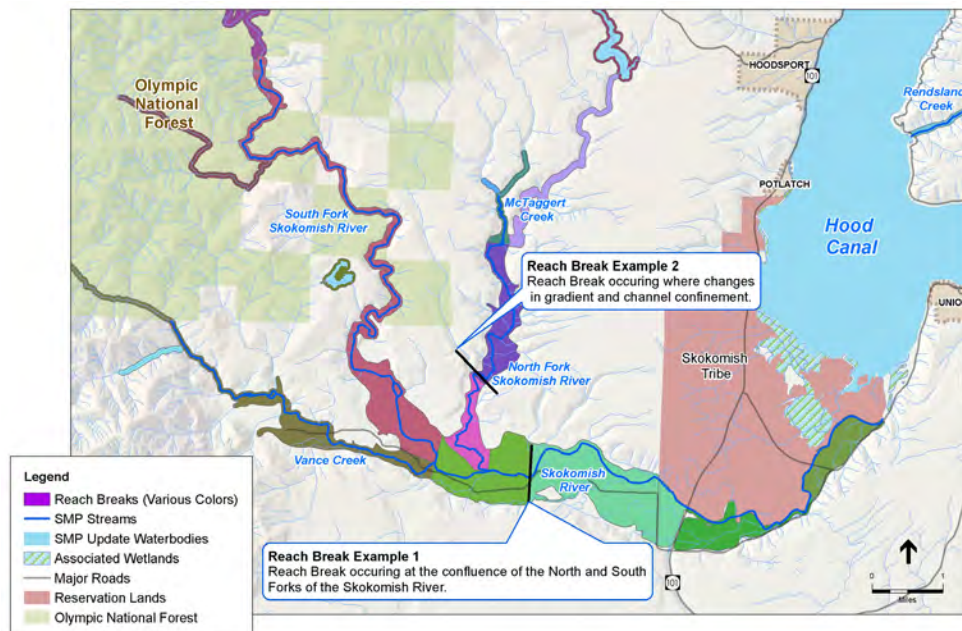
Rivers and Streams

Based upon an overview of the watersheds and the landscape setting in Mason County, the following criteria were used to determine reach breaks within rivers and streams:

- Breaks at the confluence of two SMP jurisdictional shoreline rivers. The rationale here is that major changes in geomorphology and landscape often occur downstream of major river confluences.
- Breaks at significant changes in channel morphology. These changes can include: gradient, width of floodplain, width or type of channel migration zone and/or transition in channel form. This will often include the transition from the upper watershed to lower alluvial valley.
- Breaks occur at jurisdictional boundaries. Shoreline jurisdictional streams that extend into Federal Lands (Olympic National Forest) lands, for example, will be included in the inventory and have reach breaks. Tribal reservation lands, however, are analyzed in the inventory, but will not be designated as reaches for the reach analysis since these areas lie outside of the county's jurisdiction. Reach breaks will also occur at Shelton UGA and city limit boundaries.
- Breaks where significant shifts in the pattern of land use development occur.

An example stream reach break is shown in Figure 2-2.

Figure 2-2. Rivers and Streams Reach Break Example



After applying the reach break criteria to all of the rivers/streams in the County, there were a few cases where additional changes were made based upon site specific issues:

- The Skokomish River was further divided into three reaches based on additional information provided by the Joint Technical Advisory Committee on the actual location of the confluence with the North Fork Skokomish River.

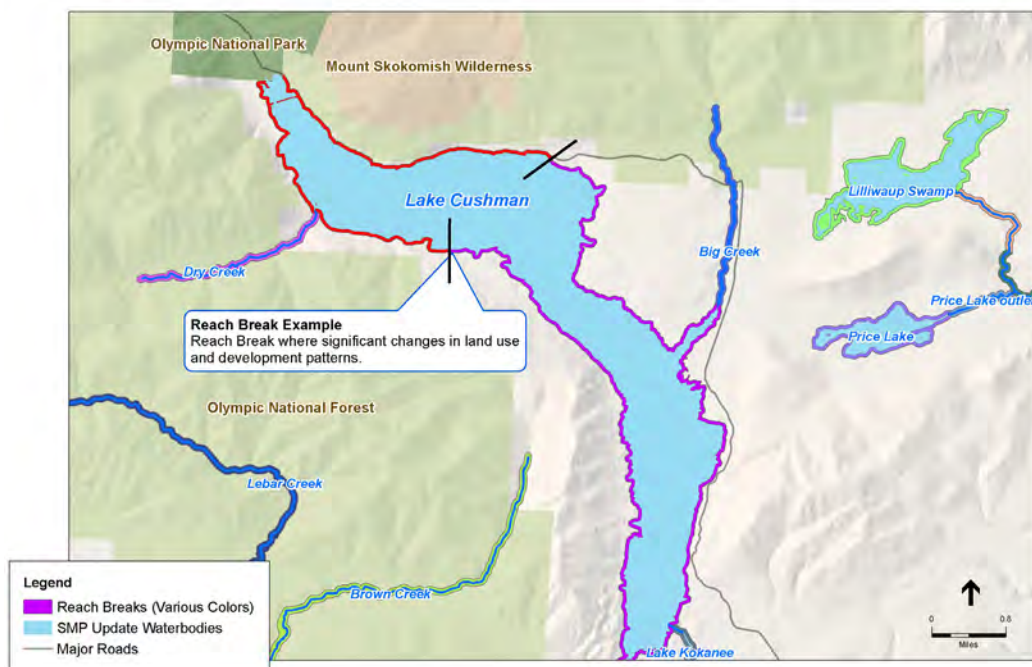
Lakes

The following criteria were used to determine reach breaks along lakes:

- Lakes and reservoirs formed wholly within river channels are separate reaches from the river reach.
- Lakes classified as “shorelines of the state” are typically considered one reach - unless significant changes in the pattern of land use development occur.
- Lakes classified as “shorelines of statewide significance” (Lake Cushman) may have several reaches due to significant changes in the pattern of land use development.
- Breaks at Shelton UGA and city limit boundaries.

An example lake reach break is shown in Figure 2-3.

Figure 2-3. Lake Reach Break Example



2.4.3 Other Methods

Several other studies conducted in the County have developed their own set of reaches for inventorying and studying ecosystem functions and processes. . Many of the other studies in the County have focused on either the freshwater or marine shoreline environments; a subset area of Puget Sound; or a characterization of ecosystem function at a watershed scale. A list of some of the other recent studies conducted in Mason County can be found below in Table 2-2.

Table 2-2 Other Studies Conducted in Mason County, Washington

Report/Study	Date	Extent	# Reaches in Mason County	Focus of Study
PSNERP - Change Analysis (V3)	2010	Marine Shoreline (Entire Puget Sound)	112 process units	Nearshore process and functions and alterations (change analysis from historic to current conditions)
Nearshore Assessment	2004	South Puget Sound (Case Inlet)	56 units	Nearshore processes and alterations
EDT Reach Breaks	2002	WRIA 22 – Lower Chehalis only	213 reaches	Salmon protection/restoration

2.5 GIS Data Sources for Reach Sheets

A description of each shoreline reach is provided in a two-page ‘reach sheet’ and included in Chapters 4-9 of this report. The information contained in the reach sheets are primarily based on GIS data sources, as shown in the examples below. If information is obtained from a non-GIS data source, a citation is provided in the reach sheets in Chapters 4-9. Additional information on the sources used for the reach sheets can be found in Appendix D: Reach Sheet Guide.

MARINE REACH SHEET – GIS DATA SOURCES

SHORELINE LENGTH	LOCATION	REACH AREA
DNR, 2007 (Reach length)	No GIS data sources were used	ESA, 2011
Ecology, 2006 (Oblique Imagery)		

PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY FEMA, 1998 (Floodplain)	HAZARD AREAS DNR Mason Watershed Landslide Hazard Zonation Project (2007)
SHOREFORM AND NET SHORE DRIFT PSNERP, 2009 (Shoreform)	NEARSHORE PROCESS DEGRADATION PSNERP, 2010 (Strategic Needs Assessment Report); DNR, 2000 (ShoreZone)
LAND COVER GAP Land Cover Analysis, 2009 (Land cover types); PNPTC, 2011 (Riparian vegetation cover types)	PRIORITY HABITATS AND SPECIES WDFW, 2011 (Bald Eagle, Fish Distribution and Wildlife Occurrence, Herring, Rocksole, Sand Lance Spawning, Shellfish, Shorebirds, Smelt Spawning); Anchor, 2003 (Nearshore Project Selection Tool) (South Puget Sound, Forage Fish); DNR, 2008 (Eelgrass and Kelp); DNR, 2011 (Hood Canal) (Aquatic Vegetation Survey); USFWS, 2010 (Critical Habitat); USFWS 2010 (wetlands)
WATER QUALITY Department of Ecology, 2008 (303 (d) list); Herrera, 2011 (Hood Canal and Oakland Bay; not in GIS format)	

HUMAN ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP Mason County Assessor Parcel Information, 2010 (Existing land uses); PSNERP, 2009 (ownership) NOTE: Ownership data is derived from a broad-scale regional dataset designed to identify large public lands. Discrepancies might exist with smaller public lands such as parks.	SHORELINE MODIFICATIONS PSNERP, 2009 (Tidal barriers); PSNERP, 2009 (Armoring); PSNERP, 2009 (Overwater nearshore fill)
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS Mason County, 2010 (Zoning designations and existing shoreline environment designations); Mason County, 2009 (Comprehensive Plan designations)	PUBLIC ACCESS Ecology, 2010 (Shoreline Public Access)
IMPERVIOUS SURFACES NOAA (CCAP), 2006 (Area of impervious surface); HCCC (2006) (Hood Canal)	AREAS OF SPECIAL INTEREST Ecology, 2009 (Ecology Facility Sites)
CULTURAL AND ARCHAEOLOGICAL RESOURCES DAHP, 2011; DAHP, 2006 (Hood Canal Probability Model)	

OPPORTUNITY AREAS

Greater Mason County Nearshore Habitat Assessment (Anchor, 2004) (South Puget Sound)
Oakland Bay and Hammersley Inlet Nearshore Habitat Assessment (Anchor, 2002) (South Puget Sound)
Nearshore Project Selection Tool (Anchor, 2003) (South Puget Sound)
Habitat Work Schedule (Washington State RCO, WDFW & USFWS, 2011)
WRIA 14 Habitat Work Schedule (Mason Conservation District, 2011)
Puget Sound Partnership Watershed Implementation Priorities (PSP, 2010)

KEY MANAGEMENT ISSUES

Greater Mason County Nearshore Habitat Assessment (Anchor, 2004) (South Puget Sound)

FRESHWATER REACH SHEET– GIS DATA SOURCES

SHORELINE LENGTH:

DNR, 2007

REACH AREA:

ESA, 2011

NAIP, 2009 and Google Earth, 2006 and 2009 (air photos)

PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY

FEMA, 1998 (Floodplain area); GeoEngineers, 2006 (Skokomish River CMZ); Ecology, CardnoEntrix, and GeoEngineers, 2011 (CMZ)

HAZARD AREAS

Mason County, 2009 (Erosion); DNR, 2009 (Landslide)

LAND COVER

GAP Land Cover Analysis (Land cover types), 2009; PNPTC, 2011 (Riparian vegetation land cover types)

PRIORITY HABITATS AND SPECIES

WDFW, 2011 (bald eagle, fish distribution and wildlife occurrence, marbled murrelet); USFWS, 2010 (bull trout critical habitat, Chinook and Chum critical habitat); USFWS, 2010 (wetlands); DNR, 2010 (natural heritage plants database, rare plant species populations and endangered ecosystems)

WATER QUALITY

Department of Ecology, 2008 (303 (d) list); Herrera, 2011 (Lake water quality data [not in GIS format])

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP

Mason County Assessor Parcel Information, 2010 (Existing land uses); PSNERP, 2009 (Ownership)
NOTE: Ownership data is derived from a broad-scale regional dataset designed to identify large public lands. Discrepancies might exist with smaller public lands such as parks.

SHORELINE MODIFICATIONS

DNR, 2009 (Overwater structures); WDFW, 2009 (Road crossings); WDFW, 2009 (Dams); WDFW, 2008 (Miscellaneous barriers)

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS

Mason County, 2010 (Zoning designations and existing shoreline environment designations); Mason County, 2009 (Comprehensive Plan designations)

PUBLIC ACCESS

No GIS data sources were used

IMPERVIOUS SURFACES

HCCC, 2006; NOAA CCAP, 2006 (Area of impervious surface)

AREAS OF SPECIAL INTEREST

Ecology, 2009 (Ecology Facility Sites)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

DAHP, 2011; DAHP, 2006 (Hood Canal Probability Model)

OPPORTUNITY AREAS

Puget Sound Partnership Watershed Implementation Priorities (PSP, 2010)

KEY MANAGEMENT ISSUES

Various sources

CHAPTER 3. ECOSYSTEM PROFILE

3.1 Introduction

This chapter provides an broad overview of the watershed conditions across Mason County and describes how ecosystem-wide processes affect the form and function of the County's shorelines as required in WAC 173-26-210(3)(d). This watershed-scale overview provides context for the reach-scale discussion provided in Chapters 4 through 9. The landscape analysis approach to understanding and analyzing watershed processes developed by Ecology (Stanley et al., 2005) has been referenced to complete this section of the report. Terms used in this section are defined in the document entitled *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes* (Stanley et al., 2005). Maps referenced in this chapter are provided in Appendix A (Map Folio).

Mason County is located in the southwestern corner of the Puget Sound Basin in western Washington. According to the U.S. Census Bureau, Mason County has a total area of 1,051 square miles, of which 961 square miles is land and 90 square miles (8.6 percent) is water. Elevations in the County range from 6,400 feet above mean sea level (MSL) in the foothills of the Olympic Mountains, to sea level along the coastline of Puget Sound and Hood Canal.

The County includes portions of five Water Resource Inventory Areas (WRIAs) as outlined below:

- WRIA 14a: Kennedy Goldsborough;
- WRIA 15: Kitsap;
- WRIA 16/14b: Skokomish-Dosewallips and South Shore of Hood Canal;
- WRIA 21: Queets-Quinault; and
- WRIA 22: Lower Chehalis.

Watersheds within the County are illustrated on Map 1 – Regional Context (Appendix A). As a result of recent legislation, the WRIA 16 planning area includes all the Hood Canal drainages along the south shore of the lower canal from the Skokomish to west of Belfair (this area is known as WRIA 14b). The portion of WRIA 21 within Mason County is located entirely within federal land (Olympic National Park) and is not discussed further in this report.

With the exception of WRIA 22, each of the remaining three basins includes both marine and freshwater shorelines. An overview of the marine shorelines of the county is provided below, followed by a summary of each of the four WRIs.

3.1.1 Marine Shorelines

The marine shorelines in Mason County are located in WRIA 14a, 15, and 16/14b and cover about 217 linear miles including the inner shores of inlets, embayments, and estuaries. Mason County nearshore character varies considerably and is comprised of numerous geomorphic shoretypes. Controlling factors within the Mason County marine landscape include climate, wave energy (exposure), sea level, and topography and bathymetry. Other variables influence Mason County marine shores including: net shore-drift of sediment, bluff geology (stratigraphy), tidal regime, and numerous fluvial systems the largest of which are the Hamma Hamma and Skokomish Rivers.

The reach scale-discussion of marine shorelines is divided into Hood Canal (Chapter 4) and South Puget Sound (Chapter 5). Hood Canal marine shorelines are located in WRIA 14b and portions of WRIA15, and 16, covering about 85 miles. Hood Canal marine shorelines in Mason County include a total area of roughly 4,003 acres, which includes approximately 2,001 acres of water. South Puget Sound marine shorelines are located entirely within WRIA 14a. South Puget Sound marine shorelines in Mason County include a total area of roughly 5,980 acres, which includes approximately 2,935 acres of water.

The Mason County marine shores encompass shorelines in two distinct areas of Puget Sound, including southern Hood Canal (from near Triton Head south) and the southern extent of the Southern Puget Sound subbasin from between the Pierce County line in northern Case Inlet to the heads of Hammersley, Totten and Little Skookum Inlets, including Oakland Bay, Pickering Passage, Peale Passage and Harstine Island. Several smaller islands are also encompassed within the County including Stretch, Reach, McMicken and Hope Islands.

Hood Canal and Puget Sound were historically a large freshwater lake called Lake Russell, which was formed by the retreat of the Fraser Glaciation, the most recent glacial period. The lake extended from the vicinity of Seattle in the north to the Black Hills, which are located in WRIA 14a, and drained south to the Chehalis River. When the glacier retreated north of the Strait of Juan de Fuca, the freshwater was replaced by saltwater and created the present marine environment of Puget Sound. In South Puget Sound, extensive alluvial deltas formed at Hammersley Inlet, Oakland Bay, Skookum Inlet, Oyster Bay (Molenaar and Noble, 1970). Each of the marine shores in Mason County has a geomorphic shoreform unit (GSU) designation. The hierarchy of process unit designation is structured upon two prominent processes

that occur around Puget Sound. The processes are littoral drift and riverine deltas. The primary GSUs are Delta Process Units (DPU) and Shoreline Process Units (SPU) (Simenstad et al., 2009; Kramer et al., 2009). The GSUs in the county include delta and shoreline process units. The total number of geomorphic process units is 113. In Mason County, there are 34 geomorphic process units along the Hood Canal shorelines and 79 along the South Puget Sound shorelines. Coastal shore types are illustrated in Map 7 – Coastal Shoreform Types (Appendix A). The dominant shoreform type in the County is bluff-backed beach. This means that most of the beaches have formed at the base of coastal bluffs.

3.1.2 WRIA 14a: Kennedy Goldsborough

WRIA 14 covers approximately 243,840 acres at the southwest terminus of Puget Sound (Kuttel, 2002). Of this area, approximately 85% of the WRIA is located in Mason County; the remainder of this WRIA is located in Thurston County. The terrain and drainage network are largely the result of past glacial episodes that gouged out the inlets and deposited and reworked large amounts of gravel, sand, and clay sediments (Molenaar and Noble 1970 in Kuttel, 2002). With the exception of the Black Hills in the extreme southwest portion of WRIA 14, the majority of this watershed is comprised of low elevation hills and valleys.

In 2008, the State Legislature passed a bill that split WRIA 14 into two separate areas for watershed planning. The bill (SB 6204) designated WRIA 14b as the portion of Kennedy-Goldsborough that drains into the southern portion of lower Hood Canal. The legislation then states that the WRIA 16 planning efforts must include WRIA 14b. No freshwater streams meeting the definition of shorelines of the state are found within WRIA 14b; however, two shoreline lakes do drain to the south shore of Hood Canal in WRIA 14b.

Principal drainages include Cranberry, Goldsborough, Kennedy, Mill, Sherwood, Johns, Deer, and Skookum Creeks. Despite the abundance of creeks, WRIA 14a has no major rivers. Numerous lakes are present. WRIA 14a includes the community of Allyn and the City of Shelton and its urban growth area. The Squaxin Island Tribe Reservation encompasses the entirety of Squaxin Island; the Tribe also holds reservation and trust lands near the mouth and other areas of Skookum Creek.

Land use in the Kennedy-Goldsborough area is primarily forest (71%) with urban and agricultural use accounting for four percent each. Timber production was the dominant industry in WRIA 14a until the 1980s when timber production slowed due to measures designed to protect the spotted owl. Since then, oyster and clam production have become other valuable local commodities (Vleming, 2011). Damming of streams and wetlands to create lakes, and shoreline modifications for residential development, have been common in WRIA 14a. These activities along

with conversion of forestland to agricultural or residential land uses have altered the natural flow regime of many streams in the region. Dams and failed culverts may hinder salmonid migration in the Kennedy-Goldsborough Basin.

Marine shorelines of WRIA 14a are the shorelines of Case Inlet, Oakland Bay, and Totten Inlet, including islands such as Harstine and Squaxin. Marine shorelines of WRIA 14b include the south shore of Hood Canal.

3.1.3 WRIA 15: Tahuya Peninsula

WRIA 15 includes approximately 631,100 acres of the Kitsap Peninsula, most of which lies within Kitsap County. Of this area, approximately 13% of the greater WRIA is located in Mason County, encompassing the Tahuya Peninsula from Belfair to Dewatto. The topography of WRIA 15 is generally low in elevation and gradient. Major water bodies in this watershed include the Union River, Tahuya River, Dewatto River, Rendsland Creek, and Mission Creek. Many small lakes also occur in the glacial till plain of Kitsap Peninsula.

Development within the Tahuya Peninsula is relatively low with residential uses occurring primarily along Hood Canal. The Tahuya State Forest, owned by DNR, occupies a large portion of the peninsula. Major land uses in WRIA 15 are forest resources, agriculture, residential, and urban services. The community of Belfair is located at the eastern end of Hood Canal. Although the degree of shoreline development is high in some areas, the upland watersheds have relatively low impervious surface areas, and predominantly forest or mixed forest/pasture land cover. This area generally lacks large urban/industrial development (Haring, 2000; ESA Adolfson, 2007). Another major impact is State Route 300 and North Shore county road, which run along the entire marine shoreline.

Anadromous salmonid distribution is limited in some WRIA 15 streams by the presence of natural barriers (falls and cascades), culverts, dams, tide gates, and reduced instream flows (Haring, 2000). The marine shoreline of Hood Canal borders the western and southern boundaries of WRIA 15 in Mason County.

3.1.4 WRIA 16/14b: Skokomish-Dosewallips and South Shore

WRIA 16 covers approximately 428,800 acres (WRIA 16 Planning Unit, 2006). Of this area, approximately 56% of the WRIA is located in Mason County. The topography ranges from mountains in the western part of the basin to low-elevation river valleys that drain to Hood Canal. The largest rivers in the Mason County portion of the watershed are the Skokomish and Hamma Hamma Rivers. Many smaller streams, some of which are intermittent, also flow directly into Hood Canal.

For watershed planning purposes, WRIA 16 has been combined with WRIA 14b, which includes lands draining to the south shore of Hood Canal from the community of Union to the southern edge of the Belfair UGA

Lake Cushman is a large reservoir formed in the 1920s by the damming of the North Fork Skokomish River for hydroelectric power. Lake Kokanee and Kokanee Dam is also located on the North Fork. Numerous small dams are located on smaller streams throughout the WRIA (Correa, 2003).

The economy in WRIA 16 relies largely on shellfish harvesting, commercial forestry, tourism, Christmas-tree farming, and some agriculture (WRIA 16 Planning Unit, 2006). Agriculture and residential development within the floodplains of many WRIA 16 watersheds have resulted in channelization of rivers and tributaries, draining of beaver ponds for livestock grazing, and logging in forested riparian zones. Forest practices in the watershed have caused adverse impacts on salmon habitat in WRIA 16 (Correa, 2003).

The Skokomish Tribe Reservation is located near the mouth of the Skokomish River on Hood Canal. The communities of Hoodsport, Potlatch, and Lilliwaup are located north of the reservation. WRIA 16 extends west into federally owned national park, national forest, and wilderness lands.

WRIA 16 has approximately 8,000 permanent residents, most of who reside along the shore of Hood Canal (WRIA 16 Planning Unit, 2006). In addition to the effects of residential development along the marine shoreline, a major impact to the nearshore environment is Highway 101 North, which extends north/south along the entire shoreline, and SR 106, which extends along the entire South Shore.

3.1.5 WRIA 22: Lower Chehalis

WRIA 22 covers approximately 939,456 acres draining from the southwestern Olympic Mountains. Of this area, only 14% of the WRIA is located in Mason County. Major water bodies in the Mason County portion of WRIA 22 include the East Fork and Middle Fork Satsop River, Cloquallum Creek, and Decker Creek. These water bodies flow southward to the mainstem Chehalis River, which in turn flows westerly discharging to Grays Harbor on the Washington coast.

The Mason County portion of WRIA 22 has a low population density and is mostly set aside for commercial forestry. Forest land in the Olympic National Forest occupies the northern part of the watershed. No marine shorelines are present in the Mason County portion of WRIA 22.

3.2 Climate, Geology, Landforms, and Channel Migration Zones

3.2.1 Climate

Mason County's climate is a West Coast marine climate with generally mild, wet winters and dry, warm summers. The climate is influenced by the Pacific Ocean, yet sheltered by the Olympic Mountains. Local climate conditions within Mason County can vary significantly depending on topographic position and season. Average temperatures in Mason County range from 32° F in January to 78° F in July (Mason County, 2005). Mason County's average daily temperature is 51° F and average precipitation is 64 inches. Large variations in precipitation occur within the county with portions of the Olympic Mountains receiving up to 250 inches of rain a year, while 60 inches is more common closer to Hood Canal. The average monthly precipitation varies from a low in July of 0.8 inches, to a high of 10.4 inches in January. The precipitation primarily falls between October and March in frequent rainfalls of low intensity. In the higher elevations, some of this precipitation falls as snow.

Climate Change

Climate change happens on scales ranging from decades to centuries. All of these fluctuations can have an impact on ecological conditions in the shoreline environment. The El Nino-Southern Oscillation (ENSO) process influences weather over months to years and occurs in different phases. Phases of ENSO include neutral, El Nino (warm event), or La Nina (cold event). These phases represent equatorial temperatures that include climate patterns in the northwest and throughout North America. The Pacific Decadal Oscillation (PDO) is similar to ENSO, but occurs over several decades. The impact of PDO is focused on the Pacific Ocean, but the causes and effects of PDO are not as well understood as ENSO, due to the generally longer time scale of the process.

In recent years, significant research has been focused on potential impacts of a changing overall climate regime. Two organizations that have completed extensive research related to climate change are the International Panel on Climate Change (IPCC) and the Climate Impacts Group (CIG), at the University of Washington (IPCC, 2007; CIG, 2009). In Western Washington there are two types of changes that could result from climate change that have the potential to influence ecological processes in Mason County: (1) changes in seasonal temperature and precipitation; and (2) sea level rise.

In the 20th century, the average annual temperature and precipitation generally increased in the Puget Sound region (CIG, 2009). Changing temperature and precipitation patterns could alter how the marine and freshwater systems function. Climate change is likely to have an impact on future water resources in Mason County. Over the next decades, increased regional temperatures are anticipated to lead to a reduction in snowpack and receding glaciers in the Olympic Mountains. Since many of the tributary streams in WRIA 16 and 22 depend upon snowmelt and glacier melt waters, these streams may be affected over time. Anticipated effects include decreased summer baseflows as snowpack and glaciers are reduced. Spring peak flows are also predicted to occur two to six weeks earlier than they do normally (CIG, 2009). Further, streams without snowmelt or headwaters in the mountains will also be affected (WRIA 14a, 14b, and 15), perhaps more strongly, as streams currently have low in-stream flows.

Additionally, the communities in Mason County that are low-lying and located adjacent to South Puget Sound and Hood Canal could be affected by sea level rise. Sea levels in Puget Sound are projected to rise between 3.0 inches and 22.0 inches by Year 2050 (Mote, 2008). Sea level rise will allow high tides to reach farther into low-lying coastal areas and rise higher on existing flood control structures such as dikes and bulkheads. Coastal flooding will persist longer and could lead to faster rates of erosion on beaches and coastal bluffs (Shipman, 2009). Ecology has suggested local governments consider preparing for sea level rise during the Shoreline Master Program update process (Appendix A of the Ecology SMP Handbook - Addressing Sea Level Rise in Shoreline Master Programs).

In addition to temperature and precipitation fluctuations, and sea level rise due to climate change, Hood Canal and Puget Sound are being affected by ocean acidification. As the world's oceans absorb more carbon dioxide from the atmosphere, pH values have decreased in the deep waters (depths greater than 40 meters) of Puget Sound and Hood Canal. Ocean acidification accounts for 24 to 49 percent of the pH decrease in the deep waters of Hood Canal (NOAA, 2010). The remaining change in pH results from the decomposition of organic matter. Acidification may be impacting oyster larvae survival in the Pacific Northwest, including within Puget Sound, potentially resulting in harm to the shellfish industry over the next several decades.

3.2.2 Geology

The geology of Mason County is shown in Map 5 – Geologic Formations (Appendix A). The bedrock in Mason County is composed of thick beds of basaltic and andesitic lavas during the early and middle parts of the Eocene Epoch of the Tertiary Period. During this period, sea level fluctuated, which caused some of the lava to be deposited in marine waters and streams to erode the volcanic rocks and deposited

sediment. These sediments formed interbed and lenses in the lava rock. Volcanic activity decreased during the late Eocene. Thousands of feet of marine sedimentary rocks were laid down on top of volcanic rocks during the late Eocene through the Oligocene and early Miocene Epochs (Garling and Molenaar, 1965).

During the late Pliocene Epoch, north-south uplift produced the Olympic Mountains. The Puget Trough formed by a downwarp associated with building of mountains. Sediments, ranging in size from fine-grained clays to coarse sands and gravels, accumulated through the Pliocene and most of the Pleistocene Epochs in freshwater lakes and swamps. When plant material accumulated at the bottom of these water bodies, peat and lignite formed. During the Pleistocene Epoch, streams draining adjacent mountains and glaciers deposited the coarse sediment (Garling and Molenaar, 1965).

During the Pleistocene Ice Age, glaciers traveled from Canada into the Puget Sound lowland area. The glaciers ranged in thickness from roughly 2,000 to 5,000 feet thick. Climate fluctuations caused the glaciers to advance and retreat repeatedly. The last glaciers in the Puget Sound region retreated about 14,000 years ago. Streams flowed from the melting glaciers, carved channels, and deposited sediments. During periods between glacial advances, vegetation, including forests, recolonized the areas. When the glaciers retreated, the vegetation was buried and formed peat beds. Glaciers distributed till, which consists of cobbles mixed with silt and clay, over the area (Garling and Molenaar, 1965). Once ice left Puget Sound, sea water created the present marine environment of Puget Sound, including the marine water bodies adjacent to Mason County (Garling and Molenaar, 1965). The historic scouring and retreat of glaciers across Mason County can be seen by the north-south orientation of many lakes within the County.

3.2.3 Landforms

There are three dominant topographic features observed in Mason County; they are: (1) the high jagged peaks and slopes of the Olympic Mountains in the northwest; (2) the lower and more rounded Black Hills along the southern border; and (3) the lower lying, rolling glacial moraine and the outwash plain (Ness et al., 1970). The elevation of the Olympic Mountains in the county is more than 6,000 feet, while elevations in the Black Hills are roughly around 1,500 feet. The glacial plain (including Kitsap Peninsula) ranges from sea level to approximately 1,000 feet. The glacial plain is cut by numerous stream channels and inlets of Puget Sound. The main one is Hood Canal which penetrates the county from the north for roughly 20 miles, then turns sharply to the northeast (the Great Bend) for roughly 17 miles (Ness et al., 1970). The Hood Canal separates roughly 90 square miles from the rest of the county.

3.2.4 Channel Migration Zones

The channel migration zone (CMZ) is the area within which a stream or river may migrate laterally over a period of time, resulting in movement of the stream or riverbed. Channel migration is a natural process associated with all sizes of flowing streams and rivers. The Washington Department of Ecology established a methodology for mapping channel migration in 2003 (Rapp and Abbe, 2003). In 2009, Patricia Olson, with the Washington Department of Ecology Shorelines and Environmental Assistance Program (SEA), prepared a document outlining a method for identifying potential channel migration reaches for SMP updates (Olson, 2009). Steps in determining channel migration include determining channel confinement and gradient, geology erosion potential, bank and floodplain erosion potential, and channel pattern and evidence of channel movement or bank erosion (Rapp and Abbe, 2003; Olson, 2009).

The Skokomish River has occupied a definable CMZ for the last 100 years, especially in the upper reaches (Bureau of Reclamation, 2009).

A CMZ characterization for the entire county has been completed by Ecology (Patricia Olson, personal communication, 2011). The CMZ data for the county was developed by Ecology (2011c) and is illustrated in Map 25 – Channel Migration Zone Assessment (Appendix A).

The Ecology CMZ characterization used a streamlined approach which differs from the 2003 and 2009 methodologies described above. The streamlined method is based on recent air photos and LiDAR elevation models. LiDAR data is used to create maps that accurately identify landscape features such as relic or prehistoric channels, alluvial fans, floodplains and terraces, wetlands, and infrastructure such as road beds, fill, and drainage ditches. Aerial imagery shows vegetation, development, land use, landslides, unvegetated banks, large woody materials in the channel, sediment bars, and oxbow lakes. Older aerial images were used to reveal erosion rates. Geology and soil layers were also used to determine erodibility of the channel banks and floodplain. The analysis also used existing GIS data on hydrography, landslides, FEMA flood hazard zones, railroads, and roads. Levees certified by the U.S. Army Corps of Engineers and state highways were assumed to act as barriers to channel migration.

The analysis identifies areas where stream channels have a high probability of moving given current hydrologic and geomorphic conditions. The CMZ maps are intended to comply with SMP guidelines, assist with planning, and indicate areas where additional data and analysis should be conducted to complete a more detailed delineation. The streamlined analysis does not include information from

historic migration rates, field verification, or geotechnical assessments. On some reaches, the CMZ extends beyond the shoreline jurisdiction area.

3.3 Surface Water and Groundwater

Mason County has significant surface water and groundwater resources. The main source of groundwater recharge is from precipitation. The main water bodies that contribute to the surface water in Mason County include (listed from north to south) the Hamma Hamma River, Lilliwaup Creek, Dewatto River, Union River, Tahuya River, Sherwood Creek, Skokomish River, Deer Creek, John's Creek, Goldsborough Creek and Mill Creek, as well as their tributary streams and lakes. The origin of many of the surface water watersheds are in the Black Hills or Olympic Mountains. Frequently flooded areas in the County are shown on Map 10 – Frequently Flooded Areas and hydrologic features are shown on Map 4 – Hydrology - County Scale (Appendix A).

In the Black Hills, the majority of the precipitation runs off because of the prevalence of impermeable rock. This causes many headwater streams in the Black Hills to go dry during summer months (Kuttel, 2002). Precipitation that falls on unconsolidated sediment of the glacial plain tends to percolate into the groundwater, providing perennial flow to low lying streams. In late summer, groundwater provides the majority of summer flows to many of the creeks in the County (Molenaar and Noble, 1970).

Minimum instream flow requirements for WRIA 14a and WRIA 15 are specified in the Washington Administrative Code (WAC). Many of the rivers and creeks in Mason County fall below the statutory minimum levels during some months. These streams have been closed to further appropriations for some or all of the year. In Mason County, four major areas are identified as critical aquifer recharge areas (Map 11 - Critical Aquifer Recharge Areas [Appendix A]).

3.4 Water Quality

One of the major watershed issues within Mason County is degrading water quality. Water quality impairments as defined by the Washington State Department of Ecology for the 2008 303(d) list are illustrated at the county scale on Map 13 – Water Quality (Appendix A).

Marine

Water quality in Puget Sound has been worsening over time. Toxic pollutants are entering the Puget Sound through stormwater runoff. Fecal coliform bacteria concentrations are present from failing septic systems or poorly managed animal waste. Nutrient loads, particularly nitrogen have been identified as a potential stressor to the Puget Sound ecosystem. One consequence of excessive nutrient loading may be low dissolved oxygen concentrations in the water. The Puget Sound Partnership has targeted water quality degradation as a primary issue to be addressed for the recovery of the Puget Sound. Trends in water quality documented for Puget Sound show degradation over time (PSAMP 2007).

Data collected in South Puget Sound show those portions of the South Sound fall below State water quality standards for dissolved oxygen, particularly Case Inlet. Dissolved oxygen levels decrease when excess nutrients (e.g., nitrogen) enter marine waters and stimulate algae growth. Low DO levels can be harmful to fish and other marine life, affecting the health of the Puget Sound ecosystem. The Washington State Department of Ecology initiated a study (South Puget Sound Dissolved Oxygen Study) to determine whether human sources of nitrogen are contributing to low DO levels (Mohamedali et al., 2011). This study determined that 77 percent of the nitrogen entering the South Puget Sound is attributable to river inputs. On the other hand, in the summer, during low stream flows, up to 90 percent of the dissolved inorganic nitrogen came from wastewater treatment plants (Mohamedali et al., 2011).

In Hood Canal, low dissolved oxygen, also termed “hypoxia”, is a serious problem. Low DO is related to nutrient loading, summer water temperatures and a lack of natural flushing within the shallow bays and inlets. Although the water quality is good in some locations, low DO levels and high fecal coliform concentrations are problematic during the summers in shallow bays. Ecology’s 2008 water quality assessment (Washington Department of Ecology 2008a) documented several segments in Hood Canal that did not meet the State’s water quality standards for dissolved oxygen, fecal coliform or both; and were subsequently placed on the EPA 303(d) list of impaired waters. These problems date back to before the 2008 assessment. Low levels of dissolved oxygen contribute to episodic fish kills in Hood Canal. Fish kills were reported as far back as 1920 (Newton et. al. 2011). However, recent scientific studies and anecdotal evidence suggest that the frequency, duration, and spatial extent of low dissolved oxygen events are increasing (Newton et. al. 2011). The latest fish kill in Hood Canal was recorded by WDFW in September 2010. A total of 2,888 individual fish or prawns were observed dead with spotted prawn and blackbelly eelpout showing the highest percentage deaths by numbers of individuals (Palsson, 2010).

Mason County participates in the Hood Canal Dissolved Oxygen Program (HCDOP) in efforts to address water quality issues in a regional context. The goal of the HCDOP is to determine the sources of low dissolved oxygen in Hood Canal and its interaction with marine life. HCDOP is working with local, state, federal and tribal government policy makers to determine potential corrective actions that will restore and maintain a level of dissolved oxygen to reduce stress on marine life (<http://www.hoodcanal.washington.edu/>).

In addition to working towards resolving low dissolved oxygen problems, Mason County has taken several steps to reduce overall pollutant loading to marine waters. These include:

- Establishing Clean Water Districts and preparing implementation plans aimed at re-opening and upgrading shellfish harvest areas.
- Participating in developing and implementing TMDLs.
- Adopting and beginning implementation of a county-wide stormwater management plan (Otak, 2009).
- Preparing and implementing an on-site septic system operation and maintenance plan.
- Developing protocol and conducting a Pollution Identification and Control (PIC) program.
- Planning, designing, constructing and maintaining regional wastewater facilities.
- Providing general and targeted education and outreach.
- Participating in the Regional Road Maintenance ESA Program.
- Participating in stormwater retrofit and habitat restoration projects.
- Ensuring new and re-development projects follows shoreline, stormwater management and resource protection ordinances.

Aside from dissolved oxygen and fecal coliform, there are no other known water quality impairments for marine waters in the county. However, sediment quality analyses conducted by the Department of Ecology in 2005 indicated moderate sediment toxicity at some Hood Canal sampling sites within Mason County, and one site that had 'intermediate/degraded' quality. These results were based on a combination of results for chemical, toxicity, and benthic data referred to as the

Sediment Quality Triad Index. No sites had individual chemical concentrations that exceeded State or National Oceanographic and Atmospheric Administration (NOAA) sediment quality standards (Long et. al. 2010). Recent testing in Shelton Harbor indicate that sediments contain residual dioxin and other toxics related to the woods product industry (Herrera 2008, 2010)

Rivers and Lakes

Shoreline development and landscape techniques around freshwater rivers and lakes can adversely affect water quality and the habitats that are maintained by specific water quality conditions. Freshwater shorelines, including wetlands and vegetated riparian areas act as buffers to filter and trap pollutants. The increase in impervious surfaces and installation of septic systems, in addition to human activities in the nearshore zone (such as boating, home maintenance, and landscaping techniques that can introduce pollutants) are all potential sources of water quality degradation in lakes and rivers.

In lakes, aquatic plant communities (native versus non-native) and aquatic plant management (herbicide use, boating, and for waterfowl and fish habitat) activities can also affect water quality. While aquatic plants provide an important physical habitat element in lakes, dense populations of these plants can negatively impact water quality and thereby degrade habitat as well as impact human uses. Few lakes in Mason County have Integrated Aquatic Vegetation Management Plans (IAVMPs) that have been developed by lake managers and lake management districts authorized under RCW 36.61.070. Lakes with IAVMPs include Mason Lake, Island Lake, and Lake Limerick (Tyler, personal communication, 2011) and a plan is currently in development for Haven Lake. Implementation of those plans may have indirect implications for water quality.

Available data regarding water quality in Mason County lakes is limited. There are 44 lakes that fall within SMP jurisdiction. Twelve of the 44 lakes were assessed by Ecology during the 1990s, and a summary statement from that assessment is included in this report for those lakes. However, as the data is nearly 12 years old, no detailed review was performed. There are only a few 303(d) listings associated with these lakes. In this case, the lack of listings is more likely associated with lack of data than it is an indicator of good water quality. There are also four lakes (Island, Limerick, Mason, and Spencer) that are categorized as 4C, waters where some characteristic uses may be impaired due to aquatic habitat degradation that is not the result of a pollutant. In these four cases, the possible impairment is related to the documented presence of invasive exotic plants.

Ecology regulates the use of aquatic herbicides to control invasive weed infestations in freshwater habitats, primarily lakes. Permits currently issued for Mason County shoreline lakes are listed in Table 3-1.

Table 3-1. Herbicide Permits for Mason County Lakes*

Lake Name	Targeted Plant Species
Anderson Lake	Nuisance weeds
Arrowhead Lake	Nuisance weeds
Fawn Lake	Nuisance weeds
Haven Lake	Nuisance weeds (untreated since 2008)
Island Lake	Nuisance weeds
Limerick Lake	Noxious weed, <i>Egeria densa</i>
Mason Lake	Noxious weeds, <i>Myriophyllum spicatum</i> and <i>Sagittaria graminea</i>
Star Lakes (main and small lake)	Nuisance weeds
Timber Lake	Nuisance weeds
Trails End Lake	Nuisance weeds

*Hamel, 2012.

3.5 Fish and Wildlife Habitats

The physiographic regions in Mason County provide many terrestrial and aquatic habitats for fish and wildlife species. These habitats occur in both the marine and freshwater shorelines of the County. This section describes some of the key Mason County habitats, the ecological functions they provide. Map 8 – Fish & Wildlife Habitat Areas (Appendix A) illustrates these occurrences and habitats at the countywide scale.

Marine Beaches

Marine beaches are generally defined as areas with unconsolidated sediments that are moved, sorted, and reworked by waves and currents. The beach area can extend landward into the zone influenced by storm waves and generally includes the upper intertidal, beach face, low-tide terraces, and offshore zone to the limit of wave action. Beaches are typically steeper than tidal flats. Beaches occur throughout Mason County marine shorelines (Hood Canal, Case Inlet, Totten Inlet, and Oakland Bay).

Ecological functions of beaches include (Williams and Thom 2001; Williams et al. 2004; WDFW 2004):

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

Tidal Sand and Mud Flats

Tidal flats are gently sloping, intertidal or shallow subtidal areas with unconsolidated sandy or muddy substrates. Mud flats are predominantly silts and clays and are high in organic content, often experiencing anaerobic conditions below the surface (Simenstad et al. 1991). Sandflats are comprised of larger particles ranging from fine sands to gravels. Sand and mud flats are not necessarily featureless – they frequently contain a number of channels formed by hydrologic processes that transport and distribute water, sediments and organic material, and provide some refuge for fish and invertebrates, especially during low tides.

Sand and mud flats typically occur at mouths of rivers and streams where relatively large supplies of sediment are deposited as currents slow, and in embayments and depositional areas where wave and current energies are low. Because these are depositional areas where sediments are retained or build up over time, toxins (e.g., heavy metals) and/or pathogens associated with sediments also are retained and can build up over time.

The shallow flats and inlets of the Mason County nearshore are highly productive habitats, supporting high primary productivity and a diverse assemblage of benthic invertebrates and fish (SPSSRG 2004). Algal production on the surface of tide flats is an important source of food for prey of salmonids and other fish. Light levels increase earlier in shallow tidal flats than in some deeper water habitats, such as eelgrass, and algal production on tide flats is important in the production of prey items used by juvenile salmon entering the nearshore in early spring (Redman et al. 2005). The shallow flats in the Mason County nearshore become productive earlier in the season than flats further north, due to higher light levels and warmer temperatures.

Nutrient cycling on tidal flats can be an important source of nutrients for algal growth and algal based food webs (Simenstad et al. 1991). Channels in tidal flats

provide habitat and refuge for fish and invertebrates, including chironomids, amphipods (both important prey for juvenile salmon), polychaetes, clams, shorecrabs, tanaids, and mysids (Dethier 1990). Tidal flats also provide habitat and foraging areas for a number of fish, including juvenile Chinook and chum salmon, as well as English sole, starry flounder, sand sole, speckled sanddab, and staghorn sculpin (Simenstad et al. 1991).

In Mason County, sand and mud flat habitats occur in lower energy environments at the head of the major bays, such as Oakland Bay, and at the mouths of rivers such as the Hamma Hamma and Skokomish Rivers. Sand and mud flats also occur in smaller bays and embayments scattered throughout Mason County.

Eelgrass and Kelp Beds

Eelgrass (*Zostera marina*) is a native marine seagrass that forms extensive meadows or beds on gravel, fine sands or mud substrates in the lower intertidal and shallow subtidal zones of protected or semi-protected shorelines in the Pacific Northwest (Bulthuis 1994; Thom et al. 1998). Native eelgrass is an important marine intertidal and subtidal habitat for salmonids, especially juvenile salmonids which forage in these areas.

Typical locations for eelgrass have medium to fine sands, adequate light, relatively high levels of organic matter and nutrients (Simenstad 2000). Typical eelgrass locations are shallow tideflats, along channels in tideflats or estuaries, and in the shallow subtidal fringe. The eelgrass zone in Puget Sound is typically confined to areas between tidal elevations of +1 meter to -2 meters relative to mean lower low water (MLLW) (Thom et al. 2001, Simenstad 2000).

In undisturbed areas with optimal conditions, eelgrass can grow to a height of 2 meters, forming a tall, dense canopy. Eelgrass beds can be dense and continuous along a stretch of shoreline, or occur in small, discontinuous patches. On the shallow flats typical of the southern Puget Sound, eelgrass beds can form wide expanses. Eelgrass beds form narrow corridors along the shoreline in areas with steeper beaches, or where light penetration is limited (Simenstad 2000).

Eelgrass ecosystems are highly productive, providing a source of organic matter to intertidal and shallow subtidal food webs. Eelgrass plants produce large amounts of organic carbon that is consumed directly by grazers, as well as forming the basis for complex detrital food webs (Williams and Thom 2001). Eelgrass provides food and refuge for a number of invertebrates, which in turn are important prey for juvenile salmon and other fish (Simenstad et al. 1991). Juvenile salmon, as well as a number of other marine animals, depend on eelgrass habitat structure for refuge from predators. Eelgrass provides physical attachment sites for epiphytic algae and other organisms, and physical structure which absorbs and dampens the energy of waves

and currents, providing some buffering for adjacent habitats. Pacific herring use eelgrass for spawning substrate and for protection while eggs and juveniles mature (Williams and Thom 2001).

Eelgrass occurs in several configurations in Puget Sound, defined by location and patch characteristics. Larger, solid and continuous beds are most frequently found on extensive tideflats and are sometimes referred to as “flats.” More fragmented and patchy beds are frequently found on the edges of continuous beds or along more narrow intertidal areas. Patchy eelgrass beds along shorelines with narrow intertidal areas are sometimes referred to as “fringing” eelgrass beds, as they form narrow patches of eelgrass fringing the shoreline (Bell et al. 2006; Berry et al. 2003; Dowty et al. 2005).

In Mason County, native eelgrass is generally more abundant in Hood Canal and North Bay (see Map 23 – DNR Eelgrass Locations based on Surveys [Appendix A]). Fewer eelgrass beds naturally occur in South Puget Sound. Eelgrass distribution is strongly influenced by light availability. In South Puget Sound and southern portion of Hood Canal, circulation and mixing are not as frequent, allowing nutrients and suspended sediments to concentrate. Excess nutrients in the water column can result in algae growth on eelgrass leaves and in the water, resulting in reduced light availability to eelgrass. Increased suspended solids from erosion, dredging activities, and storm events also reduce light availability, limiting eelgrass distribution. Alterations to the shoreline to protect property and allow development have also been shown to limit the extent of eelgrass (DNR, 2011). In recent data released by DNR and Puget Sound Partnership, native eelgrass in Hood Canal appears to be declining. Based upon surveys conducted by DNR staff, eelgrass areas in Hood Canal are smaller and more infrequent in 2011 than observed in 2008. Puget Sound Partnership identified Hood Canal as one of two regions of greatest concern for eelgrass loss, with the other being the San Juans (as per GIS data provided by DNR, 2011; PSP, 2009b). A non-native eelgrass, *Z. japonica*, is also present in Hood Canal and South Puget Sound. This eelgrass species was introduced to the Pacific Northwest in the 1950s as packing material for oysters from Japan. *Z. japonica* may pose a threat to the structure and function of Puget Sound estuaries, although this is the subject of recent debate (Mach, et al., 2010.).

Zostera japonica is located throughout Puget Sound north of Nisqually Reach, colonizing historically un-vegetated zones or areas that have significantly altered habitat structure. The non-native eelgrass is morphologically different from the native, with shorter and thinner leaf blades (Eissinger, 2009). .

Zostera japonica is usually located in the mid- to high-intertidal (+1.8 meters MLLW) above *Z. marina* with little overlap between the two species in the intertidal zone. However, some populations of *Z. japonica* extend deeper into habitat occupied by the native eelgrass, raising concerns about potential negative interactions between

the two species resulting in potential for ecological and economic damage (Britton-Simmons et al., 2010)). In addition, there is concern about *Z. japonica* expanding into historical mudflats and other areas not typically vegetated by eelgrass, reducing area for those habitats.

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

In Mason County, kelp beds are generally absent in Hood Canal except for patchy areas on the western shore. In South Puget Sound, kelp is documented around Harstine and Hope Islands and in Hammersley Inlet.

Estuaries

Estuaries are embayments (bays) or semi-enclosed inland waters with freshwater inputs that serve as transition zones between marine and freshwater environments. Estuaries include the zone at the mouth of a river or stream dominated by the discharge of freshwater, and generally extends from the head of tidal influence seaward to the point where fluvial influences no longer dominate. Within the larger Puget Sound estuary, there are many river estuaries at the mouths of major rivers, numerous smaller estuaries associated with streams or bays, and localized small embayments that sometimes have freshwater discharge from either surface or groundwater sources (Beamer 2003). These smallest estuaries are sometimes referred to as “pocket estuaries.” Pocket estuaries usually contain emergent marsh, sand or mudflats, a channel structure, uplands and open water in close proximity. They may or may not contain surface freshwater inputs.

Estuaries are characterized by a gradient of salinities in tidally influenced wetlands, ranging from salt marshes at the marine edge to brackish wetlands where there is a greater freshwater influence, to tidally influenced but entirely freshwater emergent, shrub, and/or forested wetlands. Diking and draining of tidally influenced wetlands can result in the complete loss of brackish wetlands. Restricting tidal exchange converts areas that experienced intermediate and fluctuating salinities into areas

dominated by freshwater. The presence of brackish wetlands, with salinities intermediate between freshwater and saltwater, and connected by channels to salt marshes and the nearshore, is critical to providing areas for physiological adjustment for outmigrating juvenile salmonids.

Estuarine areas, and tidal channels in estuaries, can be particularly important for physiological adjustment for juvenile salmon transitioning from freshwater to saltwater (Montgomery et al. 2003). Estuaries and large areas of habitat open to tidal exchange contain a wide variety of salinity levels and salinity gradients, which allow juvenile salmon to gradually adjust to saltwater. Complex tidal channel networks also provide a range of depths and velocities, which provide habitats suitable for a wide range of juvenile salmon sizes and life history types (Redman et al. 2005). Small, shallower tidal channels provide habitat suitable for fry which spend little time in freshwater and enter the estuary at small sizes, while deeper, larger channels provide habitat suitable for larger juveniles entering the estuary after some time rearing in freshwater or larger juveniles transitioning to pelagic habitats. Estuaries also provide large amounts of organic matter to support macro-detritus based food webs, which are particularly important for salmon prey items (Bottom et al. 1991). Estuaries in natal rivers, such as the Skokomish, are critical habitats for juveniles originating in those rivers and can support large numbers of juvenile salmon. However, small estuaries, or pocket estuaries, in streams without salmon runs may also be critical to supporting juvenile salmon, especially when pocket estuaries occur in close proximity to larger estuaries (Beamer et al. 2003).

The primary ecological functions and biological resources of estuarine shorelines include:

- Flood attenuation;
- Tidal exchange/organic matter exchange;
- Stream base-flow and groundwater support;
- Water quality improvement (nutrient retention, nutrient cycling);
- Erosion/shoreline protection;
- Food web support;
- Habitat structure;
- Habitat connectivity;
- Salinity gradients; and
- Refugia – from predators (i.e., turbid waters of tidal channels).

In Mason County, major estuaries are found at the mouth of Hama Hama River, Skokomish River, Union River, Tahuya River, Dewatto River, as well as Goldsborough and Kennedy Creeks.

Non-natal Estuaries and Pocket Estuaries

In addition to the natal estuaries described above, there are tidally influenced systems that are not directly associated with larger rivers or Chinook salmon natal watersheds, but that also provide support to juvenile salmonids (Beamer 2003, Redman et al. 2005). Numerous smaller estuaries and embayments (pocket estuaries) occur within the Mason County marine nearshore environment. In these areas, small streams or seeps provide the freshwater inputs. Linkages or connectivity between natal estuaries, pocket estuaries, and other shallow/nearshore habitats are critical for providing an array of suitable habitats easily accessible by migrating juvenile salmonids (SPSSEG 2004).

Pocket estuaries are associated with inlets and smaller streams which occur along Hood Canal, Case Inlet, Hammersley Inlet, Skookum Inlet, and Totten Inlet. Oakland Bay and Oyster Bay provide estuarine and other intertidal wetland habitats. Smaller pocket estuaries are also concentrated around Harstine Island.

Salt Marshes

Salt marshes and brackish marshes are wetland habitats that occur in areas with tidal inundation. Salt marshes typically occur at elevations at and above MHHW in areas where sediment supply and accumulation are relatively high. Therefore, salt marshes can occur in bays, along sand spits sheltered from waves and currents and most commonly on river and stream deltas. Salt marsh vegetation, especially the root mats and dense stems, protect the shoreline by trapping and stabilizing sediments. Marshes tend to grow outwards over time as sediments entering the delta from rivers are captured and retained by salt marsh vegetation. Marshes often provide a complex network of tidal channels where juvenile salmonids feed and take refuge from predators, as well as providing habitat connections to riverine and marine environments (Hood 2005).

Ecological processes that are important for creating and maintaining salt marsh habitat include sediment transport and deposition and tidal exchange. Sediment transport and deposition forms the coastal landforms subject to periodic tidal inundation and exposure, which support salt marsh vegetation. Tidal exchange provides the sediment required for building marsh surfaces that are substrate for saltmarsh vegetation, and in addition, provides twice daily flushing of organic matter, nutrients, and pollutants. Organic matter from salt marsh vegetation supports macro-detritus based food webs that provide food items for forage fish and

salmonids in nearshore habitats adjacent to salt marshes. Maintenance of salt marsh habitats depends in part on the balance between marsh aggradation due to the buildup of organic matter and sediment trapped in the marsh and sea level rise (Bottom et al. 2005).

The ecological functions and biological resources of salt marshes include:

- Detrital based food webs;
- In-situ production of invertebrate prey items of importance to nearshore fish and birds (e.g., salmonid prey);
- Tidal channels that provide refugia and foraging areas for fish and invertebrates; and
- Primary production– salt marshes are highly productive.

Salt marsh habitat in Mason County is generally coincident with the key bays, mouths of major rivers, and pocket estuaries. Linkages between the estuarine deltas and other shallow nearshore habitats such as pocket estuaries are critical for rearing and migrating juvenile salmonids (SPSSEG 2004).

Marine Riparian Vegetation

Marine riparian zones occur at the interface between upland and marine aquatic systems (Culverwell and Brennan 2003; Brennan and Culverwell 2004). Marine riparian zones occur above the area subject to tidal inundation, but may be in the area influenced by salt spray or storm waves. Vegetation that occurs within the marine riparian zone is an important contributor to the ecological functions of the shoreline.

The type of vegetation found in marine riparian areas is influenced by a number of factors. For example, the underlying geology that influences the type of shoreform, whether feeder bluff, rocky shore, or beach backshore, will influence the type of riparian vegetation present. In addition, adjacent land uses may affect the type of marine riparian vegetation, such as the presence of invasive species, or the replacement of forested riparian vegetation with ornamental landscaping, lawns, or impervious surfaces. Shorelines comprised of very steep or unstable slopes may not support vegetation except at the very top of the slope. In contrast, small bluffs or shorelines may support dense riparian vegetation that overhangs into the upper beach zone. The presence of native trees in the marine riparian zone is of greatest importance due to the ability of trees to provide overhanging cover, detritus, shade and large woody debris (LWD) to the marine environment (EnviroVision et al., 2009).

Healthy shoreline vegetation within marine riparian areas provides a range of essential functions, including water quality protection, sediment stabilization and control, wildlife habitat, nutrient retention, microclimate regulation, insect food sources for juvenile fish, shade/cover, and woody debris to provide complex habitat structure and stabilize beaches (Brennan and Culverwell 2004). Areas with intact riparian vegetation can also help protect slopes and bluffs from erosion hazards, mitigate storm damage, and stabilize slopes. Plant root masses provide stability by holding the soil in place. In addition, evapotranspiration removes moisture from the soil and can prevent high soil moisture or saturated soil conditions, which can lead to landslides or erosion hazards (Brennan and Culverwell 2004). The extent to which riparian zones perform these functions is dependent on vegetation composition, vegetation density, and the area continuously covered with vegetation (e.g., width of buffer and length of shoreline with buffer) (Knutson and Naef 1997).

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

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

Many areas of marine shoreline in Mason County have relatively intact marine riparian vegetation, with the potential to provide water quality, shoreline stabilization, and LWD functions to the nearshore. Other areas, especially along Hood Canal, support limited shoreline vegetation due to roads, highways and existing residential development that parallels the marine shore.

The Point No Point Tribal Council has conducted a recent riparian habitat assessment for certain areas within Mason County shorelines using 2009 aerial photographs (PNPTC, 2011). The results of this assessment and other data related to the presence or absence of marine riparian vegetation has been incorporated into this study. See Map 24 – Riparian Vegetation (Appendix A).

Freshwater Wetlands

The state of Washington (WAC 173-22-030) defines wetlands as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands are known to play a vital role in the landscape by performing:

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

The U.S. Fish and Wildlife Service’s National Wetland Inventory (NWI) (1989) has mapped wetlands at the national level. No countywide inventory of wetlands has been conducted by Mason County to date; therefore this analysis relies on the NWI mapping to identify freshwater and estuarine wetlands in the county (Map 4 – Hydrology – County Scale [Appendix A]).

Freshwater Riparian Areas

Freshwater riparian areas function in many of the same ways as nearshore riparian areas. Riparian zones contribute to healthy streams by dissipating energy, suppressing the erosional processes that move sediment, and by stabilizing the streambank during flood flows (Knutson and Naef, 1997). Riparian areas perform water quality functions related to pollutant removal. This occurs primarily through the removal of pollutants such as phosphates, nitrates and heavy metals that are adsorbed to fine sediments. Sediments in stormwater runoff are filtered through riparian vegetation and are captured in riparian areas before they can enter stream channels or lakes. Riparian vegetation also provides shading and detritus to adjacent water bodies to maintain stream temperatures and provide food for aquatic species and fish.

One of the most crucial roles that riparian areas play in the ecosystem is creating habitat. Riparian zones are a major source of large woody debris (LWD) input to streams. Approximately 70 % of the structural complexity within streams is derived from root wads, trees, and limbs that fall into the stream as a result of bank undercutting, mass slope movement, normal tree mortality, or windthrow. LWD creates complex hydraulic patterns that allow pools and side channels to form. It also creates waterfalls, enhances channel sinuosity, and instigates other physical

and biochemical channel changes. The in-channel structural diversity created by LWD is essential to aquatic species in deep, low velocity areas for hiding, overwintering habitat, and juvenile rearing, in all sizes of streams and rivers (Knutson and Naef, 1997).

Terrestrial Habitats

Mason County is located in the Puget Trough ecological province, which encompasses Puget Sound, the Cowlitz River valley, and the upper Chehalis River basin (Franklin and Dyrness, 1973). Westside lowlands conifer-hardwood forest is the dominant native habitat type throughout lowland areas of western Washington, including Mason County (Johnson and O'Neill, 2001). In the county, lowland forests form a mosaic with wetlands, riparian areas, and marine nearshore habitats. Residential and agricultural areas are concentrated near lake and marine shorelines.

Significant portions of the forested habitat in Mason County are used for commercial timber harvest, particularly in WRIA 22. Clear-cut logging encourages the growth of plant species that colonize disturbed areas, such as red alder, salmonberry, and big-leaf maple. Forestlands are often replanted with Douglas-fir, leading to a reduced diversity of tree species in these managed areas. (Johnson and O'Neill, 2001)

Natural Heritage Habitats

The Washington State Natural Heritage Program (WNHP) has identified more than 50 types of high-quality or rare plant communities and wetland ecosystems in Mason County (WNHP, 2011). Table 3-2 lists those that have been identified within the County's shoreline planning areas, by WRIA.

Table 3-2. WNHP Identified Vegetation Communities in Mason County Shoreline Planning Areas

Community Type	WRIA 14a	WRIA 15	WRIA 16/14b	WRIA 22
Beakrush – (Bog Cranberry)/ Sphagnum Spp.		X		
Blunt-leaved pondweed	X			X
Bog Labrador-Tea-Bog-Laurel/Sphagnum Spp.	X	X		
Brewer's Cliff-brake			X	
Chain Fern			X	
Douglas fir/Western Hemlock/Evergreen Huckleberry	X	X		
Estuarine Zone	X	X		

Community Type	WRIA 14a	WRIA 15	WRIA 16/14b	WRIA 22
Few-flowered Sedge		X		
Freshwater Tidal Surge Plain Wetland			X	
Low Elevation Sphagnum Bog	X	X		
Lyngby's Sedge	X		X	
Lyngby's Sedge/ Pacific Silverweed			X	
Mixed fine and Mud: Partly Enclosed, Eulittoral, Mesohaline (Marsh)	X		X	
Mountain, Sitka Alder/Skunk Cabbage – Water- parsley	X			
Northern Grass-of-parnassus			X	
Organic: Partly Enclosed, Backshore, Mesohaline (Marsh)			X	
Organic: Partly Enclosed, Backshore, Polyhaline (Marsh)	X			
Pacific Silverweed – Douglas Aster			X	
Shore Pine/Bog Labrador-Tea/ Sphagnum Spp.	X			
Shore Pine/Douglas-fir/ Salal		X		
Sitka Spruce / Slough Sedge – Skunkcabbage			X	
Tufted Hairgrass – Pacific Silverweed	X			
Water lobelia	X			X

3.6 Fish and Wildlife Species

The terrestrial and aquatic habitats in Mason County support numerous fish and wildlife species, including species listed as threatened or endangered under the state and/or federal Endangered Species Act (ESA). While the county's shoreline is recognized to support hundreds of mammals, birds, aquatic invertebrates, fish and other species, only the highest priority or key species are discussed in detail in this section. Information from WDFW, primarily the Priority Habitats and Species (PHS) Data (2010) has been used to illustrate the variety of fish and wildlife species present in the county's shorelines (Map 8 – Fish & Wildlife Habitat Areas – County Scale [Appendix A]).

Marine Life

Marine waters of Hood Canal and South Puget Sound support abundant marine life and provide rearing, refuge, forage and breeding habitat for numerous species. Hundreds of species of native fish, salmon, invertebrates, shellfish, waterfowl, birds of prey, marine mammals, kelp, eelgrass, and other organisms are found within or using marine waters. For example, surveys by WDFW have noted the presence of rockfish, wolf-eel, lingcod, perch, sea cucumbers, sea stars, sea anemones, spotted prawns, pricklebacks, sculpins, blackeye goby, octopus, longnose skate, Dover sole, rex sole, gunnuls, dock spring, Dungeness crab, Pacific sanddab, and others in Hood Canal.

Marine Mammals

A number of marine mammals occur in the nearshore and marine waters of Mason County, including harbor seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*), and Southern Resident killer whales, or Orcas (*Orcinus orca*). Steller sea lions (*Eumatopias jubatus*) may also occur occasionally in the South Sound. Orcas are not as common in the South Sound as in the northern portions of Puget Sound, in part because they tend to occur in deeper marine areas and much of the South Sound is comprised of nearshore habitats less than 20 feet deep.

Marine mammal haulouts have been mapped by the Washington Department of Fish and Wildlife (WDFW) along the shorelines of Hood Canal, Oakland Bay, Harstine Island, and Totten Inlet (Map 8 – Fish & Wildlife Habitat Areas [Appendix A]).

Seabirds and Waterfowl

Both resident and migratory seabirds and waterfowl are associated with Mason County shorelines (Bartels, 2012). Commonly occurring seabirds or waterfowl include loons (*Gavia* spp.), cormorants (*Phalacrocorax* spp.), mergansers (*Mergus* spp.), grebes (*Aechmophorus* spp.), herons and egrets (Ardeidae), geese (*Branta*), brants (*Branta bernicla*), gulls (Larinae), sandpipers (Scolopacidae), and ducks (dabbling and diving) (Buchanan 2006). In addition, a number of bird species identified as state priority wildlife species are associated with and forage along shorelines of Mason County, including bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), and great blue heron (*Ardea herodias*) (WDFW 2011).

According to the PHS data, significant waterfowl concentrations in Mason County are located in bays and inlets, including Annas Bay, Lynch Cove and Hamma Hamma estuary. Bald eagle nesting occurs in many areas, including the North Fork Skokomish and along Hood Canal. The Washington Ornithological Society documents bird species occurrences in the state and on a county basis. A list of bird

species associated with marine and freshwater environments is located in Appendix F.

Salmon and Trout

Mason County rivers and streams, lakes, and marine waters located in the County support numerous species of salmon and trout (Table 3-3). Some of these species are federally listed under the Endangered Species Act. In addition to data provided by WDFW, the Squaxin Island Tribe and Skokomish Tribe monitor salmon production in rivers within Mason County. Also, the Wild Fish Conservancy (WFC) has recently conducting a stream typing assessment in to determine the presence or absence of salmon and trout within streams and rivers within WRIA 14a. This work was carried out in partnership with Mason Conservation District and Washington State Recreation and Conservation Office (RCO). The assessment is based upon field surveys conducted by WFC staff and was completed in 2012 (see projects at <http://wildfishconservancy.org/>). Map 8 – Fish and Wildlife Habitat Areas (County Scale) (Appendix A) illustrates the extent and species of salmonids using shorelines in Mason County.

Table 3-3. Salmon and Trout Species Identified in Mason County Shoreline Planning Areas

Species	WRIA 14a	WRIA 15	WRIA 16/14b	WRIA 22
Bull trout/Dolly Varden*			X	X
Chinook salmon*	X	X	X	X
Summer Chum*	X	X		
Chum salmon	X	X		
Coastal cutthroat trout	X	X	X	X
Coho salmon	X	X	X	X
Kokanee salmon	X		X	
Pink salmon	X		X	
Rainbow trout	X	X	X	X
Sockeye salmon			X	
Steelhead trout*	X	X	X	X

* Federally listed under the Endangered Species Act.

State Priority Species

The Washington Department of Fish and Wildlife (WDFW) has identified several additional priority species as occurring in Mason County (WDFW, 2010). Table 3-4 lists those that have been identified within the County's shoreline planning areas, by

WRIA. Some of these species are also federally listed under the Endangered Species Act.

Table 3-4. WDFW Identified Priority Species in Mason County Shoreline Planning Areas

Priority Species	WRIA 14a	WRIA 15	WRIA 16/14b	WRIA 22
Bald eagle	X	X	X	
California myotis			X	
Cascade frog			X	
Cascade torrent salamander			X	
Common loon	X			
Cope's giant salamander			X	X
Fisher			X	
Great blue heron	X			
Little brown myotis			X	
Long-eared myotis			X	
Marbled murrelet*			X	
Mink	X			
Mountain quail	X		X	
Olympic mudminnow	X			
Olympic torrent salamander			X	X
Osprey	X	X	X	
Pacific lamprey	X			X
Pileated woodpecker			X	
Purple martin	X	X		X
Reticulate sculpin	X		X	X
Riffle sculpin			X	X
Roosevelt elk	X			
Salish sucker			X	
Tailed frog			X	X
Townsend's big-eared bat			X	
Van Dyke's salamander			X	
Western pearlshell	X			
Western toad		X	X	X

* Federally listed under the Endangered Species Act.

Forage Fish

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

Surf smelt and Pacific sand lance both spawn within a limited range of tidal elevations in the upper intertidal zones of beaches, and have specific habitat requirements including substrate size and type (Pentilla 1978, 1995). Surf smelt spawn on coarse sand or pea gravel; gravels ranging in size from 1 to 7 millimeters. Surf smelt spawning occurs during high tides, most typically during afternoons or early evening (WDFW 2004). Pacific sand lance spawn over a wider range of substrate sizes than surf smelt, ranging from fine sand beaches to beaches with gravel up to 30 millimeters in size (Pentilla 1995; Lemberg et al. 1997). Pacific herring spawn in intertidal and shallow subtidal areas, depositing eggs on marine vegetation at elevations between 0 and -10 feet MLLW (WDFW 2000). Eelgrass beds are important spawning substrate for Pacific herring; adhesive eggs are deposited on leaf blades of eelgrass and to a lesser extent on a variety of marine algae (Lemberg et al. 1997; Pentilla 1995). Due to the spawning requirements of these species, suitable spawning habitat for forage fish is limited, and these species are particularly vulnerable to changes in beach morphology (relative depth, exposure), beach sediment characteristics (substrate size - sediment sources, transport, or deposition), and nearshore riparian vegetation cover (WDFW 2000, 2004).

Documented forage fish spawning beaches in general are not as common in the South Sound as in more northern portions of Puget Sound, and spawning areas in the South Sound tend to be smaller and more scattered than further north (WDFW 2000, 2004). However, potential forage fish spawning habitat is widespread in marine nearshore areas of Mason County (Map 8 – Fish & Wildlife Habitat Areas [County Scale] [Appendix A]).

According to PHS data, Pacific herring spawning and adult holding areas are located in Hood Canal between the mouths of the Tahuya and Union Rivers (Map 8 – Fish & Wildlife Habitat Areas [County Scale] [Appendix A]). Scattered smelt and sand lance spawning areas are also located along Hood Canal shorelines (WDFW, 2010).

Hammersley Inlet supports Pacific herring spawning. Smelt and sand lance spawning areas are common along the shores of Totten Inlet, Case Inlet, Harstine Island, Hope Island, and Squaxin Island (WDFW, 2010).

Shellfish

Cobble to fine sand beaches and sand and mud flats are important habitat for many native shellfish species. Intertidal and subtidal areas that support the native Dungeness crab (*Cancer magister*) occur more abundantly in the northern portions of Puget Sound, but also occur in the South Sound, often associated with estuaries and eelgrass beds (Stevens and Armstrong 1984). Geoducks (*Panopea abrupta*) occur offshore in fine substrates of mud or soft sand, and typically burrow up to 2-3 feet deep into the substrate. A number of hardshell clams, including butter clams (*Saxidomus gigantea*), native littleneck clams (*Leukoma staminea*), manila clams (*Venerupis philippinarum*), and horse clams (*Tresus capax* and *T. nutallii*) also inhabit the intertidal shorelines. Olympia oyster (*Ostrea conchaphila*) and Pacific oysters (*Crassostrea gigas*) are common in the South Sound and Hood Canal. Other nearshore shellfish include a number of filter feeders that remove plankton from the water column, such as cockles (*Clinocardium nutallii*) and softshell clams (*Mya arenaria*). Some nearshore shellfish such as the macoma clams (*Macoma nastuta*) are detritivores that feed on organic detritus on the surface of sediments. Shellfish resources in Mason County are important as the basis for commercial, recreational, and tribal subsistence, ceremonial and commercial harvesting.

Shellfish beds perform a number of important ecological functions including nutrient cycling (Peabody and Griffin 2008), stabilizing substrate, enhancing water quality (filtering and retention of microscopic algae and suspended inorganic particles) (Brumbaugh et al. 2006), creating and maintaining habitat structure (e.g., oyster reefs) (Peabody and Griffin 2008), and providing food for a wide variety of marine invertebrates, birds, fish and mammals. As filter feeders, shellfish consume large quantities of plankton and particulate organic matter, cleaning the water column of organic matter (and any pathogens or pollutants that are present). Filtration of the water column by bivalves can increase light penetration and allow for the expansion of eelgrass habitat and aid in the eelgrass recovery, which provides additional reductions in suspended sediments and improved light conditions (Newell and Koch 2004). Shellfish species occupy a range of substrate types from mud to gravels, with each species having a preferred or optimal substrate size for larval settling and adult growth (Dethier 2006). Siltation can negatively impact larval shellfish by physical smothering, and adult shellfish through interfering with filter feeding. Shellfish are therefore sensitive to changes in sediment dynamics, especially increased erosion and inputs of fine sediments or changes in substrate type or size (Dethier 2006). Because shellfish filter the water column, they retain and concentrate pathogens and pollutants in the water – although this helps improve water quality, contaminated shellfish can negatively impact people and other animals that eat shellfish. Table 3-3 provides a list of key native shellfish found within Puget Sound.

Native shellfish beds are found along most of the marine shorelines of Mason County (WDFW 2010; Table 3-5 provides a list of key native shellfish found within Puget Sound). In Hood Canal, native geoduck beds are mostly documented at the mouth of Tahuya River, in the Skokomish River delta, and several other areas specifically in the “Big Bend” region. Oyster beds and Dungeness crab are found throughout Hood Canal. In South Puget Sound, oyster beds are found in Oakland Bay, Skookum Inlet, Totten Inlet and Oyster Bay. Hardshell clam are mostly found in the Skokomish River estuary and the Hamma Hamma stream mouth. In South Puget Sound, native geoduck beds are found on the eastern shore of Harstine Island and portions of Pickering Passage and Totten Inlet. Hardshell clam are documented for North Bay in Case Inlet, Oakland Bay, western shore of Harstine Island, Skookum Inlet and Oyster Bay. No Dungeness crab are mapped by WDFW in Case Inlet, Totten Inlet or the rest of South Puget Sound in the County.

Health officials close shellfish harvest areas when waters become polluted and do not meet water quality standards. The Washington State Department of Health identified several harvest areas in Mason County as being “threatened” with closure in 2009 due to increasing pollutants. The sites potentially to be closed were Hood Canal 9 (near Lynch Cover), Oakland Bay, North Bay and Pickering Passage. Based on 2010 data, two stations in Pickering Passage (Stations 52 and 57) are currently listed as “threatened” shellfish growing areas due to elevated fecal coliform concentrations (WDOH, 2011).

In addition to native shellfish harvest, there are numerous commercial shellfish operations in Mason County. The commercial shellfish industry is the second largest private-sector employer in Mason County (PSAT, 2003). A map showing commercial and recreational shellfish growing areas January 1, 2012 is prepared by WDOH (Map 9 – 2012 DOH Shellfish Growing Areas and Closure Zones [Appendix A]). This shows that most of Hood Canal (with the exception of the shallowest portion of Lynch Cove and portions of Hoodsport and Union) and South Puget Sound are approved for shellfish growing. Oakland Bay is considered conditional or prohibited. Polluted water has caused Department of Health to close a portion of at least one commercial shellfish harvesting area. The North Bay site has been partially closed near Allyn.

Table 3-5. Identified Key Native Shellfish Species Found in Puget Sound

Common Name	Scientific Name	General Habitat Type
Dungeness crab	<i>Cancer magister</i>	inter- and subtidal sediments
red rock crab	<i>Cancer productus</i>	very broad
geoduck	<i>Panopea generosa</i>	buried in intertidal and subtidal sediments

Common Name	Scientific Name	General Habitat Type
littleneck clam	<i>Protothaca staminea</i>	buried, intertidal sediments
butter clam	<i>Saxidomus giganteus</i>	buried, intertidal sediments
horse clam	<i>Tresus capax and nuttallii</i>	buried, intertidal and subtidal sediments
Cockle	<i>Clinocardium nuttallii</i>	near surface, intertidal sediments
bentnose clam	<i>Macoma</i> spp	buried, intertidal sediments
mussel	<i>Mytilus</i> spp.	surface, rocks or pilings
sea cucumber	<i>Parastichopus californicus</i>	surface, subtidal rock or sediment
pinot abalone	<i>Haliotis kamtschatkana</i>	surface, wave exposed rock
sea urchin	<i>Strongylocentrotus</i> spp.	surface, subtidal rock
Olympia oyster	<i>Ostreola conchaphila</i>	surface, subtidal mud, rock and shell

*Dethier, 2006.

3.7 Land Cover

Land use and land cover are important parameters affecting watershed functions and ecosystem processes. Within Mason County, human uses fall into four general types: (1) managed forest lands, (2) agriculture, (3) residential land uses, and (4) industrial uses. All of these land uses represent some level of deforestation, but the managed forest lands include forest regret in their cycle.

Spatial patterns of existing land cover are shown on Map 15 – Land Cover (Appendix A), representing GAP analysis data from 2009. Managed forest lands can be seen to be dominant in the southern part of the County, particularly in WRIA 22. A mixture of unharvested and managed forest is present throughout most of the rest of Mason County. Agricultural areas, excluding those used for aquaculture, are limited and typically located in the floodplains of major streams such as the Skokomish River. Aquaculture (e.g., shellfish operations) is practiced throughout the marine waters of Mason County for private and commercial uses. Residential land uses, included in the “developed” category on Map 15, are focused along lake and marine shorelines and within the communities of Shelton and Belfair. The only major industrial area in the County is located on Oakland Bay in Shelton. Additional non-shoreline industrial areas are along Johns Prairie Road, at the Port of Shelton around the airport, and along SR 3 outside of Belfair.

CHAPTER 4.

MARINE SHORELINES - HOOD CANAL

Chapter 4 provides a discussion of the marine nearshore shorelines of Hood Canal within Mason County, Washington. This section includes Hood Canal shorelines associated with WRIA 16/14b (Skokomish-Dosewallips/South Shore Lower Hood Canal) and WRIA 15 (Kitsap, i.e. Tahuya Peninsula).

Hood Canal is one of several unique estuarine areas listed in Washington where all marine waters, as well as the adjacent shorelands, are considered “shorelines of statewide significance” under the Shoreline Management Act (RCW 90.58.030(2)(f)(ii) (C) and (vi)). Shorelines of statewide significance are a special category of shorelines which are of important statewide interest and where specific land use preferences apply.

A total of 85.1 miles of Hood Canal shoreline lies within Mason County. To more easily evaluate the character of Hood Canal shores, the shoreline has been divided into 13 reaches labeled Marine Reach (MR) 1 through MR 13. After a summary description of the marine areas, the reaches have been described in two page reach sheets that provide a summary of data per shoreline reach. Marine reaches are described from north to south beginning on the western shore of Hood Canal at the Jefferson-Mason county line and ending on the northernmost extent of the eastern shore at the Kitsap-Mason county line. Information displayed in the reach sheets is largely based upon GIS data taken from state and county sources. Data sources and methodology are described in Chapter 2. A Glossary of Terms is provided in Appendix C.

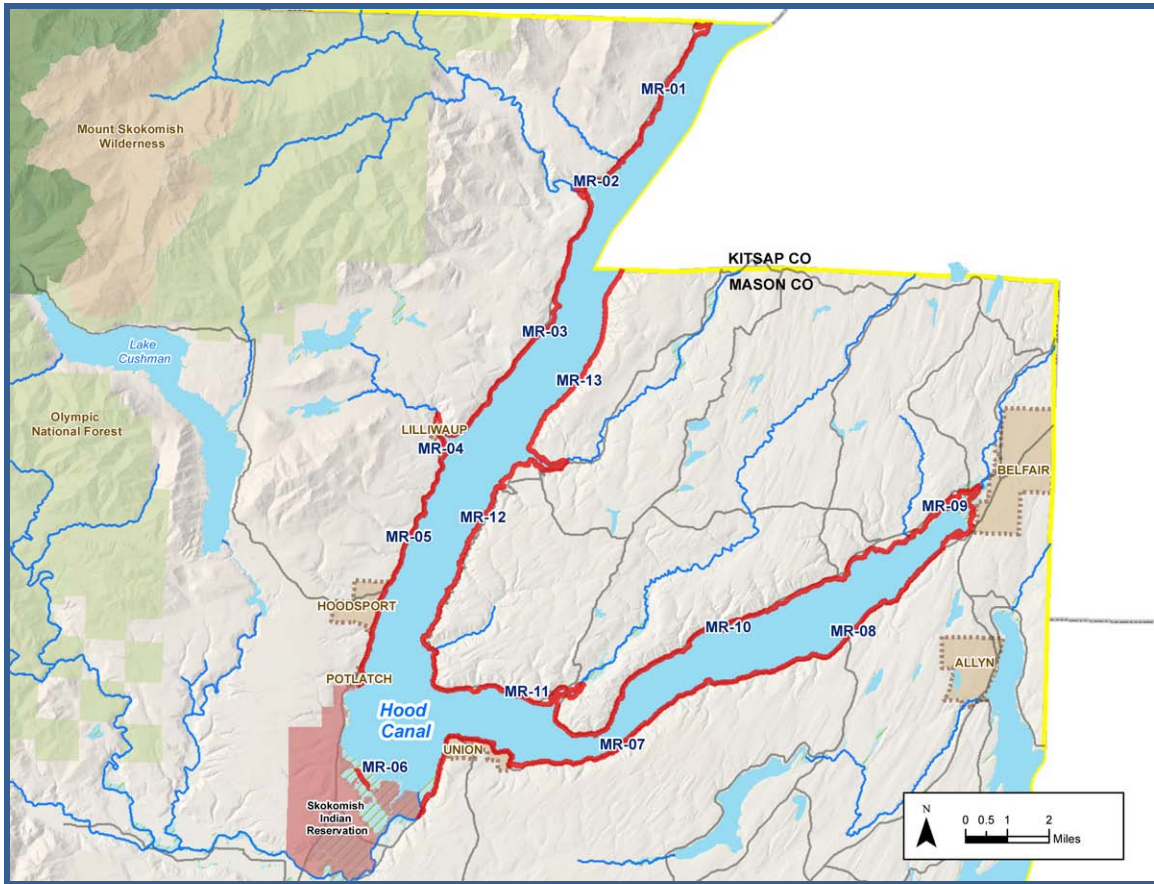
Marine Reach Organization

Marine Reach (MR)	Location Description	Shoreline Length (miles)
Hood Canal (Section 4.1)		
MR 1	Western shore (Mason/Jefferson County line near Triton Cove State Park to Hamma Hamma Delta)	5.2
MR 2	Hamma Hamma River Delta	2.9
MR 3	Hamma Hamma River Delta south to Lilliwaup River Delta	6.6
MR 4	Lilliwaup River Delta (near Lilliwaup rural area center [RAC])	3.4

Marine Reach Organization

Marine Reach (MR)	Location Description	Shoreline Length (miles)
MR 5	Western shore (Sund Creek to Potlatch RAC [includes Hoodspout RAC])	5.2
MR 6	Skokomish River Delta, excluding Tribal lands (the Great Bend)	6.5
MR 7	South shore (Skokomish River Delta east to Twanoh State Park, includes Union RAC)	10.7
MR 8	South shore (Twanoh State Park East to Lynch Cove)	7.2
MR 9	Lynch Cove (near Belfair urban growth area)	4.1
MR 10	North shore (Lynch Cove west to Tahuya River)	12.4
MR 11	North shore (Tahuya west to Great Bend)	6.0
MR 12	Great Bend north to Dewatto River	9.8
MR 13	Eastern shore (Dewatto River north to county line)	5.1

4.1 Hood Canal



4.1.1 Physical Characterization and Modifications

Hood Canal is a natural fjord carved by glaciers that separates the Olympic Peninsula from Kitsap Peninsula, and is more than 60 miles long. Hood Canal is the westernmost marine waterbody within the Puget Sound basin and is located in Jefferson, Kitsap and Mason Counties. It extends southwesterly about 45 miles from Admiralty Inlet to the “Great Bend” at Annas Bay. Hood Canal then extends northeasterly in a “hook” another 15 miles to its head at the Union River estuary near Belfair. Within Mason County, Hood Canal extends from Triton Head on the western shore, south to Annas Bay, then easterly to Lynch Cove at its terminus, then westerly along the North Shore to Ayres Point, then north to the Mason-Kitsap county line.

In WRIA 16 there are seven sub-basins in Mason County draining to Hood Canal. The main rivers include the Hamma Hamma River, Lilliwaup Creek, and the Skokomish. The headwaters of many of these rivers are located within the Olympic National Forest or Olympic National Park. The south shore of Hood Canal (WRIA 14b) has been included in the WRIA 16 planning area. This area of the watershed includes lower elevation hills and several small creeks such as Alderbrook, Deveraux, Twanoh Falls, and Happy Hollow Creeks. Each of the creeks discharges directly into Hood Canal and originates from springs, groundwater discharges or from lakes such as Devereaux Lake. From Tahuya Peninsula (WRIA 15), major rivers draining to Hood Canal include Union River, Tahuya River, Rendsland Creek and Dewatto River. Major freshwater rivers, streams and lakes discharging to Hood Canal and their process and modifications are described further in Chapter 8.

4.1.2 Coastal Processes and Shore Type

Waves are the dominant driver of coastal processes in Hood Canal. This is exemplified by (littoral) sediment transport occurring along most of the Hood Canal shoreline. The areas mapped as having no appreciable drift at the mouth of major fluvial systems, such as the Skokomish, Hamma Hamma, and Lilliwaup Rivers are fluvially dominated shores. Nearshore sediment supply is predominantly derived from eroding bluff backed beaches, which are the most abundant shoretype (see Table 4-1). Sediment is transported down-drift by wind-generated waves to form the many varieties of depositional shoreforms found in the area. Accretion shoreforms commonly occur in Hood Canal include: barrier beaches, some of which embay estuaries and lagoons, and cusped forelands. Several open coastal inlets also occur throughout this part of Mason County. Intermittent exposures of bedrock along the west shore of Hood Canal have created a single pocket beach, as well as several areas mapped as rocky platform and plunging bedrock shores. Many artificial shoreforms were also mapped along the Hood Canal shores of Mason County. These shores no longer resemble or function like their historic shoretypes.

Coastal bluffs are an important feature of marine shorelines in Mason County. Coastal bluffs provide sand and sediment to the nearshore environment and contribute to the formation of beaches, spits and natural processes related to net shore drift. Beaches that are backed by bluffs have been mapped by the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). Table 4-1 indicates the percentage of bluff-backed beaches by reach in Hood Canal.

Table 4-1. Percent of Reach Mapped as Bluff-backed Beach

Marine Reach	Location	Bluff-backed Beaches %
1	Western shore	32
2	Hamma Hamma Delta	17
3	Hamma Hamma to Lilliwaup	71
4	Lilliwaup Delta	43
5	Sund Creek to Potlatch	70
6	Skokomish River estuary	8
7	Skokomish Delta east to Twanoh State Park	74
8	Twanoh State Park East to Lynch Cove	78
9	Lynch Cove	-
10	Lynch Cove West to Tahuya River	55
11	Tahuya west to Great Bend	34
12	Great Bend north to Dewatto	74
13	Dewatto north to County Line	98

The presence of bluff-backed beaches is an important indicator of the value of the reach in terms of supporting nearshore processes and it is also an indicator of the suitability of the shore for human development. The Washington Department of Natural Resources has mapped a substantial portion of Hood Canal shoreline as a landslide and/or erosion hazard area (Table 4-2) suggesting that large segments of the marine shore are potentially hazardous for development. Some of these areas

are already partially developed with single family homes. Landslide hazards are concentrated in marine reaches 3 and 13 in the north end of Hood Canal. Erosion hazards are concentrated in the South Shore area (reaches 7 and 8).

Table 4-2. Percent of Reach Mapped as Landslide Hazard or Erosion Hazard.

Marine Reach	Location	Landslide Hazard %	Erosion Hazard %
1	Western shore – Jefferson/Mason County line	17	2
2	Hamma Hamma Delta	-	-
3	Hamma Hamma to Lilliwaup	74	6
4	Lilliwaup Delta	47	2
5	Sund Creek to Potlatch	5	1
6	Skokomish River estuary	-	-
7	Skokomish Delta east to Twanoh State Park	18	80
8	Twanoh State Park East to Lynch Cove	42	25
9	Lynch Cove	2	-
10	Lynch Cove West to Tahuya River	20	9
11	Tahuya west to Great Bend	31	45
12	Great Bend north to Dewatto	40	9
13	Dewatto north to Kitsap/Mason County Line	86	-

4.1.3 Water Quality

In many ways, the water quality in Hood Canal is good. However, low dissolved oxygen levels (DO) and high fecal coliform concentrations pose serious problems in Hood Canal especially during the summer and fall. Hood Canal has a “dead zone” related to low DO concentrations, which adversely affects marine life. This condition has recurred for many years and problems related to water quality have been documented in various studies prepared by the Puget Sound Action Team, Hood Canal Coordinating Council, Puget Sound Partnership, and others. Due to these issues, the State Legislature found that Hood Canal is a marine water of the state at significant risk and designated Hood Canal an “aquatic rehabilitation zone” in 2005 (RCW 90.88.005).

Ecology’s 2008 water quality assessment (Washington State Department of Ecology, 2008a) documented several segments (Figure 13) in Hood Canal that did not meet

the State's water quality standards for dissolved oxygen, fecal coliform or both; and were subsequently placed on the EPA 303 (d) list of impaired waters. These problems date back to before the 2008 assessment. Fish kills, presumably the result of low DO levels, were reported as far back as 1920 (Newton et. al. 2011). However, recent scientific studies and anecdotal evidence suggest that the frequency, duration, and spatial extent of low DO events are increasing (Newton et. al. 2011).

The Washington State Department of Health's (DOH) Office of Shellfish and Water Protection, in addition to local health jurisdictions, monitor Hood Canal water quality and classify commercial and recreational shellfish harvest areas to protect human health. Samples are collected to analyze fecal coliform concentrations in the water (used to indicate the presence of pathogens that cause disease and illnesses in humans), in addition to paralytic shellfish poisoning and domoic acid samples (WDOH, 2011). Growing areas are classified as Approved, Conditionally Approved, Restricted, or Prohibited. An interactive map provides information on current marine biotoxin closure zones is available at DOH's website:

<http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Step=1>

Aside from DO and fecal coliform, there are no other known water quality impairments for Hood Canal marine waters. Sediment quality analyses conducted by the Department of Ecology in 2005) indicated moderate sediment toxicity at some Hood Canal sampling sites within Mason County, and one site that had "intermediate/degraded" quality. These results were based on a combination of results for chemical, toxicity, and benthic data referred to as the Sediment Quality Triad Index. No sites had individual chemical concentrations that exceeded State or National Oceanographic and Atmospheric Administration (NOAA) sediment quality standards (Long et. al. 2010).

Dissolved Oxygen

Hood Canal is designated "extraordinary aquatic life use" in the State water quality standards WAC 173-201A. Commensurate with this designation is the standard to maintain dissolved oxygen (DO) concentrations above 7.0 mg/L. The southern reaches of Hood Canal, especially in the areas extending from Lynch Cove through Anna's Bay and the Great Bend, are particularly prone to depleted oxygen levels during the summer months (Newton et. al. 2011). DO concentrations in the Lynch Cove area have been documented as low as 0.46 mg/L; a level far below the 7 mg/L standard for 'extraordinary aquatic life use,' and even well below the 4.0 threshold for 'fair aquatic life use'. The low DO events are caused by complex interactions of physical and biological factors. A restrictive sill at the Canal's mouth to Admiralty Inlet limits the volume of water exchanged with Puget Sound. The waters of Hood Canal are also stratified with regard to density, which reduces vertical mixing. Oxygen in the water column is consumed through the process of microbial

respiration, typically through decay of algae or other organic materials. Nutrient inputs (loading) affect the amount of algal growth and the amount of organic materials that ultimately decay and result in reduced oxygen concentrations. Relatively high nutrient loading resulting from influxes of nutrient rich marine waters coupled with low water exchange and strong density stratification provides circumstances that cause very low oxygen concentrations during the summer months (Newton et. al. 2011).

Primary productivity in Hood Canal is believed to be limited by the amount of dissolved inorganic nitrogen (DIN) (Paulsen et. al. 2007, Newton et. al. 2011). Therefore, increases or decreases of DIN loads would correspondingly result in increases or decreases in primary productivity, respectively. Sources of DIN to Hood Canal include: atmospheric deposition, inflowing streams, regional ground water, and from runoff from adjacent land area, and most important from marine water flowing over the seaward sill from Admiralty Inlet (Paulsen et. al. 2007). Human actions that increase dissolved inorganic nitrogen include replacing native conifers with alder trees or scotch broom (through land clearing or logging), introduction of pet waste, and overuse of lawn and garden fertilizers.

Fecal Coliform

Elevated fecal coliform concentrations are a concern because they potentially indicate contamination from inadequate sewage treatment or failing septic systems, livestock or pet waste or other sources, which can pose a significant risk to human health. Fecal contamination poses a risk for those that contact it directly (i.e. through swimming) or indirectly through the consumption of contaminated shellfish. Hood Canal is required to meet strict fecal coliform standards because it is listed as having a designated use for "Shellfish Harvest" and "Primary Contact Recreation" (WAC 173-201A). This standard dictates that fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, and that no more than 10 percent of samples exceed 43 colonies/100 mL (WAC 173-201A).

Nine marine areas of Hood Canal were identified by Ecology's 2008 assessment as being in violation of the State's water quality standards for fecal coliform and were subsequently placed on the 303(d) list of impaired waters. Six of these marine areas were located at the mouths of streams which were also included in the 303 (d) list of impaired waters for fecal coliform contamination (Washington State Department of Ecology 2008a), suggesting that one source of the marine fecal contamination is from upland areas.

Mason County Public Health (MCPH) measured fecal coliform concentrations at more than 1,300 streams, freshwater seeps, and bulkhead drains along the south and west shores of Hood Canal as part of their grant-funded Hood Canal Pollutant Identification and Correction (HCPIC) program. The primary goal of this study was to identify specific sources of fecal coliform pollution (i.e. malfunctioning septic

systems, pet waste, natural sources, etc.) and correct the problem. Fecal coliform concentrations were found to be above 200 colonies/100mL at more than 7% of the sampled sites (Georgeson et. al. 2008), indicating areas of concern, and triggering further study of onsite septic systems. The County is currently continuing its HCPIC monitoring at sites along the north and east shores of Hood Canal, but results from this study are not yet available.

Belfair is currently in the process of constructing a new wastewater treatment and water reclamation facility. Sewage connections will be available for businesses and residents located east of Lynch Cove, within the southwestern portion of the Belfair urban growth area. This action should help to improve water quality.

Sediment Quality

Sediment quality has not been studied extensively in Hood Canal. In 2004, as part of their Puget Sound Ambient Monitoring Program (PSAMP) studies, Ecology collected sediment samples from 30 random locations in Hood Canal; five of which were in Mason County (Long et. al. 2010).

Analyses were performed on all samples to evaluate: the concentrations of potentially toxic chemicals, their potential toxicity based on laboratory toxicity testing, and their composition of benthic organisms. Sediment Quality Triad Index scores were calculated based on these three components and used to assign designations of high, intermediate, or degraded quality. All but one of the Hood Canal sites were rated as having 'intermediate/high' quality; the remaining site was rated as being 'degraded/intermediate' quality (Long et al, 2010)

4.1.4 Critical or Priority Habitat and Species Use

Hood Canal shorelines support a diverse array of fish, wildlife, birds and marine aquatic life. Hood Canal provides forage and nesting habitat for waterfowl, bald eagle, osprey, gulls, great blue heron, shorebirds, and other birds. Hummingbirds, woodpeckers, and other upland forest birds can be found in the marine riparian zones along the water's edge. Waterfowl concentrations are documented in several estuaries which provide protected harbors. Approximately 29 species of water-dependent birds are commonly observed in saltwater areas along the Mason County shoreline (Audubon Society, 2012). In addition, marine mammals such as harbor seals, otters, Southern Resident Killer Whale (Orca) and an occasional grey whale or humpback whale occur. Marine life found in the waters of Hood Canal is exceptionally diverse including Dungeness crab, geoduck clam, several species of oyster and other native clam, octopus, squid, sea star, and shrimp. Native fish documented in Hood Canal include salmonid species such as coho, steelhead,

summer chum and fall Chinook, as well as forage fish, bass, cod, English sole, red snapper, and other fish.

Critical or priority habitats and priority species mapped within the Mason County shoreline jurisdiction of Hood Canal are specifically covered in this section. Discussion of the priority habitats and species follows, with select quantitative data only located in the reach sheets, where noted.

Hood Canal is known to support many federal and state-listed priority salmonid species (Appendix B: WDFW, 2010; Table 4-1). Habitat use for priority salmon in Hood Canal is primarily migration and juvenile rearing.

Table 4-3. Priority salmon species documented for Hood Canal

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarkii clarki</i>	Presence/Migration	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Known juvenile rearing, , and Presence/Migration	Threatened	Candidate SSC
fall Chum salmon	<i>Oncorhynchus keta</i>	Known juvenile rearing, and Presence/Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Presence/Migration	Threatened	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Known juvenile rearing, and Presence/Migration	Concern	~
Dolly Varden/Bull trout	<i>Salvelinus confluentus</i>	Presence/Migration	~	Candidate
Pink salmon	<i>Oncorhynchus gorbuscha</i>	Known juvenile rearing, and Presence/Migration	~	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~
Sockeye salmon	<i>Oncorhynchus nerka</i>	Presence/Migration	~	~
summer Steelhead trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Known juvenile rearing, and Presence/Migration	Threatened	~

Critical habitat has been designated by the US Fish and Wildlife Service (USFWS) for the Puget Sound Evolutionarily Significant Unit (ESU) Chinook salmon and the Hood Canal ESU summer-run chum salmon for all reaches of Hood Canal covered in this section. These designations extend upstream to the point of tidal influence (Appendix B: USFWS, 2010).

Spawning areas for forage fish, including Pacific herring, surf smelt and sand lance, are also listed as priority habitats. Forage fish are important links in the ecosystem of Puget Sound and Hood Canal as they provide a key food source for marine birds, rockfish, salmon and numerous other fish species (Pentilla 2007). These fish spawn in the intertidal areas of Hood Canal and Puget Sound. Herring spawning areas are documented in Lynch Cove (Pentilla, 2007). Holding habitat for herring is mapped by WDFW as occurring in Hood Canal, especially in marine reaches 7, 8 and 10. Sand lance spawning habitat is mapped for several reaches (Appendix B: WDFW, 2010; see reach sheets). Pacific surf smelt spawning in Hood Canal is mapped along the nearshore in marine reaches MR 7, 8, 10 11 and 12 (Appendix B: WDFW, 2010). According to Pentilla (2007), surf smelt spawning has been documented along both the North and South Shores of Hood Canal in the past.

According to PHS data, Dungeness crab and pandalid shrimp are recorded in Hood Canal. Native and commercial shellfish including geoduck, hardshell clam, and oyster beds are found in numerous reaches (Appendix B: WDFW, 2010). However, the Lower Hood Canal Watershed Council notes a distinct decline in the abundance of Dungeness crab in Hood Canal over the past six years (Personal communication, Bob Hager, 2011). A dramatic decline in the Hood Canal Dungeness crab fishery is confirmed by WDFW and summarized in a state audit evaluating the fishery (Sonntag, 2010). The recreational harvest of Dungeness crab in Hood Canal has dropped to less than 50% of its catch as compared to 2002-2003; this may be related to over-fishing (Sonntag, 2010).

Eelgrass and kelp beds are documented for many reaches of Hood Canal in Mason County (DNR, 2008; DNR, 2011). Submerged aquatic vegetation surveys were conducted by DNR staff along the shores of Hood Canal in 2010. Both native and non-native types of eelgrass were observed. Native (*Zostera marina*) and non-native (*Z. japonica*) eelgrass species are found in the nearshore environment of Hood Canal and Puget Sound, but their distributions typically do not overlap. *Z. japonica* typically occupies a higher tidal elevation than does the native *Z. marina*. DNR has documented a significant decline in native eelgrass abundance in Hood Canal in several locations based upon the aquatic vegetation mapping (DNR, 2011). Eelgrass areas surveyed in 2010 were compared to earlier data taken from 2000, 2003 and 2005. Significant decline in native eelgrass in Hood Canal is documented for the South and North Shore areas in particular (Reaches 8, 10 and 11).

Kelp species, such as bull kelp (*Nereocystis luetkeana*), giant kelp (*Macrocystis integrifolia*) and non-floating kelp species have limited distribution within the Mason County portion of Puget Sound. Non-floating kelp species are the most widely distributed, primarily concentrated in parts of Hood Canal, Hammersley Inlet, and Totten Inlet (Eissinger, 2009).

Priority wildlife species occurring along Hood Canal include osprey, bald eagle, purple martin, and great blue heron. Osprey is found in Reach 1 only; however, bald eagle are found in several reaches, such as marine reaches 1, 2, 8, and 13. Priority species occurrences for purple martin and great blue heron are documented in several reaches (Appendix B: WDFW, 2010).

Wetlands, another priority habitat, are found along the nearshore for most reaches located in Hood Canal (Appendix B: USFWS, 2010). Major estuarine wetlands occur at the mouths of the Hamma Hamma River, Lilliwaup, Skokomish River, Union (Lynch Cove) and Dewatto.

4.1.5 Shoreline Land Use

Land use in shoreline areas refers to current uses, broader land use patterns and existing development within the shoreline jurisdiction. The primary types of land uses in the shorelines of Hood Canal include residential, transportation, forestry, and commercial aquaculture.

Residential development, primarily single family residential, occurs along most of the shores of Hood Canal in Mason County. Residential development is most concentrated on the western shore near Hoodspport and on the South and North Shore areas of lower Hood Canal. The largest communities along Hood Canal are Hoodspport, Lilliwaup, Potlatch, Tahuya, Dewatto, Union and Belfair. Approximately 68 percent of the population in the watershed is located in the southern portion of Hood Canal (Hoodspport/Lilliwaup, Lower Skokomish River, and South Shore Sub-basins) while the largest population growth rates since the 1990 census occurred in the South Shore, Lower Skokomish River, and Lower North Fork Skokomish River Sub-basins (Envirovision, 2003). Residential occupancy on Hood Canal is seasonal and increases greatly in the summer. According to estimates in the Mason County Comprehensive Plan, roughly 30 to 35 percent of County utilities customers are seasonal, and a large portion of the County's summer residents reside along the shores of Hood Canal.

Residential uses within the Hood Canal shoreline comprise approximately 49 percent of the existing land uses. Commercial land uses are primarily located in communities described above within existing UGA areas, RAC or hamlets. Vacant

land uses are scattered throughout Hood Canal with the highest concentration in Reach 6 (Skokomish River Delta).

Transportation corridors are another dominant land use within the shorelines of Hood Canal. Most roads are state highways owned by Washington Department of Transportation (WSDOT) and these transportation corridors closely parallel the shorelines. US Route 101 parallels the entire western shore of Hood Canal. SR 106 runs parallel to the South Shore from Union to Belfair. SR 300 and the NE North Shore Road run parallel to the North Shore from Union to Dewatto Bay; however north of the point, the NE North Shore Road climbs uphill outside of the shoreline jurisdiction. Roads and associated infrastructure comprise approximately 9 percent of the land uses in Hood Canal shoreline jurisdiction.

Forestry land uses are concentrated around Tahuya and Dewatto to the north on the eastern shore. While most of the forestry uses occur outside of the shoreline jurisdiction, some timber harvest has occurred within the 200 foot jurisdictional area. Based upon 2011 aerial photographs, approximately 2,300 linear feet of the eastern shore, north of Dewatto has experienced logging within the 200 foot shoreline jurisdiction.

In addition to the upland land uses, there are significant land uses within the aquatic environment. Water-dependent uses in Hood Canal include marinas, residential and community docks, and most importantly commercial and tribal aquaculture. Aquaculture is a significant resource and important economic driver in Mason County. Between 2007 and 2011, the U.S. Army Corps of Engineers received 134 general permit applications for shellfish operations (See Appendix A, Figure 26). Large commercial shellfish growers operating in Hood Canal are Hama Hama Oyster Company, Taylor Shellfish, and Admiralty Seafood Inc. In addition, many of the shellfish growers are small family businesses dating back generations. According to Assessor's data, commercial or tribal aquaculture is present on 7 out of 13 reaches on Hood Canal.

4.1.6 Shoreline Modifications

Information on nearshore geomorphic processes and shoreline modifications was derived in part from the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). A composite measure of nearshore process degradation provides a summary of nearshore ecosystem conditions at the drift cell scale. The levels of degradation determined by PSNERP range from "not degraded", "least degraded", "less degraded", "moderately degraded", "more degraded" to "most degraded". Degradation scores are relative Sound-wide. These results can help to identify and focus protection and restoration strategies. Note that PSNERP did not evaluate biological conditions (such as vegetation or habitat availability), but assessed the

configuration of the shoreline compared to historic conditions. For example, this information evaluates the presence of modifications or ecological stressors such as fill, armoring, marinas, dams and other physical features. Within the Hood Canal areas of Mason County overall process degradation was most commonly “more degraded” and “most degraded”. Far fewer areas were categorized as “less degraded.” However, portions of Reach 1 and Reach 13 are considered “least degraded”. These areas have some of the greatest forested cover and least development (see 4.1.5). Information related to process degradation is provided on the reach sheets in Section 4.1.9.

Existing man-made structures, along with modifications to the shoreline, occur along Hood Canal and are part of this shoreline characterization. These are referred to as shoreline modifications, which include bridges, bulkheads (i.e., shoreline armoring), roads, dikes and overwater structures like docks. The number and extent of modifications along the shoreline in Hood Canal has been described by marine reach (Appendix B: PSNERP, 2010).

Table 4-4. Shoreline Modifications By Reach for Hood Canal

Marine Reach	Location	Overwater Structures				Tidal Barrier			Shoreline Armoring (%)
		Bridges	Buildings	Buoys	Docks	Fill	Dike	Road	
1	Western shore	4	-	2	13	2	-	2	20%
2	Hamma Hamma Delta	2	1	-	4	4	2	5	1%
3	Hamma Hamma to Lilliwaup	3	2	-	1	2	-	3	36%
4	Lilliwaup Delta	3	2	1	6	-	-	4	36%
5	Sund Creek to Potlatch	4	5	1	29	-	-	-	58%
6	Skokomish River estuary	3	-	-	-	-	-	-	0%
7	Skokomish Delta east to Twanoh State Park	1	51	21	133	-	-	2	61%
8	Twanoh State Park East to Lynch Cove	8	8	24	77	-	-	-	76%
9	Lynch Cove	2	-	-	1	4	6	11	0%

Marine Reach	Location	Overwater Structures				Tidal Barrier			Shoreline Armoring (%)
		Bridges	Buildings	Buoys	Docks	Fill	Dike	Road	
10	Lynch Cove West to Tahuya River	4	30	41	44	6	4	-	56%
11	Tahuya west to Great Bend	3	8	4	16	-	-	-	34%
12	Great Bend north to Dewatto	3	4	7	17	3	2	-	16%
13	Dewatto north to County Line	-	-	1	-	-	-	-	1%
Total		40	111	102	352	21	14	27	38%

4.1.7 Land Cover

Land cover provided in this section refers to both the aerial extent of existing vegetation and the coverage of developed areas (paved or built surfaces) within the shoreline jurisdiction. Riparian vegetation is an important feature of marine habitats in Puget Sound. Several studies have shown that salmon in the Pacific Northwest feed on insects falling from terrestrial or upland vegetation. For example, Simenstad (2000) found that summer chum collected in Hood Canal had fed primarily on insects from terrestrial sources.

Riparian vegetative cover along the shorelines of Hood Canal in Mason County is generally less than 40 percent forested, according to the Point No Point Treaty Council data (Appendix B: PNPTC, 2011). The greatest forested cover (over 46 percent) can be found in Reaches 1, 11, 12 and 13 (see Table 4-2). Little to no forested cover is recorded for the Skokomish River estuary, due to the presence of primarily estuarine wetland in this reach. According to the GAP data, the reaches with the highest percentage of “developed” lands occurs in Reaches 5, 8, and 10; these correspond to Hoodsport, Union and Belfair. These three reaches also have the lowest forested cover (25 to 30%) according to the PNPTC riparian analysis (2011).

**Table 4-5. Land Cover within Hood Canal Shoreline Marine Reaches¹
(PNPTC, 2011)**

Marine Reach	Location	Forested Cover %	Non-Forested Cover %	Other Natural Vegetation %
1	Western Shore	53	32	9
2	Hamma Hamma Delta	36	29	27
3	Hamma Hamma to Lilliwaup	35	42	18
4	Lilliwaup Delta	32	50	13
5	Sund Creek to Potlatch	30	54	14
6	Skokomish River estuary	5	-	95
7	South Shore - Skokomish Delta east to Twanoh State Park	38	53	7
8	South Shore - Twanoh State Park East to Lynch Cove	25	72	2
9	Lynch Cove	34	21	40
10	North Shore - Lynch Cove West to Tahuya River	29	59	5
11	North Shore - Tahuya west to Great Bend	46	40	10
12	Great Bend north to Dewatto	77	16	4
13	Dewatto north to County Line	95	4	1

¹Land cover as a percentage of the shoreline planning area 200 feet landward of the ordinary high water mark.

The following table shows the amount of areas considered impervious based on a 2008 study prepared by the Hood Canal Coordinating Council. Eighteen percent of Hood Canal shoreline jurisdiction is mapped as impervious surface (Appendix B: HCCC, 2008).

**Table 4-6. Impervious Surface Area within the Hood Canal Marine Reaches¹
(Appendix B: HCCC, 2008).**

Marine Reach	Location	Impervious %
1	Western shore	10
2	Hamma Hamma Delta	7
3	Hamma Hamma to Lilliwaup	17
4	Lilliwaup Delta	11
5	Sund Creek to Potlatch	26
6	Skokomish River estuary	9
7	Skokomish Delta east to Twanoh State Park	27
8	Twanoh State Park East to Lynch Cove	35
9	Lynch Cove	4
10	Lynch Cove West to Tahuya River	30
11	Tahuya west to Great Bend	24
12	Great Bend north to Dewatto	4
13	Dewatto north to County Line	0

¹Land cover as a percentage of the shoreline planning area 200 feet landward of the ordinary high water mark.

4.1.8 Public Access Opportunities

Public access to the shorelines of Hood Canal is provided through an array of Washington State Parks, County Parks, Port Districts and access from water as part of the Cascadia Marine Trail (a state-recognized water trail for non-motorized boaters). State-owned tidelands also provide public access to intertidal zones where recreational shellfish harvest is popular. The Mason County Regional Trail Plan (2008) notes that the combination of private residential development along Hood Canal, with the presence of land constraints (such as state highways and landslide hazards), limit the places where additional public access and parking can be provided. Roads and private homes line much of Hood Canal shores. In undeveloped areas, steep slopes make landing boats and kayaks difficult and provide few places where a flat camping or resting area could exist (Mason County Parks, 2008). Public access is often provided by highways and roads but without

adequate public parking. Camping, day use and public access to the shore are provided at four parks: Triton Cove State Park, Potlatch State Park, Twanoh State Park and Belfair State Park. A boat ramp and a public dock are found in Hoodspport. The Port of Union offers a public boat launch. Menard's Landing, a County park, provides hand-held boat launch.

4.1.9 Summary of Key Management Issues

Key management issues for Hood Canal include the following:

- Water quality degradation as evidenced by low dissolved oxygen concentrations resulting in fish kills;
- Water quality degradation related to nutrient loading and high fecal coliform bacteria concentrations in marine waters;
- Modifications along the shoreline due to existing bulkheads and hardened armoring;
- Highways and transportation corridors (i.e. US Highway 101) resulting in impervious surfaces which cause stormwater runoff and pollutant loading;
- Bridges and causeways creating constrictions at estuary mouths which impair tidal flow;
- Development near the shoreline resulting in tree removal and reductions in forested canopy and habitat;
- Cumulative effects on environmental resources and views of additional residential docks and piers;
- Strong and strict enforcement of the existing regulations;
- Alteration of the marine riparian zone by removing of native trees and other vegetation.
- Enforcement of existing regulations to protect shorelines
- WSDOT and Mason County complete identified stormwater retrofits on Highway 101, SR 106, SR 300 and North Shore County Road.
- Increased oversight and mandatory (not voluntary) requirements for onsite septic systems within the shoreline to ensure system are working properly
- Coordinated purchase development rights, conservation easements, property acquisition by Land Trusts, and land swaps with government agencies.
- Increase oversight of all resource extraction activities
- Develop a county-wide local wetland survey or inventory

- Protect remaining view corridors
- Clearing Ordinance adoption by Mason County
- Consider tax incentives for homeowners to use best management practices
- Additional and improved parking to allow for public access (Mason County Parks, 2008).
- Develop additional overnight camping for kayakers and users of the Cascadia Marine Trail (Mason County Parks, 2008).
- Regional trails connecting State Parks on Hood Canal to other parks or points of interest (Mason County Parks, 2008).

4.1.10 Reach Analysis

An analysis by marine reach is given in the following section. Reach sheets are provided corresponding to specific shoreline segments as listed below:

- Hood Canal – Western Shore (Reaches 1- 5);
- Skokomish River Delta (Reach 6);
- Hood Canal – South Shore (Reaches 7 and 8);
- Lynch Cove (Reach 9); and
- Hood Canal – North and Eastern Shore (Reaches 10-13).

Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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HOOD CANAL - REACH 01

SHORELINE LENGTH

5.2 MI

LOCATION

WESTERN SHORE –
MASON/JEFFERSON COUNTY
LINE TO HAMMA HAMMA DELTA

REACH AREA

122.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 7% (8 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

2% erosion, 17% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 32% bluff-backed beaches, 29% rocky platforms, 26% plunging bedrock shores, 10% barrier beaches, 3% pocket beaches. Net shore drift - predominantly northward, a few cells with no appreciable drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Mostly Moderately Degraded; south end Least Degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

6% developed, 11% mudflat, 75% forest, 1% sand, 7% wetland (Appendix B: GAP, 2009)
53% forested cover, 32% Non-forest, 15% off-shore, 10% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. Sand lance spawning habitat. Dungeness crab habitat. Hardshell clam beds, oyster, and pandalid shrimp. Continuous and patchy eelgrass present. 7.2 acres of native eelgrass mapped by WDNR in 2010. Wetlands – 6.2 acres (5.0% of reach); habitat types include estuarine intertidal aquatic bed and beach/bar.

WATER QUALITY (MAP 13)

Reach 1 is included in the 303(d) list of impaired waters due to low dissolved oxygen (DO) concentrations. Based on Newton et. al. (2010) DO concentrations during the summer may fall to levels well below the water quality standard of 7 mg/L, and even below the 4 mg/L standard for 'fair aquatic life use'. Monitoring as part of the HCPIC (Georgeson et. al. 2008) indicated that fecal coliform is of only moderate concern.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES / OWNERSHIP (MAP 18)

Land Use – Residential (44%), Vacant (26%), Parks, Open Space, & Recreation Areas (18%), Forestry (11%), and Aquaculture (1%). Ownership – 100% Private.

There is one permit for aquaculture on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 4 locations in the reach where tidal barriers exist: 2 road and 2 fill locations. Overwater structures in the reach include: 12 small docks, 4 upland bridges, and 1 large dock. Shoreline armoring is mapped along 20% of reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (81%) and Rural Tourist (19%). Comprehensive Plan Designations – 100% Rural. Existing SED – Urban Residential (88%) and Conservancy (12%).

PUBLIC ACCESS (MAP 14)

No parks or public access areas are mapped in the reach.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 27% of reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC indicates 10% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show much of the reach to be forested, with limited residential development.

US 101 runs parallel to Hood Canal.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

There are 8 private cabins and large dock associated with a commercial scuba diving resort (Mikes Beach Resort, 2011).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried early historic sites within this reach. Resource probability mapping suggests there is a high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Wacketickeh Estuary; Remove fill and relocate structures along north side of Wacketickeh estuary.
- Beacon Point Salt Marsh Habitat; Relocate community picnic area at Beacon Point to restore salt marsh habitat.
- Mike's Beach Campground Creek; At Mike's Beach Campground, extend the SR101 span across the campground creek.
- Mike's Beach Migration Corridor; Redesign dock at Mike's Beach to eliminate fill and reestablish shallow water migration corridor.
- Mike's Beach Migration Corridor/ Sediment Transport; Mike's Beach Migration Corridor/Sediment Transport-Relocate cabins and associated bulkhead to reestablish juvenile migration corridor and sediment transport.
- Triton Head; Remove tide gate and culvert and return a swimming pond along south side of Triton Head to salt marsh to limit impacts to fish.
- Triton Cove Pilings; Remove abandoned creosote pilings at Triton Cove,
- Wacketickeh Tidal Channel; Extend bridge across the Wacketickeh to reestablish lost tidal channel.
- Beacon Point Pilings; Remove creosote pilings at Beacon Point.

KEY MANAGEMENT ISSUES

- Protect existing forested riparian areas.
- Maintain visual corridor and aesthetic views.
- Identify opportunities for public access where appropriate.

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HOOD CANAL - REACH 02

SHORELINE LENGTH	LOCATION	REACH AREA
2.9 MI	HAMMA HAMMA RIVER DELTA	55.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Hamma Hamma River estuary; Floodplain - 45% (25 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) No listed erosion or landslide areas
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 65% delta shores, 18% artificial shoreforms, 17% bluff backed beaches. Net shore drift - predominantly no appreciable drift, a few cells with northward drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) Moderately Degraded.
LAND COVER (MAP 15) 5% developed, 12% mudflat, 31% forest, 4% sand, 48% wetland (Appendix B: GAP, 2009) 36% forest cover, 29% non-forest, 6% off-shore, 27% other vegetation, 2% water (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 4-1 for priority salmon species. Dungeness crab habitat. Hardshell clam beds and oyster present. Continuous eelgrass present. Wetlands – 6.1 acres (11% of reach); estuarine intertidal aquatic bed, and palustrine scrub-shrub.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

There are no segments in this reach included on the 303 (d) list of impaired waters. High fecal coliform levels were detected in only one out of 21 samples collected along this reach (Georgeson et. al. 2008), likely a reflection of the lack of development in the Hamma Hamma River watershed. As with the rest of southern Hood Canal, low dissolved oxygen levels can be a problem during the summer (Newton et. al. 2011).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (47%), Agriculture (20%), Vacant (16%), Forestry (11%) and Aquaculture (6%). Ownership – 100% Private.

There are 7 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 11 locations in the reach where tidal barriers exist: 5 road instances, 4 fill locations, and 2 spur dikes. Overwater structures in the reach include: 4 small docks and the North and South Hamma Hamma Bridges. Shoreline armoring is mapped along 1% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (77%), Rural Natural Resource (13%), with the remaining 9% a mix of Long Term Commercial Forest and Agricultural Resource (LTCFAR) Lands.

Comprehensive Plan Designations – Rural (91%) with the remaining 9% a mix of LTCFAR Lands. Existing SED – Conservancy (38%), Rural (33%), and Urban Residential (29%).

PUBLIC ACCESS (MAP 14)

No parks or public access areas are mapped in the reach.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 9% of reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC shows 7% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show much of the reach to be forested, with limited residential development and one shellfish processing facility. US 101 runs parallel to Hood Canal through part of the reach.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried early historic sites within this reach. The reach also includes the North and South Hamma Hamma Bridges, both of which are registered historic sites. The bridges were built in 1924 (Mason County Parks and Recreation Department, 2008). Resource probability mapping suggests there is a moderate-high to high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Hamma Hamma US Forest Service Road Decommissioning (08-06-001) (Habitat Work Schedule, 2011); decommission 24 miles of logging roads to reduce sediment delivery to the river and reduce sedimentation in the estuary.

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Hamma Hamma ELJ and Off Channel Restoration; Two actions directly address the cause of river estuary degradation: 1) Add Engineered Log Jams (ELJ) to provide habitat for salmon, and 2) the improve access to an additional 1.8 acres of salt marsh for migrating juvenile salmonid access by increasing the channel into the restored salt marsh and adding LWD to provide cover for juvenile salmonids.
- Hamma Hamma; remove all levees/dikes and armoring, particularly mainstem dike, the dike along the north side of the estuary, and other minor dikes to restore historic mainstem channel, tidal channels and estuary function.
- Hamma Hamma Replant; Remove exotic vegetation in the vicinity of shellfish facility and replant with native conifers and shrubs.

Hamma Hamma Causeway Replacement and Estuary Restoration Project (PSNERP, 2011) – Reconstruct US 101 bridge over the river estuary and restore estuary processes and functions. Available at:

<http://www.pugetsoundnearshore.org/factsheets/HammaHammaCauseway.pdf>. See Conceptual Design

Report at: <http://www.pugetsoundnearshore.org/cdr.html>.

KEY MANAGEMENT ISSUES

- Sedimentation due to erosion and runoff from logging roads in Olympic National Forest.
- Highway crosses Hamma Hamma River estuary and constrains sediment transport, reduces tidal influence and adversely affects estuary function.
- Maintain excellent water quality in the Hamma Hamma River and estuary which supports native shellfish and important commercial aquaculture.
- Improve in-stream habitat for this major salmonid-bearing river.
- Maintain visual corridor and aesthetic views.
- Consider opportunities for public access.

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HOOD CANAL - REACH 03

SHORELINE LENGTH	LOCATION	REACH AREA
6.6 MI	HAMMA HAMMA RIVER DELTA SOUTH TO LILLIWAUP RIVER DELTA	157.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 1% (2 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 6% erosion, 74% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 71% bluff backed beaches, 20% barrier beaches, 6% bedrock shores, 2% artificial shoreforms. Net shore drift - predominantly northward drift, a few cells with southward drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) More Degraded.
LAND COVER (MAP 15) 7% developed, 25% mudflat, 61% forest, 1% sand, 5% wetland (Appendix B: GAP, 2009) 35% forested cover, 42% non-forest, 5% off-shore, 18% other natural vegetation (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 4-1 for priority salmon species. Dungeness crab, geoduck, hardshell clam beds and oyster mapped. Pandalid shrimp. Continuous and patchy eelgrass mapped. 9 acres of native eelgrass observed by DNR in 2010. Japanese eelgrass documented in 2009. Patchy kelp beds. Wetlands – 8.3 acres (5% of reach); wetland habitat types include estuarine intertidal aquatic bed.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Reach 3 is not included on the 303(d) list of impaired waters. Of the 14 sites sampled in this reach by Mason County (Georgeson et. al. 2008), none exhibited fecal coliform concentrations above 200 colonies per 100 mL, the threshold used to determine areas of potential concern.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (36%), Transportation (25%), Forestry (16%), Vacant (15%), with remaining 8% a mix of Aquaculture, Parks, Open Space, & Recreation Areas, and Commercial. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 5 locations in the reach where tidal barriers exist: 3 road instances and 2 fill locations. Overwater structures in the reach include: 3 upland bridges, 2 buildings, and 1 large dock. Shoreline armoring is mapped along 36% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (86%) with the remaining 13% a mix of Long Term Commercial Forest and Rural Natural Resource. Comprehensive Plan Designations – Rural (92%) and Long Term Commercial Forest (8%). Existing SED – Urban Residential (80%), Conservancy (13%), and Rural (8%).

PUBLIC ACCESS (MAP 14)

Lilliwaup Tidelands State Park, managed by Washington State Parks and DNR, accounts for 11% of linear miles. The Eagle Creek Recreational Tidelands and South Jorsted Creek tidelands, managed by DNR and WSDOT, account for 8% of linear miles. Eagle Creek Recreational Tidelands offer beach access, clamming and crabbing (Mason Co. Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 16% of reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 17% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show much of the reach to be forested, with limited residential development. US 101 runs parallel to Hood Canal in this reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic site within this reach. Resource probability mapping suggests there is a moderate to moderate-high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Lilliwaup to Jorsted Creek Feeder Bluff Reconnection (09-03-001) (Habitat Work Schedule, 2011); to reconnect coastal feeder bluffs to restore sediment supply to nearshore areas.

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Ayock Point Salt Marsh; Preserve and expand remnant salt marsh to include remnant lagoon and reestablish tidal connection at northern end of spit to the south of Ayock Creek.
- Jorsted Creek Sediment Supply; Restore sediment supply from feeder bluff.
- Ayock Point Bulkheads; Acquire and remove bulkheads along south part of south side of Ayock Point.
- Ayock Point/Eagle Creek Bulkheads; Remove bulkhead and fill to north of Eagle Creek.
- Jorsted Creek Restoration; Remove armoring, fill and log skid apparatus to north of Jorsted Creek.
- Cabin Point/Lilliwaup Sediment Supply; Restore sediment supply from feeder bluff.
- Eagle Creek/Carroll/Cabin Point; Remove bulkhead and fill between Eagle Creek and Carroll/Cabin Point to preserve and enhance salt marsh.

KEY MANAGEMENT ISSUES

- Numerous restoration opportunities identified by WDFW and PSNERP.
- Protection and restoration of coastal feeder bluffs and bluff-backed beaches.
- Maintain visual corridor and aesthetic views.

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HOOD CANAL - REACH 04

SHORELINE LENGTH	LOCATION	REACH AREA
3.4 MI	LILLIWAUP RIVER DELTA	80.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Lilliwaup Creek estuary; Floodplain - 17% (14 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain.

HAZARD AREAS (MAP 12)

2% erosion, 47% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 43% bluff backed beaches, 23% barrier estuary shores, 13% artificial shoreforms, 13% bedrock platform shores, 5% barrier beaches, 4% rocky shores. Net shore drift - predominantly northward drift, an area with no appreciable drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

North shore Moderately Degraded, south shore Most Degraded.

LAND COVER (MAP 15)

6% developed, 23% mudflat, 50% forest, 15% wetland, 7% floodplain/riparian (Appendix B: GAP, 2009);
32% forested cover, 50% non-forest, 4% off-shore, 13% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. PHS maps Dungeness crab, geoduck, hardshell clam beds, and oyster. Continuous and patchy eelgrass shown. 6.7 acres of native eelgrass mapped by DNR in 2010. Kelp beds.

Wetlands – 4.8 acres (6% of reach); wetland habitat types include estuarine intertidal aquatic bed and intertidal emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Reach 4 is included on the 303(d) list of impaired waters due to elevated fecal coliform concentrations. The marine segment at the mouth of Liliwaup creek exceeded water quality standards due to fecal coliform concentrations (Ecology, 2008a); indicating upland sources may be an important source of contamination. Of 55 sites sampled along this reach, 5 had fecal coliform levels greater than 200 colonies/100mL (Georgeson et.al., 2008). In 2006, dissolved oxygen levels were measured at less than 1.5 mg/L in this reach, a level far below the 7 mg/l water quality standard, and a level very stressful to fish and other marine life (Newton et. al., 2011). A fish kill believed to be caused by low oxygen was observed near Sund Rock (Newton, 2010).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (47%), Vacant (32%), with the remaining 21% a mix of Transportation, Forestry, Aquaculture, Parks, Open Space, & Recreation Areas, and Commercial. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts (County) – Rural Residential (95%) with the remaining 4% a mix of Rural Tourist and Rural Commercial. Zoning districts (Lilliwaup) – Rural Residential (80%) and Rural Commercial (20%). Comprehensive Plan Designations – Rural (97%) and Hamlet (3%). Existing SED – Urban Residential (80%), Conservancy (15%), and Urban Commercial (5%).

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 16% of reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 12% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show much of the reach to be forested, with some residential development and a small commercial area in the south end of the reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 4 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 6 small docks, 3 upland bridges, 2 buildings and 1 buoy. Shoreline armoring is mapped along 36% of the reach.

PUBLIC ACCESS (MAP 14)

Lilliwaup Tidelands State Park, managed by Washington State Parks and DNR, provides access. About 4,100 LF of tidelands are available for public use, a portion of which is in the reach (Mason Co. Parks and Trails, 2006).

AREAS OF SPECIAL INTEREST

No listed contaminated sites.
Rest-A-While RV Park located in the southern portion of the reach has 30 waterfront RV parking stalls, a marina and sling launch, private oyster and clam beach (Rest-A-While, 2011).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists six inventoried early historic sites within this reach. Resource probability mapping suggests there is a very low to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Lilliwaup Creek Restoration Design (09-01-000) (Habitat Work Schedule, 2011) –restore salmonid habitat due to gravel aggradation in 0.7 mile reach and stabilize streambanks where landslides have occurred in 2007.

Lilliwaup Causeway Replacement (09-03-000) (Habitat Work Schedule, 2011) –restore tidal connectivity by replacing restricting causeway.

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Lilliwaup Estuary; Daylight creek to falls on right bank of Lilliwaup estuary west of SR101 bridge.
- Lilliwaup Point Nearshore Process; Remove bulkhead, fill, structures and groins at Lilliwaup Point to restore nearshore processes and juvenile migration corridor.
- Lilliwaup Restoration; Remove trout pond diking, set back structures and roads and expand access road bridge.
- Little Lilliwaup Creek; Remove boathouse southeast of Little Lilliwaup Creek to restore sediment drift and migration corridor.
- Little Lilliwaup Nearshore Process/Migration Corridor; Remove concrete bulkhead and fill on point southeast of Little Lilliwaup Creek to restore nearshore process and migration corridor.
- Sund Creek Restoration; Relocate dive shop and parking lot away from shoreline at Sund Creek.
- Little Lilliwaup; Replace undersized culvert at SR101 with bridge.
- Lilliwaup Salt Marsh Habitat; Remove fill and developments seaward of southern bridge abutment of SR101 to reestablish salt marsh habitat.
- Sund Creek Salt Marsh; Remove parking lot fill to reestablish salt marsh at Sund Creek.

Lilliwaup Causeway Replacement and Estuary Restoration Project (PSNERP, 2011) – Reconstruct US 101 bridge over the river estuary and restore estuary processes and functions. Available at:

<http://www.pugetsoundnearshore.org/factsheets/LilliwaupCauseway.pdf>. See Conceptual Design

Report at: <http://www.pugetsoundnearshore.org/cdr.html>.

KEY MANAGEMENT ISSUES

- Numerous restoration opportunities identified by WDFW and PSNERP.
- Landslides and stream bank erosion causing downstream gravel aggradation.
- Decommissioning of USFS roads in drainages above to protect marine water quality.
- Estuary constricted due to causeway and highway crossing.
- Alterations in estuary limiting habitat.
- Water quality degradation due fecal coliform bacteria from upstream sources.
- Maintain visual corridor and aesthetic views.
- Determine adequacy of sanitation services at Lilliwaup State Park.

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HOOD CANAL - REACH 05

SHORELINE LENGTH	LOCATION	REACH AREA
5.2 MI	WESTERN SHORE – SUND CREEK TO POTLATCH, INCLUDING HOODSPORT	125.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 1% (2 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 1% erosion, 5% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 70% bluff backed beaches, 12% barrier beaches, 10% rocky platform shores, 5% artificial shoreforms, 2% pocket beaches. Net shore drift - northern shore has northward drift, southern shore has southward drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) North shore Most Degraded, south shore More Degraded.
LAND COVER (MAP 15) 16% developed, 28% mudflat, 48% forest, 5% wetland, 3% floodplain/riparian (Appendix B: GAP, 2009); 30% forested cover, 54% non-forest, 3% off-shore, 14% other natural vegetation (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 4-1 for priority salmon species. PHS maps Dungeness crab, geoduck, hardshell clam beds, and oyster. Pandalid shrimp. Patchy eelgrass and kelp beds. Wetlands – 37 acres (30% of reach); wetland habitat types include estuarine intertidal aquatic bed.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Reach 05 is included on the 303(d) list of impaired waters for low DO concentrations. Dissolved oxygen concentrations in 2006 were measured as low as 0.8 and 1.4 mg/L, levels potentially lethal to fish and other marine life, and well below the standard of 7.0 mg/L (Newton et. al., 2011; Newton, 2010). Fish kills were also observed in this area during September, 2010 (Newton, 2010). Sampling by Mason County identified 21 sites, out of 218 sites sampled, which had fecal coliform levels greater than 200 colonies/100mL and were consider areas of potential concern (Georgeson et. al., 2008).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (35%), Transportation (30%), Forestry (14%), Vacant (12%), with the remaining 9% a mix of Agriculture, Commercial, Aquaculture, and Parks, Open Space, & Recreation Areas. Ownership – Private (98%) and Public (2%). There are 11 aquaculture permits on this reach, located primarily in the southern half of the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 23 small docks, 6 large docks, 5 buildings, 4 upland bridges, and 1 buoy. Shoreline armoring is mapped along 58% of the reach. No tidal barriers mapped. There is a Hood Canal Salmon Hatchery at Hoodsport (Mason County Parks and Recreation, 2008).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts (County) – Rural Residential (96%) with the remaining 4% a mix of Rural Tourist and Long Term Commercial Forest. Zoning districts (Hoodsport) – Rural Residential (87%), Rural Commercial (10%), and Rural Tourist (3%). Zoning districts (Potlatch) – 100% Rural Residential. Comprehensive Plan Designations – Rural (55%), Rural Activity Center (33%), Hamlet (12%), and Long Term Commercial Forest (1%). Existing SED – Urban Residential (73%) and Urban Commercial (27%).

PUBLIC ACCESS (MAP 14)

Hoodsport tideland area, adjacent to the hatchery, is managed by DNR, accounting for 14% of total linear miles. Hoodsport Marina, managed by the Port of Hoodsport has 2% of total linear miles. Public access is available at both sites. Public dock and boat launch provided by Port of Hoodsport.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 24% of reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 26% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show a substantial amount of residential and commercial development along the shoreline. Developments are present east of US 101, between the highway and Hood Canal.

AREAS OF SPECIAL INTEREST

No listed contaminated sites.
The Glen Ayr Resort located north of Hoodsport has motel rooms, townhouse suites, 36 RV sites, 750 LF of beach area, and a dock with 16 moorage slips (Glen Ayr, 2011).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists seven inventoried early historic sites within this reach. Resource probability mapping suggests there is a very low to moderate-low probability of finding unknown artifacts.

OPPORTUNITY AREAS

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Finch Creek Historic Estuary; Acquire right bank of mouth of Finch Creek and restore historic estuary.
- Clark Creek Culvert; Replace undersized culvert at Clark Creek.
- Clark Creek Pier; Reduce width of marina pier at Clark Creek.
- Miller Creek Salt Marsh Habitat; Remove riprap and fill north of community center to reestablish salt marsh habitat.
- Port of Hoodsport; Remove unused dock, floats, fill and creosoted pilings and relocate buildings at Port of Hoodsport.
- Clark Creek/Hoodsport; Remove bulkhead, fill and structures, including creosoted pilings between Clark Creek and Hoodsport.
- Clark Creek/Hoodsport Pilings; Remove creosoted piling north of Hoodsport.
- Hoodsport Hatchery; Relocate part of Hoodsport Hatchery to reestablish shallow water migration corridor.
- Hill Creek Estuary Function; Replace undersized culvert at Hill Creek to reestablish estuary function.
- Hill Creek South; Remove bulkhead, fill and structures to south of Hill Creek.
- Hoodsport Intertidal Fencing; Remove fill and zigzag intertidal fencing to south of Hoodsport.
- Hoodsport Pilings; Remove structure on pilings to the south of Hoodsport.
- Hoodsport Restoration; Remove bulkhead, fill, dock and structure to south of Hoodsport.
- Hoodsport South; Remove bulkhead, fill and three houses to south of Port of Hoodsport.
- Hoodsport Water Migration; Remove zigzag bulkhead and adjacent bulkhead, fill and houses to reestablish shallow water migration.
- Neelim Point Salt Marsh; Restore sediment supply to restore beach berm protecting Neelim salt marsh and further south.

KEY MANAGEMENT ISSUES

- Numerous restoration opportunities identified by WDFW and PSNERP.
- Water quality degradation due fecal coliform bacteria from upstream sources.
- Ensure adequate public sanitation facilities available in Hoodsport core area along HWY 101 North
- Maintain visual corridor and aesthetic views.

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HOOD CANAL - REACH 06

SHORELINE LENGTH	LOCATION	REACH AREA
6.5 MI	SKOKOMISH RIVER DELTA (EXCLUDING TRIBAL LANDS)	146.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 55% (81 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) No listed erosion or landslide areas
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 89% delta shores, 8% bluff backed beaches, 3% artificial shoreforms. Net shore drift - predominantly no appreciable drift, a small area along the western extent with southward drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) Moderately Degraded.
LAND COVER (MAP 15) 73% wetland, 27% floodplain/riparian (Appendix B: GAP, 2009); 5% forest cover, 95% other natural vegetation (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 4-1 for priority salmon species. PHS maps Dungeness crab, hardshell clam beds, and oyster. Large beds of eelgrass observed by DNR staff at mouth of the delta in 2010. Japanese eelgrass present. Wetlands – 101 acres (70% of reach); wetland habitat types include estuarine intertidal aquatic bed, estuarine intertidal beach/bar, intertidal emergent, palustrine emergent, forested, and scrub-shrub.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Reach 06 is not included on the 303(d) list of impaired waters. However, more stringent standards apply in shellfish growing areas. In August of 2005, WDOH downgraded 300 acres of shellfish growing area on the east side of Anna's Bay from 'approved' for shellfish harvest to 'prohibited' due to fecal coliform contamination. A reach of the Skokomish river, near where it discharges into Anna's Bay also exceeded water quality standards for fecal coliform; indicating upland areas in the Skokomish River watershed are a likely source of contamination (Book, 2007). The Anna's Bay area has since reopened for shellfish harvest, but has been given a 'concern' rating (WDOH, 2011).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (97%) with the remaining 3% a mix of Residential and Transportation. Ownership – 100% Public.

Skokomish Tribal lands not included in the Mason County reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include 3 upland bridges. No shoreline armoring or tidal barriers are mapped in the reach. Tacoma City Light Hydropower Plant is located north of Potlatch State Park. Power is conveyed to the plant from dams at Skokomish River and Lake Cushman (Mason County Parks and Recreation, 2008).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (99%) and Rural Multi Family (1%). Comprehensive Plan Designations – Indian Reservation (43%), Agricultural Resource Lands (31%), and Rural (26%). Existing SED – Rural (100%).

PUBLIC ACCESS (MAP 14)

Potlatch State Park, managed by DNR and WA State Parks, accounts for 40% of total linear miles. The park is 57 acres in total size and has campgrounds, mooring buoys, picnic tables, and beach access for scuba diving and recreational shellfish harvesting (Mason County Parks and Trails, 2006; WA State Parks, 2011).

IMPERVIOUS SURFACES (MAP 16)

NOAA does not map impervious surfaces in this reach (Appendix B: NOAA CCAP, 2006). HCCC maps 9% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show development focused in the NW part of the reach, with the undeveloped Skokomish River delta and tidelands occupying most of the reach.

AREAS OF SPECIAL INTEREST

No state listed contaminated sites.

Waterfront at Potlatch is a resort with waterfront access located north of the Tacoma City Light plant. The resort has 450 feet of private beach access, 14 RV sites, motel rooms and cabins (Waterfront at Potlatch, 2011).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a moderate-low to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Skokomish River General Investigation (10-01-000) (Habitat Work Schedule, 2011); to address ecosystem restoration and flooding problems.

<http://www.nws.usace.army.mil/publicmenu/menu.cfm?sitename=skokogi&pagename=home>

Skokomish Estuary Restoration Phase 3- Skokomish Flats (10-03-002) (Habitat Work Schedule, 2011); This phase is a continuation of Phase I and II and will restore estuarine functions by re-connecting wetland channels through the salt marsh, restoring tidal channels, enhancing roads to connect natural wetland flow or tidal channels, and filling or enhancing ditches for wetland channel habitat.

KEY MANAGEMENT ISSUES

- Major restoration project to be undertaken by Corps of Engineers and Skokomish Tribe.
- Flooding and sedimentation in the lower river segments and estuary.
- Water quality concerns related to fecal coliform from upstream sources.
- Agricultural uses in the delta which may degrade estuary through ditching/draining of wetlands.
- Maintain visual corridor and aesthetic views.

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HOOD CANAL - REACH 07

SHORELINE LENGTH

10.7 MI

LOCATION

SOUTH SHORE – SKOKOMISH
RIVER DELTA TO TWANOH
STATE PARK, INCLUDING
UNION, WA

REACH AREA

257.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 27% (71 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

80% erosion, 18% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 74% bluff backed beaches, 18% barrier beaches, 7% delta shores, 2% artificial shoreforms. Net shore drift - no appreciable drift at the estuary mouth, some areas of southward, northward, and westward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

West end and small section of east end of shore more degraded. Most of east shore most degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

5% developed, 14% mudflat, 59% forest, 20% wetland, 1% floodplain/riparian (Appendix B: GAP, 2009);
38% forested cover, 53% non-forest, 2% off-shore, 7% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. PHS data indicates herring, smelt and sand lance spawning habitat. Dungeness crab, geoduck, hardshell clam beds, and significant oyster beds. Continuous and patchy eelgrass; kelp beds.

Wetlands – 7.0 acres (3% of reach); habitat types include estuarine intertidal aquatic bed.

WATER QUALITY (MAP 13)

Reach 7 marine waters are included on the 303(d) list of impaired waters due to low dissolved oxygen. Dissolved oxygen concentrations in this reach have been measured below 0.8 mg/L, a level extremely stressful and potentially lethal for fish and other marine life (Newton et. al., 2011; Newton, 2010). This reach is not listed for fecal coliform contamination. However, Twanoh Creek and Twanoh Falls Creek, which discharge into this reach are on the list due to elevated fecal coliform concentrations. Contamination of marine water with fecal coliform may be due to these sources of pollution. Several shoreline seeps or drains sampled by Mason County along this reach exhibited concentrations of fecal coliform above 200 colonies/100 mL, indicating areas of potential concern (Georgeson et. al., 2008). One sediment sample was collected from this reach. Results indicated intermediate/high quality sediment quality based on the sediment quality triad index (Long et. al., 2010).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (63%), Vacant (12%), Transportation (10%), with the remaining 15% a mix of Parks, Open Space, and Recreational Areas, Commercial, Forestry, and Utilities. Ownership – Private (96%) and Public (4%).

There are 16 aquaculture permits on this reach, most located toward the western end of the reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 2 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 117 small docks, 51 buildings, 21 buoys and floats, 16 large docks, and 1 bridge. Shoreline armoring is mapped along 61% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts (County) – Rural Residential (97%) and Rural Tourist (2%). Zoning districts (Union) – Rural Residential (74%), Rural Multi Family (16%), and Rural Commercial (10%). Comprehensive Plan Designations – Rural (82%) and Rural Activity Center (18%).

Existing SED – Urban Residential (85%) with the remaining 14% a mix of Urban Commercial, Conservancy, and Rural.

PUBLIC ACCESS (MAP 14)

Twanoh State Park, managed by Washington State Parks, has 4% total linear miles of tideland ownership. The park is 182 acres in total size. The park has camping facilities, mooring buoys, picnic tables, 100 foot dock with 200 feet of moorage, and a boat launch (Mason County Parks and Trails, 2006; Washington State Parks, 2011). The eastern end of Twanoh State Park and Union Public Boat Launch are managed by Mason County, accounting for 3% of total linear miles.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 14% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 27% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show residential development in Union. SR 106 paralleling Hood Canal through most of the reach.

AREAS OF SPECIAL INTEREST

No listed contaminated sites.

Alderbrook Resort and Spa has 1,500 LF of dock for guest moorage and guest and meeting rooms. The marina has a fuel dock (owned by Hood Canal Marina) and a boat launch (Alderbrook Resort and Spa, 2011). Hood Canal Corporation Marina is another private marina located in Union, WA.

BUILT ENVIRONMENT AND LAND USE

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried early historic sites and one inventoried pre-contact site within this reach. Additionally, the Dalby Waterwheel (a registered historic site) and the McReavy House Site (a Mason County Historic Preservation Register site) are both located directly outside this reach. Resource probability mapping suggests there is a very low to high probability of finding unknown artifacts within this reach, with smaller portions of the reach in high to very high probability zones.

OPPORTUNITY AREAS

Twanoh State Park (Habitat Work Schedule, 2012); Remove fill and riprap at Twanoh State Park, restore salt marsh and intertidal habitat, and remove concrete wall and culvert at wading pool.

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Twanoh State Park Boat Ramp; When replacement is necessary, convert the Twanoh State Park boat ramp to a raised design to allow sediment transport and enhance juvenile salmonid migration.
- Big Bend Creek Barge; Remove derelict barge at mouth of Big Bend Creek.
- Big Bend Creek Culvert; Evaluate tidal exchange at the mouth of Big Bend Creek and replace culvert with bridge if natural processes are hindered by the culvert and road fill.
- Alderbrook Creek Estuary; Remove bulkhead along Alderbrook Creek estuary and restore the historic inlet.
- Remove barge-like structure from Big Bend estuary.

Twanoh State Park Beach Restoration Project (PSNERP, 2011) – Remove armoring along the shoreline and stream mouth and restore natural beach processes. Available at: <http://www.pugetsoundnearshore.org/factsheets/TwanohStatePark.pdf>. See Conceptual Design Report at: <http://www.pugetsoundnearshore.org/cdr.html>.

KEY MANAGEMENT ISSUES

- Water quality degradation due to fecal coliform bacteria from upstream sources.
- Maintain adequate sanitation facilities and trash removal for Skokomish fishery.
- Fund and implement stormwater retrofits identified for WSDOT and Mason county roads.
- Key restoration projects planned.

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HOOD CANAL - REACH 08

SHORELINE LENGTH

7.2 MI

LOCATION

SOUTH SHORE – TWANOH
STATE PARK EAST TO LYNCH
COVE

REACH AREA

170.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 66% (112 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

25% erosion, 42% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 78% bluff backed beaches, 21% barrier beaches, and 1% artificial shoreforms. Net shore drift - predominantly northward drift, one cell with southward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

South Shore is considered Most Degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

44% forest, 28% wetland, 3% floodplain/riparian, 10% developed, 14% mudflat, (Appendix B: GAP, 2009);
25% forested cover, 72% non-forest, 2% off-shore, 2% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. PHS data indicates herring, sand lance and smelt spawning habitat. Dungeness crab (present but declining). 8.1 acres of hardshell clam and 45.8 acres of oyster beds. 37.7 acres of eelgrass mapped by DNR in 2010. Compared to DNR surveys in 2000, eelgrass has significantly declined. Japanese eelgrass present.

Wetlands – 7.1 acres (4% of reach); wetland habitat estuarine intertidal aquatic bed, intertidal emergent.

WATER QUALITY (MAP 13)

Reach 8 is included on the 303(d) list of impaired waters due to low dissolved oxygen concentrations (Ecology, 2008). Newton et. al. (2010) documents that this reach of Hood Canal is among the most likely to experience severely low oxygen concentrations. Dissolved oxygen concentrations were estimated at times to be at or below, 0.5 mg/L during the summer of 2006, a level extremely stressful and potentially lethal for fish and other marine life (Newton et. al. 2011; Newton 2010). This reach is not included in the 303(d) list of impaired waters due to fecal coliform concentrations. However several small streams that flow into this reach have elevated fecal coliform concentrations and most are on the 303(d) list. Georgeson et. al. (2008) identified this particular reach as a segment of concern because up to 17 samples per mile from shoreline seeps or drains had fecal coliform concentrations above 200 colonies/100mL. One sediment sample was collected from this reach. Results indicated intermediate/high quality sediment quality based on the sediment quality triad index (Long et. al., 2010).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (72%), Transportation (16%), with the remaining 12% a mix of Vacant, Parks, Open Space, and Recreational Areas, and Aquaculture. Ownership – 100% Private.

There are 18 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 74 small docks, 24 buoys, 8 bridges, 8 buildings, and 3 large docks. Several permanent floats are found in this reach. Shoreline armoring is mapped along 76% of the reach. No tidal barriers are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

No parks or public access areas are mapped in the reach.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 42% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 35% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show residential development along much of the shoreline, with SR 106 running parallel to Hood Canal through most of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low to moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore native eel grass (*Zostera marina*) along the shore.

Lynch Cove Coastal Wetlands Acquisition (11-02-001) (Habitat Work Schedule 2012); Acquire coastal wetlands and adjacent uplands in the Lynch Cove area to protect habitat for fish and wildlife.

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Holyoke Creek; Restore tidal function at the mouth of Holyoke Creek by installing a bridge.
- Lakewood Creek; Restore the natural estuary of Lakewood Creek (Springbrook Creek) and install a bridge under SR 106 to allow tidal influence upstream.
- Rearing Pond Creek; Restore tidal processes and anadromous fish access to Rearing Pond Creek (about 0.17 miles east of stream #14.0130, see oblique photo #151646) by removing barriers and assessing road crossing.
- Happy Hollow Creek; Restore tidal function at the mouth of Happy Hollow Creek by installing a bridge.
- Twanoh Falls Creek Bulkhead Removal; design, construct, and monitor a shoreline restoration project on 400 feet of private shoreline on the South shore of Lower Hood Canal (Twanoh Falls Creek Bulkhead Removal Project). The Twanoh Falls Community Club has 250 feet of bulkhead.

KEY MANAGEMENT ISSUES

- Water quality degradation due to fecal coliform bacteria from upstream sources.
- Identify and manage upstream sediment sources (i.e., erosion along Sunset Beach and from Holyoke Creek).
- Monitor presence of native and non-native eel grass along the shore .
- Identify opportunities for public access.

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HOOD CANAL – LYNCH COVE - REACH 09

SHORELINE LENGTH

4.1 MI

LOCATION

LYNCH COVE

REACH AREA

98.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 47% (46 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

22% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 99% open coastal inlet shores, 1% barrier beaches. Net shore drift - predominantly no appreciable drift, an area along southwest shore with northward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

More Degraded.

LAND COVER (MAP 15)

1% developed, 2% agriculture, 8% forest, 88% wetland, 1% floodplain/riparian (Appendix B: GAP, 2009);
34% forested cover, 21% non-forest, 0.1% off-shore, 40% other vegetation, 5% water (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. Large expanses of eelgrass mapped by DNR in 2010. Compared to DNR surveys in 2000, eelgrass has significantly declined. Japanese eelgrass present. Wetlands – 88% of reach (GAP 2009).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Reach 9 is included in the 303(d) list of impaired waters due to high fecal coliform concentrations. The Union River, which discharges to Lynch Cove is also included on the 303(d) list due to elevated fecal coliform concentrations, and likely contributes to contamination of the marine waters. Runoff, and improperly treated septic discharges from the town of Belfair may also contribute to marine fecal coliform concentrations. However, limited sampling conducted by Mason County did not identify elevated fecal coliform concentrations in any of the sampled shoreline seeps or drains (Georgeson et. al., 2008). Low DO levels during the summer are a serious concern. The Lynch Cove area experiences less marine water circulation than other areas of Hood Canal, so it is most prone to oxygen depletion. Estimated dissolved oxygen levels were at 0.46 mg/L or lower during the summer of 2006, a level extremely stressful and potentially lethal for fish and other marine life (Newton et. al., 2011; Newton, 2010).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (74%), Residential (11%), with the remaining 15% a mix of Commercial, Transportation, Aquaculture, Agriculture, and Utilities. Ownership – Private (86%) and Public (14%).

SHORELINE MODIFICATIONS (MAP 16)

There are 21 locations mapped in the reach where tidal barriers exist: including 11 roads, 6 spur dikes, and 4 fill areas. Overwater structures in the reach include: 2 bridges and 1 large dock. No shoreline armoring is recorded.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (87%), Agricultural Resource Lands (10%), and Rural Industrial (3%). Comprehensive Plan Designations - Rural (90%) and Agricultural Resource Lands (10%). Existing SED – Conservancy (51%), Rural (28%), and Urban Residential (21%).

PUBLIC ACCESS (MAP 14)

Union River Wildlife Area, managed by Washington Department of Fish and Wildlife (WDFW), has 75% of total linear miles. Mary E Theler Community Center and Theler Wetlands Trail found in this reach along the south shore of Union River to Lynch Cove. Public access to estuarine wetlands through boardwalks and interpretative center.

IMPERVIOUS SURFACES (MAP 16)

NOAA shows 12% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 4% impervious area (Appendix B: HCCC, 2006). Aerial photos from 2009 show the reach to be mainly undeveloped tidelands. SR 300 and other roads intersect the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites. Belfair is currently in the process of constructing a sewage and wastewater treatment plant. This may improve water quality in the Lynch Cove area.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic site within this reach. Resource probability mapping suggests there is a generally very low to moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS (MAP 22)

Klingel Wetland Restoration (Appendix B: PSNERP, 2010); restore key habitat forming processes and functions of historic estuarine habitats in the Union River Estuary. The salt marsh complex is currently protected in perpetuity as property of the Great Peninsula Conservancy (GPC). This proposed project will allow for complete tidal inundation, natural tidal formation, improved exotic species control, and improved revegetation to a high salt marsh community.

Lynch Cove Coastal Wetlands Acquisition (11-02-001) (Habitat Work Schedule, 2011); This project will acquire coastal wetlands and adjacent uplands in the Union River Estuary to provide long-term conservation benefits to fish, wildlife and their habitat.

Union River Estuary Restoration (11-03-003) (Habitat Work Schedule, 2011); Restore the estuary and tidal function to over 32 acres by breaching the existing dike in two locations, re-contouring to elevations similar to adjacent marsh conditions, and accommodating stormwater drainage. It is designed to prevent flooding of surrounding agricultural property.

KEY MANAGEMENT ISSUES

- Stewardship and management of acquired easements and conservation areas.
- Water quality degradation due to fecal coliform bacteria from upstream sources.
- Preservation of significant estuarine wetlands in Union River estuary.
- Provide opportunities for regional trails and improved public access (Mason County Parks 2008).

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HOOD CANAL - REACH 10

SHORELINE LENGTH

12.4 MI

LOCATION

NORTH SHORE – LYNCH COVE
WEST TO TAHUYA RIVER

REACH AREA

294.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 32% (94 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

9% erosion, 20% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 55% bluff backed beaches, 41% barrier beaches, 2% artificial shoreforms, 1% barrier estuary, 1% barrier lagoon. Net shore drift - predominantly northeastward drift, a few cells with southward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Most mapped as More degraded, smaller reaches of moderately and less degraded shoreline.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

20% developed, 44% mudflat, 28% forest, 8% wetland (Appendix B: GAP, 2009);
29% forested cover, 59% non-forest, 7% off-shore, 5% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. PHS data shows herring, smelt and sand lance spawning habitat. Dungeness crab, geoduck clam, and oyster beds present. Eelgrass mapped by DNR in 2010. Since 2000, native eelgrass has significantly declined. Japanese eelgrass is present.
Wetlands – 13.8 acres (5% of reach); habitat types include estuarine intertidal aquatic bed and emergent.

WATER QUALITY (MAP 13)

Marine Reach 10 is included on the 303(d) list of impaired waters due to high fecal coliform concentrations and low dissolved oxygen levels. The fecal coliform listings are coincident with the mouths of creeks that are also included on the 303(d) due to elevated fecal coliform concentrations; specifically Little Mission Creek and Stimson Creek. In 2006, dissolved oxygen concentrations were measured at less than 1.0 mg/L, which is very stressful or lethal to fish and other marine life, (Newton et. al., 2011; Newton, 2010). One sediment sample was collected from this reach. Results indicated intermediate/high quality sediment quality based on the sediment quality triad index (Long et. al., 2010).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (77%), Vacant (10%), with the remaining 13% a mix of Parks, Open Space, and Recreational Areas, Transportation, and Forestry. Ownership – Private (97%) and Public (3%).
There are 63 aquaculture permits on this reach, with most located in the western half of the reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 10 locations mapped in the reach where tidal barriers exist: 6 fill areas, and 2 spur dikes, and 2 locations with partial dike removal. Overwater structures in the reach include 42 small docks, 41 buoys and floats, 30 buildings, 4 large docks and 4 bridges. Shoreline armoring is mapped along 56% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Urban Residential (90%) and Conservancy (10%).

PUBLIC ACCESS (MAP 14)

Belfair State Park, managed by Washington State Parks, accounts for 6% of total linear miles. The 63 acre park has about 3,800 LF of public tidelands. The North Shore Dock (Belfair), managed by Port of Allyn, has moorage and launch ramp facilities. (Port of Allyn, 2011; Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 15% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 30% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show a mixture of residential and commercial developments, forest, Belfair State Park facilities, and roads in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried early historic sites and one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a moderate-low to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Big Mission Creek Restoration Belfair S.P.; Restore habitat-forming processes that will allow natural maintenance of this freshwater tributary, its estuarine interface, and intertidal marsh. Currently floodwaters are contained in the lower river by thousands of feet of riprap.
- Lynch Cove Salt Marsh; Remove the small concrete pool, boat ramp, fill, and bulkhead at Lynch Cove Community Park to restore lost salt marsh.
- Snooze Junction Salt Marsh; Remove fill at Snooze Junction and restore lost salt marsh habitat.

KEY MANAGEMENT ISSUES

- Water quality degradation due to fecal coliform bacteria from upstream sources.
- Monitor presence of native eelgrass along the shore. Investigate reasons for eelgrass decline.
- Protection of commercial aquaculture and recreational shellfish harvest.
- Expansion of existing homes given lot configurations, septic systems and physical constraints.

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HOOD CANAL - REACH 11

SHORELINE LENGTH

6.0 MI

LOCATION

NORTH SHORE – TAHUYA WEST
TO GREAT BEND

REACH AREA

139.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 37% (52 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

44% erosion, 31% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 34% bluff backed beaches, 25% barrier beaches, 21% barrier estuary, 17% coastal inlet shores, 3% artificial shoreforms.

Net shore drift - eastward drift converges with northern drift at the mouth of the Tahuya River embayment, no appreciable drift within the inner shore of the embayment.

NEARSHORE PROCESS DEGRADATION (MAP 17)

More Degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

8% developed, 42% mudflat, 31% forest, 16% wetland, 4% floodplain/riparian (Appendix B: GAP, 2009);
46% forested cover, 40% non-forest, 5% off-shore, 10% other natural vegetation, 0.2% water (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. PHS data shows smelt spawning habitat. Dungeness crab, geoduck and oyster. 9.5 acres of eelgrass mapped by DNR in 2010. Since 2000, native eelgrass has significantly declined. Japonica is present. Wetlands – 17.9 acres (13% of reach); wetland habitat types include estuarine intertidal aquatic bed and emergent; palustrine emergent and forested.

WATER QUALITY (MAP 13)

Marine Reach 11 is included on the 303(d) list of impaired waters due to low dissolved oxygen concentrations. There are no 303(d) listings for fecal coliform. Fecal coliform contamination may be less of a problem in this reach as compared to others because the watershed in this area is generally less developed. Evaluations as part of Mason County's grant funded HCPIIC program are currently ongoing throughout this reach, but results have yet to be published (Pers. Comm., Amy Georgeson, MCPH).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (48%), Forestry (40%), with the remaining 11% a mix of Transportation, Vacant, and Parks, Open Space, and Recreation Areas. Ownership – 100% Private.

There are 13 aquaculture permits on this reach, with the largest cluster located near the mouth of the Tahuya River.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include 12 small docks, 8 buildings, 4 buoys and floats, 4 large docks, and 3 bridges. Shoreline armoring is mapped along 34% of the reach. No tidal barriers are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (99%) and Rural Tourist (1%). Comprehensive Plan Designations – Rural (100%). Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

No public access areas are mapped in the reach.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 6% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 24% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show a mix of residential development, forest, and roads in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic site within this reach. Resource probability mapping suggests there is a moderate-high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Tahuya River; Remove the helicopter landing pad on the left bank of the Tahuya River downstream from Northshore Road.
- Caldervin Creek; Remove intertidal fill in the vicinity of Caldervin Creek and restore lost mudflat and salt marsh habitats.
- Tahuya River Floating Docks; Store floating docks on upland areas during the winter months, rather than stockpiling along the right bank of the Tahuya River downstream from Northshore Road.
- Tahuya River Tidal Circulation; Evaluate the bridge span at the northshore Road Crossing of the Tahuya River for impaired tidal circulation and, if necessary, construct a longer span to improve tidal flow.
- Tahuya River West End; Remove log structures in old log yard on western end of Tahuya bridge.

Tahuya River Causeway Replacement and Estuary Restoration Project (PSNERP, 2011) – Reconstruct bridge over estuary to restore tidal connectivity and estuary processes and functions. Available at:

<http://www.pugetsoundnearshore.org/factsheets/TahuyaCauseway.pdf>. See Conceptual Design

Report at: <http://www.pugetsoundnearshore.org/cdr.html>.

KEY MANAGEMENT ISSUES

- Monitor presence of native eelgrass along the shore. Investigate reasons for eelgrass decline.
- Protection of commercial aquaculture and recreational shellfish harvest.

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HOOD CANAL - REACH 12

SHORELINE LENGTH

9.8 MI

LOCATION

GREAT BEND NORTH TO
DEWATTO RIVER

REACH AREA

229.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 74% (170 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

10% erosion, 40% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 74% bluff backed beaches, 19% open coastal inlets, 4% barrier beach, 2% artificial shoreforms, 1% barrier estuary. Net shore drift - northward drift from Bald Point to mouth of Dewatto Bay, no appreciable drift within the upper extent of Dewatto Bay, eastward drift along the north shore halfway into the bay.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

81% forest, 8% wetland, 2% riparian (Appendix B: GAP, 2009)

77% forested cover, 16% non-forest, 3% off-shore, 4% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 4-1 for priority salmon species. PHS data show smelt spawning habitat, Dungeness crab, hardshell clam beds and oyster. Pandalid shrimp. Continuous and patchy eelgrass. 5.2 acres of eelgrass observed by DNR in 2010. Wetlands – 9.9 acres (4% of reach); estuarine intertidal aquatic bed, beach/bar, and flats.

WATER QUALITY (MAP 13)

Reach 12 is included in the 303(d) list of impaired waters due to low dissolved oxygen concentrations. There are no listings for fecal coliform. Similar to Reach 11, fecal coliform contamination may be less of a problem in this reach, as compared to the western and southern shore reaches because the watershed is generally less developed. Evaluations of streams, surface seeps, and bulkhead drains for fecal coliform by Mason County are currently ongoing in this reach, but results have yet to be published (Pers. Comm., Amy Georgeson, MCPH). Two sediment samples were collected from this reach; both samples indicate intermediate/high sediment quality based on the sediment quality triad index (Long et. al., 2010).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (33%), Residential (31%), Vacant (24%), with the remaining 12% a mix of Parks, Open Space, and Recreation Areas, Agriculture, and Transportation. Ownership – Private (97%) and Public (3%).

There are 4 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 5 instances in the reach where mapped tidal barriers exist: 3 fill areas and 2 spur dikes. Overwater structures in the reach include: 16 small docks, 7 buoys and floats, 4 buildings, 3 bridges, and 1 large dock. Shoreline armoring is mapped along 16% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (91%) and Rural Tourist (9%). Comprehensive Plan Designations – 100% Rural. Existing SED – Rural (74%), Conservancy (15%), and Urban Residential (11%).

PUBLIC ACCESS (MAP 14)

Dewatto Bay tidelands, managed by DNR, accounts for 2% of total linear miles. Menard's Landing County Park provides a picnic area and boat launch for kayaks. Also, Rendsland Creek State of Washington shellfish beach is open to the public..

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 13% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC data show 4% impervious in this reach (Appendix B: HCCC, 2006). Aerial photos from 2009 show most of the reach to be forested, with residential development focused in the southern portion.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach, with smaller portions of the reach in very high probability zones.

OPPORTUNITY AREAS

Restoration opportunities identified by Washington State RCO, WDFW & USFWS, 2011, Appendix B:

- Dewatto Bay Pilings; Remove old pilings in Dewatto Bay, near Red Bluff, and on the Rendsland Creek delta.
- Rendsland Creek; Remove intertidal fill and shoreline armoring on spit at the mouth of Rendsland Creek.
- Musqueti Point Salt Marsh and Lagoon Habitat; Approach the owner of land about one mile north of Musqueti Point regarding restoring lost salt marsh and lagoon habitat.

KEY MANAGEMENT ISSUES

Protection of existing forested riparian areas.

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HOOD CANAL - REACH 13

SHORELINE LENGTH	LOCATION	REACH AREA
5.1 MI	EASTERN SHORE - DEWATTO NORTH TO COUNTY LINE	123.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 93% (115 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 86% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 98% bluff backed beaches, 2% barrier beaches. Net shore drift - predominantly northward drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) Least Degraded.
LAND COVER (MAP 15) 96% forest, 4% wetland (Appendix B: GAP, 2009) 95% forested cover, 4% non-forest, 1% other natural vegetation (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 4-1 for priority salmon species. PHS data shows Dungeness crab, hardshell clam beds, and oyster. Pandalid shrimp present. 4.8 acres of eelgrass mapped by DNR in 2010 north of Dewatto. Wetlands – 7.4 acres (6.0% of reach); wetland habitat types include estuarine intertidal beach/bar.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Reach 13 is included on the 303(d) list of impaired waters because of low dissolved oxygen concentrations. Dissolved oxygen concentrations in 2006 were estimated to have fallen below 1.5 mg/L, a level considered very stressful for fish (Newton, 2011). There are no 303(d) listings due to fecal coliform concentrations in this reach. As with Marine Reach 11 and Marine Reach 12, fecal coliform contamination may be less of a problem in this reach as compared to reaches along the western and southern shoreline because there is generally less development. Evaluations as part of Mason County's grant-funded HCPIC program are currently ongoing.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (39%), Forestry (34%), and Residential (26%). Ownership – 100% Private. There is 1 aquaculture permit on this reach, located near the northern end of the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include 1 buoy. Shoreline armoring is mapped along 1% of the reach. No tidal barriers are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

Hood Canal tideland areas, managed by DNR, account for 40% of total linear miles. Public access is available at this site by boat.

IMPERVIOUS SURFACES (MAP 16)

NOAA maps 7% of the reach as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). HCCC maps 0.1% impervious in this reach (Appendix B: HCCC, 2006).

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested cover in the shoreline jurisdiction.
Protect significant area of landslide hazard and coastal feed bluffs.

KEY MANAGEMENT ISSUES

- Protection of existing undeveloped shorelands and forested riparian cover.
- Protection of significant coastal bluffs and bluff-backed beaches.
- Landslide hazard areas are present.
- Protection of in-water aquatic resources and habitat.

4.2 Data Gaps

Data gaps have been identified for Hood Canal shorelines as part of this shoreline inventory and characterization. The following information is currently lacking:

- Countywide wetland inventory;
- A comprehensive inventory and assessment of coastal feeder bluffs in Mason County;
- Current data on shoreline modifications, specifically bulkheads;
- Current and quantifiable data for specific priority species, such as Dungeness crab and other native shellfish;
- Current survey for forage fish spawning;
- Location of abandoned pilings and docks; and
- Location of derelict structures, gear and debris in the nearshore environment.

CHAPTER 5.

MARINE SHORELINES - SOUTH PUGET SOUND

Chapter 5 provides a discussion of the marine nearshore shorelines of South Puget Sound within Mason County, Washington, including marine areas associated with Kennedy-Goldsborough Water Resource Inventory Area (WRIA) 14a. This chapter covers Case Inlet, Pickering Passage, Peale Passage, Harstine Island, Hammersley Inlet, Oakland Bay, Totten Inlet and Little Skookum Inlet. Marine waters of South Puget Sound seaward of the line of extreme low tide are considered “shorelines of statewide significance” under the Shoreline Management Act [RCW 90.58.030(2)(f)(iii)]. Shorelines of statewide significance are a special category of shorelines which are of important statewide interest, and where specific land use preferences apply.

A total of 132.4 miles of South Puget Sound shoreline lies within Mason County. To more easily evaluate the character of South Puget Sound shores, the shoreline has been divided into 35 reaches labeled Marine Reach (MR) 14 through MR 47 (marine reaches 1-13 are addressed in Chapter 4). Marine shorelines are described generally from north to south and arranged in three groupings: 1) Case Inlet, 2) Hammersley Inlet and Oakland Bay, and 3) Totten Inlet and Little Skookum Inlet. After a summary description of the marine areas, the reaches have been described in two page reach sheets that provide a summary of data per shoreline reach. Information displayed in the reach sheets is largely GIS data taken from a combination of state and county data sources. Data sources and methodology are described in Chapter 2. A Glossary of Terms is provided in Appendix C.

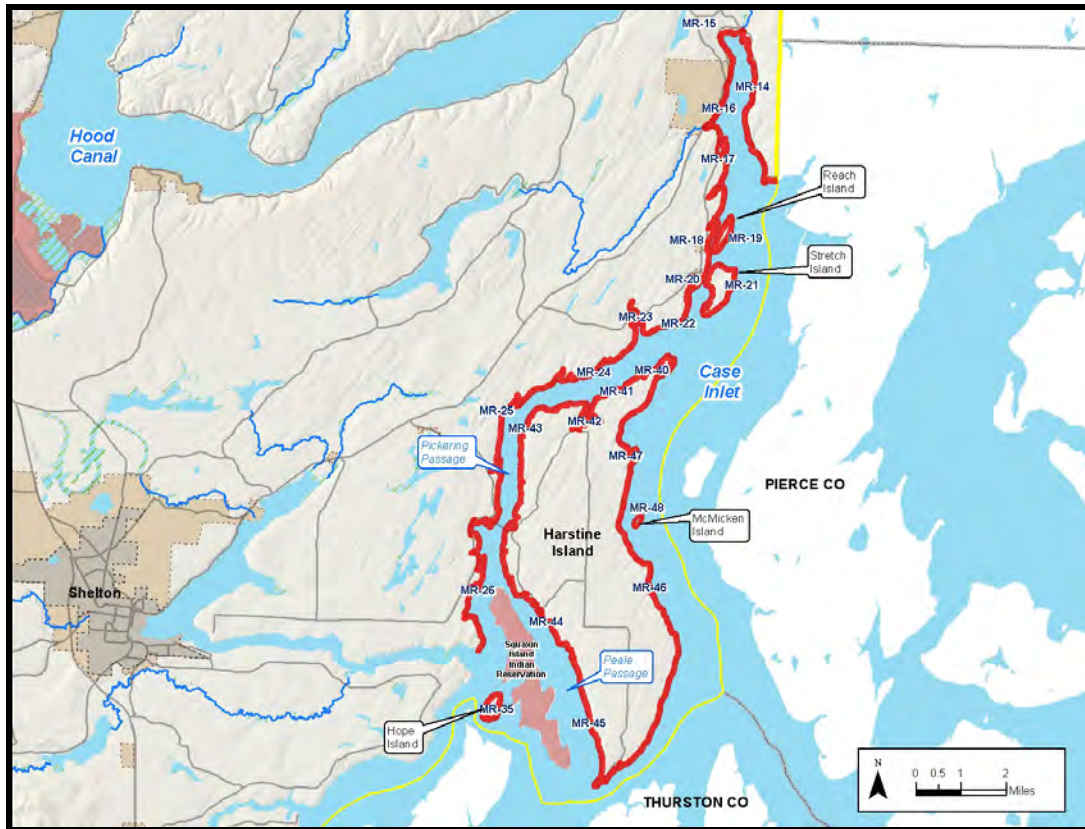
Marine Reach Organization

Marine Reach (MR)	Location Description	Shoreline Length (miles)
Case Inlet, Pickering Passage, and Peale Passage (including Harstine Island) (Section 5.1)		
MR 14	Mason-Pierce County line near Rocky Point north to Coulter Creek in North Bay, Case Inlet	4.0
MR 15	Coulter Creek to northern limit of Allyn urban growth area (UGA) in North Bay, Case Inlet	1.6
MR 16	Allyn UGA in North Bay, Case Inlet	1.9
MR 17	Southern limit of Allyn UGA south towards Reach Island in North Bay, Case Inlet	5.0
MR 18	Grapeview hamlet near Reach Island in Case Inlet	1.0
MR 19	Reach Island	1.9
MR 20	Mainland across from Stretch Island in Case Inlet	0.8
MR 21	Stretch Island	3.4
MR 22	Mainland between Stretch Island and McLane Cove in Case Inlet	2.7
MR 23	McLane Cove in Pickering Passage	2.0
MR 24	South of McLane Cove to south point of Reach 24 in Pickering Passage	4.5
MR 25	Pickering Passage from north point of Reach 25 to Graham Point	4.4
MR 26	Pickering Passage from Graham Point to Hungerford Point	5.8
MR 40	Harstine Island, north around Dougall Point, west to northern limits of Indian Cove	3.3
MR 41	Harstine Island, Indian Cove south to northern limits of Jarrell Cove on north shore	1.7
MR 42	Harstine Island, Jarrell Cove	2.5
MR 43	Harstine Island, Southern limits of Jarrell Cove south to north point of Reach 44, near northern end of Squaxin Island	6.7
MR 44	Harstine Island, western shore side across from Squaxin Island	2.6
MR 45	Harstine Island, western shore across from Squaxin Island south to Briscoe Point	3.7

Marine Reach Organization

Marine Reach (MR)	Location Description	Shoreline Length (miles)
MR 46	Harstine Island, From Briscoe Point north just past Fudge Point on eastern shore	6.9
MR 47	Harstine Island, eastern shore, north past McMicken Island	3.3
MR 48	McMicken Island	0.6
MR 35	Hope Island	1.6
Totten Inlet (including Skookum Inlet and Oyster Bay (Section 5.2))		
MR 34	Along Totten Inlet between Hammersley and Little Skookum Inlets	5.4
MR 36	Little Skookum Inlet	12.4
MR 37	Along Totten Inlet between Little Skookum Inlet and southern point of Reach 37	1.7
MR 38	Along Totten Inlet between northern point of Reach 38 and Oyster Bay	3.7
MR 39	Oyster Bay	2.7
Hammersley Inlet and Oakland Bay (Section 5.3)		
MR 27	Hammersley Inlet (North Shore, Hungerford Point West to Munson Point)	8.7
MR 32	Hammersley Inlet (South Shore including City of Shelton UGA)	7.1
MR 33	Hammersley Inlet (Arcadia Point)	1.7
MR 28	Eastern Shore of Oakland Bay (Chapman Cove), North of Munson Point.	4.9
MR 29	Along Eastern and Western Shore of Oakland Bay north of Chapman Cove to south of Bayshore hamlet	6.4
MR 30	Along Western Shore in Oakland Bay south of Bayshore hamlet to Shelton city limits (includes City of Shelton UGA)	2.5
MR 31	Along Shelton Harbor in Oakland Bay within City of Shelton city limits	3.5

5.1 Case Inlet, Pickering Passage and Peale Passage (including Harstine Island)



5.1.1 Physical Characterization and Modifications

Case Inlet, including Pickering Passage and Peale Passage are part of South Puget Sound located in Mason County. These marine nearshore environments in Mason County lie within the WRIA 14a (Kennedy-Goldsborough) watershed. WRIA 14a is divided into four sub-basins – Case Inlet, Goldsborough Creek, Kennedy Creek, and Skookum. The Goldsborough sub-basin is the largest of the four and includes all of Oakland Bay and Hammersley inlet (discussed in Section 5.3.1). This section discusses the Case Inlet sub-basin draining to Case Inlet including Harstine Island and Squaxin Island. Other smaller islands included are Reach Island, Stretch Island, and Hope Island.

The streams and wetlands of WRIA 14a empty into the shallow bays and inlets of South Puget Sound. Freshwater shorelines of WRIA 14a are discussed in detailed in Chapter 6 of this document. Due to its low elevation, this watershed receives very little snow and therefore streams and rivers are mostly fed by rain and groundwater sources. Issues with water availability and low instream flows occur within this watershed.

5.1.2 Coastal Processes and Shore Type

Waves are the dominant driver of coastal geomorphic processes in the Case Inlet, Pickering Passage, and Peale Passage shoreline. This is exemplified by on or near shore (littoral) sediment transport occurring along most shores. Eroding bluff backed beaches are the most common shoreform type on South Puget Sound shorelines of Mason County. This beach type is important because it supplies the nearshore with sediment that is then is transported down-drift to form the many varieties of depositional shoreforms found in the area. Accretion shoreforms commonly occur in this area including: barrier beaches, some of which embay estuaries and lagoons, cusped forelands and tombolos (a sandbar that connects an island to the mainland or to another island). Open coastal inlets are also abundant throughout this part of Mason County.

Coastal bluffs are an important feature of marine shorelines in Mason County. Coastal bluffs, referred to as “feeder” bluffs, provide sand and sediment to the nearshore environment and contribute to the formation of beaches, spits and natural processes related to net shore drift. Beaches that are backed by bluffs have been mapped by the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). Table 5-1 indicates the percentage of bluff-backed beaches by reach in Case Inlet, Pickering Passage and Peale Passage.

Table 5-1. Percent of Marine Region Mapped as Bluff-backed Beach

Marine Region	Reaches	Bluff-backed Beaches %
Case Inlet	14-18, 20, 22	41
Harstine Island	40-47	68
Hope Island	35	63
McMicken Island	48	85
Pickering Passage	23-26	58
Reach Island	19	48
Stretch Island	21	66

The presence of bluff-backed beaches is an important indicator of the value of the reach in terms of supporting nearshore processes and it is also an indicator of the suitability of the shore for human development. The Washington Department of Natural Resources has mapped portions of South Puget Sound shoreline as a landslide and/or erosion hazard area (see Table 5-2). Harstine and Hope Islands have high concentrations of landslide hazard areas suggesting steeper sections of the marine shore may be potentially hazardous for development. Some of these areas are already partially developed with single family homes.

Table 5-2. Percent of Region Mapped as Landslide Hazard or Erosion Hazard.

Marine Region	Marine Reaches	Landslide Hazard %	Erosion Hazard %
Case Inlet	14-18, 20, 22	3	6
Harstine Island	40-47	12	20
Hope Island	35	45	-
McMicken Island	48	3	-
Pickering Passage	23-26	4	8
Reach Island	19	-	-
Stretch Island	21	11	11

5.1.3 Water Quality

Water quality in South Puget Sound is degraded. This has resulted in low levels of dissolved oxygen, the presence of fecal coliform bacteria, and contaminants in sediments. Ecology is currently conducting a water quality study in the South Sound to identify the causes for low dissolved oxygen (Ecology, 2008a). The study is designed to determine how both human activities and natural factors affect water quality in South Puget Sound. Low dissolved oxygen levels result in distress for marine organisms and cause fish kills. An excess of nutrients, including nitrogen, lead to low dissolved oxygen levels in the Sound. Discharges of nitrogen and nutrients from septic systems, wastewater treatment plants, agricultural runoff, and other man-made sources contribute to this problem. Based upon data collected from wastewater treatment plant discharges and from river inputs in both South Puget Sound and Central Puget Sound, it appears that high nitrogen loads are entering South Puget Sound from both local sources and from the more intensely developed areas of Central Puget Sound, thereby affecting water quality (Ecology, 2011). Lack of natural flushing and water circulation in the South Sound serves to exacerbate water quality problems, especially during the warm summer months.

In Oakland Bay, sediments have been documented to be contaminated with chemicals and wood waste. Ecology is conducting the Oakland Bay Sediment investigation and has determined that dioxins are present in Oakland Bay and Shelton Harbor. Dioxin concentrations are above state standards and become much higher with increasing depth (from two to three feet) in these sediments (Ecology, May 2011). Plans to cleanup sediments and water quality are in development (http://www.ecy.wa.gov/programs/tcp/sites/oaklandBay/oaklandBay_hp.htm).

Several portions of the South Puget Sound within Mason County are listed as Category 5 on the 303(d) list of impaired waters (Ecology, 2008a). Category 5 waters require the preparation of a Total Maximum Daily Load (TMDL) to address water quality concerns.

- Case Inlet – Category 5 listing for fecal coliform bacteria (four reaches), dissolved oxygen (one reach) and PCBs (one reach).
- Pickering Passage – Category 5 listing for fecal coliform (one reach) and PCBs (one reach). Category 2 listings (several reaches on eastern and western shores) for dissolved oxygen.
- Harstine Island – Category 5 listing for PCBs; and
- Hope Island and McMicken Island - Category 2 listings for fecal coliform bacteria and dissolved oxygen (Ecology, 2008a).

The Washington State Department of Health's (DOH) Office of Shellfish and Water Protection, in addition to local health jurisdictions, monitor South Sound water

quality and classify commercial and recreational shellfish harvest areas to protect human health. Samples are collected to analyze fecal coliform concentrations in the water (used to indicate the presence of pathogens that cause disease and illnesses in humans), in addition to paralytic shellfish poisoning and domoic acid samples (WDOH, 2011). Growing areas are classified as Approved, Conditionally Approved, Restricted, or Prohibited. An interactive map provides information on current marine biotoxin closure zones is available at DOH's website:
<http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Step=1>

5.1.4 Critical or Priority Habitat and Species

Case Inlet, Pickering Passage, and Peale Passage shorelines support a diverse array of fish, wildlife, birds and marine aquatic life. South Puget Sound provides forage, nesting and breeding habitat for bald eagle, osprey, great blue heron, shorebirds and many species of waterfowl. Concentrations of shorebirds and waterfowl are documented in several estuaries and bays, such as Oakland Bay and Oyster Bay. Approximately 29 species of water-dependent birds are commonly observed in saltwater areas along the Mason County shoreline (Audubon Society, 2012). In addition, marine mammals such as harbor seals, otters, Southern Resident Killer Whale (Orca) and an occasional whale occur. Marine aquatic species found in South Puget Sound include several species and types of oyster (Pacific, Olympia, Totten Inlet), geoduck clam, hardshell clam, butter clam, as well as other species of clam and native mussel. Native fish documented in South Puget Sound include salmonid species such as coho, steelhead, summer chum and Chinook, forage fish, rock sole and other species.

Critical or priority habitats and priority species identified within the Mason County shoreline jurisdiction of Case Inlet, Pickering Passage, and Peale Passage are specifically covered in this section. Discussion of the mapped priority habitats and species follows, with select quantitative data only located in the reach sheets, where noted.

Case Inlet, Pickering Passage, and Peale Passage are mapped as supporting many federal and state-listed priority salmonid species (Appendix B: WDFW, 2011; Table 5-1).

Table 5-3. Priority salmonid species documented for Case Inlet, Pickering Passage, and Peale Passage

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Presence/Migration	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Known spawning	Threatened	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Known spawning and Presence/Migration	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~

Critical habitat has been designated for the Puget Sound Evolutionarily Significant Unit (ESU) Chinook salmon for all reaches covered in this section, with the exception of MR 14. This designation extends upstream to the point of tidal influence. Critical habitat has also been designated for the Southern Resident killer whale Distinct Population Segment (DPS) for all reaches covered in this section, extending to waters deeper than 20 feet (Appendix B: USFWS, 2010).

Spawning areas for forage fish, including Pacific herring, surf smelt and sand lance are also listed as priority habitats. Forage fish are important links in the ecosystem of South Puget Sound as they provide a key food source for marine birds, rockfish, salmon and numerous other fish species (Pentilla, 2007). These fish spawn in the intertidal areas of South Puget Sound. Forage fish and other priority marine fish species are abundant in the marine shorelines of South Sound in Mason County (Appendix B: WDFW, 2011). Habitat areas for herring, sand lance, smelt and other fish are documented in the PHS data in terms of linear miles or acres of habitat. Holding habitat for herring is mapped by WDFW as occurring in Case Inlet, Pickering Passage, and Peale Passage, especially in marine reaches 48 and 26 (Appendix B: WDFW, 2011). Both sand lance and surf smelt spawning habitat is mapped for several reaches along the nearshore (Appendix B: WDFW, 2011; see reach sheets). Essential fish habitat for rock sole is mapped for the following marine reaches: 22, 24-26, 35, and 43-46 (Appendix B: WDFW, 2011).

Native and commercial shellfish beds including geoduck, hardshell clam, and oyster are documented for numerous reaches (Appendix B: WDFW, 2011). Eelgrass and

kelp beds are documented for many reaches in Case Inlet, Pickering Passage, and Peale Passage in Mason County (DNR, 2008).

Kelp species, such as bull kelp (*Nereocystis luetkeana*), giant kelp (*Macrocystis integrifolia*) and non-floating kelp species have limited distribution within the Mason County portion of Puget Sound. Non-floating kelp species are the most widely distributed, primarily concentrated in parts of Hood Canal, Hammersley Inlet, and Totten Inlet (Eissinger, 2009).

Priority wildlife species occurrences are mapped for pigeon guillemot along marine reach 48 and for purple martin along marine reach 42. Bald eagle species occurrences are located along marine reaches 17, 22, 24, 35, 43, 46, and 48. Bald eagle buffer is mapped for several of the reaches covered in this section (Appendix B: WDFW, 2011). Wetlands, another priority habitat, are found along the nearshore in many reaches in South Puget Sound.

5.1.5 Shoreline Land Use

Land use in shoreline areas refers to current uses, broader land use patterns and existing development within the shoreline jurisdiction. The primary types of land uses in the shorelines of Case Inlet, Pickering Passage and Peale Passage include residential and commercial aquaculture.

Aquaculture is a significant resource and important economic driver in Mason County. Between 2007 and 2011, the U.S. Army Corps of Engineers received 55 general permit applications for shellfish operations (See Appendix A, Figure 26). Large commercial shellfish growers operating in Case Inlet, Pickering Passage and Peale Passage are Arcadia Point Seafood, Taylor Shellfish and Admiralty Seafood Inc. In addition, many of the shellfish growers are small family businesses dating back generations. According to Assessor's data, commercial or tribal aquaculture is present on 15 out of 23 reaches in Case Inlet, Pickering Passage and Peale Passage shorelines.

Land use along Case Inlet is predominately single-family residential with the exception of the Allyn UGA (Reach 16), which includes multifamily and commercial uses and zoning. The remaining areas are mostly classified by the Mason County Assessors as vacant lands. SR Route 302 parallels the entire eastern shore of North Bay.

Properties are generally armored with few docks or piers. According to Assessor data, aquaculture is present on 6 of 7 reaches on Case Inlet. Public access is available along state-owned tidelands, Watson Wildwood View County Park, Allyn Waterfront Park, Allyn Kayak Park, and state-owned beaches and bridges. There are also several

public boat launches managed by port districts (Mason County Department of Parks and Trails, 2006).

Reaches along Pickering Passage have a mix of residential and vacant land uses. There are more docks/piers and bridge crossings over stream mouths than in Case Inlet. According to Assessor's data, aquaculture is present on 3 of 4 reaches on Pickering Passage. Public access includes Mason County-owned Latimer's Landing Boat Launch and Latimer's Landing Overflow Parking. Both parks have public boat launches (Mason County Parks and Trails, 2006).

Harstine Island has a mix of residential; parks, open space and recreation areas; forestry; and vacant land uses. Residential development and vacant lands are located throughout the island. Forestry land uses are concentrated mostly along the southern portion of the island. Most of the reaches have a limited number of properties with hard armoring and overwater structures. According to Assessor's data, aquaculture is present on 5 of 8 reaches on Harstine Island. Public access includes state-owned Jarrell Cove State Park and Harstine Island State Park. The parks are mainly undeveloped but provide moorage, trails, and beach access (Mason County Parks and Trails, 2006).

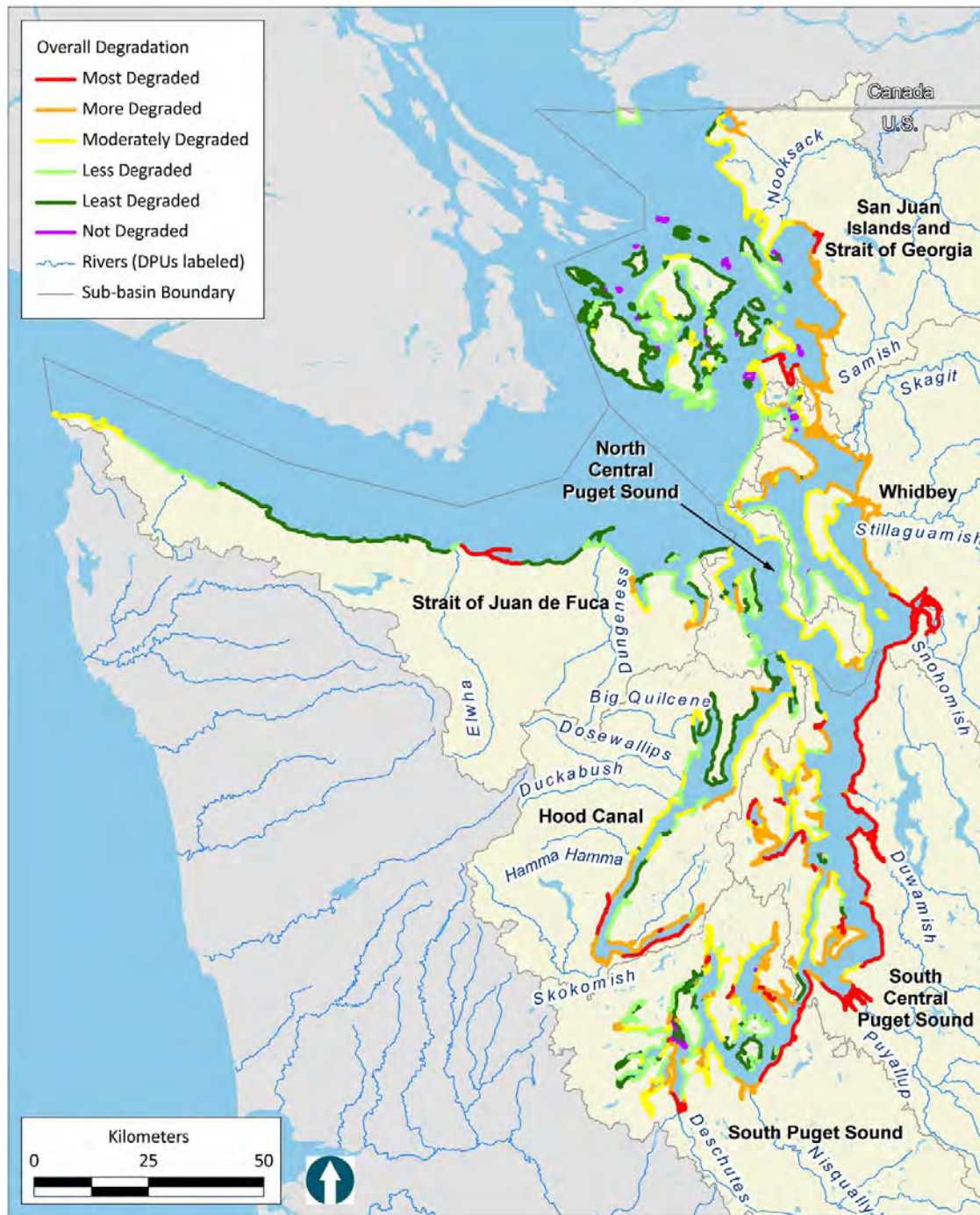
McMicken Island and Hope Island are predominately in parks, open space and recreational use, although the Mason County Assessor classifies Hope Island's as 100 percent vacant. Washington State Parks manages McMicken Island State Park and Hope Island Park. Both parks are undeveloped and accessible only by boat (Mason County Parks and Trails, 2006).

Reach Island is almost entirely in residential land use, though aquaculture is present. Public access is limited to property associated with Reach Island Bridge, managed by Washington State. Stretch Island is predominately in residential land use with remaining properties classified as vacant, with some aquaculture present. Public access is available at Stretch Point State Park, managed by Washington State Parks. The park is mostly undeveloped but has mooring buoys for boat access (Mason County Parks and Trails, 2006).

5.1.6 Shoreline Modifications

Information on nearshore geomorphic processes and shoreline modifications was derived in part from the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). A composite measure of nearshore process degradation provides a summary of nearshore ecosystem conditions at the drift cell scale. The levels of degradation determined by PSNERP range from "not degraded", "least degraded", "less degraded", "moderately degraded", "more degraded" to "most degraded." Degradation scores are relative Sound-wide. These results can help to identify and focus protection and restoration strategies. Note that PSNERP did not evaluate

biological conditions (such as vegetation or habitat availability), but assessed the configuration of the shoreline compared to historic conditions. For example, this information evaluates the presence of modifications or ecological stressors such as fill, armoring, marinas, dams and other physical features. Within Case Inlet, Pickering Pass, and Peale Passage overall process degradation was most commonly “least” and “less” degraded. Greater overall degradation (“more degradation”) had occurred along the south shore of Stretch Island, along the westward shore up to Reach Island and along the shore west of the north shore of Squaxin Island. Reach Island was one of very few areas ranked as “most” degraded places in South Puget Sound shorelines of Mason County.” Mason County’s South Sound marine shorelines are regionally significant as they include the greatest length of “least degraded” shorelines in the South and South Central Puget Sound. See Figure 5-1 PSNERP Degradation Scores. Information related to process degradation is also provided on the reach sheets in Section 5.1.9.

Figure 5-1. PSNERP Degradation Scores

Existing man-made structures, along with modifications to the shoreline, occur along South Puget Sound and are part of this shoreline characterization. These are referred to as shoreline modifications, which include bridges, bulkheads (i.e., shoreline armoring), roads, dikes and overwater structures like docks. The number

and extent of modifications along the shoreline in South Puget Sound has been described by marine region (Appendix B: PSNERP, 2010) in Table 5-2.

Table 5-4. Shoreline Modifications by Region for Case Inlet, Pickering Passage and Peale Passage

Marine Region	Overwater Structures				Tidal Barrier			Shoreline Armoring (%)
	Bridges	Buildings	Buoys	Docks	Fill	Dike	Road	
Case Inlet	7	4	29	26	1	-	17	40%
Harstine Island	6	8	10	31	-	-	7	13%
Hope Island	-	-	-	-	-	-	-	0%
McMicken Island	-	-	1	-	-	-	-	0%
Pickering Passage	10	7	13	47	1	-	3	27%
Reach Island	1	1	13	6	-	-	-	97%
Stretch Island	1	1	13	6	-	-	-	39%
Total	25	21	79	116	2	0	27	59%

5.1.7 Land Cover

Land cover provided in this section refers to both the aerial extent of existing vegetation and the coverage of developed areas (paved or built surfaces) within the shoreline jurisdiction. Riparian vegetation is an important feature of marine habitats in Puget Sound. Several studies have shown that salmon in Hood Canal and Puget Sound feed on insects falling from terrestrial or upland vegetation (Simenstad, 2000).

According to the GAP 2009 data, the dominant land cover type for Case Inlet is conifer dominated forests, at 45 percent. The next highest percent cover is provided by harvested forest (17 percent). The third highest percent land cover type is beach shore and sand at 11 percent. Developed land comprises eight (8.0) percent of the overall land cover of Case Inlet shorelines. Additional information on land cover by reach is summarized on the reach sheets for Case Inlet, Pickering Passage and Peale Passage.

According to the PNPTC 2011 data set, the dominant land cover type of Case Inlet is forest cover at 49 percent. The next highest percent cover is provided by non-forest (33 percent). The third highest land cover type is off-shore at 10 percent, and other natural vegetation comprises 8 percent of the overall land cover.

5.1.8 Public Access Opportunities

Public access to the shorelines of Case Inlet, Pickering Passage and Peale Passage is provided through an array of Washington State Parks, County Parks, Port Districts and access from water as part of the Cascadia Marine Trail (a state-recognized water trail for non-motorized boaters). State-owned tidelands also provide public access to intertidal zones where recreational shellfish harvest is popular. The Mason County Regional Trail Plan (Mason County Department of Parks and Trails, 2008) notes that public access opportunities exist in the form of overlooks, boat launches, waterfront parks, trails, short path or stairs, and small parking areas. Access opportunities are more limited on developed shorelines. Public access is available along state-owned tidelands, Watson Wildwood View County Park, Allyn Waterfront Park, Allyn Kayak Park. There are also several public boat launches including Latimer's Landing Boat Launch and Latimer's Landing Overflow Parking. Several undeveloped parks provide limited moorage, trails and/or beach access, including Jarrell Cove State Park, Harstine Island State Park, McMicken Island State Park and Hope Island Park and Stretch Point State Park.

5.1.9 Summary of Key Management Issues

Key management issues for Case Inlet, Pickering Passage and Peale Passage include the following: 1) protection of documented forage fish spawning beaches; 2) conserve riparian forested cover where unaltered; 3) protection of reaches designated as "least degraded" through PSNERP as well as intact marshes, stream deltas and spits; 4) conservation of priority fish species in major salmonid-bearing streams; and 5) protection and improvement of water quality to support significant recreational and tribal shellfish harvest and commercial aquaculture.

5.1.10 Reach Analysis

An analysis by marine reach is given in the following section. Reach sheets are provided corresponding to specific shoreline segments as listed below:

- Case Inlet (Reaches 14-18, 20, 22), Reach Island (Reach 19), Stretch Island (Reach 21) and Pickering Passage (Reaches 23-26);
- Harstine Island (Reaches 40 -47);
- McMicken Island (Reach 48); and
- Hope Island (Reach 35).

Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

CASE INLET - REACH 14

SHORELINE LENGTH

4.0 MI

LOCATION

EASTERN COUNTY LINE NEAR
ROCKY POINT, NORTH TO
COULTER CREEK

REACH AREA

94.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 96% (91 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain.

HAZARD AREAS (MAP 12)

1% erosion

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 61% bluff backed beaches, 39% barrier beaches. Net shore drift -northward drift from Rocky Point to Point Victor.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Mostly moderately degraded with very small section of less degraded shoreline.

LAND COVER (MAP 15)

18% developed, 36% mud flat, 26% forest, 15% wetland, 5% floodplain/riparian (Appendix B: GAP, 2009);

Riparian vegetation: 27% forest cover, 66% non-forest, 2% off-shore, 5% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species. Surf smelt breeding area. Hardshell clam beds. Patchy eelgrass (DNR, 2008). Osprey use documented.

Wetlands – 8.7 acres (9% of reach); habitats include estuarine intertidal aquatic bed, emergent, rocky shore, and unconsolidated shore.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listings (Category 5) for fecal coliform and dissolved oxygen (Ecology, 2008a).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Cover – Residential (84%), remaining 16% is a mix of Vacant, Aquaculture; Forestry, Parks, Open Space, and Recreation Areas. Ownership – 100% Private.

There are 17 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.

Existing SED – Urban Residential (86%) and Rural (14%).

SHORELINE MODIFICATIONS (MAP 16)

Two roads serve as tidal barriers. Overwater structures in the reach include: 1 upland bridge, 2 buildings, and 9 buoys and floats. Shoreline armoring is mapped along 55% of the reach. . Overhead transmission line crossing Case Inlet According to aerial imagery (2009), aquaculture is present in the southern part of the reach.

PUBLIC ACCESS (MAP 14)

North Bay Tidelands, managed by Washington Department of Natural Resources (DNR), provides public access to 18% of total linear shoreline miles. Northeast Case Inlet Tidelands, managed by WDFW provides public access to 10% of total linear miles. Mason County manages Watson Wildwood View County Park, a 63 acre undeveloped site that is near the reach (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

27% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development along the reach. State Route 302 parallels the shoreline along the entire reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.
Medium sediment supply with no nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists six inventoried pre-contact sites and one inventoried pre-contact village within this reach. Resource probability mapping suggests there is a moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Re-vegetate shoreline and restore native trees (Appendix B: Anchor, 2004).

Replace riprap protecting road with LWD.

Remove remnant pilings.

KEY MANAGEMENT ISSUES

- Priority rearing area for juvenile salmonids from Sherwood and Coulter Creeks with an eelgrass bed near reach and large mudflat located in the reach (Appendix B: Anchor, 2004).
- Protect documented surf smelt breeding areas.

CASE INLET - REACH 15

SHORELINE LENGTH

1.6 MI

LOCATION

COULTER CREEK TO NORTH
LIMIT OF ALLYN UGA

REACH AREA

37.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 44% (17 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

18% erosion

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 91% large open coastal inlet, 9% barrier beaches. Net shore drift -predominantly no appreciable drift at the head of Case Inlet, northward drift in a small area along the S end of the W shore.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Moderately degraded.

LAND COVER (MAP 15)

18% developed, 4% mud flat, 17% forest, 32% wetland, 30% floodplain/riparian (Appendix B: GAP, 2009);

Riparian vegetation: 44% forest cover, 26% non-forest, 10% off-shore, 19% other natural vegetation, 0.5% water (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Hardshell clam beds present.

Wetlands – 3 acres (6% of reach); wetland types include estuarine intertidal aquatic bed and emergent. Note: (NWI underestimates wetland; forested wetlands west of Coulter Creek).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage (North Bay), 303(d) listing (Category 5) for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (31%), Residential (25%), Vacant (22%), remaining 22% is a mix of Aquaculture and Transportation. Ownership – 100% Private.

There are 2 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Conservancy (56%), Rural (40%), and Urban Residential (4%).

IMPERVIOUS SURFACES (MAP 16)

18% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a small amount of residential development in the western part of the reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 6 instances in the reach where mapped road(s) serve as tidal barriers. Overwater Structures in the reach include: 1 upland bridge, 1 building, 1 buoy/float, and 1 small dock. No shoreline armoring is mapped along the reach.

PUBLIC ACCESS (MAP 14)

North Case Inlet, managed by WDFW, provides public access to 34% of total linear miles in the reach.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

A portion of the reach (0.5 MI) with medium sediment supply and no nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate-high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove remnant pilings (Appendix B: Anchor, 2004).

Remove potential filled areas/dike.

The entire length of the reach (100%) is identified for conservation of habitat beneficial to juvenile salmonids (Anchor, 2003)

KEY MANAGEMENT ISSUES

- Priority rearing area for juvenile salmonids from Sherwood and Coulter Creeks with a large mudflat located in the reach (Appendix B: Anchor, 2004).
- Conserve emergent marsh and mudflat habitat types (Appendix B: Anchor, 2004).
- Conserve significant forested wetlands associated with North Bay west of Coulter Creek mouth.

CASE INLET - REACH 16

SHORELINE LENGTH	LOCATION	REACH AREA
1.9 MI	ALLYN UGA	48.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 4% (2 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 18% erosion
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 77% bluff backed beaches, 18% open coastal inlets, 5% barrier beaches. Net shore drift - predominantly northward drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) Moderately degraded.
LAND COVER (MAP 15) 38% developed, 8% mud flat, 15% forest, 11% wetland, 28% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 30% forest cover, 47% non-forest, 19% off-shore, 4% other natural vegetation (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-3 for priority salmon species. Hardshell clam beds. Patchy eelgrass present (DNR, 2008). Wetlands – 3.7 acres (8% of reach); wetland habitat types include estuarine intertidal aquatic bed and emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listing (Category 5) for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use –Residential (49%), Vacant (24%), remaining 26% is a mix of Aquaculture; Parks, Open Space; and Recreation Areas; Commercial, Utilities, Forestry; and Transportation. Ownership – 100% Private.

There is 1 aquaculture permit on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential (5%). Allyn UGA: Single Family Residential (68%), Village Commercial (14%), remaining 13% is a mix of Multi Family Residential and Public Open Space. Comprehensive Plan Designations – Urban Growth Area (95%) and Rural (5%). Existing SED – Urban Residential (42%), Urban Commercial (36%), and Rural (22%).

SHORELINE MODIFICATIONS (MAP 16)

Overwater Structures in the reach include: 1 upland bridge and 1 large dock. Shoreline armoring is mapped along 61% of the reach. There are no mapped tidal barriers in the reach. Overhead transmission line crossing Case Inlet.

PUBLIC ACCESS (MAP 14)

WDFW provides water access near the Sherwood Creek stream mouth. Northwest Case Inlet Tidelands and North Case Inlet, managed by WDFW, provide public access to 10% of total linear miles in the reach. Allyn Waterfront Park is managed by Port of Allyn and provides 400 feet of waterfront access (4% of total linear miles of reach). The park provides moorage at the Allyn Dock, and has two launch ramps, picnic area, gazebo, basketball court and parking facilities. Allyn Kayak Park, also managed by Port of Allyn, provides access to the water, has a sandy beach and interpretive and historic signage. (Port of Allyn, 2011; Mason County Parks and Trails, 2006; Mason County Parks and Recreation, 2008).

IMPERVIOUS SURFACES (MAP 16)

26% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development and roads, particularly in the southern part of the reach.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists six inventoried pre-contact sites within this reach. This reach includes the Allyn Church at 18510 State Route 3, which is listed on the Washington Historic Register. Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads or replace with natural logs where feasible.

Revegetate shoreline where native trees are lacking.

Improve public access (e.g., placement of trash cans, erosion control measures) (Appendix B: Anchor, 2004).

Work to implement public access policies of the Allyn UGA Plan. Policy 5.2 states that “sites that provide shoreline access to North Bay/Case Inlet” are a high priority area for future park acquisition.

Work to implement natural environment policies of the Allyn UGA Plan. Implementation plans include a UGA-wide program for shoreline restoration, a long-term water quality monitoring program, and a detailed inventory and delineation of wetlands.

Approximately 36% of the reach is identified for restoration of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003)

KEY MANAGEMENT ISSUES

- Priority area for juvenile salmonids from Sherwood and Coulter Creeks with a large mudflat located in the reach (Appendix B: Anchor, 2004).
- Restoration would improve the mouth of Sherwood Creek and enhance intertidal habitats encountered by juvenile salmonids outmigrating from the major salmon-bearing tributary (Appendix B: Anchor, 2004).
- Public access issues.
- Replacement of bulkheads with soft-shore stabilization where feasible.

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CASE INLET - REACH 17

SHORELINE LENGTH

5.0 MI

LOCATION

SOUTHERN LIMIT OF ALLYN
UGA SOUTH TO REACH ISLAND

REACH AREA

106.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 19% (21 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

4% erosion

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 29% barrier beaches, 24% barrier estuary, 23% open coastal inlets, bluff backed beaches, 2% artificial shoreforms. Net shore drift - predominantly northward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Moderately degraded.

LAND COVER (MAP 15)

13% developed, 2% beach, 7% mud flat, 66% forest, 8% wetland, 3% floodplain/riparian (Appendix B: GAP, 2009);

39% forest cover forest, 44% non-forest, 9% off-shore, 9% other (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Hardshell clam beds present. Bald eagle breeding and habitat territories.

Wetlands – 5.8 acres (6% of reach); habitats include estuarine intertidal aquatic bed and emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listed (Category 5) for fecal coliform bacteria and dissolved oxygen (offshore).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (60%), Vacant (24%), remaining 26% is a mix of Aquaculture; Parks, Open Space; and Recreation Areas; Commercial, Utilities, Forestry; and Transportation. Ownership – 100% Private.

There are 2 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

16% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development and roads, particularly in the NW part of the reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 7 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 14 buoys and floats, 7 small docks, Grapeview Loop Road bridge and 1 large dock. Shoreline armoring is mapped along 33% of the reach.

PUBLIC ACCESS (MAP 14)

Northwest Case Inlet Tidelands, managed by WDFW, provides public access to 36% of total linear miles in the reach.

AREAS OF SPECIAL INTEREST

No state-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads and replace with natural logs where feasible (Appendix B: Anchor, 2004).

Replace culvert with a bridge spanning the stream

Improve public access (e.g., placement of trash cans, erosion control measures)

Case Inlet Pocket Estuary Connectivity Project (Appendix B: PSP, 2010); The pocket estuary south of Sherwood Creek has a tidal barrier at the mouth that is currently unarmored. The area is a priority sediment source for the reach. There is extensive surf smelt spawning throughout the estuary.

Approximately 55% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES:

- Restoration in this area would improve the mouth of Sherwood Creek and enhance the initial estuarine habitats encountered by juvenile salmonids outmigrating from the major salmon-bearing tributary (Appendix B: Anchor, 2004).
- Conserve emergent marsh and sand spit habit types (Appendix B: Anchor, 2004).

CASE INLET - REACH 18

SHORELINE LENGTH

1.0 MI

LOCATION

GRAPEVIEW HAMLET NEAR
REACH ISLAND

REACH AREA

22.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 2% (0.4 acre) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 56% open coastal inlet, 23% barrier beaches, 20% bluff backed beaches. Net shore drift - converging cells, large area of no appreciable drift along the protected shore west of Reach Island.

NEARSHORE PROCESS DEGRADATION (MAP 17)

More degraded.

LAND COVER (MAP 15)

23% developed, 7% beach, 59% forest, 10% wetland (Appendix B: GAP, 2009);
24% forest cover forest, 68% non-forest, 8% off-shore (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.
Sand lance spawning habitat present. Patchy eelgrass present (DNR, 2008). Purple martin documented.
Wetlands – 0.3 acre of estuarine intertidal (1%).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listed (Category 5) for fecal coliform bacteria and dissolved oxygen (offshore).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (83%), remaining 17% is a mix of Vacant, Industrial; Parks, Open Space, and Recreation Areas; and Aquaculture. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential (86%). Grapeview Hamlet: Mix of Rural Residential, Rural Commercial, and Rural Industrial (14%). Comprehensive Plan Designations – Rural (86%) and Hamlet (16%). Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

5% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development and roads; a marina in the southern part of the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 5 buoys and floats, 3 small docks, Reach Island Bridge that provides access to Reach Island, and 1 large dock. Shoreline armoring is mapped along 100% of the reach. There are no mapped tidal barriers in the reach. Grapeview Fair Harbor Marina provides private moorage, covered moorage, and 350' of guest dock space (Fair Harbor Marina, 2011).

PUBLIC ACCESS (MAP 14)

Two boat launches, managed by the Port of Grapeview and the Port of Shelton, provide public access in this reach. Public access is also available on property associated with Reach Island Bridge, managed by Washington State.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.
Medium sediment supply with no nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. The reach also shares the inventoried early historic Treasure Island Bridge site with Marine Reach 19 (Reach Island). Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts.

OPPORTUNITY AREAS

Revegetate shoreline (Appendix B: Anchor, 2004).

Remove unnecessary bulkheads or replace with natural logs

KEY MANAGEMENT ISSUES

- Revegetation of degraded riparian zone.
- Water quality improvement.
- Consider bulkhead removal and replacement with soft-shore protection where feasible.

REACH ISLAND - REACH 19

SHORELINE LENGTH

1.9 MI

LOCATION

REACH ISLAND

REACH AREA

42.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 55% (23 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas.

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 48% bluff backed beaches, 35% barrier beaches, 17% open coastal inlets. Net shore drift - two northward transport cells diverge at the south tip of Reach Island, southward transport along the east shore and the northern half of the west shore, area of no appreciable drift between the two cells along the central leeward side of the island.

NEARSHORE PROCESS DEGRADATION (MAP 17)

More degraded.

LAND COVER (MAP 15)

27% developed, 43% beach, 29% forest, 2% wetland (Appendix B: GAP, 2009);
Riparian vegetation: 24% forest cover, 63% non-forest, 12% off-shore, 2% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.
Surf smelt breeding areas documented. Continuous and patchy eelgrass beds present (DNR, 2008).
Wetland: 1 acre of unconsolidated shore (2% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (90%); remaining 10% is a mix of Vacant; Parks, Open Space, and Recreation Areas; and Aquaculture. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

50% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be almost entirely developed with single-family residences.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 18 buoys and floats, 13 small docks, 5 buildings, Reach Island Bridge, and 1 large dock. Shoreline armoring is mapped along 97% of the reach. No tidal barriers.

PUBLIC ACCESS (MAP 14)

Public access is available to property associated with Reach Island Bridge, managed by Washington State.

AREAS OF SPECIAL INTEREST

No listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic site, the Treasure Island Bridge, which is shared with MR-18 (Case Inlet). Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect eelgrass areas as critical saltwater habitats.

Remove or reduce the linear footage of shoreline armoring and replace with soft-shore stabilization.

Restore vegetation where lacking in the riparian zone.

KEY MANAGEMENT ISSUES

- Armoring of the shoreline alters natural processes.
- Impervious surface within 200 feet of the ordinary high water mark is high and could be reduced.
- Restoration of riparian zone (restore native trees).

CASE INLET - REACH 20

SHORELINE LENGTH	LOCATION	REACH AREA
0.8 MI	ACROSS FROM STRETCH ISLAND	18.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 8% (1 acre) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) No listed erosion or landslide areas
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 55% barrier beaches, 48% bluff backed beaches. Net shore drift - two cells converge at the Stretch Island bridge, convergence zones on the east and west shores have lead to a development of a tombolo or isthmus.	NEARSHORE PROCESS DEGRADATION (MAP 17) Moderately to more degraded.
LAND COVER (MAP 15) 25% developed, 14% beach, 53% forest, 8% wetland, 1% floodplain/riparian (Appendix B: GAP, 2009); 27% forest cover forest, 53% non-forest, 10% off-shore, 11% other (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-3 for priority salmon species. Sand lance and surf smelt breeding habitat present. Wetlands – 1.0 acre (5% of reach); wetland habitat types include estuarine intertidal aquatic bed and unconsolidated shore.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listed (Category 5) for fecal coliform bacteria and dissolved oxygen (offshore).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (90%); remaining 10% is a mix of Vacant; Parks, Open Space, and Recreation Areas; and Aquaculture. Ownership – 100% Private. There are 4 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

26% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development within most of the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 2 small docks and Stretch Island Bridge. Shoreline armoring is mapped along 62% of the reach. There are no mapped tidal barriers in the reach.

PUBLIC ACCESS (MAP 14)

Public access is available to property associated with Stretch Island Bridge, managed by Washington State.

AREAS OF SPECIAL INTEREST

No contaminated sites listed by Ecology.
Medium sediment supply with no nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Revegetate shoreline (Appendix B: Anchor, 2004).

Remove unnecessary bulkheads or replace with natural logs

KEY MANAGEMENT ISSUES

- Replace bulkheads with soft-shore stabilization where feasible.
- Restoration of native trees in the riparian zone.

STRETCH ISLAND - REACH 21

SHORELINE LENGTH	LOCATION	REACH AREA
3.4 MI	STRETCH ISLAND	73.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 45% (33 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 11% erosion, 11% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 66% bluff backed beaches, 27% barrier beaches, 7% open coastal inlets. Net shore drift - predominantly northward transport along Stretch Island shore and W shore, eastward transport along the N shore, short cell with southward drift along the NW corner of the island.	NEARSHORE PROCESS DEGRADATION (MAP 17) Moderately degraded, some less degraded shoreline.
LAND COVER (MAP 15) 42% developed, 31% beach, 23% forest, 3% wetland, 1% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 33% forest cover, 39% non-forest, 17% off-shore, 12% other vegetation (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-3 for priority salmon species. Surf smelt and Pacific sand lance spawning habitat present; mostly on E shore of island. Geoduck beds also mapped offshore. Patchy eelgrass and kelp beds present (DNR, 2008). Wetlands – 1.9 acres (3% of reach); include estuarine intertidal aquatic bed, palustrine aquatic bed and emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

One 303(d) listing (Category 5) for PCBs; however, this listing is offshore.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (71%); Vacant (16%); remaining 13% is a mix of Agriculture; Aquaculture; and Parks, Open Space, and Recreation Areas. Ownership – Private (95%) and Public (5%). There are 5 aquaculture permits on this reach, all on the west side of the island.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: buoys and floats, 13 small docks, 5 buildings, Stretch Point Bridge, and 1 large dock. Shoreline armoring is mapped along 39% of the reach. There are no tidal barriers mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (95%) and Agricultural Resource Lands (5%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

Public access is available to Stretch Point beach, located in the SE portion of the reach, and property associated with Stretch Point Bridge, both managed by Washington State. They account for 10% of total linear miles. Stretch Point State Park provides access to 7% of the reach's total linear miles. The park is a total of 4 acres and is mostly undeveloped. The park has 5 mooring buoys (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

43% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006).

AREAS OF SPECIAL INTEREST

No state-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove or reduce the linear footage of shoreline armoring and replace with soft-shore stabilization. Restore vegetation where lacking in the riparian zone.

KEY MANAGEMENT ISSUES

- Protect eelgrass areas and forage fish spawning as critical saltwater habitats.
- Restoration of native vegetation in degraded riparian areas.
- Replacement of hardened bulkheads with soft-shore stabilization if feasible.

CASE INLET - REACH 22

SHORELINE LENGTH	LOCATION	REACH AREA
2.7 MI	BETWEEN STRETCH ISLAND AND MCLANE COVE	56.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 6% (3 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 7% erosion, 21% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 47% bluff backed beaches, 43% barrier estuaries, 10% barrier beaches. Net shore drift - predominantly northeastward drift, no appreciable drift on the leeward shore.	NEARSHORE PROCESS DEGRADATION (MAP 17) Least degraded.
LAND COVER (MAP 15) 19% developed, 20% beach, 50% forest, 5% wetland, 6% floodplain/riparian (Appendix B: GAP, 2009); 41% forest cover forest, 43% non-forest, 11% off-shore, 5% other natural vegetation (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-3 for priority salmon species. Surf smelt breeding areas. Bald eagle territories. Patchy kelp beds present. Wetlands – 5.9 acres (10% of reach); wetland habitat types include estuarine intertidal aquatic bed and unconsolidated shore.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listed (Category 5) for fecal coliform bacteria, dissolved oxygen, and PCBs in fish tissue (offshore).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (77%) and Vacant (23%).
Ownership – 100% Private.
There are 3 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural (86%). Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

17% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development interspersed with forested areas throughout the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 10 small docks, 1 upland bridge, and 1 building. Shoreline armoring is mapped along 15% of the reach. There are no mapped tidal barriers in the reach.

PUBLIC ACCESS (MAP 14)

DNR manages a beach near Grapeview in the southeast portion of the reach, accounting for 13% of total linear miles. Public access is available at this site.

AREAS OF SPECIAL INTEREST

No contaminated sites listed by Ecology.
High sediment supply with moderate nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a high very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads or replace with natural logs.
Revegetate the shoreline.

KEY MANAGEMENT ISSUES

- Conserve feeder bluff (Appendix B: Anchor, 2004).
- Conserve tributary mouth with emergent marsh habitat

PICKERING PASSAGE - REACH 23

SHORELINE LENGTH

2.0 MI

LOCATION

MCLANE COVE

REACH AREA

49.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 42% (20 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

5% erosion, 1% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 74% open coastal inlet shoreforms, 26% bluff backed beaches.

Net shore drift - no appreciable drift for much of the northern extent of McLane Cove, a few short converging cells in the northeast cove of the embayment.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Least degraded.

LAND COVER (MAP 15)

13% beach, 78% forest, 9% wetland (Appendix B: GAP, 2009);

Riparian vegetation: 65% forest cover, 23% non-forest, 9% off-shore, 3% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Wetlands – 2.5 acres (5% of reach); wetland types include estuarine intertidal unconsolidated shore.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Pickering Passage, 303(d) listing (Category 5) for fecal coliform bacteria. Testing conducted in the cove.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land use – Residential (48%), Vacant (22%), Forestry (18%), and Aquaculture (3%). Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

9% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered residential development throughout the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 6 small docks, East Grapeview Loop Road bridge and 1 building. No shoreline armoring or tidal barriers are mapped in the reach.

PUBLIC ACCESS (MAP 14)

There are no public access areas mapped in the reach.

AREAS OF SPECIAL INTEREST

No contaminated sites listed by Ecology. Medium sediment supply with high nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a moderate-high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Realign road corridor (Appendix B: Anchor, 2004).

Approximately 63% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES

- Conserve tributary mouth habitat (Appendix B: Anchor, 2004).

PICKERING PASSAGE - REACH 24

SHORELINE LENGTH

4.5 MI

LOCATION

SOUTH OF MCLANE COVE

REACH AREA

107.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 11% (11 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

4% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 84% bluff backed beaches, 8% open coastal inlet, 4% barrier beaches, 4% barrier estuary. Net shore drift - predominantly northeastward, several cells converge along the W portion of the N shore of Pickering Pass.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Mostly least degraded, some less degraded and narrow reach of not degraded shoreline.

LAND COVER (MAP 15)

7% developed, 26% beach, 63% forest, 4% wetland (Appendix B: GAP, 2009);
Riparian vegetation: 41% forest cover, 24% non-forest, 20% off-shore, 15% other vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.
Surf smelt spawning areas. Rock sole breeding documented. Bald eagle territories. Great blue heron breeding colony. Patchy kelp beds present.
Wetlands – 5.4 acres (5% of reach); habitat types include estuarine intertidal aquatic bed.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Pickering Passage, 303(d) listing (Category 5) for PCBs (offshore) in fish tissue. One Category 2 listing for dissolved oxygen, which indicates some evidence of water quality problems associated with that parameter.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (75%), Vacant (21%), remaining 4% is a mix of Agriculture, Aquaculture, and Forestry. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

9% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered residential development throughout the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 4 buildings, 3 small docks, and 1 buoy. Shoreline armoring is mapped along 18% of the reach. There are no mapped tidal barriers in the reach.

PUBLIC ACCESS (MAP 14)

There are no public access areas mapped in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.
Medium sediment supply with high, moderate, and low nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove floats in stream channels (Appendix B: Anchor, 2004).

Remove bulkheads or replace with natural logs.

Revegetate the shoreline.

Approximately 33% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES

- Priority area targeting mainland tributary inlets that provide good conservation opportunities that could be enhanced by implementing restoration activities (Appendix B: Anchor, 2004).
- Conserve tributary mouth and emergent marsh habitat types.
- Protect bluffs and riparian zone.

PICKERING PASSAGE - REACH 25

SHORELINE LENGTH	LOCATION	REACH AREA
4.4 MI	FROM NORTH POINT OF REACH 25 COVE TO GRAHAM POINT	101.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 13% (13 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 31% erosion, 2% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 48% bluff backed beaches, 23% barrier beaches, 12% barrier estuary, 14% open coastal inlet, 2% barrier lagoon. Net shore drift - predominantly northward, areas of no appreciable drift at the embayments, a short cell with southward drift located north of the Jones Creek embayment.	NEARSHORE PROCESS DEGRADATION (MAP 17) Mostly less degraded, with intermittent areas of least degraded shoreline.
LAND COVER (MAP 15) 21% developed, 12% beach, 49% forest, 14% wetland, 3% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 29% forest cover, 47% non-forest, 15% off-shore, 10% other natural vegetation (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-3 for priority salmon species. Surf smelt and sand lance spawning areas. Rock sole breeding documented. Geoduck mapped offshore in Pickering Passage. Patchy kelp beds. Wetlands – 13.2 acres (13% of reach); types include estuarine intertidal aquatic bed and emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Pickering Passage, Category 2 listing for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (69%); Vacant (21%); remaining 10% is a mix of Forestry; Parks, Open Spaces, and Recreation Areas; Agriculture and Aquaculture. Ownership – 100% Private.

There is 1 aquaculture permit on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 3 locations mapped in the reach where tidal barriers exist: 2 road instances and 1 fill. Overwater structures in the reach include: Harstine Island Bridge and 1 large dock. Shoreline armoring is mapped along 27% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

Public access is available at property associated with Harstine Island Bridge, managed by Washington State. Latimer's Landing Boat Launch, managed by Mason County, has a public boat launch and associated parking (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

25% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered residential development.

AREAS OF SPECIAL INTEREST

No contaminated sites listed by Ecology.
Part of reach (0.8 MI) has medium sediment supply with low nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads or replace with natural logs (Appendix B: Anchor, 2004).

Revegetate stream corridor and delta with native trees.

Sund Point Estuary Conservation and Restoration (Appendix B: PSP, 2010); Second pocket estuary south of Sund Point is a high priority for conservation and needs restoration of small riparian buffer.

Sund Point Conservation and Restoration (Appendix B: PSP, 2010); Conserve large parcels at the head of the estuary with stream bisecting; restoration needed at the mouth.

Approximately 35% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES:

- Portions of this reach are priority area consisting of mainland marshes not associated with stream mouths. Marshes are in good condition that provide important habitat for juvenile salmonids (Appendix B: Anchor, 2004).
- Portions of this reach contain mainland tributary inlets that provide good conservation opportunities
- Conserve intact riparian zone.
- Conserve emergent marsh and forest spit habitats.
- Extensive forage fish breeding areas mapped.

PICKERING PASSAGE - REACH 26

SHORELINE LENGTH	LOCATION	REACH AREA
5.8 MI	FROM GRAHAM POINT TO HUNGERFORD POINT	124.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 21% (26 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 7% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 56% bluff backed beaches, 19% barrier beaches, 17% open coastal inlet, 7% barrier lagoon. Net shore drift - predominantly northward drift, no appreciable drift in areas where drift cells commonly converge.	NEARSHORE PROCESS DEGRADATION (MAP 17) North shore is less degraded, central shore is more degraded and south shore is moderately degraded.
LAND COVER (MAP 15) 11% developed, 15% beach, 58% forest, 12% wetland, 4% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 41% forest cover, 41% non-forest, 7% off-shore, 12% other natural vegetation (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-3 for priority salmon species. Pacific herring, surf smelt and sand lance spawning areas. Rock sole breeding documented. Hardshell clam beds present. Geoduck mapped offshore in Pickering Passage. Patchy kelp beds present. Wetlands – 6.7 acres (5% of reach); habitat types include estuarine intertidal aquatic bed, emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Pickering Passage, 303(d) listing (Category 5) for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (80%), Vacant (17%), remaining 3% is a mix of Forestry, Parks, Open Space, and Recreation Areas. Ownership – 100% Private.

There are 2 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 24 small docks, 9 buoys and floats, 5 bridges and 3 large docks, and 2 buildings. Shoreline armoring is mapped along 43% of the reach. No tidal barriers are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (97%) and Rural Tourist (3%). Comprehensive Plan Designations – 100% Rural. Existing SED – Urban Residential (97%) and Rural (3%).

PUBLIC ACCESS (MAP 14)

Public access is available at South Graham Point and Latimer's Landing Overflow Parking, both managed by Mason County. Latimer's Landing Overflow Parking is a community park that is 2.5 acres in total size. The park has a boat launch and fishing access (Mason Co. Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

14% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development interspersed with forested areas throughout the reach.

AREAS OF SPECIAL INTEREST

No contaminated sites listed by Ecology.
The reach (0.6 MI) has medium sediment supply and low nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads or replace with natural logs (Appendix B: Anchor, 2004).

Remove floating dock that ground at low tide.

Replace culvert with a bridge spanning the stream/delta.

Revegetate shoreline and conserve intact riparian zones.

KEY MANAGEMENT ISSUES

- Portions of this reach are priority area consisting of mainland marshes not associated with stream mouths. Marshes are in good condition and provide important habitat for juvenile salmonids (Appendix B: Anchor, 2004).
- Conserve emergent marsh, mudflat habitat, and forest spit habitats.
- Conserve extensive surf smelt breeding areas.

HARSTINE ISLAND - REACH 40

SHORELINE LENGTH

3.3 MI

LOCATION

NW SHORE OF HARSTINE
ISLAND, DOUGALL POINT TO
INDIAN COVE

REACH AREA

71.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 19% (14 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

44% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 80% bluff backed beaches, 11% barrier beaches, 9% barrier lagoon.

Net shore drift - predominantly northward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Mostly less degraded, with some least degraded shoreline.

LAND COVER (MAP 15)

7% developed, 18% beach, 73% forest, 3% wetland (Appendix B: GAP, 2009);

Riparian: 46% forest cover, 18% non-forest, 19% off-shore, 17% other (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Geoduck and hardshell clam beds present. Patchy kelp beds present. Wetland: 1 acre of estuarine intertidal unconsolidated shore (1% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Pickering Passage, 303(d) listing (Category 5) for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Parks, Open Space, and Recreation Areas (44%); Residential (28%); Vacant (20%); remaining 8% is a mix of Forestry; Aquaculture; and Transportation. Ownership – 100% Private.

There are 3 aquaculture permits at the southern end of this reach on the east side of the island.

SHORELINE MODIFICATIONS (MAP 16)

There are 2 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 1 upland bridge and 1 small dock. Shoreline armoring occurs along 14% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There are no public access areas mapped in the reach.

IMPERVIOUS SURFACES (MAP 16)

21% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show residential development interspersed with forested areas throughout the reach.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.
A portion of the reach (1.3MI) has exceptional sediment supply and high nearshore connectivity. High sediment supply with high nearshore connectivity also present in the reach (<0.1MI) (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads and riprap or replace with natural logs (Appendix B: Anchor, 2004).

Remove road along top of the spit.

Revegetate shoreline.

Replace tires making up the breakwater with natural logs.

Dougall Point Lagoon to North Point Spit Restoration (Appendix B: PSP, 2010); Creating a suite of projects, this project would also restore the North Point neighborhood spit and target the bulkhead north of the pocket estuary, with one small bulkhead within the pocket estuary.

KEY MANAGEMENT ISSUES

- Portions of this reach are priority area that has exceptional supply of sediments that remain well connected to the nearshore. Shoreline includes largely intact riparian vegetation (Appendix B: Anchor, 2004).
- Conserve coastal feeder bluffs and intact riparian corridors.
- Documented forage fish spawning at Dougall Point.
- The feeder bluffs present along the entire unit are rated as exceptional.

HARSTINE ISLAND - REACH 41

SHORELINE LENGTH

1.7 MI

LOCATION

INDIAN COVE TO NORTHERN
LIMIT OF JARRELL COVE,
W SHORE OF HARSTINE ISLAND

REACH AREA

41.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 80% (31 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

14% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 87% bluff backed beaches, 7% open coastal inlet, 6% barrier beaches. Net shore drift - predominantly NE drift, a short cell with SW drift at Indian Cove.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Least degraded.

LAND COVER (MAP 15)

2% beach, 96% forest, 2% wetland (Appendix B: GAP, 2009);

Riparian vegetation: 74% forest cover, 12% non-forest, 7% off-shore (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Sand lance spawning habitat and hardshell clam beds present. Patchy kelp beds present.

Wetland: 1.1 acre of estuarine intertidal unconsolidated shore mapped (3% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Pickering Passage, 303(d) listing (Category 5) for fecal coliform bacteria and PCBs (tissue).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (53%); Parks, Open Space, and Recreation Areas (29%); and Vacant (19%).
Ownership – Private (91%) and Public (9%).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Rural.

IMPERVIOUS SURFACES (MAP 16)

5% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos show a marina at Indian Cove in the northern part of the reach; the rest of the reach is mostly forested with scattered single-family residences.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 1 large dock. Shoreline armoring is mapped along 18% of the reach. No tidal barriers are mapped in the reach.

PUBLIC ACCESS (MAP 14)

A portion of Jarrell Cove State Park is located in this reach. See Reach 42 for more information.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.
High sediment supply with high nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Replace tires making up the breakwater with natural logs (Appendix B: Anchor, 2004).

Remove bulkheads or replace with natural logs.

Revegetate shoreline.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Portions of this reach are priority area with riparian vegetation and unmodified shoreline that could contribute to maintaining high functioning habitat for juvenile salmonids. Area provides important early estuarine rearing habitat for outmigrants (Appendix B: Anchor, 2004).

HARSTINE ISLAND - REACH 42

SHORELINE LENGTH

2.5 MI

LOCATION

JARRELL COVE

REACH AREA

59.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 42% (25 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

5% erosion, 6% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 82% open coastal inlet. 18% bluff backed beaches. Net shore drift - southward drift along the western shore, large area of no appreciable drift in the bayhead of the cove, northeastward drift along the northeastern shore.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Least degraded.

LAND COVER (MAP 15)

3% developed, 11% beach, 71% forest, 7% wetland, 8% floodplain/riparian (Appendix B: GAP, 2009);
Riparian vegetation: 61% forest cover, 27% non-forest, 7% off-shore, 5% other (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.
Sand lance spawning habitat and hardshell clam beds present. Kelp beds present.
Wetlands – 11.8 acres (20% of reach); wetland habitat types include estuarine intertidal aquatic bed, emergent, and unconsolidated shore.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

One Category 2 listing for fecal coliform bacteria, which indicates some evidence of water quality problems associated with that parameter.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (54%); Parks, Open Space, and Recreation Areas (24%); Vacant (12%); remaining 10% is a mix of Transportation; Forestry; and Aquaculture. Ownership – Private (80%) and Public (20%).

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 6 small docks, 4 large docks, and 1 buoy. Shoreline armoring is mapped along 8% of the reach. No tidal barriers. Replacement of road culvert on south end tributary to Jarrell Cove to facilitate fish passage. Jarrell Cove Marina is located across from Jarrell Cove State Park. The marina has 70 slips and a fuel dock (Sail the Net, 2011).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (96%) and Rural Tourist (4%). Comprehensive Plan Designations – 100% Rural.

Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

Jarrell Cove State Park, managed by WA State Parks, and surrounding Jarrell Cove beach, managed by DNR, account for 30% of total linear miles in this reach. Jarrell Cove State Park has 22 campsites, 2 docks with 680 feet of moorage, 14 mooring buoys, hiking and biking trails, volleyball field and a badminton area. The total park size is 106 acres, a portion in this reach. Harstine Island State Park is an 310-acre undeveloped park with 3,100 feet of tidelands (Mason County Parks and Trails, 2006; WA State Parks, 2011).

IMPERVIOUS SURFACES (MAP 16)

10% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a marina on the NW side of Jarrell Cove; the central part of the reach is single-family residential development, while the NE is forested.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

A portion of the reach (0.2 MI) has high sediment supply with high nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone and revegetate shoreline with native vegetation.

Remove bulkheads or replace with natural logs (Appendix B: Anchor, 2004).

Remove float that grounds at low tide.

Approximately 39% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003)

KEY MANAGEMENT ISSUES

- Portions of this reach are priority area with riparian vegetation and unmodified shoreline that could contribute to maintaining high functioning habitat for juvenile salmonids. Area provides important early estuarine rearing habitat for outmigrants (Appendix B: Anchor, 2004).

HARSTINE ISLAND - REACH 43

SHORELINE LENGTH

6.7 MI

LOCATION

SOUTH OF JARRELL COVE TO
SHORE FACING SQUAXIN
ISLAND

REACH AREA

158.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 88% (139 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

37% erosion, 7% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 79% bluff backed beaches, 10% barrier beaches, 6% open coastal inlets, 4% barrier estuary. Net shore drift - predominantly northward drift, small area of no appreciable drift, small area of E drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Least degraded.

LAND COVER (MAP 15)

3% developed, 1% open water, 14% beach, 68% forest, 12% wetland, 2% floodplain/riparian (Appendix B: GAP, 2009);

Riparian vegetation: 67% forest cover, 22% non-forest, 7% off-shore, 5% other (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Sand lance spawning habitat is mapped by PHS. Significant hardshell clam beds. Oyster beds present. Patchy kelp beds present. Wetlands: 2.9 acres (2% of reach); includes estuarine intertidal aquatic bed.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

One Category 2 listing for fecal coliform bacteria, which indicates some evidence of water quality problems.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (55%); Vacant (36%); and remaining 9% is a mix of Forestry and Agriculture. Ownership – 100% Private.

There are 3 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Rural (90%) and Conservancy (10%).

IMPERVIOUS SURFACES (MAP 16)

10% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show stretches of intact forested interspersed with single-family residential development.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 5 small docks, 3 buoys and floats, and 1 upland bridge and the Harstine Island Bridge. Shoreline armoring is mapped along 11% of the reach. No tidal barriers are mapped in the reach.

PUBLIC ACCESS (MAP 14)

DNR tidelands associated with Harstine Island beach and Jarrell Cove beach provide public access. Public access is also available to property associated with Harstine Island Bridge, managed by Washington State. The beaches and bridge property account for 11% of total linear miles.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

Part of reach (2.8 MI) has medium sediment supply with moderate and high nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian areas and revegetate shoreline with native plantings.

Remove bulkheads or replace with natural logs (Appendix B: Anchor, 2004).

Remove dock and boat removal structure.

Harstine Island Pocket Estuary Conservation (Appendix B: PSP, 2010); This reach (NW point of Harstine to Dougall Point) has one pocket estuary that is a priority for conservation with surf smelt spawning and is a priority sediment source. It is one large parcel with no armoring.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Conserve feeder bluffs (Appendix B: Anchor, 2004).
- Conserve stream delta, lagoon with emergent marsh and spit (Appendix B: Anchor, 2004).
- Significant shellfish (clam and oyster beds) present.

HARSTINE ISLAND - REACH 44

SHORELINE LENGTH

2.6 MI

LOCATION

WEST SHORE OF HARSTINE
ISLAND FACING SQUAXIN
ISLAND

REACH AREA

60.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY

Floodplain - 93% (56 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

4% erosion

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 40% bluff backed beaches, 32% barrier lagoon. Net shore drift - predominantly northward drift, small area of eastward drift at the N end of the reach.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Mostly less degraded with small reach of more and least degraded shoreline.

LAND COVER (MAP 15)

1% developed, 40% beach, 53% forest, 6% wetland (Appendix B: GAP, 2009);

Riparian vegetation: 66% forest cover, 30% non-forest, 3% other (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Hardshell clam beds present. Continuous and patchy kelp beds present. Wetland: 1.6 acres of estuarine intertidal unconsolidated shore (3%).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Squaxin, Peale and Pickering Passage, 303(d) listing (Category 5) for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (55%); Forestry (30%); remaining 15% is a mix of Vacant; Aquaculture; and Parks, Open Space, and Recreation Areas.

Ownership – 100% Private.

There is 1 aquaculture permit on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Rural.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 2 small docks, 1 buoy, and 1 upland bridge. Shoreline armoring is mapped along 22% of the reach. There are no mapped tidal barriers in the reach.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

IMPERVIOUS SURFACES (MAP 16)

9% of reach is mapped as impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of forested areas and residential development in the N part of the reach, while the S part of the reach is more intact forest. A shellfish processing facility is located in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.
High sediment supply with moderate nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Create riparian buffer and set back shellfish operations (Appendix B: Anchor, 2004).

Revegetate shoreline with native plantings.

Remove pipe outfall depositing in tributary mouth.

Salmon Point Shoreline Restoration (Appendix B: PSP, 2010); Priority restoration site at the tip of the Salmon Point. Currently there is armoring that would be removed to expand the existing intertidal vegetation. A freshwater stream feeds the site and there is forage fish spawning.

Salmon Point Pocket Estuary Conservation (Appendix B: PSP, 2010); There are two pocket estuaries south of Salmon Point that are priorities for conservation with freshwater streams feeding them and intertidal vegetation.

NW Harstine Island Conservations (Appendix B: PSP, 2010); This unit (Salmon Point to the northwest point of Harstine) has four pocket estuaries within it, all high priorities for conservation due to priority sediment sources and/or forage fish spawning.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Priority area due to two tributaries that can provide favorable rearing conditions for juvenile salmonids outmigrants. Restoration opportunities could enhance water quality and prey productivity in the area as well as provide improved predator refuge habitat (Anchor, 2004).

HARSTINE ISLAND - REACH 45

SHORELINE LENGTH

3.7 MI (INCLUDING BRISCOE POINT)

LOCATION

W SIDE OF HARSTINE ISLAND
SOUTH TO BRISCOE POINT

REACH AREA

76.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 99% (75 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

66% erosion

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 58% bluff backed beaches, 27% barrier beaches, 14% barrier lagoon shores. Net shore drift - predominantly northward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

LAND COVER (MAP 15)

16% beach, 76% forest, 6% wetland, 2% floodplain/riparian (Appendix B: GAP, 2009);
Riparian vegetation: 63% forest cover, 25% non-forest, 7% off-shore (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.
Hardshell clam beds present. Patchy kelp beds present. Wetland: 1.7 acres of estuarine intertidal unconsolidated shore (2% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (53%); Forestry (34%); remaining 13% is a mix of Vacant and Aquaculture. Ownership – 100% Private.

There is 1 aquaculture permit on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There is 1 instance in the reach where a mapped road serves as a tidal barrier. Overwater structures in the reach include: 5 buoys and floats, 2 small docks, 2 bridges, and 1 building. Shoreline armoring is mapped along 15% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

IMPERVIOUS SURFACES (MAP 16)

2% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show stretches of intact forest interspersed with single-family residential development.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

High sediment supply with moderate nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a moderate-high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Remove bulkheads or replace with natural logs (Appendix B: Anchor, 2004).

Revegetate shoreline with native plantings (Appendix B: Anchor, 2004).

Brisco Point Pocket Estuary Passage Restoration (Appendix B: PSP, 2010); Pocket estuary on the Southern tip of Brisco Point has a tidal barrier. Remove tidal barrier and restore estuary function.

KEY MANAGEMENT ISSUES

- Protection of existing high quality forested riparian areas.
- Restoration to remove tidal barriers.

HARSTINE ISLAND - REACH 46

SHORELINE LENGTH

6.9 MI

LOCATION

FROM BRISCOE POINT NORTH
PAST FUDGE POINT

REACH AREA

159.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 2% (4 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

14% erosion, 3% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 73% bluff backed beaches, 22% barrier beaches, 4% barrier estuaries, 1% barrier lagoon. Net shore drift - northward drift along the E shore of the island to just beyond Fudge Point, no drift on leeward shore of Buffington's Lagoon.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

LAND COVER (MAP 15)

1% developed, 14% beach, 78% forest, 5% wetland, 2% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 62% forest cover, 19% non-forest, 6% off-shore, 12% other vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species. Sand lance spawning habitat present. Patchy kelp beds present. Wetlands: 4.4 acres (3% of reach); habitat types include estuarine intertidal aquatic bed, emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (46%); Forestry (31%); and Vacant (23%). Ownership –Private (99%) and Public (1%).

There are 6 aquaculture permits on this reach, most near the northern end of the reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 4 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 9 small docks, 6 buildings, and 1 upland bridge. Shoreline armoring is 17% of reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

IMPERVIOUS SURFACES (MAP 16)

0% of reach is mapped as impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show stretches of intact forest interspersed with single-family residential development.

AREAS OF SPECIAL INTEREST

The reach has a section with medium sediment supply and high nearshore connectivity (0.4 mi) and a section with medium sediment supply and moderate connectivity (0.4 mi) (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian areas, and re-vegetate shoreline.

Remove bulkheads or replace with natural logs (Appendix B: Anchor, 2004).

Fudge Point Conservation and Restoration (Appendix B: PSP, 2010); This property is a priority for conservation with numerous freshwater streams and a pocket estuary. The bluff is a priority sediment source.

Wilson Point Pocket Estuaries Conservation (Appendix B: PSP, 2010); Wilson Point and the spit to the south are high priorities for conservation with a pocket estuary and priority sediment sources. Large parcels and sand land and surf smelt spawning throughout. The spit has no armoring or tidal barriers.

KEY MANAGEMENT ISSUES

- Portions of this reach are priority area providing a long, primarily intact stretch of shoreline that has an exceptional supply of sediment that is well connected to the nearshore (Appendix B: Anchor, 2004).
- Conserve lagoons and emergent marsh habitat (Appendix B: Anchor, 2004).
- Conserve feeder bluffs and forage fish spawning beaches (Appendix B: Anchor, 2004).
- Replace hardened bulkheads with soft-shore stabilization if feasible.
- Protect existing intact forested riparian areas.

HARSTINE ISLAND - REACH 47

SHORELINE LENGTH

3.3 MI

LOCATION

E SHORE OF HARSTINE ISLAND,
NORTH PAST MCMICKEN
ISLAND TO DOUGALL POINT

REACH AREA

78.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 2% (2 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

8% erosion, 24% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 82% bluff backed beaches, 13% barrier estuary, 5% barrier beaches. Net shore drift - two cells converge on the shore landward on McMicken Island, northward drift converges with a southward drift cell at a barrier embayment.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Least degraded with small section of less degraded shore.

LAND COVER (MAP 15)

1% developed, 5% beach, 87% forest, 5% wetland, 2% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 67% forest cover, 13% non-forest, 12% off-shore, 7% other (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species. Hardshell clam beds and oyster beds present. Wetlands – 2.1 acres (3% of reach); wetland habitat types include estuarine intertidal aquatic bed and unconsolidated shore.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listing (Category 5) for dissolved oxygen (offshore).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (45%); Residential (32%); Forestry (20%); remaining 3% is a mix of Aquaculture and Parks, Open Space, and Recreation Areas. Ownership – 100% Private.

There are 4 aquaculture permits on this reach, most near the southern end of the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include 1 small dock. No shoreline armoring or tidal barriers are mapped along the reach. Aquaculture facilities are located at the north end of the reach

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Rural (82%) and Conservancy (18%).

PUBLIC ACCESS (MAP 14)

Fudge Point, managed by Washington State Parks accounts for 16% of total linear miles. Public access is available at this site.

IMPERVIOUS SURFACES (MAP 16)

1% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show stretches of intact forest interspersed with single-family residential development.

AREAS OF SPECIAL INTEREST

No listed contaminated sites.
A portion of the reach (0.4 MI) has medium sediment supply with high nearshore connectivity (CGS, 2003)

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian areas.

Harstine Island Conservation (Appendix B: PSP, 2010); Washington State Parks and Recreation Commission's Harstine Island acquisition project protects the fee simple interest of approximately 112 acres of tidelands, wetlands and associated uplands.

The shorelines of Dougall Point have been substantially impacted by shoreline hardening. The lagoon to the south has been recommended as a priority restoration site due to loss of the riparian corridor, shoreline hardening and a road built on the spit (South Puget Sound Salmon Recovery Group, 2005).

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Conserve overhanging riparian vegetation and intact riparian corridor (Appendix B: Anchor, 2004).
- Conserve stream mouth habitat (Appendix B: Anchor, 2004).

MCMICKEN ISLAND - REACH 48

SHORELINE LENGTH

0.6 MI

LOCATION

MCMICKEN ISLAND

REACH AREA

9.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 77% (7 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

2% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 85% bluff backed beaches, 15% barrier beaches. Net shore drift - northeastward drift refracts around the north tip of the island, southward drift and northwestward drift converge at the southwest point of the island.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Least degraded.

LAND COVER (MAP 15)

30% beach, 55% forest, 16% wetland (Appendix B: GAP, 2009);

Riparian vegetation: 71% forest cover, 4% non-forest, 18% other (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Herring spawning habitat present. Patchy kelp beds present. No wetlands are mapped in this reach.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Case Inlet and Dana Passage, 303(d) listing (Category 5) for dissolved oxygen (offshore).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Parks, Open Space, and Recreation Areas. Ownership – Public (100%)

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Conservancy.

IMPERVIOUS SURFACES (MAP 16)

0% of reach is mapped as impervious (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show most of the island to be forested, with a few structures at the south end of the island.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include 1 buoy. No shoreline armoring or tidal barriers are mapped along the reach.

PUBLIC ACCESS (MAP 14)

McMicken Island State Park, managed by Washington State Parks, is an undeveloped park that serves as a boater destination. Activities include hiking trails, wildlife viewing, and shellfish harvesting. It provides public access to 100% of the linear miles in the reach (Mason County Parks and Trails, 2006; WA State Parks, 2011).

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian areas and native vegetation.

Provide amenities for public access where not in conflict with habitat protection.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Balance recreational uses with environmental protection and habitat conservation.

STRETCH ISLAND - REACH 21

SHORELINE LENGTH

3.4 MI

LOCATION

STRETCH ISLAND

REACH AREA

73.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 45% (33 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

11% erosion, 11% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 66% bluff backed beaches, 27% barrier beaches, 7% open coastal inlets.

Net shore drift - predominantly northward transport along Stretch Island shore and W shore, eastward transport along the N shore, short cell with southward drift along the NW corner of the island.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Moderately degraded, some less degraded shoreline.

LAND COVER (MAP 15)

42% developed, 31% beach, 23% forest, 3% wetland, 1% floodplain/riparian (Appendix B: GAP, 2009);

Riparian vegetation: 33% forest cover, 39% non-forest, 17% off-shore, 12% other vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species.

Surf smelt and Pacific sand lance spawning habitat present; mostly on E shore of island. Geoduck beds also mapped offshore. Patchy eelgrass and kelp beds present (DNR, 2008). Wetlands – 1.9 acres (3% of reach); habitats include estuarine intertidal aquatic bed, palustrine aquatic bed and emergent.

PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

One 303(d) listing (Category 5) for PCBs; however, this listing is offshore.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (71%); Vacant (16%); remaining 13% is a mix of Agriculture; Aquaculture; and Parks, Open Space, and Recreation Areas. Ownership – Private (95%) and Public (5%).

There are 5 aquaculture permits on this reach, all on the west side of the island.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (95%) and Agricultural Resource Lands (5%). Comprehensive Plan Designations – 100% Rural.

Existing SED – 100% Urban Residential.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: buoys and floats, 13 small docks, 5 buildings, Stretch Point Bridge, and 1 large dock. Shoreline armoring is mapped along 39% of the reach. There are no tidal barriers mapped in the reach.

PUBLIC ACCESS (MAP 14)

Public access is available to Stretch Point beach, located in the SE portion of the reach, and property associated with Stretch Point Bridge, both managed by Washington State. They account for 10% of total linear miles. Stretch Point State Park provides access to 7% of the reach's total linear miles. The park is a total of 4 acres and is mostly undeveloped. The park has 5 mooring buoys (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

43% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006).

AREAS OF SPECIAL INTEREST

No state-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove or reduce the linear footage of shoreline armoring and replace with soft-shore stabilization.
Restore vegetation where lacking in the riparian zone.

KEY MANAGEMENT ISSUES

- Protect eelgrass areas and forage fish spawning as critical saltwater habitats.
- Replace hardened armoring with soft-shore stabilization if feasible.
- Restore degraded vegetation in riparian areas.

HOPE ISLAND - REACH 35

SHORELINE LENGTH

1.6 MI

LOCATION

HOPE ISLAND

REACH AREA

36.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 50% (18 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

45% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 63% bluff backed beaches, 34% barrier beach, 3% barrier estuary. Net shore drift - northward drift along the eastern shore, southward drift along the north and southwest shore.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Not degraded.

LAND COVER (MAP 15)

6% beach, 93% forest, 1% wetland (Appendix B: GAP, 2009);

Riparian vegetation: 93% forest cover, 3% non-forest, 4% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-3 for priority salmon species. Pacific sand lance and surf smelt spawning habitat present. Breeding habitat for rock sole. Hardshell clam beds present. Continuous and patchy kelp beds are mapped. Bald eagle breeding area. Wetlands: 1.2 acres of estuarine intertidal unconsolidated shore (3% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

No 303(d) Category 5 listings. One Category 2 listing for fecal coliform bacteria, which indicates some evidence of water quality problems.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Vacant. Ownership – Public (98%) and Private (2%).

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Hope Island State Park, managed by Washington State Parks, provides public access to 52% of total linear miles. The park is 106 acres in total size and accessible only by boat. The park has old growth forests, saltwater marshes, and a sandy beach. Camping is available on the island (Mason County Department of Parks and Trails, 2006; Washington State Park, 2011).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be almost entirely undeveloped and in forest cover.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

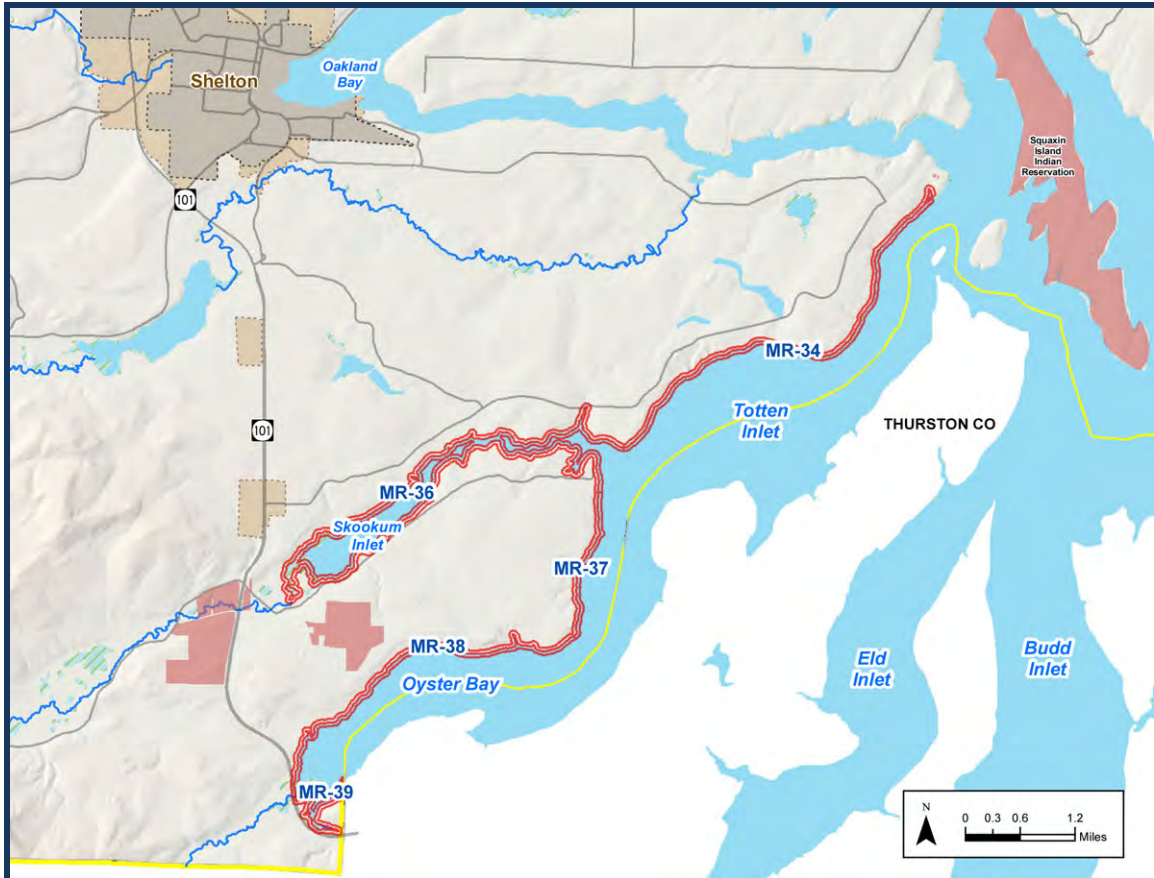
OPPORTUNITY AREAS

- Protect existing forested riparian areas.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Protection of forage fish habitat and spawning beaches.

5.2 Totten Inlet (including Skookum Inlet and Oyster Bay)



5.2.1 Physical Characterization and Modifications

Totten Inlet and Little Skookum Inlet are located in Mason County as part of South Puget Sound. Totten and Little Skookum Inlets are part of the Kennedy sub-basin in WRIA 14a (Kennedy-Goldsborough Creeks). Skookum Creek and Kennedy Creek are the major streams; these are discussed as freshwater shorelines of the state under Chapter 6.

Coastal Processes and Shore Type

Totten and Little Skookum Inlets are some of the most sheltered low-energy shores of the Puget Sound region. Little Skookum Inlet is highly complex, with frequent changes in shore orientation and includes several minor embayments. Erosion rates are very slow in this environment, as are sediment transport rates. Close to half of Little Skookum Inlet is mapped as having no appreciable drift due to the negligible quantity of sediment transport resulting from very low wave energy. The entire inlet was mapped by PSNERP as a large open coastal inlet. Totten Inlet is similar in character to Budd Inlet in Thurston County, as it is comprised largely of bluff backed beaches with many small embayments (see Table 5-5). Contiguous net shore-drift cells are mapped north of Oyster Bay, which is an area with no appreciable drift. Depositional shoreforms found within this area include: a single barrier estuary, intermittent barrier beaches and open coastal inlets and an artificial shoreform just north of Oyster Bay.

Coastal bluffs are an important feature of marine shorelines in Mason County. Coastal bluffs provide sand and sediment to the nearshore environment and contribute to the formation of beaches, spits and natural processes related to net shore drift. Beaches that are backed by bluffs have been mapped by the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). Table 5-5 indicates the percentage of bluff-backed beaches by region in Totten Inlet, Skookum Inlet, and Oyster Bay.

Table 5-5. Percent of Region Mapped as Bluff-backed Beach

Marine Region	Reaches	Bluff-back Beaches %
Totten Inlet	34, 37, 38	85
Skookum Inlet	36	7
Oyster Bay	39	-

The presence of bluff-backed beaches is an important indicator of the value of the reach in terms of supporting nearshore processes and it is also an indicator of the suitability of the shore for human development. The Washington Department of Natural Resources has mapped portions of South Puget Sound shoreline as a landslide and/or erosion hazard area (Table 5-6). Totten Inlet has higher concentrations of hazard areas suggesting the marine shore is potentially hazardous for development. Some of these areas are already partially developed with single family homes.

Table 5-6. Percent of Reach Mapped as Landslide Hazard or Erosion Hazard

Marine Region	Reaches	Landslide Hazard %	Erosion Hazard %
Totten Inlet	34, 37, 38	19	33
Skookum Inlet	36	2	1
Oyster Bay	39	-	-

5.2.2 Water Quality

Totten Inlet, Little Skookum Inlet and Oyster Bay are part of the Sound Puget Sound Dissolved Oxygen Study (Ecology 2008a); similar to the rest of South Sound which is being evaluated for nutrient loading leading to low levels of dissolved oxygen. In addition, Totten Inlet and Little Skookum Inlet have been part of a TMDL undertaken by the EPA and Ecology for fecal coliform. In addition, as part of the fecal coliform pollution reduction program, Mason County Public Health Department has conducted a septic system survey and analysis to evaluate septic sources of nutrients (Mason County PH, 2009). Nutrient loading contributing to the low levels of dissolved oxygen are likely related to non-point sources such as septic sewer systems, agricultural runoff, use of fertilizers and other man-made sources.

The Washington State Department of Health's (DOH) Office of Shellfish and Water Protection, in addition to local health jurisdictions, monitor Totten Inlet and Skookum Inlet water quality and classify commercial and recreational shellfish harvest areas to protect human health. Samples are collected to analyze fecal coliform concentrations in the water (used to indicate the presence of pathogens that cause disease and illnesses in humans), in addition to paralytic shellfish poisoning and domoic acid samples (WDOH, 2011). Growing areas are classified as Approved, Conditionally Approved, Restricted, or Prohibited. An interactive map provides information on current marine biotoxin closure zones is available at DOH's website:

<http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Step=1>

5.2.3 Critical or Priority Habitat and Species

Critical or priority habitats and priority species mapped within the Mason County shoreline jurisdiction of Totten Inlet are specifically covered in this section. Discussion of the priority habitats and species follows, with select quantitative data only located in the reach sheets, where noted.

According to the PHS data, Totten Inlet supports several federal and state-listed priority salmonid species (Appendix B: WDFW, 2011; Table 5-2).

Table 5-7. Priority salmonid species documented for Totten Inlet and Skookum Inlet

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Presence/Migration	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Presence/Migration	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~

Critical habitat has been designated for the Puget Sound ESU Chinook salmon for all reaches covered in this section, extending upstream to the point of tidal influence. Critical habitat has also been designated for the Southern Resident killer whale DPS for all reaches covered in this section, extending to waters deeper than 20 feet (Appendix B: USFWS, 2010).

Spawning areas for forage fish, including Pacific herring, surf smelt and sand lance, are also listed as priority habitats. Forage fish are important links in the ecosystem of South Puget Sound as they provide a key food source for marine birds, rockfish, salmon and numerous other fish species (Pentilla, 2007). These fish spawn in the intertidal areas of South Puget Sound. Holding habitat for herring is mapped by WDFW as occurring in Totten Inlet (Appendix B: WDFW, 2011). Sand lance spawning habitat is recorded in Marine Reach 34 (Appendix B: WDFW, 2011). Pacific surf smelt spawning in Totten Inlet is mapped along the nearshore for all marine reaches covered in this section, with the exception of MR 39 (Appendix B:

WDFW, 2011). Essential fish habitat for rock sole is mapped for marine reaches 34 and 37 (Appendix B: WDFW, 2011).

Native and commercial shellfish including hardshell clam and oyster beds are recorded for selected reaches and described on the reach sheets (Appendix B: WDFW, 2011).

Patchy occurrences of kelp beds are recorded for two reaches in Totten Inlet as described on the reach sheets that follow (DNR, 2008). Kelp species, such as bull kelp (*Nereocystis luetkeana*), giant kelp (*Macrocystis integrifolia*) and non-floating kelp species have limited distribution within the Mason County portion of Puget Sound. Non-floating kelp species are the most widely distributed, primarily concentrated in parts of Hood Canal, Hammersley Inlet, and Totten Inlet (Eissinger, 2009).

Priority wildlife species known to occur include mountain quail, purple martin, and bald eagle. Nesting bald eagle habitat is also documented in Totten Inlet and Little Skookum Inlet (Appendix B: WDFW, 2011). Wetlands, a priority habitat, are found in many reaches located in this section (Appendix B: USFWS, 2010). Estuarine wetlands occur at the mouths of bays, pocket estuaries and river deltas.

5.2.4 Shoreline Land Use

Land use in shoreline areas refers to current uses, broader land use patterns and existing development within the shoreline jurisdiction. Land use is a mix of residential, forestry, aquaculture and vacant lands along Totten Inlet, Little Skookum Inlet and Oyster Bay.

Aquaculture is a significant resource and important economic driver in Mason County. Between 2007 and 2011, the U.S. Army Corps of Engineers received 69 general permit applications for shellfish operations (See Appendix A, Figure 26). Large commercial shellfish growers operating in Totten Inlet and Skookum Inlet are Arcadia Point Seafood and Taylor Shellfish. In addition, many of the shellfish growers are small family businesses dating back generations. According to Assessor's data, commercial or tribal aquaculture is present on 4 of 5 reaches.

There are several docks and piers and limited armoring located throughout these shorelines. Public access is only available by accessing tidelands managed by WDNR in parts of Little Skookum Inlet and Oyster Bay.

5.2.5 Shoreline Modifications

The PSNERP Strategic Needs Assessment composite measure of degradation to multiple nearshore processes highlights areas to target for restoration and conservation within Mason County (see Section 5.1.6). Within the shores of Totten and Skookum Inlets and Oyster Bay nearshore process degradation was most commonly mapped as “least” and “less” degraded. Only one area was mapped as “moderately” degraded, which was located along the shore south of the mouth of Little Skookum Inlet.

Existing man-made structures, along with modifications to the shoreline, occur along Totten and Skookum Inlets and Oyster Bay and are part of this shoreline characterization. These are referred to as shoreline modifications, which include bridges, bulkheads (i.e., shoreline armoring), roads, dikes and overwater structures like docks. The number and extent of modifications along the shoreline in Totten and Skookum Inlets and Oyster Bay has been described by marine region (Appendix B: PSNERP, 2010).

Table 5-8. Shoreline Modifications by Region for Totten and Skookum Inlets and Oyster Bay

Marine Region	Overwater Structures				Tidal Barrier			Shoreline Armoring
	Bridges	Buildings	Buoys	Docks	Fill	Dike	Road	
Totten Inlet	-	5	3	15	4	-	1	11%
Skookum Inlet	1	4	8	13	-	-	-	5%
Oyster Bay	-	-	-	-	-	-	3	2%
Total	1	9	11	28	4	0	4	7%

5.2.6 Land Cover

Land cover provided in this section refers to both the aerial extent of existing vegetation and the coverage of developed areas (paved or built surfaces) within the shoreline jurisdiction. Riparian vegetation is an important feature of marine habitats in Puget Sound. Several studies have shown that salmon in Hood Canal and Puget Sound feed on insects falling from terrestrial or upland vegetation (Simenstad, 2000).

According to the GAP 2009 data, the dominant land cover type for Little Skookum and Totten Inlets is conifer dominated forest at 42 percent. The next highest percent cover is provided by harvested forest at 19 percent. The third highest land cover type is salt, brackish, and estuary wetland at 7 percent. Developed land comprises 6 percent of the overall land cover of Totten Inlet shorelines.

According to the PNPTC 2011 data set, the dominant land cover type of Little Skookum and Totten Inlets is forest cover at 63 percent. The next highest percent cover is provided by non-forest at 23 percent. The third highest land cover type is other natural vegetation, at 9 percent, and off-shore comprises 5 percent of the overall land cover.

5.2.7 Public Access Opportunities

Public access to the shorelines of Totten Inlet and Little Skookum Inlet is limited to access from water as part of the Cascadia Marine Trail (a state-recognized water trail for non-motorized boaters). State-owned tidelands also provide public access to intertidal zones where recreational shellfish harvest is popular. The Mason County Regional Trail Plan (2008) notes that public access opportunities exist in the form of overlooks, boat launches, waterfront parks, trails, short path or stairs, and small parking areas. Public access is often provided by highways and roads but without adequate public parking.

5.2.8 Summary of Key Management Issues

Key management issues for Totten Inlet and Little Skookum Inlet include the following: 1) protection of documented forage fish spawning beaches and native shellfish beds; 2) conservation of riparian forested cover where unaltered; 3) protection of intact marshes, stream deltas and pocket estuaries; 4) protection and improvement of water quality to support significant recreational and tribal shellfish harvest and commercial aquaculture; and 5) conservation of priority fish species in major salmonid-bearing streams.

5.2.9 Reach Analysis

An analysis by marine reach is given in the following section. Reach sheets are provided corresponding to specific segments as listed below:

- Totten Inlet (Reaches 34, 37 and 38);
- Little Skookum Inlet (Reach 36); and
- Oyster Bay (Reach 39).

Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

TOTTEN INLET - REACH 34

SHORELINE LENGTH

5.4 MI

LOCATION

BETWEEN HAMMERSLEY AND
LITTLE SKOOKUM INLETS

REACH AREA

125.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 14% (18 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

13% erosion, 2% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 87% bluff backed beaches, 7% barrier estuary, 6% intermittent barrier beaches. Net shore drift - predominantly northward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

LAND COVER (MAP 15)

11% developed, 11% beach, 1% mud flat, 76% forest, 1% wetland (Appendix B: GAP, 2009); Riparian vegetation: 54% forest cover, 26% non-forest, 8% off-shore, 12% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-7 for priority salmon species. Surf smelt and Pacific sand lance spawning habitat present. Hardshell clam beds and oyster beds present. Geoduck beds are mapped in Totten Inlet. Patchy kelp beds present. Wetlands – 5.9 acres (5% of reach); including estuarine intertidal aquatic bed.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

No 303(d) Category 5 listings. Three Category 2 listings for temperature, dissolved oxygen, and pH.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (65%), Vacant (26%), remaining 9% is a mix of Forestry, Agriculture, and Aquaculture. Ownership – 100% Private.

There are 39 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

5% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show forested areas with limited residential development along the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 5 small docks, 2 buildings, 1 large dock and buoy.

Shoreline armoring is mapped along 15% of the reach. No tidal barriers are mapped in the reach.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

KEY MANAGEMENT ISSUES

- Protection of existing riparian forested habitat.

LITTLE SKOOKUM INLET - REACH 36

SHORELINE LENGTH	LOCATION	REACH AREA
12.4 MI	LITTLE SKOOKUM INLET	294.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 44% (130 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 1% erosion, 2% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 91% open coastal inlet, 7% bluff backed beach, 2% barrier beaches. Net shore drift - predominantly no appreciable drift, westward drift in a few cells at the mouth of the Little Skookum Inlet, eastward drift in a few cells on the north and south shores of the inlet.	NEARSHORE PROCESS DEGRADATION (MAP 17) Least degraded.
LAND COVER (MAP 15) 5% developed, 8% mud flat, 51% forest, 22% wetland, 13% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 59% forest cover, 29% non-forest, 4% off-shore, 8% other natural vegetation, (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-7 for priority salmon species. Pacific herring spawning habitat present near mouth of Skookum Inlet. Extensive hardshell clam and oyster beds. Patchy kelp beds present. Bald eagle breeding area and purple martin. Wetlands – 38.6 acres (13%); intertidal aquatic bed, emergent; palustrine emergent, scrub-shrub, and forested.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Skookum Creek was listed on 2004 303(d) list as Category 5 water for fecal coliform bacteria and temperature. Skookum Creek and Little Skookum Inlet are part of a TMDL for fecal coliform bacteria and temperature.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (33%), Forestry (33%), Vacant (18%), remaining 16% is a mix of Agriculture, Aquaculture; and Transportation. Ownership – Private (92%) and Public (8%).

There are 23 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 11 small docks, 8 buoys and floats, 4 buildings, 2 large docks and 1 upland bridge. Shoreline armoring is mapped along 5% of the reach. No tidal barriers are mapped in the reach. According to aerial imagery (2009) there is aquaculture located in Little Skookum Inlet.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – Rural (89%) and Agricultural Resource Lands (11%). Existing SED – Rural (84%) and Urban Residential (16%).

PUBLIC ACCESS (MAP 14)

Little Skookum, managed by DNR accounts for 7% of total linear miles.

IMPERVIOUS SURFACES (MAP 16)

3% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of forested areas, residential development, and agricultural uses along the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists 11 inventoried pre-contact sites within this reach. Resource probability mapping suggests that there is a moderate-high to very high probability of finding unknown artifacts within this reach, with a smaller portion of the reach in a very low probability zone.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

Skookum Inlet Dike Removal (Appendix B: PSP, 2010); Skookum (Skookum Valley) creek habitat acquisition - easement on McDonald property, 300 acres with restoration to follow.

KEY MANAGEMENT ISSUES

- Significant hardshell clam and oyster beds documented by PHS.
- Protection of intact riparian forested areas.

TOTTEN INLET - REACH 37

SHORELINE LENGTH	LOCATION	REACH AREA
1.7 MI	BETWEEN LITTLE SKOOKUM INLET AND SOUTHERN POINT OF REACH 37	41.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 1% (1 acre) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 77% erosion, 10% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 93% bluff backed beaches, 7% barrier beaches. Net shore drift - two cells converge at Quarters Point, southward drift from Big Cove to the south.	NEARSHORE PROCESS DEGRADATION (MAP 17) Mostly least degraded some moderately degraded and narrow reach of less degraded shoreline.
LAND COVER (MAP 15) 4% mud flat, 87% forest, 8% wetland (Appendix B: GAP, 2009); Riparian vegetation: 71% forest cover, 15% non-forest, 6% off-shore, 8% other natural vegetation (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-7 for priority salmon species. Surf smelt and sand lance spawning areas. Extensive hard shell clam beds and oyster beds present. Harbor seal occurrences and purple martin. 2.5 acres of mapped estuarine intertidal aquatic bed wetland (6% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not listed as a 303(d) Category 5 impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (46%), Forestry (32%), remaining 22% is a mix of Vacant; Aquaculture; and Parks, Open Space, and Recreation Areas.
Ownership – 100% Private.

There are 5 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 2 buoys and floats, 2 large docks, 1 building and a small dock. Shoreline armoring is mapped along 7% of the reach. No tidal barriers are mapped in the reach. According to aerial imagery (2009), aquaculture is present south of Big Cove.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential.
Comprehensive Plan Designations – 100% Rural.
Existing SED – Rural (84%) and Urban Residential (16%).

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

IMPERVIOUS SURFACES (MAP 16)

1% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show forested areas with limited residential development along the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

Hurley Cove to County Line Estuary Restoration; Sponsor (Appendix B: PSP, 2010); Restore the estuary at Big Cove and Kennedy / Schneider estuaries.

KEY MANAGEMENT ISSUES

- Protection of existing riparian forested habitat.

TOTTEN INLET - REACH 38

SHORELINE LENGTH	LOCATION	REACH AREA
3.7 MI	BETWEEN NORTHERN POINT OF REACH 38 AND OYSTER BAY	89.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 33% (29 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 44% erosion, 20% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 79% bluff backed beaches, 10% intermittent barrier beaches, 8% open coastal inlet, 3% artificial shoreforms. Net shore drift - predominantly eastward, a short cell with southwestward drift south of the divergent zone near Totten Inlet.	NEARSHORE PROCESS DEGRADATION (MAP 17) Mostly less degraded, with some least degraded shoreline.
LAND COVER (MAP 15) 1% developed, 1% beach, 11% mud flat, 79% forest 8% wetland (Appendix B: GAP, 2009); Riparian vegetation: 67% forest cover, 16% non-forest, 7% off-shore, 10% other natural vegetation (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-7 for priority salmon species. Surf smelt spawning areas. Extensive hardshell clam beds and oyster beds present. Wetlands – 1.9 acres of mapped wetland (2% of reach); wetland habitat types include estuarine intertidal aquatic bed and beach/bar.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not listed as a 303(d) Category 5 impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (50%), Residential (25%) remaining 25% is a mix of Vacant and Aquaculture. Ownership – 100% Private.

There are 2 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 5 locations mapped in the reach where tidal barriers exist: 4 sites with fill and 1 road. Overwater structures in the reach include: 4 small docks, 2 large docks, and 2 buildings. Shoreline armoring is mapped along 7% of the reach. According to aerial imagery (2009), aquaculture is present in the middle of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Rural (59%) and Conservancy (41%).

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

IMPERVIOUS SURFACES (MAP 16)

3% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show forested areas with limited residential development, and a shellfish processing facility in the central part of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a moderate to high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

KEY MANAGEMENT ISSUES

- Protection of existing riparian forested habitat.

OYSTER BAY - REACH 39

SHORELINE LENGTH	LOCATION	REACH AREA
2.7 MI	OYSTER BAY	62.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY Floodplain - 44% (28 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) No listed erosion or landslide areas.
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 100% open coastal inlet. Net shore drift - no appreciable drift.	NEARSHORE PROCESS DEGRADATION (MAP 17) Least degraded.
LAND COVER (MAP 15) 16% developed, 8% mud flat, 56% forest, 16% wetland 3% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 71% forest cover, 17% non-forest, 0.5% off-shore, 12% other natural vegetation, 0.5% water (Appendix B: PNPTC, 2011)	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-7 for priority salmon species. Extensive oyster beds and hard shell clam present. Waterfowl and shorebird concentrations documented in Oyster Bay. Mountain quail occurrences. Wetlands – 3.0 acres (5% of reach); wetland habitat types include estuarine intertidal aquatic bed and estuarine emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not listed as a 303(d) Category 5 impaired waterbody. However, Kennedy Creek has a 303(d) listing (Category 5) for dissolved oxygen. Oyster Bay is part of the Totten Inlet/Skookum Inlet TMDL.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (57%), Vacant (22%), remaining 21% is a mix of Agriculture and Forestry. Ownership – Public (58%) and Private (42%).

SHORELINE MODIFICATIONS (MAP 16)

There are 3 instances in the reach where mapped road(s) serve as tidal barriers. Shoreline armoring is mapped along 2% of the reach. According to aerial imagery (2009), US 101 is located within the southern part of the reach and crosses over the Kennedy Creek stream mouth.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (69%) and Agricultural Resource Lands (21%). Comprehensive Plan Designations - Rural (69%) and Agricultural Resource Lands (21%). Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Kennedy Creek Tidelands, managed by DNR accounts for 83% of total linear miles.

IMPERVIOUS SURFACES (MAP 16)

13% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be mostly forested; SR 101 intersects the central part of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

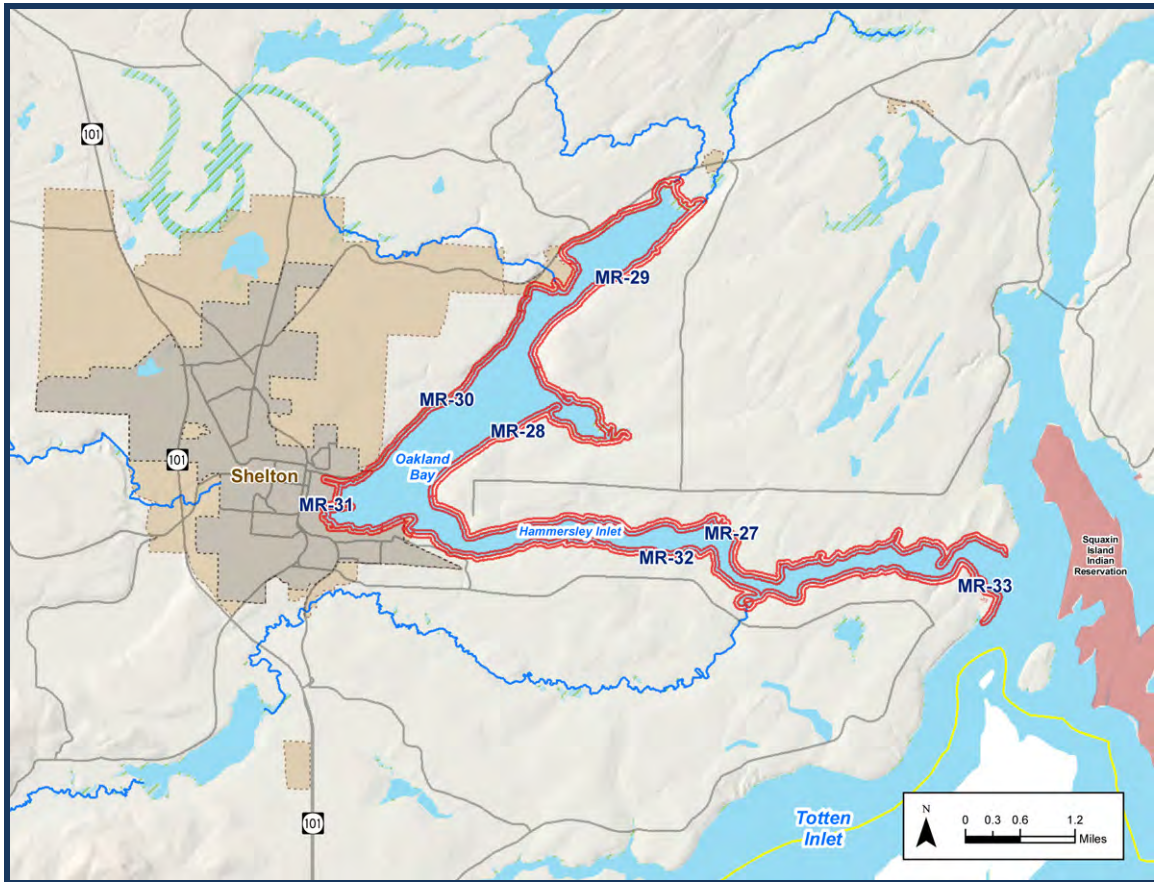
Kennedy Creek NAP Hwy 101 Modification Nearshore Restoration (Appendix B: Washington State RCO, WDFW & USFWS, 2011); Modify Hwy 101, which bisects the Kennedy Creek NAP, to restore estuarine processes and functions to Oyster Bay in Totten Inlet.

Approximately 64% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES

- Protection of existing riparian forested habitat.
- Alterations to estuary from existing infrastructure.

5.3 Hammersley Inlet and Oakland Bay



5.3.1 Physical Characterization and Modifications

Hammersley Inlet and Oakland Bay are located within Mason County and are part of South Puget Sound. These marine nearshore environments are within the WRIA 14a (Kennedy-Goldsborough) watershed. WRIA 14a is divided into four sub-basins – Case Inlet, Goldsborough Creek, Kennedy Creek, and Skookum. The Goldsborough sub-basin is the largest of the four and includes all of Oakland Bay and Hammersley inlet.

The largest rivers in this section of WRIA 14a are Goldsborough Creek, Johns Creeks, Mill Creek, Deer and Cranberry. Freshwater shorelines of WRIA 14a are discussed in detailed in Chapter 6 of this document. Due to its low elevation, this watershed receives very little snow and therefore streams and rivers are mostly fed by winter rains and groundwater sources. Issues with water availability and low instream flows occur within this watershed.

5.3.2 Coastal Processes and Shore Type

Hammersley Inlet and Oakland Bay are some of the more sheltered low-energy shores of the Puget Sound region. These highly complex shores, frequently change shore orientation and have many small scale embayments. Tidal currents are significant particularly in the narrowest parts of Hammersley Inlet. Net shore-drift occurs in several drift cells of variable length throughout these waterbodies. Erosion rates are very slow in this environment, as are sediment transport rates. Intermittent areas of no appreciable drift have been mapped due to bedrock exposures, stream mouths, and extremely sheltered conditions at bayheads, such as along the shores of the City of Shelton and the head of Oakland Bay. Bluff backed beaches are the most abundant shoreform (see Table 5-9, but many open coastal inlets and barrier beaches also are found in this area of Mason County. The largest artificial shoreform mapped in the South Puget Sound occurs at along the shores of the City of Shelton.

Coastal bluffs are an important feature of marine shorelines in Mason County. Coastal bluffs provide sand and sediment to the nearshore environment and contribute to the formation of beaches, spits and natural processes related to net shore drift. Beaches that are backed by bluffs have been mapped by the Puget Sound Nearshore Ecosystem Restoration Program (PSNERP). Table 5-9 indicates the percentage of bluff-backed beaches by region in Hammersley Inlet and Oakland Bay.

Table 5-9. Percent of Region Mapped as Bluff-backed Beach

Marine Region	Reaches	Bluff-back Beaches %
Hammersley Inlet	27, 32, 33	82
Oakland Bay	28-31	50

The presence of bluff-backed beaches is an important indicator of the value of the reach in terms of supporting nearshore processes and it is also an indicator of the suitability of the shore for human development. The Washington Department of Natural Resources has mapped portions of South Puget Sound shoreline as a landslide and/or erosion hazard area (Table 5-10). Both Hammersley Inlet and Oakland Bay have concentrations of hazard areas suggesting the marine shore is potentially hazardous for development. Some of these areas are already partially developed with single family homes.

Table 5-10. Percent of Reach Mapped as Landslide Hazard or Erosion Hazard

Marine Region	Reaches	Landslide Hazard %	Erosion Hazard %
Hammersley Inlet	27, 32, 33	15	5
Oakland Bay	28-31	9	13

5.3.3 Water Quality

Oakland Bay water quality has been adversely impacted by development and its historical and current industrial uses (Herrera, 2010). Four of the five delineated marine reaches are included on the 303(d) list of impaired waters due to elevated fecal coliform concentrations (Map 13). Ecology identified Oakland Bay for focused investigation related to source control, sediment cleanup, and restoration (Herrera, 2008). Ecology initiated this investigation because previous environmental investigations have documented contamination from historical and current industrial and commercial activities. Previous sediment quality investigations had indicated that contaminant concentrations exceeded Chapter 173-204 Washington Administrative Code (WAC) Sediment Management Standards (SMS) (Herrera, 2008). However, during an extensive sediment sampling and characterization study conducted between 2008 and 2010, none of the samples collected exceeded State sediment quality standards (Herrera, 2010). However, results from this study did

indicate that there are elevated levels of wood, and wood related chemicals (e.g., sulfides and ammonia) in most samples; and that all samples contained detectable levels of dioxin, a chemical that can cause cancer and other deleterious health effects (Washington State Department of Health, 2010a). Dioxin source assessments conducted in Washington indicate that incinerators, hog fuel (wood waste) boilers, bleached pulp and paper mills, cement kilns, kraft black liquor boilers, tire combustion, and sewage sludge incineration are potential sources of dioxin production (Washington State Department of Ecology, 1998).

Dissolved oxygen levels in Oakland Bay are typically above State water quality limits and are therefore not discussed further in this section. Other water quality generally meets water quality standards (Washington State Department of Ecology, 2004).

The Washington State Department of Health's (DOH) Office of Shellfish and Water Protection, in addition to local health jurisdictions, monitor Hammersley Inlet and Oakland Bay water quality and classify commercial and recreational shellfish harvest areas to protect human health. Samples are collected to analyze fecal coliform concentrations in the water (used to indicate the presence of pathogens that cause disease and illnesses in humans), in addition to paralytic shellfish poisoning and domoic acid samples (WDOH, 2011). Growing areas are classified as Approved, Conditionally Approved, Restricted, or Prohibited. An interactive map provides information on current marine biotoxin closure zones is available at DOH's website:

<http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Step=1>

Fecal Coliform

Fecal coliform contamination of Oakland Bay is a persistent problem. Oakland Bay was first placed on the 303 (d) list of impaired waters for fecal coliform contamination in 1996 (Coots and Whitman, 2005), and shellfish harvest was restricted in the southern end of the bay as early as 1987 (Kenny, 2007). Fecal coliform contamination is of particular concern for Oakland Bay because of its importance as a shellfish growing area. Shellfish growing and harvesting areas are subject to stringent fecal coliform standards (less than 14 colonies per 100mL); and exceedance of this standard results in restrictions (e.g., conditional closures during rain events) or complete prohibition of harvest from that area (Washington State Department of Health, 2008).

Washington State Department of Health evaluated trends in fecal coliform concentrations at 15 stations in Oakland Bay for the period from 1998-2008. This study documented that fecal coliform concentrations decreased between 1998 and 2005, but increased again in 2006, and remained relatively high throughout 2008 (Washington State Department of Health, 2008). In 2007, approximately 1,434

acres of Oakland Bay's shellfish growing areas were classified as Conditionally Approved; fifty- five acres at the north end of the bay were classified as Restricted; and 774 acres in the south end were classified as Prohibited due to Shelton's Wastewater Treatment Plant discharge (Kenny, 2007). (The acreage closed due to the treatment plant discharge is a mandated closure related to all treatment plants and not related to poor performance at the Shelton plant.) Sampling conducted in 2010 as part of the WDOH Early Warning System reaffirmed these designations (Washington State Department of Health, 2010b). In 2010, Mason County conducted extensive sampling of shoreline freshwater inputs for fecal coliform as part of the County's Pollutant Identification and Correction (PIC) program (Kenny, 2010). It is suspected that the source of fecal coliform in the tested shoreline seeps may be failing septic systems (Kenny, 2010). Where results indicate fecal coliform levels that exceed the study's threshold of 100 colonies/100mL, additional sampling and investigation of potential septic system pollutant sources are conducted (Kenny, 2010).

A variety of sources are likely responsible for the high fecal coliform concentrations in Oakland Bay. Several tributaries that contribute surface water to Oakland Bay have elevated fecal coliform levels. Campbell, Uncle John, and Malaney Creeks are on the 303 (d) list of impaired waters due to elevated fecal coliform concentrations (Washington State Department of Ecology, 2008a). Shelton and Goldsborough Creeks, while not on the 303 (d) list also have fecal coliform concentrations that sometimes exceed State water quality standards (Kenney and Estrada, 2009). Many other small water courses (122 pipes and culverts, 43 seepages, 27 unnamed tributaries and 87 drainages) may also transport fecal coliform from the land surface or subsurface (i.e. septic systems) to Oakland bay (Ahmed and Konovsky, 2010). Surface runoff during storm events may also contribute substantial amounts of fecal coliform to Oakland bay, especially for fecal coliforms originating from livestock, pets, and wildlife. Point sources such as sanitary sewer overflows, or discharges from Shelton's municipal wastewater treatment plant may also contribute fecal coliforms to the Bay. In addition to the traditional suspected sources of fecal coliform contamination, resuspension of sediments contaminated with fecal coliform has been suggested as a source (Konovsky et. al., 2010) and is currently being investigated.

Sediment Quality and Dioxin

Sediment quality is a serious issue for Oakland Bay because of the Bay's historic and current use by the wood products industry (Herrera, 2008; Herrera, 2010). The Shelton waterfront and harbor are currently (and were historically) used by several timber and wood product manufacturing industries, including saw mills and plywood manufacturing, pulp and paper production, and insulation board and fiberboard manufacturing. Over time, process chemicals and wastewater from

wood-product manufacturing processes have either been discharged (through onsite industrial stormwater systems and process wastewater discharge) or released (due to accidental spills and leaks to the harbor) to Shelton and Goldsborough Creeks and to Shelton Harbor, or across upland portions of the waterfront. Discharges and spills of process chemicals and wastewater have included; release of process wastewater discharges and sulfite waste liquor generated from the former Rayonier pulp mill; release of air emission particulates from wood-fired power plants and associated emission stacks; power plant baghouse solids; laboratory chemicals; wood preservatives containing chlorinated phenols; releases of petroleum products, polychlorinated biphenyl (PCB)-contaminated oil, and resin and veneer wastewater; wood waste directly released directly into the bay through chip loading, log rafts, and log transfer operations (Herrera, 2010).

Recently, concerns have arisen throughout Puget Sound about the potential adverse effects of wood waste in sediments. Several studies have indicated that wood waste can have a variety of physical and chemical related adverse impacts on aquatic life. Common impacts include; organic enrichment of sediments; oxygen depletion in the water column; alteration of benthic communities to more pollution tolerant species; leaching of toxic chemicals such as phenols, methylated phenols, benzoic acid, benzyl alcohol, terpenes, and tropolones; and physical alteration of the benthic substrate (Norton and et. al., 2000).

Wood waste enters and is distributed across the Oakland Bay system in two primary ways: low concentrations spread across deeper portions of Oakland Bay by tidal flows near the sediment bed, and significant accumulations (greater than 20 percent by volume) near both historical and current log rafting and wood processing (milling) locations. Milling primarily generates wood chips and sawdust, and log rafting primarily generates bark. The patchy distribution of wood waste; significant localized accumulations combined with low wood concentrations in much of the area; indicates that wood waste is relatively immobile (Herrera, 2010).

Sediment sampling results from the Oakland Bay Sediment Investigation (Herrera, 2010) indicated that no chemicals on the state Sediment Management Standards list were present above the sediment quality standards.. However, dioxins/furans, (which are not included in the Sediment Management Standards), were found at relatively high concentrations in 65% of samples collected in the study area. Additionally, many of the sediment samples from Shelton Harbor and Oakland Bay failed toxicity tests. It is likely that these failures resulted from conditions associated with the presence of wood waste, fine-grain sediment, synergistic effects of these and other correlated constituents of concern, or some unmeasured condition (Herrera, 2010).

No discernable source-specific spatial pattern of chemical contamination of sediments was observed; however, dioxin/furan concentrations were much higher in Shelton Harbor, and were also higher in subsurface samples. This indicates that inputs to the system, at least in part, originated in Shelton Harbor and that inputs to the system appear to be diminishing; and recent, cleaner sediments are likely covering older, more contaminated deposits. However, some surface samples also exhibited high dioxin concentrations. This suggests there is a continuing source of dioxin, or sediments from areas with higher concentrations are being redistributed to areas with lower concentrations by tidal currents, or that mixing of deeper and shallower sediments has occurred as a result of human or natural processes (Herrera, 2010).

Sediment sulfide concentrations were elevated throughout Shelton Harbor and Oakland Bay in comparison to reference sediments collected from Carr Inlet. Mean concentrations of total sulfides in surface sediment in Shelton Harbor (661 mg/kg) and Oakland Bay (666 mg/kg) were greater than the mean reference sediment result (168 mg/kg) (Herrera, 2010). Ammonia, another common by product of microbial degradation of organic materials (i.e. wood products) was not found to be at higher concentrations than in the reference sediments collected from Carr Inlet. Ammonia and sulfides can be toxic to benthic invertebrates. A negative correlation was documented in Herrera 2010 between ammonia and sulfide concentrations and mussel larval (larval) development bioassays. However results were inconclusive as to whether the observed toxicity resulted from elevated sulfide and ammonia concentrations, or from the presence of other toxic constituents.

Although Oakland Bay sediment quality is a concern, especially with regard to high dioxin concentrations, it does not appear to pose a serious threat for consumers and growers of shellfish. A recent review by the WDOH and the Agency for Toxic Substances and Disease Registry, documented that no toxic exposure risk is likely to occur for employees of the shellfish industry who contact Oakland Bay sediments on a regular basis (Washington State Department of Health, 2010a). It was also concluded that dioxin in shellfish poses a very low human health risk from consuming them, because shellfish, due to their low fat content, do not accumulate dioxin (Washington State Department of Health, 2010a). However, dioxin is highly persistent in the environment, and is a toxic chemical that can enter and be distributed through the food web, accumulating in the tissues of animals, including humans (Washington Department of Ecology, 1998).

5.3.4 Critical or Priority Habitat and Species

Critical or priority habitats and priority species mapped within the Mason County shoreline jurisdiction of Hammersley Inlet and Oakland Bay are specifically covered

in this section. Discussion of the mapped priority habitats and species follows, with select quantitative data only located in the reach sheets, where noted.

Hammersley Inlet and Oakland Bay are mapped as supporting many federal and state-listed priority salmonid species (Appendix B: WDFW, 2011; Table 5-3).

Table 5-11. Priority salmonid species documented for Hammersley Inlet and Oakland Bay

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Presence/Migration	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	Threatened	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Known spawning and Presence/Migration	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~

Critical habitat has been designated for the Puget Sound ESU Chinook salmon for all reaches covered in this section, extending upstream to the point of tidal influence. Critical habitat has also been designated for the Southern Resident killer whale DPS for all reaches covered in this section, extending to waters deeper than 20 feet (Appendix B: USFWS, 2010).

Spawning areas for forage fish, including Pacific herring, surf smelt and sand lance, are also listed as priority habitats. Forage fish are important links in the ecosystem of South Puget Sound as they provide a key food source for marine birds, rockfish, salmon and numerous other fish species (Pentilla, 2007). These fish spawn in the intertidal areas of South Puget Sound. Hammersley Inlet and Oakland Bay have recorded occurrences of forage fish, such as herring spawning habitat, sand lance spawning, and Pacific surf smelt spawning (Appendix B: WDFW, 2011). Essential fish habitat for rock sole is recorded for these marine shorelines (Appendix B: WDFW, 2011)

Native and commercial shellfish beds including hardshell clam and oyster are mapped for several reaches (Appendix B: WDFW, 2011). Kelp beds are also documented for several reaches (DNR, 2008). Kelp species, such as bull kelp (*Nereocystis luetkeana*), giant kelp (*Macrocystis integrifolia*) and non-floating kelp species have limited distribution within the Mason County portion of Puget Sound. Non-floating kelp species are the most widely distributed, primarily concentrated in parts of Hood Canal, Hammersley Inlet, and Totten Inlet (Eissinger, 2009).

Priority wildlife species present include: purple martin and bald eagle (Appendix B: WDFW, 2011).

5.3.5 Shoreline Land Use

Land use in shoreline areas refers to current uses, broader land use patterns and existing development within the shoreline jurisdiction. Land use in Hammersley Inlet and Oakland Bay is a mix of residential and vacant lands and aquaculture operations. Oakland Bay Reach 28 also has agriculture and forestry land uses. SR Route 3 parallels the entire western shore of Oakland Bay.

Aquaculture is a significant resource and important economic driver in Mason County. Between 2007 and 2011, the U.S. Army Corps of Engineers received 104 general permit applications for shellfish operations (See Appendix A, Figure 26). Large commercial shellfish growers operating in Hammersley Inlet and Oakland Bay are Taylor Shellfish and Arcadia Point Seafood. In addition, many of the shellfish growers are small family businesses dating back generations. According to Assessor's data, commercial or tribal aquaculture is present on 4 out of 7 reaches in Hammersley Inlet and Oakland Bay. For example, Reach 30 includes the Taylor Shellfish FLUPSY (Floating Upwelling System) facility.

Public access is available to tidelands mostly managed by WDFW. Mason County manages several community parks along both Hammersley Inlet and Oakland Bay: Jacoby Shorecrest County Park, Walker County Park and Oakland Bay Historical Park (Mason County Department of Parks and Trails, 2006). In addition, there are two public boat launches: one is managed by Taylor Shellfish and WDFW and provides access to Oakland Bay; and a second, Arcadia Boat Launch, is owned by Squaxin Island Tribe and provides access to Hammersley Inlet (Explore Hood Canal, 2011).

5.3.6 Shoreline Modifications

The PSNERP Strategic Needs Assessment composite measure of degradation to multiple nearshore processes highlights areas to target for restoration and conservation within Mason County (see Section 5.1.6). Within the Hammersley Inlet and Oakland Bay shorelines nearshore process degradation is predominantly “less”.

The “least” degradation has occurred to the east shore of Oakland Bay and “moderate” degradation has occurred to the northwest shore of Hammersley Inlet. However, the most degradation has occurred along the City of Shelton’s shores, which were mapped as “more” degraded.

Existing man-made structures, along with modifications to the shoreline, occur along Hammersley Inlet and Oakland Bay and are part of this shoreline characterization. These are referred to as shoreline modifications, which include bridges, bulkheads (i.e., shoreline armoring), roads, dikes and overwater structures like docks. The number and extent of modifications along this section of the shoreline has been described by marine region in Table 5-12 (Appendix B: PSNERP, 2010).

Table 5-12. Shoreline Modifications by Region for Hammersley Inlet and Oakland Bay

Marine Region	Overwater Structures				Tidal Barrier			Shoreline Armoring
	Bridges	Buildings	Buoys	Docks	Fill	Dike	Road	
Hammersley Inlet	-	4	10	22	-	-	-	41%
Oakland Bay	8	1	4	14	-	-	18	10%
Total	8	5	14	36	-	-	18	25%

5.3.7 Land Cover

Land cover provided in this section refers to both the aerial extent of existing vegetation and the coverage of developed areas (paved or built surfaces) within the shoreline jurisdiction. Riparian vegetation is an important feature of marine habitats in Puget Sound. Several studies have shown that salmon in the Pacific Northwest feed on insects falling from terrestrial or upland vegetation

According to the GAP 2009 data, the dominant land cover type of Hammersley Inlet and Oakland Bay is conifer dominated forest at 38 percent. The next highest percent cover is provided by harvested forest at 21 percent. The third highest land cover type is developed land at 12 percent.

According to the PNPTC 2011 data set, the dominant land cover type of Hammersley Inlet and Oakland Bay is forest cover at 50 percent. The next highest percent cover is provided by non-forest at 38 percent. The third highest land cover type is other natural vegetation at 10 percent. Off-shore comprises 2 percent.

5.3.8 Public Access Opportunities

Public access to the shorelines of Hammersley Inlet and Oakland Bay is provided through an array of County Parks and state- and tribal- owned boat launches, and access from water as part of the Cascadia Marine Trail (a state-recognized water trail for non-motorized boaters). State-owned tidelands also provide public access to intertidal zones where recreational shellfish harvest is popular. The Mason County Regional Trail Plan (2008) notes that public access opportunities exist in the form of overlooks, boat launches, waterfront parks, trails, short path or stairs, and small parking areas. Access opportunities are more limited on developed shorelines. Public access is often provided by highways and roads but without adequate public parking. Public access is available along state-owned tidelands, Jacoby Shorecrest County Park, Walker County Park, and Oakland Bay Historical Park (Mason County Department of Parks and Trails, 2006). There are two public boat launches: one provides access to Oakland Bay and the other access to Hammersley Inlet (Explore Hood Canal, 2011).

5.3.9 Summary of Key Management Issues

Key management issues for Hammersley Inlet and Oakland Bay include the following: 1) protection and improvement of water quality to support significant recreational and tribal shellfish harvest and commercial aquaculture, 2) control of sediments from tributaries that affect water quality, 3) conservation of riparian forested cover where unaltered, 4) protection of intact marshes, stream deltas and pocket estuaries, and 5) conservation of priority fish species in major salmonid bearing streams.

5.3.10 Reach Analysis

An analysis by marine reach is given in the following section. Reach sheets are provided corresponding to specific segments as listed below:

- Hammersley Inlet (Reaches 27, 32 and 33); and
- Oakland Bay (Reaches 28-31).

Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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HAMMERSLEY INLET - REACH 27

SHORELINE LENGTH

8.7 MI

LOCATION

N SHORE, HUNGERFORD POINT
WEST TO MUNSON POINT

REACH AREA

203.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 38% (77 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

9% erosion, 2% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 80% bluff backed beaches, 11% barrier beaches, 12% barrier estuaries, 6% open coastal inlets.

Net shore drift - predominantly eastward drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Mostly moderately degraded, with some least degraded shore at central-eastern end of reach.

LAND COVER (MAP 15)

5% developed, 4% open water, 18% beach, 66% forest, 7% wetland (Appendix B: GAP, 2009)

Riparian vegetation: 48% forest cover, 42% non-forest, 1% off-shore, 8% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-11 for priority salmon species.

Pacific herring spawning habitat and sand lance spawning habitat present. Hardshell clam beds and oyster bed present. Patchy kelp beds present. Bald eagle territories.

Wetlands – 13.7 acres (7% of reach); habitat types include estuarine intertidal aquatic bed, emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Hammersley Inlet, 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Cover – Residential (58%), Vacant (34%) remaining 8% is a mix of Forestry; Agriculture, Transportation, and Parks, Open Space, and Recreation Areas. Ownership – 100% Private. There are 25 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Urban Residential (57%) and Rural (43%).

IMPERVIOUS SURFACES (MAP 16)

10% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be dominated by forested and single-family residential areas, with limited agricultural uses.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 9 small docks, 5 buoys and floats, and 2 buildings. Shoreline armoring is mapped along 37% of the reach. No tidal barriers are mapped in the reach.

PUBLIC ACCESS (MAP 14)

Jacoby Shorecrest County Park is a Mason County community park. It is about 3 acres in total size and provides beach access, boat launch and picnic tables. (Mason County Parks and Trails, 2006).

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

East Hammersley Inlet (Appendix B: PSP, 2010) At the mouth of the Inlet, acquire conservation easement on 30 acres - several sites, 18 acres with restoration to follow; other properties across the water.

KEY MANAGEMENT ISSUES

- Extensive documented forage fish spawning areas
- Cape Horn, the creek mouths and the active feeder bluffs have been rated as priority conservation sites due to exceptional habitat (South Puget Sound Salmon Recovery Group, 2005).

HAMMERSLEY INLET - REACH 32

SHORELINE LENGTH	LOCATION	REACH AREA
7.1 MI	SOUTH SHORE INCLUDING CITY OF SHELTON UGA	166.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10) Floodplain - 24% (40 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain	HAZARD AREAS (MAP 12) 1% erosion, 14% landslide
SHOREFORM AND NET SHORE DRIFT (MAP 7) Shoreform - 83% bluff backed beaches, 12% open coastal inlet, 4% intermittent barrier beaches, 1% barrier estuary, 1% barrier lagoon. Net shore drift - eastward drift along most of the southern inlet shore, one cell with westward drift occurs in western end of reach, an area of no appreciable drift at the mouth of Mill Creek.	NEARSHORE PROCESS DEGRADATION (MAP 17) Less degraded.
LAND COVER (MAP 15) 17% developed, 1% beach, 68% forest, 8% wetland, 7% floodplain/riparian (Appendix B: GAP, 2009) Riparian vegetation: 46% forest cover, 49% non-forest, 2% off-shore, 2% other natural vegetation (Appendix B: PNPTC, 2011).	PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23) See Table 5-11 for priority salmon species. Pacific herring spawning habitat present in eastern part of reach. Marine bird colonies (alcids) documented. Patchy kelp beds present. Wetlands – 6.6 acres (4% of reach); habitats include estuarine intertidal aquatic bed, emergent.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Hammersley Inlet, 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (66%); Vacant (24%); remaining 8% is a mix of Forestry; Parks, Open Space, and Recreation Areas; and Transportation. Ownership – 100% Private.

There are 29 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 19 small docks, 4 buoys and floats, 3 large docks, and 2 buildings. Shoreline armoring is mapped along 45% of the reach. There are no mapped tidal barriers. According to aerial imagery (2009), aquaculture is present in the middle of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Urban Residential (69%) and Rural (31%).

PUBLIC ACCESS (MAP 14)

The Port of Shelton owns a small portion of a sandy beach in this reach. Public access is also available at Walker County Park, a Mason County community park. The park has beach access, a picnic shelter, a play area and can be used by kayakers for overnight camping. The park is mostly forested and is 5 acres in total size (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

14% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of forested and single-family residential areas throughout the reach.

AREAS OF SPECIAL INTEREST

No Ecology-listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

KEY MANAGEMENT ISSUES

- Almost 50% of this reach is armored with bulkheads.
- Protection of existing intact riparian forest.

HAMMERSLEY INLET - REACH 33

SHORELINE LENGTH

1.7 MI

LOCATION

ARCADIA POINT

REACH AREA

38.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 21% (8 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

87% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 94% bluff backed beaches, 6% barrier beach.

Net shore drift - northwestward drift into Hammersley Inlet and extends to Cape Cod, eastward transport E of Cape Cod, a few areas of no appreciable drift by eastern headlands.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

LAND COVER (MAP 15)

13% developed, 11% beach, 67% forest, 9% wetland (Appendix B: GAP, 2009)

Riparian vegetation: 57% forest cover, 37% non-forest, 4% off-shore, 2% other natural vegetation (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-11 for priority salmon species.

Pacific herring and sand lance spawning habitat present. Patchy kelp beds present. Geoduck beds documented in deeper water.

Wetland: 4.5 acres of mapped estuarine intertidal unconsolidated shore habitat (12% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Hammersley Inlet, 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (70%); Vacant (25%); remaining 5% is a mix of Aquaculture and Forestry. Ownership – 100% Private.

There is 1 aquaculture permit on this reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 9 small docks and 1 buoy. Shoreline armoring is mapped along 43% of the reach. There are no mapped tidal barriers in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – Conservancy (61%) and Urban Residential (41%).

PUBLIC ACCESS (MAP 14)

Arcadia Point boat launch, managed by the Squaxin Island Tribe, provides public access. The launch site has associated parking.

IMPERVIOUS SURFACES (MAP 16)

5% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the western part of the reach to be mostly forested, while the eastern part is developed with single-family residences.

AREAS OF SPECIAL INTEREST

No listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover.

WRIA 14 Bulkhead Removal (Appendix B: PSP, 2010); Remove 5 bulkheads in WRIA 14: Arcadia Point, 100 feet of nearshore total - Demonstration project adjacent to boat ramp.

Approximately 44% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2002).

KEY MANAGEMENT ISSUES

BULKHEADS AND HARDENED ARMORING LIMIT HABITAT FOR FORAGE FISH.

COASTAL FEEDER BLUFFS ARE CONCENTRATED IN THIS REACH. THESE BLUFFS PROVIDE SEDIMENT TO MAINTAIN DOWNDRIFT BEACHES.

OAKLAND BAY - REACH 28

SHORELINE LENGTH

4.9 MI

LOCATION

E SHORE OF OAKLAND BAY
(INCLUDING CHAPMAN COVE)

REACH AREA

105.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 76% (80 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

34% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 53% open coastal inlet, 42% bluff backed beaches, 6% barrier beaches.

Net shore drift - two cells converge into Chapman Cove, northward drift from a divergence zone north of Munson Point to the barrier beach that embays Chapman Cove, southward drift adjacent to the northern spit, no drift along inner shore of embayment.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

1% developed, 2% agriculture, 7% beach, 55% forest, 25% wetland, 10% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 62% forest cover, 22% non-forest, 0.5% off-shore, 15% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-11 for priority salmon species.
Rock sole breeding areas. Hardshell clam beds and oyster beds present. Documented occurrences of harbor seals.
Wetlands – 21.9 acres (21% of reach); habitat types include estuarine intertidal aquatic bed, emergent, intertidal flat, palustrine emergent, and forested.

WATER QUALITY (MAP 13)

Oakland Bay (Chapman Cove), 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (37%), Agriculture (21%) Forestry (18%), Residential (18%), remaining 6% is a mix of Transportation and Aquaculture. Ownership – 100% Private.
There are 19 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 10 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 4 upland bridges, 2 small docks, and 1 buoy. Shoreline armoring is mapped along 9% of the reach. According to aerial imagery (2009), aquaculture is present in Chapman Cove.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential (80%) and Agricultural Resource Lands (20%). Comprehensive Plan Designations – Rural (80%) and Agricultural Resource Lands (20%). Existing SED - Urban Residential (64%) and Rural (36%).

PUBLIC ACCESS (MAP 14)

Oakland Bay and Chapman Cove Exclusive mud flats, managed by WDFW accounts for 9% of total linear miles. Public access is available at the site.

IMPERVIOUS SURFACES (MAP 16)

14% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be predominantly forest and agriculture with limited single-family residential uses.

AREAS OF SPECIAL INTEREST

No listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists three inventoried pre-contact sites within this reach. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian forested cover and unarmored shorelines near Sunset Bluff.

Protect floodplain area from alteration and fill.

Chapman Cove Fish Passage Restoration (Appendix B: Mason Conservation District, 2011).

Approximately 53% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES

- Intensive shellfish aquaculture operations in upper Oakland Bay and Chapman Cove. (South Puget Sound Salmon Recovery Group, 2005).
- Significant hard shell clam and oyster beds documented in this reach and Chapman Cove (PHS).
- The dendritic channels in upper Oakland Bay, the upper of intertidal salt marsh of Chapman Cove and the sandy beach north of Munson Point have been rated as priority conservation areas (South Puget Sound Salmon Recovery Group, 2005).

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OAKLAND BAY - REACH 29

SHORELINE LENGTH

6.4 MI

LOCATION

N SHORE OF OAKLAND BAY
NORTH OF CHAPMAN COVE TO
SOUTH OF BAYSHORE HAMLET

REACH AREA

155.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 56% (88 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

31% erosion, 7% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 47% bluff backed beaches, 38% open coastal inlet, 14% barrier beaches, 1% barrier lagoon.

Net shore drift - predominantly northward drift, a few areas with no appreciable drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Southeast shore least degraded, northwest shore less degraded.

PHYSICAL AND ECOLOGICAL FEATURES

LAND COVER (MAP 15)

7% developed, 7% beach, 63% forest, 18% wetland, 4% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 49% forest cover, 31% non-forest, 3% off-shore, 17% other natural vegetation, 0.5% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-11 for priority salmon species.
Rock sole breeding areas. Hardshell clam beds and oyster beds present.
Wetlands – 9.9 acres (6% of reach); habitat types include estuarine intertidal aquatic bed and estuarine emergent.

WATER QUALITY (MAP 13)

Oakland Bay, 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use –Residential (50%), Vacant (28%), remaining 22% is a mix of Forestry, Transportation and Aquaculture. Ownership – 100% Private.
There are 8 aquaculture permits on this reach.

SHORELINE MODIFICATIONS (MAP 16)

There are 8 instances in the reach where mapped road(s) serve as tidal barriers. Overwater structures in the reach include: 4 small docks, 3 upland bridges, 2 buoys and floats. Shoreline armoring is mapped along 6% of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential (73%), mix of Agricultural Resource Lands and Rural Tourist-Campground (10%). Bay Shore Hamlet: a mix of Rural Tourist and Rural Residential (17%). Comprehensive Plan Designations – Rural (75%), Hamlet (17%), and Agricultural Resource Lands (8%).

Existing SED –Urban Residential (68%), Conservancy (20%), and Rural (11%).

PUBLIC ACCESS (MAP 14)

Oakland Bay and Chapman Cove Exclusive mud flats, managed by WDFW, and North Oakland Bay and Oakland Bay mud flats, managed by Washington State Department of Transportation, provide public access to 38% of total linear miles. The reach also has a public boat launch, managed both by Taylor Shellfish and WDFW.

Oakland Bay Historical Park, a regional park managed by Mason County, is 82 acres in total size. The park provides waterfront access to Oakland Bay and is the site of an old homestead. The homestead includes a turn of the century home and an orchard. (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

13% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the south shore of Oakland Bay within the reach to be a mix of forest, residential, and agricultural areas; the north shore is more developed with roads, agriculture, residential, and a golf course.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.
The privately-owned Shelton Bayshore Golf Course is located at the stream mouth of John's Creek.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried pre-contact sites and one early historic inventory site within this reach.

OPPORTUNITY AREAS

Johns Creek Estuary and Nearshore Acquisition and Restoration (Appendix B: Washington State RCO, WDFW & USFWS, 2011); Johns Creek estuary and nearshore acquisition and restoration project seeks to acquire 76 acres of riparian, nearshore and estuary habitat and associated uplands. Chum and Coho salmon spawn in this section of Johns Creek. The estuary is important rearing habitat.

Johns Creek Large Woody Debris Placement (Appendix B: Mason Conservation District, 2011).

Oakland Bay Habitat Protection Twin Rivers (Appendix B: PSP, 2010); In an effort to conserve four of the remaining five large marine shoreline properties on Oakland Bay, Twin Rivers has been targeted as critical habitat, incorporating 133 acres abutting upper Oakland Bay. Property is near closed for conservation. Currently there is the need for invasive species removal and revegetation.

Oakland Bay Habitat Protection 36-acre shoreline (Appendix B: PSP, 2010); Conserve a 36 acre marine shoreline property on Oakland Bay. Then remove invasive vegetation and shoreline access structure, and revegetate.

Approximately 67% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2003).

KEY MANAGEMENT ISSUES

- Water quality impairments and sediments contaminated by dioxin and wood waste chemicals.
- Significant hard shell clam and oyster beds documented in this reach and north Oakland Bay (PHS).
- The dendritic channels in upper Oakland Bay have been rated as priority conservation areas (South Puget Sound Salmon Recovery Group, 2005).
- The mouth of John's creek has been channelized bypassing its estuary (South Puget Sound Salmon Recovery Group, 2005).
- Modifications at Bayshore have altered Johns Creek estuary and adversely affected shoreline ecological functions.

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OAKLAND BAY - REACH 30

SHORELINE LENGTH

2.5 MI

LOCATION

W SHORE, S OF BAYSHORE TO
SHELTON CITY LIMITS
(INCLUDES SHELTON UGA)

REACH AREA

60.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach

HAZARD AREAS (MAP 12)

28% landslide

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 97% bluff backed beaches, 3% barrier beach. Net shore drift - predominantly N drift.

NEARSHORE PROCESS DEGRADATION (MAP 17)

Less degraded.

LAND COVER (MAP 15)

31% developed, 3% open water, 15% beach, 48% forest, 3% wetland (Appendix B: GAP, 2009)
Riparian vegetation: 46% forest cover, 44% non-forest, 10% other natural vegetation, (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-11 for priority salmon species.
Hardshell clam beds and oyster beds present.
2.3 acres of mapped estuarine intertidal aquatic bed wetland (4% of reach).

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Oakland Bay, 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (46%), Vacant (23%), Forestry (16%), remaining 16% is a mix of Transportation and Commercial. Ownership – 100% Private.

There are 22 aquaculture permits on this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

IMPERVIOUS SURFACES (MAP 16)

17% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show SR 3 running parallel to the shoreline through most of the reach; single-family residences and a barge loading facility are located in the central part of the reach.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: 3 small docks, 1 building, buoy, and large dock. Conveyor crosses SR 3 from uphill gravel and aggregate mining company. Shoreline armoring is mapped along 38% of the reach. No tidal barriers.

PUBLIC ACCESS (MAP 14)

Oakland Bay and Chapman Cove Exclusive mud flats, managed by WDFW, provide public access to 3% of total linear miles.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one registered historic site: the Oakland townsite, 3 miles NE of Shelton on WA-3. Resource probability mapping suggests there is a moderate-high to high probability of finding unknown artifacts within this reach, with a small portion of the reach in a very high probability zone.

OPPORTUNITY AREAS

Re-vegetate riparian areas by planting native trees and shrubs.

Planting native shoreline buffers (Appendix B: Mason Conservation District, 2011).

Approximately 96% of the reach is identified for conservation of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2002)

KEY MANAGEMENT ISSUES

- Water quality impairments and sediments contaminated by dioxin and wood waste chemicals.
- Significant hard shell clam and oyster beds documented in this reach and north Oakland Bay (PHS).
- Overwater structures and log rafting creating potential obstacles to juvenile salmonids (Sound Puget Sound Salmon Recover Group, 2005).

OAKLAND BAY - REACH 31

SHORELINE LENGTH

3.5 MI

LOCATION

SHELTON HARBOR, WITHIN
CITY OF SHELTON CITY LIMITS

REACH AREA

68.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4 AND 10)

Floodplain - 67% (46 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas.

SHOREFORM AND NET SHORE DRIFT (MAP 7)

Shoreform - 76% artificial shoreforms, 24% bluff backed beach. Net shore drift - two cells with westward drift converge into a large area of no appreciable drift at the bayhead in downtown Shelton, another convergence occurs south of Shelton.

NEARSHORE PROCESS DEGRADATION (MAP 17)

More degraded.

LAND COVER (MAP 15)

26% developed, 3% open water, 6% beach, 50% forest, 13% wetland, 3% floodplain/riparian (Appendix B: GAP, 2009); Riparian vegetation: 30% forest cover, 47% non-forest, 19% off-shore, 4% other (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAPS 8 AND 23)

See Table 5-11 for priority salmon species. Harbor seals are documented in Shelton Harbor along with purple martin. Wetlands - 3.8 acres of (7% of reach); habitat types include estuarine emergent aquatic bed and estuarine emergent flat.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Oakland Bay (Shelton Harbor), 303(d) listing (Category 5) for fecal coliform.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Parks, Open Space, and Recreation Areas. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

Overwater structures in the reach include: buoys and floats, 3 small docks, 1 building, 1 buoy, and 1 large dock. There are no mapped tidal barriers or shoreline armoring in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Shelton UGA: 100% General Commercial. Comprehensive Plan Designations – 100% Urban Growth Area.

Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in this reach.

IMPERVIOUS SURFACES (MAP 16)

15% of reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be largely developed with industrial facilities.

AREAS OF SPECIAL INTEREST

No Ecology- listed contaminated sites. Port of Shelton owns property in Shelton's UGA that is set aside as open space tracts for Alder Creek.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact site within this reach. Resource probability mapping suggests there is a low to high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Provide public access through purchase of easements or partnering with Simpson or Port, if feasible.

Approximately 97% of the reach is identified for restoration of habitat beneficial to juvenile salmonids (Appendix B: Anchor, 2002).

Creosote Removal (Appendix B: PSP, 2010); Move log rafts and pilings toward the north to protect Goldsborough Creek fish.

Goldsborough Creek Mouth Reconstruction (Appendix B: PSP, 2010); Re-build delta and creek mouth.

Goldsborough Creek Fish Passage Projects (Appendix B: PSP, 2010); Target outcomes from project development grant (NFWF) to remove blocking culverts, habitat protection, wood placement, etc.

Eagle Point Shoreline Acquisition (Appendix B: PSP, 2010); The Shoreline Acquisition is to conserve the habitat function and value of this priority area for use of adult migrating salmonids and juvenile salmonids as they exit the Goldsborough Creek and Johns Creek watersheds.

Oakland Bay Salmon Safe Marina (Appendix B: Mason Conservation District, 2011).

KEY MANAGEMENT ISSUES

- Water quality impairments and sediments contaminated by dioxin and wood waste chemicals.
- Modifications to the Goldsborough Creek estuary including armoring, channelization and harbor uses.
- Most of the shoreline in this area has been heavily modified by shoreline hardening (South Puget Sound Salmon Recovery Group, 2005).
- Extensive floating log storage exists west of Eagle Point (South Puget Sound Salmon Recovery Group, 2005).
- Eagle point has been rated a priority conservation site due to its high quality habitat.

5.4 Data Gaps

Data gaps have been identified for the marine shorelines of South Puget Sound within Mason County as part of this shoreline inventory and characterization. The following information is currently lacking:

- Better information related to location and type of wetlands in Mason County; a county-wide wetland inventory is lacking;
- Current survey for forage fish spawning;
- Location of abandoned pilings and docks;
- A comprehensive inventory and assessment of coastal feeder bluffs in Mason County;
- Current data on shoreline modifications, specifically bulkheads; and
- Location of derelict structures, gear and debris in the nearshore environment.

CHAPTER 6.

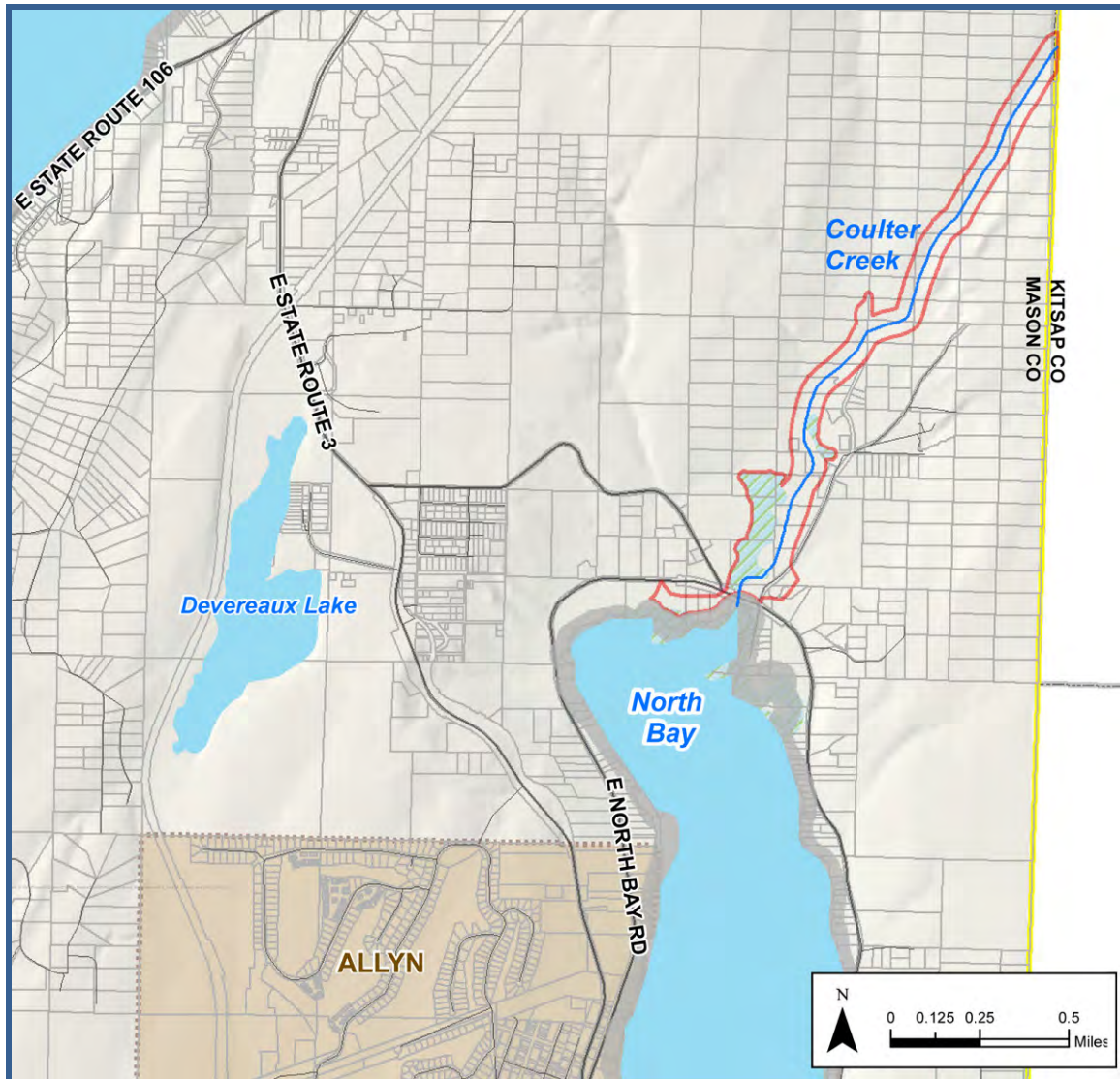
WRIA 14A: KENNEDY-GOLDSBOROUGH

Chapter 6 provides a discussion of the freshwater shoreline waterbodies located within the Mason County portion of Kennedy-Goldsborough Water Resource Inventory Area (WRIA) 14a. See Map 1 (Appendix A) for the location of WRIA 14a. This chapter covers 21 lakes and 14 streams that are considered to be shorelines of the state. There are no freshwater shorelines of statewide significance designated in WRIA 14a. Marine shorelines in the South Puget Sound have been characterized in Chapter 5.

Waterbodies within this chapter are grouped based on drainage patterns and watersheds beginning with rivers and lakes located in the far northeastern corner of WRIA 14a. Within each section, the streams are generally ordered in geographic order moving from the river mouth upstream and the lakes from North to South.

After a summary description of the waterbodies, the reaches have been described in two page reach sheets that provide a summary of data per shoreline reach. Information displayed in the reach sheets is largely based upon GIS data taken from state and county sources. Data sources are described in Chapter 2. A Glossary of Terms is provided in Appendix C.

6.1 Coulter Creek



6.1.1 Physical Characterization and Modifications

The Coulter Creek drainage basin is one of the largest streams in the watershed (Haring, 2003). The mainstem of Coulter Creek is approximately eight miles long; several tributaries contribute an additional 10 to 12 miles of channel length. The headwaters of Coulter Creek and upper seven miles of the mainstem are located in Kitsap County. The lower 1.9 mile of Coulter Creek is located in Mason County. Coulter Creek flows southwardly into North Bay in Case Inlet. There is significant wetland area in this watershed, both on the mainstem and tributaries of Coulter Creek. The natural floodplain of Coulter Creek is generally intact and stable. A fish hatchery operated by Washington State Department of Fish and Wildlife (WDFW) is located at RM 0.25 on Coulter Creek. At the hatchery, Coulter Creek water is pumped into two asphalt rearing ponds which discharge into an adult pond (WDFW, 2003).

The Coulter Creek drainage basin has been modified by past development. Some of the process modifications include:

- Land conversion from forest to residential uses;
- Logging adjacent to the stream;
- Bridge crossing near mouth for SR 302; and
- Diversion of water into the hatchery.

6.1.2 Water Quality

Water quality in Coulter Creek is generally very good. Coulter Creek is not included on Ecology's 303 (d) Category 5 list of impaired waters (Ecology, 2008a). Kitsap County Health District has monitored the stream since 1996. According to a 2010 Water Quality Monitoring Report, the statistical analysis for the stream shows a stationary long-term trend, but a worsening water quality since 2008 (Kitsap County Health District, 2010). There has been a recent increase in fecal coliform bacteria levels but the stream still meets state water quality standards.

6.1.3 Critical or Priority Habitat and Species

Coulter Creek is documented as providing migratory and spawning habitat for several priority salmonid species (Appendix B: WDFW, 2011; Table 6-1). Priority habitats and species (PHS) data are provided by WDFW and discussed in Chapter 3 of this report. The Coulter Creek Hatchery, operated by WDFW, is located in this reach and was originally built to raise chum to supplement natural spawning. The hatchery is now used to rear Deschutes River Fall Chinook for release into Capitol Lake near Olympia. Chum, coho and cutthroat trout spawn naturally in Coulter Creek and are allowed to bypass the holding pond and pass upstream through the

in-stream fish ladder. Coho return in September and chum return in October to Coulter Creek.

Table 6-1. Priority fish species documented for Coulter Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	T	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	T	~
Pacific lamprey	<i>Lampetra tridentata</i>	Migration/Spawning	Concern	~

North Bay and the Coulter Creek system have been identified by Pierce County and WDFW as an area of biodiversity for wildlife species and habitats within both Pierce and Mason Counties (Brooks et al., 2004). As part of the Pierce County biodiversity connector network, WDFW staff confirmed high quality habitat and riparian vegetation along Coulter Creek (Brooks et al. 2004).

Approximately 21 acres of wetlands, are mapped along Coulter Creek within Mason County shoreline jurisdiction, which represents 18 percent of the reach (Appendix B: USFWS, 2010). Wetlands in the reach are relatively undisturbed.

No priority wildlife species occurrences have been mapped in the vicinity of the Coulter Creek (Appendix B: WDFW, 2011). In addition to the fish listed above, reticulate sculpin was also identified in Coulter Creek (Appendix B: WDFW, 2011). The Washington Department of Natural Resources (DNR) Natural Heritage Program (NHP) has not identified priority plants or vegetation communities within the Coulter Creek shoreline planning area (Appendix B: DNR, 2009).

6.1.4 Land Use

Land uses in the Coulter Creek shoreline planning area are mainly rural residential, forest resources including Christmas tree farms, and the WDFW fish hatchery.

6.1.5 Summary of Key Management Issues

See reach sheet for key management issues.

6.1.6 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

COULTER CREEK

SHORELINE LENGTH

1.9 mi

REACH AREA

117.6 ac



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 28% (33 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 73% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

16% erosion, 5% landslide

LAND COVER (MAP 15)

4% developed, 44% forest, 5% wetland, 47% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 74% forest cover, 8% non-forest, 18% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, and winter steelhead trout; Pacific lamprey; reticulate sculpin
Wetlands – 21 acres (18% of reach); wetland habitat types include estuarine intertidal emergent; palustrine emergent, scrub-shrub, and forested.

WATER QUALITY (MAP 13)

Generally very good water quality. Not listed as a 303(d) Category 5 water.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (53%); Residential (28%); Vacant (10%); and Aquaculture (9%). Ownership – Private (90%) and Public (10%).

SHORELINE MODIFICATIONS (MAP 16):

There is one road crossing in the southern portion of the reach at Coulter Creek Rd. A dam is located in the southern portion adjacent to the WDFW fish hatchery.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Rural Residential 10 Acres (49%), Rural Residential 5 Acres (44%) and Agricultural Resource Lands (7%). Comprehensive Plan Designations – Rural (93%) and Agriculture Resource Lands (7%).

Existing Shoreline Environment Designation (SED) – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

There is no mapped public access to Coulter Creek Reach 01.

IMPERVIOUS SURFACES (MAP 16)

3% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences, roads, and the Coulter Creek fish hatchery in lower part of reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach, with a small portion of the reach in a moderate probability zone.

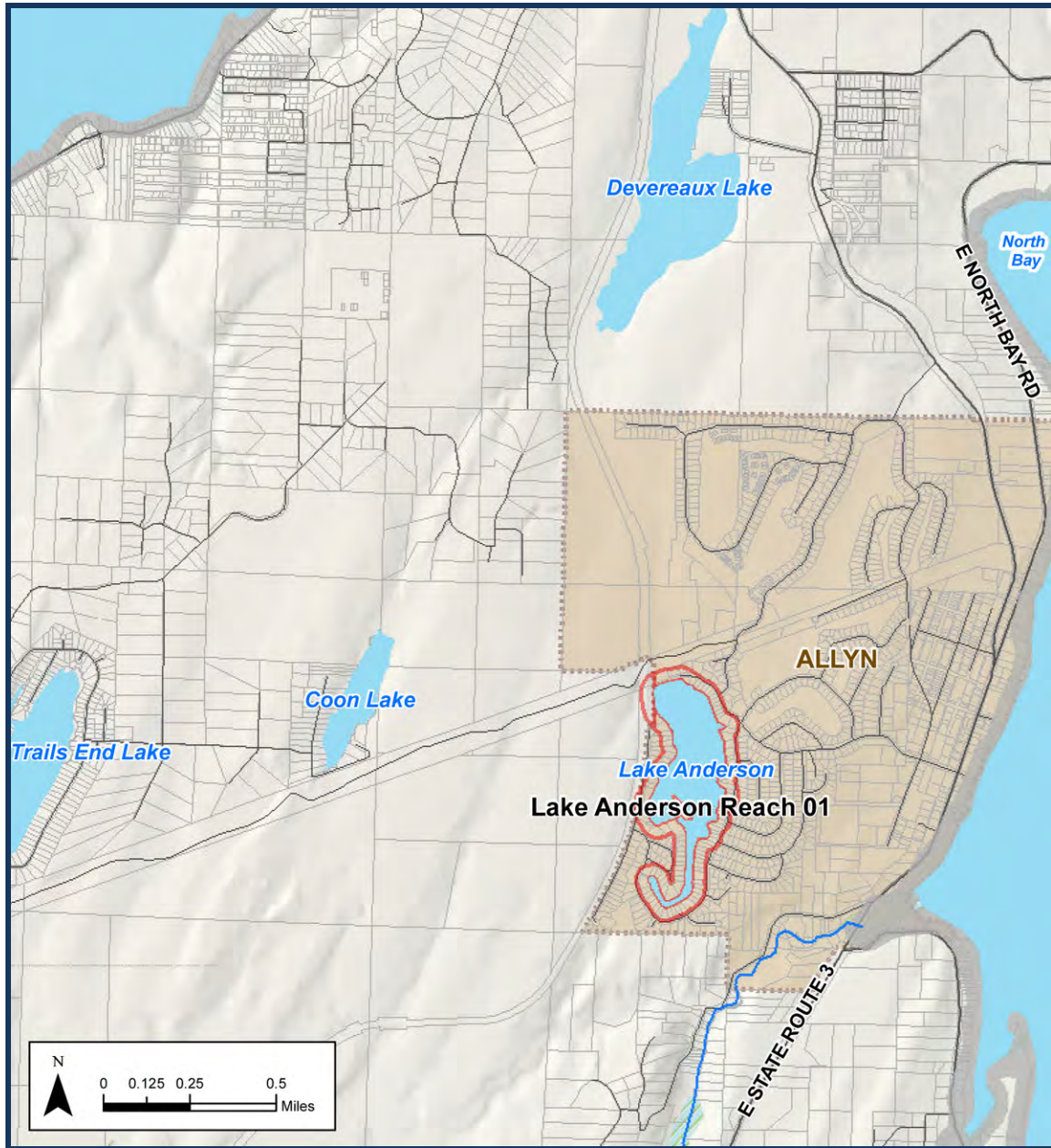
OPPORTUNITY AREAS

Protect riparian area and associated wetlands to restore overall good water quality in Coulter Creek. Work with public agencies with ownership in the reach to identify public access opportunities, if appropriate. Protect associated wetlands to the west of the creek and forested wetlands at the creek mouth south of SR 302.

KEY MANAGEMENT ISSUES

- Septic systems may be contributing to an increase in fecal coliform.
- Use of best management practices in agricultural uses to protect stream from sedimentation and erosion.
- Associated wetlands protect water quality in the creek.
- Development of South Kitsap Industrial Area in the headwaters of Coulter Creek.

6.2 Lake Anderson



6.2.1 Physical Characterization and Modifications

A significant portion of the West Drainage Basin of the Allyn Urban Growth Area drains into Anderson Lake (Otak, 2007). Lake Anderson is a man-made lake that performs regional detention prior to discharge into Anderson Creek, a tributary of Sherwood Creek that ultimately discharges into the North Bay of Case Inlet. Two partial fish passage barriers are located on Anderson Creek (WDFW, 2012).

The Lake Anderson shoreline has been modified by development. Some of the process modifications include:

- Dams that have artificially raised water levels;
- Land conversion from pervious to impervious surfaces:
 - Lake Anderson is primarily surrounded by impervious surfaces associated with residential development.

6.2.2 Water Quality

Lake Anderson is not included on Ecology's 303(d) list of impaired waters (Ecology, 2008a). No other water quality assessments or aquatic plant management plans were identified for this lake. Lake Anderson is an important source of cold water for Anderson Creek.

6.2.3 Critical or Priority Habitat and Species

Lake Anderson

Several state and federally-listed priority fish species have been identified as occurring in Lake Anderson (Appendix B: WDFW, 2011; Table 6-2).

Table 6-2. Priority fish species documented for Lake Anderson

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	Threatened	~

No wetlands are mapped around Lake Anderson. No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or vegetation communities within the Lake Anderson shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

6.2.4 Land Use

Lake Anderson is mostly developed with residential homes and individual docks/piers. The Allyn UGA is served by the North Bay/Case Inlet Water Reclamation Facility.

6.2.5 Summary of Key Management Issues

See Reach Sheet.

6.2.6 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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LAKE ANDERSON

SHORELINE PERIMETER

2.2 MI

WATERBODY AREA

45.3 AC

REACH AREA

95.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 42% (21 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

6% erosion, 6% landslide

LAND COVER (MAP 15)

6% developed, 32% open water, 3% beach; 47% forest, 11% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 22% forest cover, 32% non-forest, 1% other natural vegetation, 45% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, winter steelhead trout.

No wetlands mapped.

Cold water refugia for juvenile salmonids and priority coho rearing habitat.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters. Important source of cold water for Anderson Creek.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (67%); Vacant (13%); Parks, Open Space, and Recreation Areas (12%); and Transportation (8%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

A dam is located in the southwestern portion of the reach. According to 2009 aerial imagery, there are numerous individual docks/piers associated with single-family homes.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential 5 Acres (6%), Allyn Urban Growth Area (UGA): Residential Platted (92%), and Residential Recreational (2%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Lake Anderson.

IMPERVIOUS SURFACES (MAP 16)

13% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show numerous single-family residences and several roads along the lake shore.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore trees to riparian zones where vegetation is lacking.

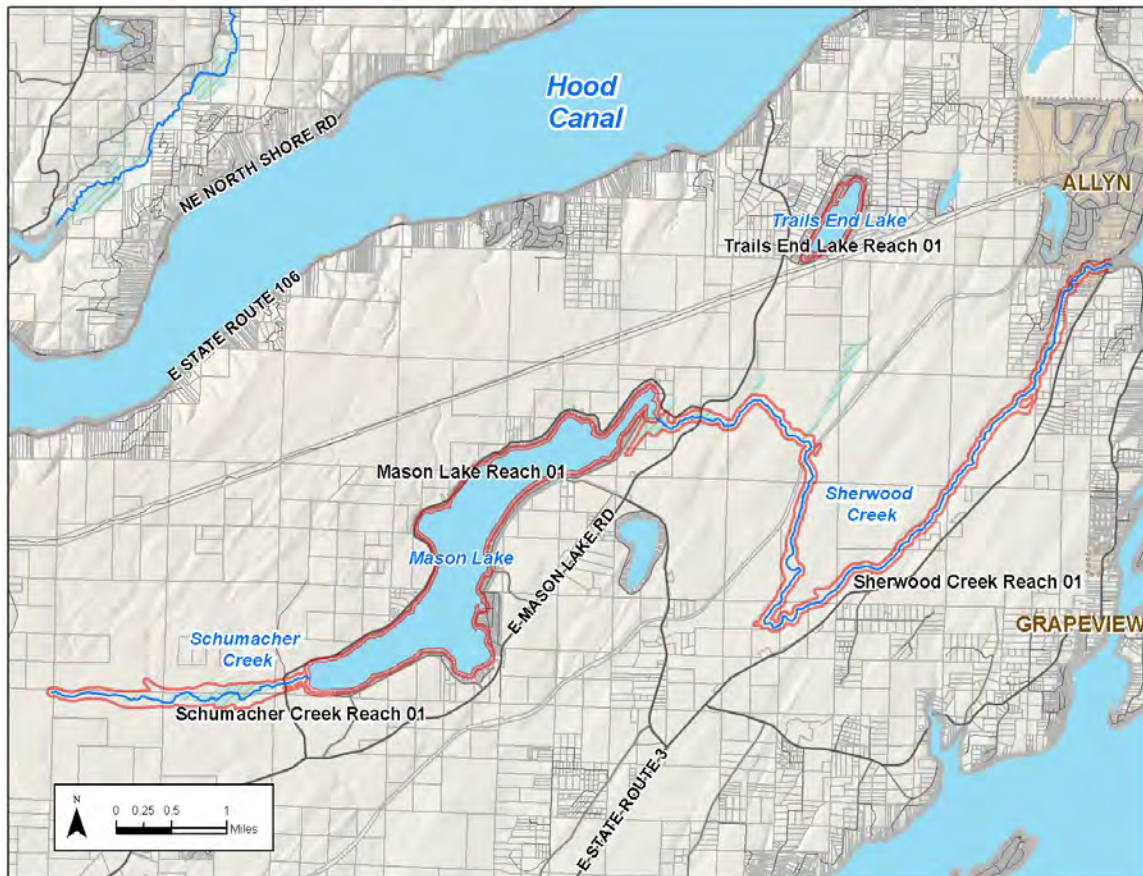
Reduce number of new docks over time by considering joint use docks.

Identify potential opportunities for public access.

KEY MANAGEMENT ISSUES

- Proliferation of single family docks and overwater structures.
- Use of best management practices to protect water quality; minimize use of fertilizers and pesticide within shoreline jurisdiction.
- Cold water refugia for juvenile salmonids and priority coho rearing habitat.

6.3 Sherwood Creek and Tributaries (Mason Lake, Trails End Lake, Schumacher Creek)



6.3.1 Physical Characterization and Modifications

Schumacher Creek and four tributaries flow into Mason Lake, which flows into Sherwood Creek. Mason Lake and Trails End Lake (also known as Prickett) drain via Sherwood Creek to the North Bay of Case Inlet, near the town of Allyn.

Mason Lake is the largest and deepest natural lake in Mason County with an area of 997 acres and a depth of 48 feet. Mason Lake is approximately four miles long and has a drainage area of approximately 20 square miles (Ecology, 2011a). Mason Lake has 10.9 miles of shoreline. Trails End Lake is 74 acres in area, has no surface water inlets and a drainage area of approximately 0.4 square miles (Ecology, 2011a).

Sherwood Creek contains 18.3 miles of channel and is the largest stream system in WRIA 14a (Kuttel, 2002). The average flow in Sherwood Creek is 15 to 25 cfs. A small mill pond is located at approximately RM 1.0 on Sherwood Creek. Above RM 3.0 on Sherwood Creek, dense stands of second growth conifers and cultivated Christmas trees are prevalent. Fish passage barriers are located on Sherwood Creek near the outlets of Mason and Trails End Lakes (Kuttel, 2002). The fish passage barriers located near the Mason Lake outlet are not complete barriers.

The drainage basins of Sherwood Creek, Trails End Lake, Mason Lake, and Schumacher Creek have been modified to varying degrees. Some of the process modifications affecting shoreline function include:

- Timber harvest adjacent to the creeks and lakes;
- Conversion of forested lands to impervious surfaces;
- Undersized culverts at road crossings;
- Residential development within shoreline areas; and
- Roads and infrastructure.

A mill and mill pond was constructed near the mouth of Sherwood Creek in 1854 (Kuttel, 2002). This resulted in logs being transported down the creek and erosion. In the 19th and 20th centuries culverts were built. These culverts are undersized and result in high water velocities.

6.3.2 Water Quality

Sherwood Creek, Schumacher Creek and Trail's End Lake are not included on Ecology's 303(d) Category 5 list of impaired waters (Ecology, 2008a). However, there is some evidence of water quality problems in Sherwood Creek with respect to the temperature and dissolved oxygen parameters, which has resulted in Category 2 listings for Sherwood Creek for both parameters (Ecology, 2008a; Otak, 2007).

Mason Lake is currently on the 303(d) list due to high concentrations of PCBs in fish tissue. Total PCB concentrations were 10.1 mg/kg in northern pikeminnow tissue samples collected from Mason Lake in 2006. Methyl mercury concentrations are also high in Mason Lake. Concentrations as high as 450 ug/kg were detected in pikeminnow tissue samples, exceeding National Toxics Rule criterion (Washington Department of Ecology, 2008a, b). Mason Lake is also listed by Ecology as having impairments associated with the presence of Eurasian water-milfoil (*Myriophyllum spicatum*); and an Integrated Aquatic Vegetation Management Plan (IAVMP) has been developed for the lake to guide plant management. In addition, residents of Mason Lake have formed a Lake Management District to coordinate actions to address water quality and management of aquatic weeds.

6.3.3 Critical or Priority Habitat and Species

Sherwood Creek

Sherwood Creek is mapped as providing habitat for multiple state and federally-listed priority fish species (Appendix B: WDFW, 2011; Table 6-3). The Squaxin Island Tribe operates smolt traps to monitor natural salmon production in Sherwood and Schumacher Creeks (Squaxin Island Natural Resource Division, 2010). Fall Chinook are observed in the lowest reach of Sherwood Creek but these are not considered a self-sustaining population (SaSI, 2002).

Table 6-3. Priority salmonid species documented for Sherwood Creek, Mason Lake, and Schumacher Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Sherwood Creek only) and Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Sherwood Creek only) and Migration	T	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	~	~
kokanee salmon (Mason Lake /Schumacher only)	<i>Oncorhynchus nerka</i>	Migration/Spawning	~	~
winter Steelhead	<i>Oncorhynchus mykiss</i>	Spawning (Sherwood Creek only) and Migration	T	~

Approximately 86 acres of wetland, another priority habitat, have been mapped along the shoreline of Sherwood Creek, representing 17 percent of the reach (Appendix B: USFWS, 2010). No priority wildlife species occurrences have been mapped in the vicinity of the creek, nor have priority plant species or vegetation communities been identified (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

Trails End Lake

Trails End Lake supports coastal cutthroat trout (Appendix B: WDFW, 2011). No wetlands are mapped in the shoreline planning area of the lake. The shores of the lake are heavily developed. No priority wildlife species occurrences have been mapped in the vicinity of the lake (Appendix B: WDFW, 2011). The DNR NHP has identified approximately 48 acres of water lobelia within the Trails End Lake shoreline planning area (Appendix B: DNR, 2009).

Mason Lake

Mason Lake, due to its association with Sherwood Creek and Schumacher Creek, supports many priority salmon and trout species (Appendix B: WDFW, 2011; Table 6-3). There are reports of coho and chum escapements above Mason Lake (Kuttel, 2002). Approximately 10 acres of wetland have been mapped around the lake (Appendix B: USFWS, 2010). Residential development along the shoreline has impacted wetland habitat over time. Osprey has been documented on Schumacher Creek in the vicinity of Mason Lake (Appendix B: WDFW, 2011). The DNR NHP has identified 215 acres of water lobelia habitat within the Mason Lake shoreline planning area (Appendix B: DNR, 2009).

Schumacher Creek

Schumacher Creek is mapped as supporting several species of priority fish (Appendix B: WDFW, 2011; Table 6-3). Coho production is monitored through smolt traps placed by the Squaxin Island Tribe and the stream is a major anadromous fish production stream (Kuttel, 2002). Coho spawning is mapped immediately upstream of Mason Lake. Approximately 81 acres (36 percent of the reach) is mapped as wetland (Appendix B: USFWS, 2010). Osprey is documented in the vicinity of the lake (Appendix B: WDFW, 2011). The DNR NHP has identified approximately half an acre of water lobelia habitat and 20 acres of Douglas fir/Hemlock/Evergreen Huckleberry vegetation community within the Schumacher Creek shoreline planning area (Appendix B: DNR, 2009).

6.3.4 Land Use

Sherwood Creek is primarily mapped as forestry with some residential uses in the lower portion of the reach near the stream mouth. Schumacher Creek is similar, with almost the entire reach designated as recreational open space or forestry use.

Mason Lake is extensively developed with residential homes and individual single family docks and bulkheads. Mason Lake Park is a County-owned community park located at the north end of the lake (Mason County Parks and Trails, 2006). The park has a boat launch, barbeques, picnic tables and a parking area. Mason Lake Picnic Park is a small, undeveloped park located at the south end of the lake.

Trails End Lake is similar to Mason Lake in that the predominant use is residential but it is not as extensively developed. Trails End Lake has a WDFW public boat launch at the south end of the lake (Mason Parks and Recreation Department, 2008).

6.3.5 Summary of Key Management Issues

The key management issues for Sherwood Creek, Schumacher Creek, Mason Lake, and Trails End Lake are: 1) reducing dock proliferation and limiting construction of new overwater structures, 2) protection and preservation of lake water quality, 3) control of invasive aquatic plant species such as Eurasian water milfoil, and 4) securing parks and open space on Mason Lake to provide public access.

6.3.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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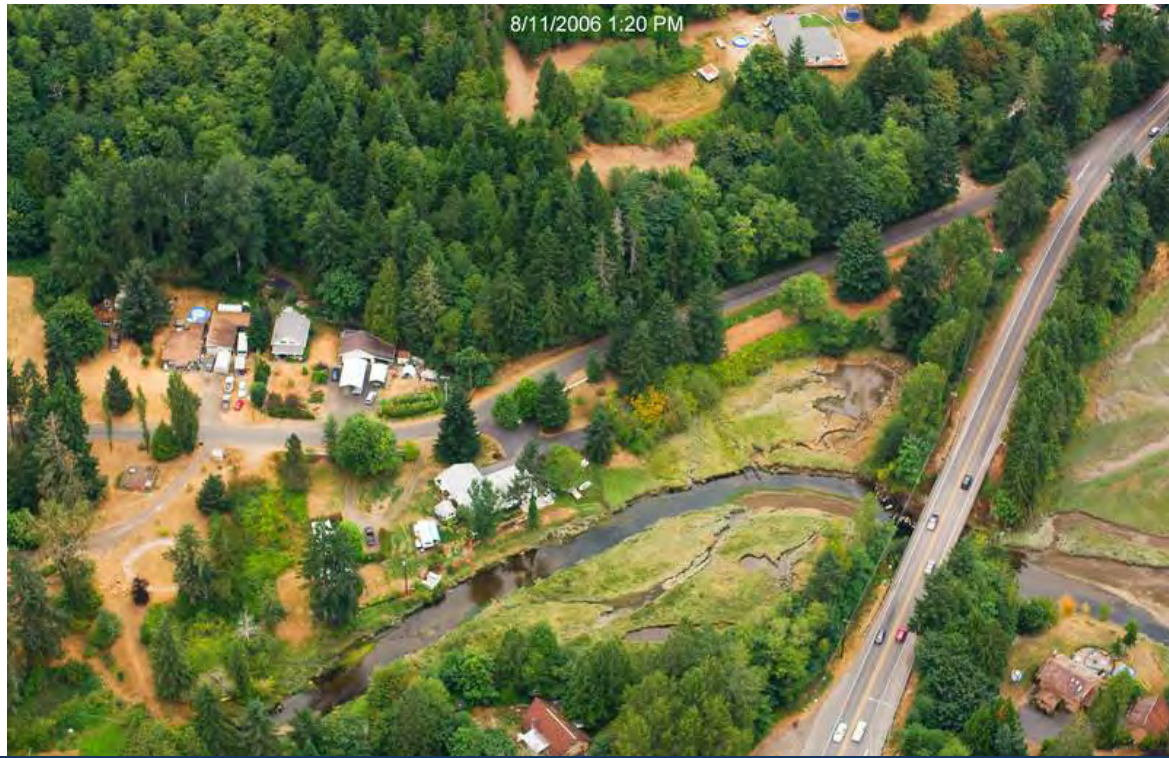
SHERWOOD CREEK

SHORELINE LENGTH

9.0 MI

REACH AREA

502.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 33% (168 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 70% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

33% erosion, 34% landslide

LAND COVER (MAP 15)

61% forest, 1% wetland, 37% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 57% forest cover, 4% non-forest, 37% other natural vegetation, 2% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, winter steelhead trout.

Wetlands – 86.4 acres (17% of reach); wetland habitat types include estuarine intertidal emergent (near stream mouth) and palustrine scrub-shrub.

WATER QUALITY (MAP 13)

Not listed as a 303 (d) Category 5 water; Category 2 for temperature and dissolved oxygen.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (82%); Vacant (9%); Residential (7%); and remaining 2% is a mix of Parks, Open Space, and Recreation Areas and Transportation. Ownership - Private (56%) and Public (44%). DNR and the State of Washington own several large parcels along Sherwood.

SHORELINE MODIFICATIONS (MAP 16)

There are 3 crossings of the creek, moving west to east: East Trails Rd., a railroad crossing with a bridge and SR 3 at the mouth in Allyn. The creek also flows through the BPA powerline corridor.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Long Term Commercial Forest (78%), Rural Residential 5 Acres (10%), Rural Residential 20 Acres (5%); Inholding Lands (2%); and Allyn UGA: Single Family Residential (4%). Comprehensive Plan Designations: Long Term Commercial Forest (81%), Rural (17%) and Inholding Lands (2%).

Existing SED: Conservancy (84%) and Rural (16%).

PUBLIC ACCESS (MAP 14)

There is no mapped public access to Sherwood Creek; most of the reach is owned by either the State of Washington or private timber companies like Green Diamond.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show most of this is single-family residential development in the lower part of the reach.

AREAS OF SPECIAL INTEREST

The Ecology-listed facilities and sites within the reach include a Voluntary Cleanup Site.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is generally a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Riparian forest of 100 feet in width remains following timber harvest that extends several miles over nonconsecutive parcels. Restore trees in the riparian buffer within shoreline jurisdiction.

Restore associated wetlands impacted by logging.

Work with public agencies with ownership in the reach to identify public access opportunities.

Sherwood Creek LWD Placement (Appendix B: PSP, 2010); Sherwood LWD four sites. Working with TAG and available models and studies, identify landowners and develop preliminary designs that lead to restoration projects.

KEY MANAGEMENT ISSUES

- Important cold water refugia for juvenile salmon.
- Development and removal of riparian habitat increasing stream temperatures.
- Lack of large woody debris.
- Maintain constant discharge from Mason Lake to Sherwood to maintain adequate base flows and cold water inputs.

TRAILS END LAKE

SHORELINE PERIMETER

2.2 MI

WATERBODY AREA

73.0 AC

REACH AREA

125.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 39% (21 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

less than 1% erosion, less than 1% landslide

LAND COVER (MAP 15)

3% developed, 47% open water, 2% beach, 2% playa, 46% forest (Appendix B: GAP, 2009).
Riparian vegetation: 17% forest cover, 23% non-forest, 2% other natural vegetation, 59% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout; water lobelia.
No wetlands mapped.

WATER QUALITY (MAP 13):

Not included on Ecology's 303 (d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (74%); Vacant (21%); with the remaining 4% a mix of Parks, Open Space, and Recreation Areas and Transportation. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

A total of 51 residential docks were observed on the lake along with 22 residential floats (Google Earth, 2011). Several floats are in the center of the lake due to its shallow depth. There is a public boat launch at the south end of the lake. Very few of the residential properties appear to have bulkheads or armoring.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAP 19)

Zoning Districts - County: 100% Rural Residential 5 Acres. Comprehensive Plan Designations – 100% Rural.

Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW gravel boat launch on the south shore that provides access to Trails End Lake (WDFW Lands, 2011).

IMPERVIOUS SURFACES (MAP 16)

Approximately 11% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences along most of the lake shore.

AREAS OF SPECIAL INTEREST (MAP 13)

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to very high probability of finding unknown artifacts within this reach

OPPORTUNITY AREAS (MAP 22):

Restore trees in riparian zone where only lawn exists.

KEY MANAGEMENT ISSUES:

- Limit new docks over time by considering joint use docks.
- Limit overwater structures to reduce shading (i.e., limit float size).

MASON LAKE

SHORELINE PERIMETER

11.1 MI

WATERBODY AREA

997 AC

REACH AREA

1,245 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 48% (128 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

2% erosion, 21% landslide

LAND COVER (MAP 15)

4% developed, 76% open water, 2% beach, 16% forest, 2% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 7% forest cover, 12% non-forest, 1% other natural vegetation, 80% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, kokanee salmon, winter steelhead trout. Water lobelia.

Wetlands – 10.0 acres (4% of reach); wetland habitat types include lacustrine aquatic bed and palustrine scrub-shrub.

WATER QUALITY (MAP 13):

Listed on Ecology's 303(d) list of impaired waters for PCB in fish tissue and methyl mercury. Eurasian water milfoil and Sagittaria are also problem weeds; an integrated aquatic vegetation management plan has been developed. The lake is currently undergoing treatment with aquatic herbicides to control milfoil (Mason and Benson Lakes Community Club, 2012).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (82%); Parks, Open Space, and Recreation Areas (9%); Vacant (7%) and Forestry (2%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 503 docks/piers mapped throughout the reach, one buoy/float mapped in the southwest portion of the reach and a boat launch in the north part of the lake (Mason County Parks and Trails, 2006). Bulkheads exist on many lots.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential: 5 Acres (97%) and Rural Residential 20 Acres (3%). Comprehensive Plan Designations – 100% Rural. Existing SED – Urban Residential (94%) and Conservancy (6%).

PUBLIC ACCESS (MAP 14)

Mason Lake Park is a County-owned community park located at the north shore. The park has a boat launch, barbecues, picnic tables, and parking. The park is 17 acres with only 2 acres developed. The remaining area is undeveloped, forested lands (Mason County Parks and Trails, 2006).

Mason Lake Picnic Park is a 1 acre undeveloped, forested park located on the south side of the lake. (Mason County Parks and Trails, 2006). There is also a small private marina on the eastern shore that provides community access. The Simpson Employees Recreation Area lies on the southwestern end of the lake near Schumacher Creek. According to the Simpson web page, this 48-acre open space area is listed to be sold (<http://www.simpson.com/Information-Center.aspx>).

IMPERVIOUS SURFACES (MAP 16)

Approximately 7% of the reach contains mapped impervious surfaces. Aerial photos from 2009 show single-family houses along most of the lake shore.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove bulkheads and use soft-shore bank stabilization where feasible.
Reduce number of new docks over time by considering joint use residential docks.
Restore trees in the riparian zone.
Remove non-native predator species (e.g. bass).

KEY MANAGEMENT ISSUES:

- Water quality impaired by nutrients, resulting in Eurasian water milfoil and nuisance aquatic plants.
- Manage recreational uses and balance with environmental protection.
- Maintain constant lake discharge (from the hypolimnion) to Sherwood Creek to maintain adequate base flows and cold water input.
- Proper management and maintenance of residential on-site septic systems.
- Dock proliferation and overwater structures.

SCHUMACHER CREEK

SHORELINE LENGTH

2.6 MI

REACH AREA

223.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – 77% (173 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 38% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

16% erosion, 14% landslide

LAND COVER (MAP 15)

1% developed, 59% forest, 1% wetland, 40% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 73% forest cover, 4% non-forest, 21% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, kokanee salmon, winter steelhead trout. Osprey. Water lobelia and Douglas fir/Western Hemlock/Evergreen Huckleberry.

Wetlands – 81 acres (36% of reach); habitat types include palustrine forested and scrub-shrub.

WATER QUALITY (MAP 13)

Not listed as a 303 (d) Category 5 water

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Parks, Open Space, and Recreation Areas (92%) and Forestry (8%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are two road crossings: Mason Lake Drive W and an unnamed road. Few modifications observed and extensive associated wetlands along the stream.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential 20 Acres (91%) and Rural Residential 5 Acres (9%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

The Simpson Employees Recreation Area on Mason Lake lies on either side of at the creek as it enters the lake. According to the Simpson web page, this 48-acre open space area is listed to be sold (<http://www.simpson.com/Information-Center.aspx>).

IMPERVIOUS SURFACES (MAP 16)

1.4% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show one road crossing near the confluence with Mason Lake.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach

OPPORTUNITY AREAS

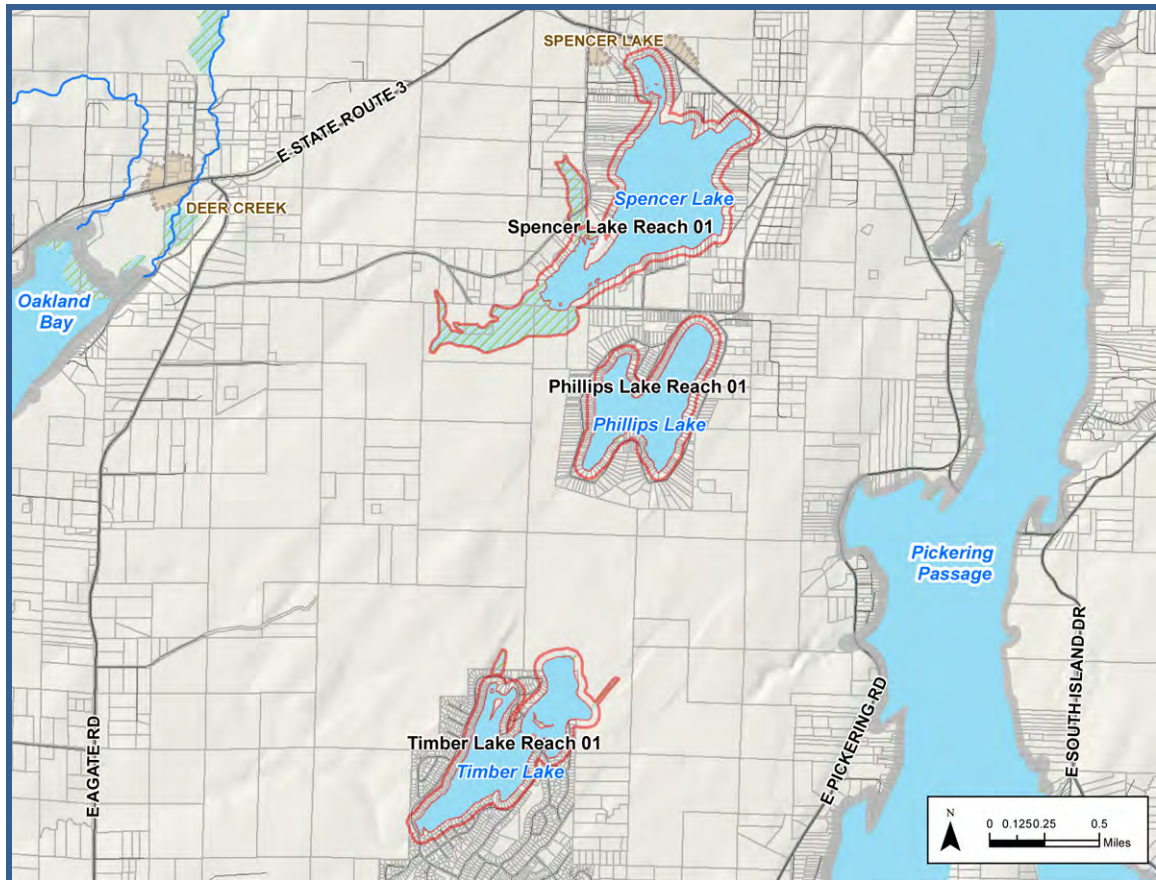
Protect and conserve wetlands associated with Schumacher Creek.

Restore forested riparian zones where impacted by forestry and timber cutting.

KEY MANAGEMENT ISSUES

- Protect cold water temperatures that provide habitat component for salmonids
- Improve opportunities for public access to this reach.

6.4 Lakes Near Spencer Lake (Spencer, Phillips, Timber)



6.4.1 Physical Characterization and Modifications

Three shoreline lakes -Spencer, Phillips, and Timber Lakes - are located approximately seven miles northeast of Shelton and one to two miles east of Oakland Bay. Spencer Lake has a drainage basin area of approximately 1.7 square miles, no surface inlets, and drains via Malaney Creek, which flows to Oakland Bay (Ecology, 2011). Spencer Lake is controlled by a concrete outlet structure that is 12 feet wide and five feet tall; the concrete span poses no barrier to fish migration into and out of Spencer Lake (Appendix B: WFC, 2011).

Phillips Lake has a drainage basin area of approximately 0.5 square miles, no surface inlets, and drains via wetlands to Timber Lake, which drains to Campbell Creek through a marshy area to Oakland Bay (Ecology, 2011).

Water elevations in Timber Lake are controlled by a concrete vault outlet structure and spillway. Timber Lake drains to Campbell Creek which is fish passable to its outlet at Chapman Cove (Appendix B: WFC, 2011).

The drainage basins of Spencer, Phillips, and Timber Lakes have been modified to varying degrees in the past. Some of the process modifications include:

- Conversion of pervious to impervious areas;
- Logging adjacent to the lakes;
- Outlet control structures; and
- Residential development along the shoreline.

6.4.2 Water Quality

Spencer Lake is included on Ecology's 303 (d) list of impaired waters for possible impairments related to the presence of big floating bladderwort (*Utricularia inflata*), otherwise known as swollen bladderwort, identified in 2002. Big floating bladderwort is a non-native, invasive aquatic weed that is freely floating, rootless and carnivorous. This aquatic weed is native to the southeastern US, primarily Florida (<http://www.ecy.wa.gov/programs/wq/plants/weeds/bladder.html>).

Phillips and Timber lakes are not included on the 303(d) list. No recent data on any of these lakes were identified.

6.4.3 Critical or Priority Habitat and Species

Spencer Lake

Multiple state and federally-listed priority salmon and trout species are documented in Spencer Lake (Appendix B: WDFW, 2011; Table 6-4). Malaney Creek drains Spencer Lake and fish use occurs in the creek. No barriers to fish migration are presented by the concrete span at the outlet (Appendix B: WFC, 2011).

Table 6-4. Priority salmonid species documented for Spencer Lake

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	~	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	T	~

Spencer Lake has approximately 93 acres of wetland, another priority habitat, mapped, which represents 52 percent of the reach (Appendix B: USFWS, 2010). A large wetland area extends from the southwest portion of the lake surrounding the Malaney Creek outlet. Wetland also extends from the lake to the northwest to E. Spencer Lake Road. No priority wildlife species occurrences have been mapped in the vicinity of the lake (Appendix B: WDFW, 2011). The DNR NHP has identified 28.5 acres of water lobelia within the Spencer Lake shoreline planning area (Appendix B: DNR, 2009).

Philips Lake

Coastal cutthroat trout have been documented in Phillips Lake (Appendix B: WDFW, 2011). No wetlands are mapped within the shoreline planning area (Appendix B: USFWS, 2010). No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or

vegetation communities within the Phillips Lake shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

Timber Lake

Timber Lake supports two priority species of fish: coastal cutthroat trout and winter steelhead (Appendix B: WDFW, 2011). Winter steelhead are listed as Threatened under the Endangered Species Act. Approximately 9.7 acres of wetland, primarily located in the northeast portion of the lake, have been mapped, representing 10 percent of the reach. Juvenile cutthroat trout, sculpin and western pearlshell have been observed in Campbell Creek, the outlet of Timber Lake (Appendix B: WFC, 2011). No priority wildlife species occurrences or priority plant communities have been documented (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

6.4.4 Land Use

Spencer Lake and Timber Lake have a mix of residential and forestry uses. There are individual docks/piers associated with most residences. There is a WDFW public boat launch at the north end of Spencer Lake (Mason County Parks and Recreation Department, 2008). Phillips Lake is mostly in residential use and has numerous single family residential docks. There is a WDFW public boat launch at the north end of the lake and Phillips Lake County Park at the south end (Mason County Parks and Recreation Department, 2008; Mason County Department of Parks and Trails, 2006). Phillips Lake Park is a County-owned community park located next to the WDFW boat launch. It also has a boat launch and parking facilities (Mason County Department of Parks and Trails, 2006).

6.4.5 Summary of Key Management Issues

The key management issues for Spencer, Phillips and Timber lakes are: 1) protect and preserve lake water quality; for example through management of fertilizers and herbicides used on residential properties, 2) protect in-water habitats and cold water sources for salmon including coastal cutthroat trout, 3) control of invasive aquatic plant species, and 4) limit dock proliferation and construction of new overwater structures.

6.4.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

SPENCER LAKE

SHORELINE PERIMETER

5.0 MI

WATERBODY AREA

213 AC

REACH AREA

391.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 55% (98 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

3% developed, 49% open water, 3% beach, 17% forest, 6% wetland, 21% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 25% forest cover, 12% non-forest, 2% other natural vegetation, 61% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, rainbow trout, winter steelhead trout. Water lobelia.

Wetlands – 93.4 acres (52% of reach); wetland habitat types include palustrine emergent and scrub-shrub.

WATER QUALITY (MAP 13)

Listed on Ecology's 303(d) list for invasive weed, swollen bladderwort. Swollen bladderwort is a non-native, invasive aquatic plant.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (54%); Forestry (29%); Vacant/Rural (16%); and Parks, Open Space, and Recreation Areas (1%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There is a road crossing in the western portion of the reach at Spencer Lake Rd. A dam is located in the southwestern portion of the reach. There are 115 docks/piers mapped throughout the reach. Many residences have bulkheads.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential: 5 Acres (77%), 10 Acres (22%) and Rural Tourist (1%). Comprehensive Plan Designations – Inholding Lands (75%) and Long Term Commercial Forest (25%). Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch that provides access to the north end of Spencer Lake. The boat launch is a 12-foot wide concrete launch. The total park size is 2 acres and includes parking (WDFW, 2011; Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

5.4% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences around most of the lake shore, except for the SW portion which contains a large wetland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Reduce number of new docks over time by considering joint use docks
Preserve and protect associated wetlands and floodplains.

KEY MANAGEMENT ISSUES

- Over water structures and dock proliferation.
- Protection of trees in the riparian areas.
- Control and management of invasive aquatic weeds (i.e. big floating bladderwort)

PHILLIPS LAKE

SHORELINE PERIMETER

2.6 MI

WATERBODY AREA

106.5 AC

REACH AREA

172.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 40% (26 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. Drains to Campbell Creek then Oakland Bay.

HAZARD AREAS (MAP 12)

6% erosion, 6% landslide

LAND COVER (MAP 15)

3% developed, 56% open water, 5% beach, 34% forest, 1% wetland, 2% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 16% forest cover, 19% non-forest, 65% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout.

No wetlands mapped.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list for impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (87%); and Vacant/Rural (12%); and Aquaculture (1%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2010 aerial imagery, there are 147 individual docks/piers, with a dock associated with most residences. There are two public boat launches.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential 5 Acres. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch with associated parking that provides access to the north end of Phillips Lake. The boat launch is a 10-foot wide concrete launch. The park is 1 acre in size and is co-managed with Mason County (Washington Department of Fish and Wildlife WDFW Lands, 2011; Mason County Parks and Trails, 2006). Phillips Lake County Park is a community park located next to the WDFW boat launch. It also has a boat launch and parking facilities (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

7% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads surrounding most of the lake.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Reduce number of new docks over time by considering joint use docks.
Preserve and protect wetlands draining to the lake.

KEY MANAGEMENT ISSUES

- Overwater structures and dock proliferation.
- Protection of salmonid habitat and good overall water quality.

TIMBER LAKE

SHORELINE PERIMETER

4.4 MI

WATERBODY AREA

123.0 AC

REACH AREA

217.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 45% (43 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

4% developed, 28% open water, 3% beach, 46% forest, 14% wetland, 5% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 30% forest cover, 23% non-forest, 7% other natural vegetation, 40% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat and winter steelhead trout.
Wetlands – 9.7 acres (10% of reach); wetland habitat types include palustrine aquatic bed, emergent, scrub-shrub, and forested.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list for impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (33%); Parks, Open Space, and Recreation Areas (32%); Forestry (18%); and Vacant (17%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

A dam and concrete control structure is located in the southwestern portion of the reach. According to 2009 aerial imagery, there are 123 individual residential docks, as well as multiple floats and buoys.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Rural Residential: 5 Acres (80%) and Rural Residential 20 Acres (20%).
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is no mapped public access to Timber Lake. Several small private community parks are situated on Timber Lake providing fishing, swimming and community access (Timber Lake Community Club, 2012).

IMPERVIOUS SURFACES (MAP 16)

15% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads along most of the shoreline except for a large wetland on the NE part of the lake.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to moderate to high probability of finding unknown artifacts within this reach, with small portions of the reach in high to very high probability zones.

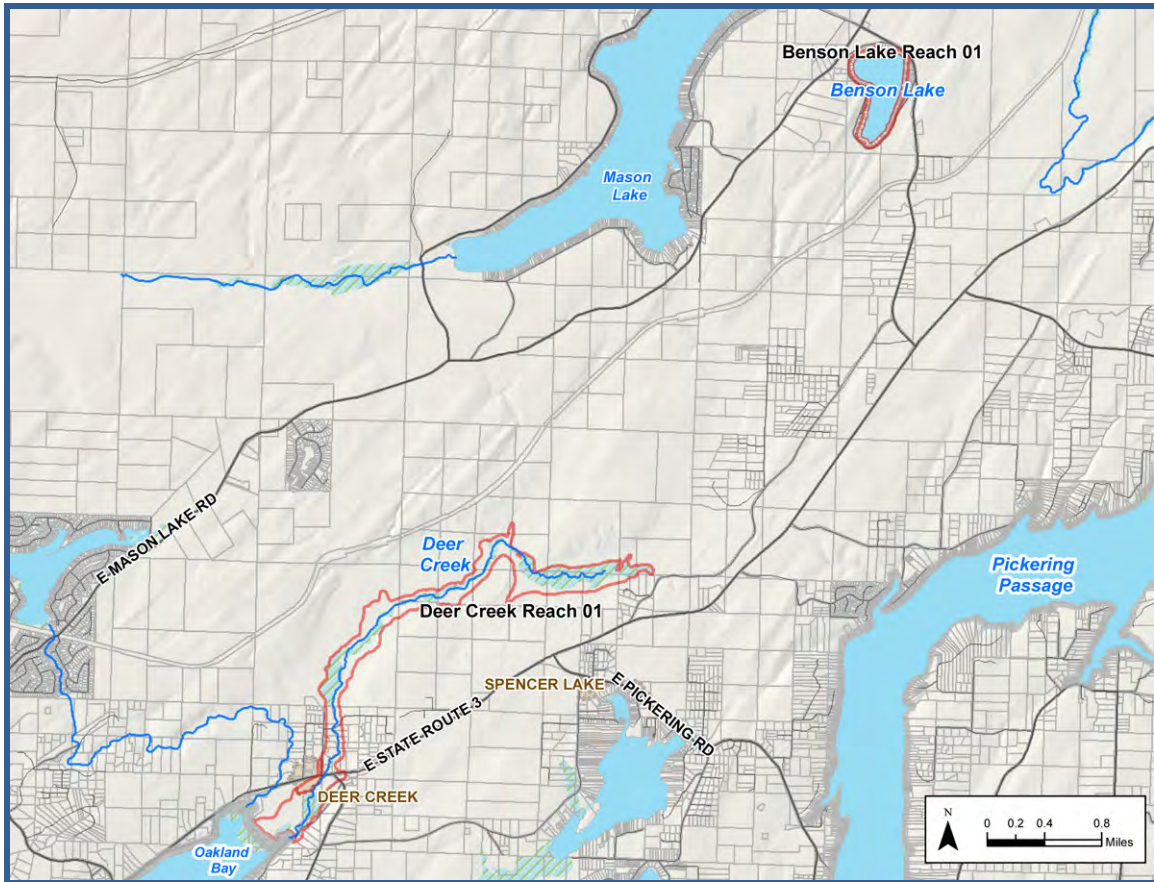
OPPORTUNITY AREAS

Reduce number of new docks over time by considering joint use docks.
Restore trees along the lake shore.

KEY MANAGEMENT ISSUES

- Maintain cold temperature in lake discharge.
- Overwater structures and residential dock proliferation.
- Protection of headwaters of Campbell Creek.

6.5 Deer Creek and Benson Lake



6.5.1 Physical Characterization and Modifications

The headwaters of Deer Creek include both wetlands/springs and the outflow from Benson Lake. Benson Lake covers an area of approximately 80 acres and length of 0.8 mile. Six streams or ditches flow into Benson Lake. The lower approximately three miles of Deer Creek entering Oakland Bay is characterized as a shoreline of the state. The upper section of Deer Creek, from north of the intersection of E Anthony Road and SR 3 to Benson Lake, is not considered a shoreline of the state due to mean annual flows less than 20 cfs.

Deer Creek flows through Christmas tree farms and wetlands prior to entering Oakland Bay, about ¼ mile east of Cranberry Creek. Five small tributaries enter Deer Creek between RM 3 and RM 6 (Kuttel, 2002). Culverts are located along many of the tributaries to Deer Creek. Several sections of Deer Creek itself just downstream of Benson Lake are culverted. Homes and associated bank armoring are located adjacent to the stream in the lower 1.5 miles of Deer Creek. Extensive open water and emergent wetlands are located upstream of RM 1.5.

The Deer Creek drainage basin has been modified by logging and development. Some of the process modifications include:

- Land conversion from pervious to impervious surfaces;
- Timber harvest adjacent to the creek;
- Culverts and other structures that change the flow patterns;
- Lack of large woody debris key piece abundance; and
- Severe erosion and bank armoring due to development.

6.5.2 Water Quality

Two monitoring stations on Deer Creek have recorded high water temperatures that exceed Washington State water quality standards. The stream is listed on the 303(d) list of impaired waters (Category 5 water) for the temperature parameter (Ecology, 2008a). In addition, the north end of Oakland Bay at the mouth of Deer Creek is listed for fecal coliform, which is related to sediments entering the estuary from streams and other non-point sources of pollution. A TMDL for Fecal coliform in Oakland Bay indicates that control of sediments entering the shallow north end is needed to reduce overall fecal coliform (Ahmed and Wagner, 2011).

No water quality data were identified for Benson Lake. Benson Lake is not included on Ecology's 303(d) list of impaired waters.

6.5.3 Critical or Priority Habitat and Species

Deer Creek

Deer Creek drains to Oakland Bay and has been mapped as supporting multiple species of priority fish (Appendix B: WDFW, 2011; Table 6-5). The entire length of Deer Creek is considered fish-bearing from Oakland Bay to Benson Lake. Coho production is documented as significant; while summer chum utilization is lower (Kuttel, 2002). Coho spawn through the entire shoreline reach, whereas summer chum spawn appear limited to within a mile of Oakland Bay. Fall Chinook salmon are occasionally observed at the mouth but are not considered a self-sustaining population (SaSI, 2002).

Table 6-5. Priority salmonid species documented for Deer Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	T	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	T	~

Deer Creek has 143 acres of wetland mapped along its shoreline, representing 37 percent of the reach (Appendix B: USFWS, 2010). No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or vegetation communities within the Deer Creek shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

Benson Lake

Benson Lake supports coastal cutthroat trout (Appendix B: WDFW, 2011). The lake is also stocked with rainbow and cutthroat trout by WDFW for recreational fishing. Juvenile pumpkinseed and yellow perch were electrofished just downstream of the lake in Deer Creek (Wild Fish Conservancy, 2010). No wetlands have been mapped around the shoreline of the lake (Appendix B: USFWS, 2010). No priority wildlife

species occurrences have been mapped in the vicinity of the lake (Appendix B: WDFW, 2011). The DNR NHP maps approximately 43.7 acres of water lobelia in the lake (Appendix B: DNR, 2009).

6.5.4 Land Use

Benson Lake is almost entirely developed with residential uses and individual docks and floats. Approximately 150 homes with septic systems surround Lake Benson (Taylor et al., 2000). There is a WDFW public boat launch at the north end of the lake and an undeveloped open space owned by Mason County (Mason County Parks and Recreation Department, 2008). Use of internal combustion engines are prohibited on Benson Lake by County Ordinance. Deer Creek is mainly in forestry use with some residential uses upstream of Agate Road.

6.5.5 Summary of Key Management Issues

Protection of water quality is a key management issue for both Deer Creek and Benson Lake. Control of nutrients and total suspended solids at all stormwater discharges to Deer Creek has been noted to help reduce fecal coliform in Oakland Bay (Ahmed and Wagner, 2011). Maintenance and proper management of on-site septic systems is also considered an issue related to controlling potential human sources of fecal coliform in the watershed.

6.5.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

DEER CREEK

SHORELINE LENGTH

3.9 MI

REACH AREA

385.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 67% (259 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 70% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

2% erosion, 3% landslide

LAND COVER (MAP 15)

3% developed, 4 percent agriculture, 34% forest, 3% wetland, 56% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 63% forest cover, 11% non-forest, 26% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, winter steelhead trout. River lamprey, freshwater mussel, and juvenile cutthroat trout observed by WFC (Appendix B: WFC, 2011).

Wetlands -- 143 acres (37% of reach); habitat types include estuarine intertidal emergent; freshwater aquatic bed, scrub-shrub and forested.

WATER QUALITY (MAP 13)

Listed on Ecology 303(d) as Category 5 for high water temperatures.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (70%); Residential (22%); and remaining 9% of land uses a mix of Transportation, Vacant, and Agriculture. Ownership – 100% Private. Capitol Land Trust owns some parcels at the mouth of the creek.

SHORELINE MODIFICATIONS (MAP 16)

There is a bridge at the SR 3 crossing in this reach, along with other bridges for private driveways. Bank armoring exists along left bank on Gosser Road (Appendix B: WFC, 2011). Several culverts on creek upstream (i.e. railroad crossing, others).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning district – Rural Residential 20 Acres (58%), Rural Residential 5 Acres (18%), Rural Residential 10 Acres (11%), Agriculture Resource Lands (11%), and Rural Commercial 2 (2%). Comprehensive Plan Designations – Rural (87%), Agriculture Resource Lands (11%) and Hamlet (2%).
Existing SED - Conservancy (67%) and Rural (33%).

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in the Deer Creek planning area.

IMPERVIOUS SURFACES (MAP 16)

7% of the reach contains mapped impervious surfaces. Aerial photos from 2009 show single-family residences and roads, mainly in lower part of reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low to moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian areas and associated wetlands.
Restore riparian areas by planting native trees along the creek.
Identify areas in forestry use that could provide public access.
Possible public access opportunity at SR 3 road crossing.

KEY MANAGEMENT ISSUES

- Protect water quality and in stream areas that supports salmonid habitat.
- Remove culverts and other over-water structures on upper Deer Creek and tributaries to improve fish passage and reduce downstream bank erosion.
- Protect associated wetlands and floodplains that filter stormwater and protect water quality.
- Public access to the stream is needed.

BENSON LAKE

SHORELINE PERIMETER

1.7 MI

WATERBODY AREA

80 AC

REACH AREA

124.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 37% (16 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

4% erosion, 4% landslide

LAND COVER (MAP 15)

58% open water, 1% beach, 40% forest, 1% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 16% forest cover, 19% non-forest, 65% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout; water lobelia.
No mapped wetlands within shoreline jurisdiction.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (91%); remaining 9% is a mix of Parks, Open Space, and Recreation Areas and Vacant. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2010 aerial imagery, there are approximately 93 individual residential docks and 36 floats. Many properties appear to have bulkheads.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: 100% Rural Residential 5 Acres. Comprehensive Plan Designations – 100% Rural.

Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW concrete boat launch with associated parking that provides access to Benson Lake. Mason County owns an undeveloped parcel to the north of the boat launch that provides public access (Benson Lake Lot A). The total park size is about 79 acres (WDFW, 2011; Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

3.4% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2010 show single-family residences along most of the lake shore.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

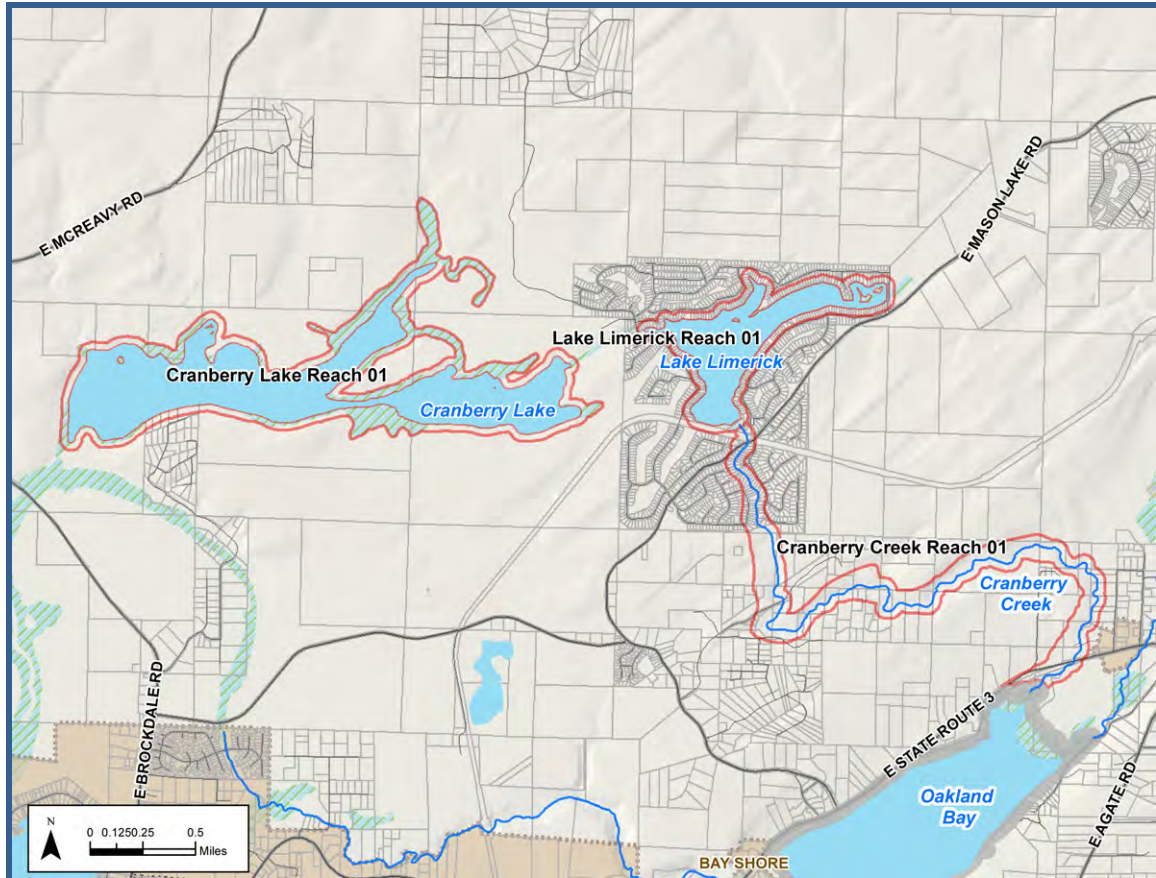
OPPORTUNITY AREAS

Consider improvements to existing public access near WDFW boat launch.

KEY MANAGEMENT ISSUES

- Overwater structures and dock proliferation. Reduce number of new docks over time by considering joint use docks.
- Maintain prohibition on use of internal combustion engines on the lake.
- Continue to protect good water quality.
- Management and maintenance of on-site septic systems.
- Protection of trees in riparian areas.

6.6 Cranberry Creek and Tributaries (Cranberry Lake, Lake Limerick)



6.6.1 Physical Characterization and Modifications

The Cranberry Creek drainage basin has been extensively logged and converted to rural residential uses and Christmas tree farms. Cranberry Creek flows approximately 9.7 miles, including areas upstream and downstream of Cranberry and Limerick Lakes, before draining into the northern portion of Oakland Bay. Cranberry Lake is surrounded by about 99 acres of springs, marsh and bog wetland habitat. Intermittent streams flow into the lake from bog lakes located up to a mile northward.

Lake Limerick is located about five miles northeast of Shelton, at RM 3.5 of Cranberry Creek, and drains an area of about 13 square miles (Ecology, 2011). Lake Limerick was formed in 1966 by building a 15-foot-high dam on Cranberry Creek (Kuttel, 2002). A fish ladder facilitates passage to the lake.

The Cranberry Creek drainage basin has been extensively modified. Some of the process modifications include:

- Creation of the lake by damming the creek;
- Adjacent logging;
- Culverts; and
- Conversion of pervious to impervious surfaces.

6.6.2 Water Quality

Ten monitoring stations on Cranberry Creek have recorded high water temperatures that exceed Washington State water quality standards. The stream is listed on the 303(d) list of impaired waters (Category 5) for temperature exceedances (Ecology, 2008a). No other water quality impairments have been identified at this time. Stream temperatures in Cranberry Creek exceed state standards from above Lake Limerick to Oakland Bay (Ecology, 2008a).

Ecology has prepared a quality assurance project plan (QAPP) with respect to the Total Maximum Daily Load (TMDL) for Oakland Bay-Hammersley Inlet and associated tributaries with respect to temperature. Cranberry Creek is included in this report (Ecology, 2005). In October 2011, Ecology convened the first advisory group meeting to address temperature issues for certain Oakland Bay tributaries. This group is targeting completion of the Cranberry, Johns, and Mill Creek's Temperature TMDL WQIR for September 2012.

Cranberry Lake and Lake Limerick are not included on Ecology's 303 (d) list of impaired waters except for possible impairments in Lake Limerick associated with

Brazilian elodea (*Egeria densa*) and swollen bladderwort. Lake Limerick is a nutrient rich, meso-eutrophic lake with an extensive aquatic plant community (Ecology, 1997) that is currently managed under an IAVMP.

6.6.3 Critical or Priority Habitat and Species

Cranberry Creek

Cranberry Creek drains to Oakland Bay and is documented to support many federal and state-listed species of priority fish (Appendix B: WDFW, 2011; Table 6-6).

Table 6-6. Priority salmonid species documented for Cranberry Creek, Cranberry Lake, Lake Limerick

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Cranberry Creek and only) and Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Cranberry Creek and only) and Migration (Cranberry Lake and Lake Limerick only)	T	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Spawning (Cranberry Creek and only) and Migration (Cranberry Lake and Lake Limerick only)	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	~	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	T	~

No priority wildlife species or priority plant communities have been mapped in the vicinity of Cranberry Creek (Appendix B: WDFW, 2011).

Cranberry Lake

Several priority fish species have been identified by WDFW in Cranberry Lake (Appendix B: WDFW, 2011; see Table 6-6). Approximately 167 acres of the Cranberry Lake shoreline reach (62 percent) is mapped as wetland (Appendix B: USFWS, 2010). Wetland habitat has not been impacted by direct development, but is surrounded by logged areas and some residential development. Priority species occurrences that have been observed in the area of the lake include bald eagle and osprey (Appendix B: WDFW, 2011).

Wetland habitat associated with Cranberry Lake is considered high quality and includes sphagnum bog. The DNR NHP has identified the following priority wetland vegetation communities within the Cranberry Lake shoreline planning area (Appendix B: DNR, 2009):

- 37 acres of Bog Labrador-Tea-Bog-Laurel/Sphagnum Spp.;
- 37 acres of Low Elevation Sphagnum Bog;
- 99 acres of Mountain, Sitka Alder / Skunk Cabbage - Water-parsley; and
- 37 acres of Shore Pine / Bog Labrador-Tea / Sphagnum Spp.

Lake Limerick

Many priority fish species have been documented in Lake Limerick since it drains to Cranberry Creek, which flows into Oakland Bay (Appendix B: WDFW, 2011; Table 6-6). Lake Limerick has approximately 4 acres of wetland mapped in the adjacent area, representing 4 percent of the reach. Much of the area surrounding the lake contains residential development. No priority wildlife species occurrences or priority vegetation communities have been mapped in the vicinity of the lake (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

6.6.4 Land Use

Land uses along Cranberry Creek are a mix of forestry, residential and open space. The creek crosses beneath overhead transmission lines at the E Mikkelsen Road Crossing. Cranberry Lake is almost entirely in commercial forestry use with limited development. Lake Limerick is developed with residences and has numerous residential docks. A railroad right-of-way owned by the United States government crosses into the Lake Limerick shoreline on the southern shore. A golf course and private community beach owned by the Lake Limerick Country Club is located near the southwestern shore. There is a WDFW boat launch near East Mason Lake Road on the south side of the lake (Mason County Parks and Recreation, 2008).

6.6.5 Summary of Key Management Issues

The key management issues for Cranberry Creek, Lake Limerick, and Cranberry Lake include: 1) fish passage and removal of barriers for salmon, 2) lack of sufficient large woody debris and trees in the riparian corridor to support salmon habitat, 3) lack of public access, and 4) protection of high value wetlands associated with Cranberry Lake.

6.6.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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CRANBERRY CREEK

SHORELINE LENGTH

3.9 MI

REACH AREA

258.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 64% (165 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 72% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

7% erosion, 30% landslide

LAND COVER (MAP 15)

1% developed, 83% forest, 1% wetland, 15% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 73% forest cover, 12% non-forest, 15% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, winter steelhead trout.
No wetlands mapped.

WATER QUALITY (MAP 13)

On the 303(d) list for exceeding stream temperature standards. TMDL quality assurance project plan for temperature.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (33%); Vacant (33%). Forestry (29%); and remaining 5% is a mix of Agriculture; Parks, Open Space, and Recreation Areas; and Transportation.

Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 4 creek crossings: Navy Railway, E Mason Lake Drive, E Mikkelsen Road and SR 3.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (95%) and remaining 5% is a mix of Agriculture Resource Lands and Rural Residential 20 Acres. Comprehensive Plan Designations – Rural (96%) and Agricultural Resource Lands (4%). Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in Cranberry Creek Reach 01.

IMPERVIOUS SURFACES (MAP 16)

5% of the reach contains mapped impervious surfaces. Aerial photos from 2009 show single-family residences and roads, particularly in the upper part of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore forested riparian zones where impacted by logging.

Restore associated wetlands, especially those near the Tacoma Power right of way.

Cranberry Creek LWD Placement (Appendix B: PSP, 2010); Cranberry LWD four sites. Working with TAG and available models and studies, identify landowners and develop preliminary designs that lead to restoration projects.

Possible public access opportunities at SR 3, E Mikkelsen Road and Mason Lake Drive road crossings.

KEY MANAGEMENT ISSUES

- Increase LWD in lower reach.
- Restoration of trees in riparian zones.

LAKE LIMERICK

SHORELINE PERIMETER

4.4 MI

WATERBODY AREA

132 AC

REACH AREA

227.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 32% (31 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

6% developed, 48% open water, 2% beach, 36% forest, 1% wetland, 6% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 19% forest cover, 20% non-forest, 1% other natural vegetation, 59% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, winter steelhead trout.

Wetlands – 3.8 acres (4% of reach); includes lacustrine littoral unconsolidated shore, palustrine aquatic bed, forested, and scrub-shrub habitats.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters; Brazilian elodea and swollen bladderwort infestations managed under an integrated aquatic vegetation management plan

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (80%); Parks, Open Space, and Recreation Areas (10%); Vacant (8%); and Forestry (2%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 2 road crossings in the western portion of the reach; Access Area Rd and E St Andrews Dr. A dam (with a spillway and fish ladder) is located on the southeastern shore. There are numerous docks and piers visible via 2009 aerial imagery and one public boat launch.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential: 5 Acres (92%) and remaining 8% is a mix of Rural Residential 20 Acres and Rural Tourist. Comprehensive Plan Designations – 100% Rural. SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW concrete boat launch with associated parking that provides access to Lake Limerick. The total park size is about 0.5 acres (WDFW Lands, 2011; Mason County Parks and Trails, 2006). The Lake Limerick Country Club provides private community access to the water with a private marina and golf course.

IMPERVIOUS SURFACES (MAP 16)

21% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads along most of the lake shore.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore vegetation in degraded riparian areas to improve stream temperatures.

Work with Lake Limerick Homeowners Association to manage lake and decrease stream temperatures (http://www.ecy.wa.gov/programs/wq/tmdl/oakland_bay/013012OBTribsTempAdvMtgNotesFinal.pdf)

KEY MANAGEMENT ISSUES

- Maintain cold temperatures in lake discharge.
- Use best management practices for use of fertilizer and pesticides on residential lawns and golf courses.
- Alterations and ditching of small tributaries creating fish passage barriers (Appendix B: WFC, 2011)
- Reduce number of new docks over time by considering joint use docks

CRANBERRY LAKE

SHORELINE PERIMETER

8.6 MI

WATERBODY AREA

398 AC

REACH AREA

665.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 21% (56 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

1% erosion, 2% landslide

LAND COVER (MAP 15)

14% open water, 16% forest, 61% wetland, 9% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 55% forest cover, 17% other natural vegetation, 27% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, winter steelhead trout.

Bald eagle and osprey; several rare wetland plant communities (see text.).

High quality wetlands –167 acres (62% of reach); wetland types include lacustrine aquatic bed, palustrine emergent, scrub- shrub and forested.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (96%) and remaining 4% are a mix of Parks, Open Space, and Recreation Areas and Residential.

Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach. However, past timber harvest has removed most of the trees in the sub-basin. The forested buffer surrounding the lake and its associated wetlands is between 50 and 100 feet wide.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 20 Acres (96%) and Rural Residential 5 Acres (4%). Comprehensive Plan Designations – 100% Rural.

Existing SED - Natural (50%) and Rural (50%).

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access points to Cranberry Lake. Cranberry Lake Environmental Learning Center is a privately owned educational center that will provide public access and boardwalks to the lake.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show minor roads and no other development in the area.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore forested riparian zone where impacted by timber harvest.

Restore forested riparian area surrounding associated wetlands.

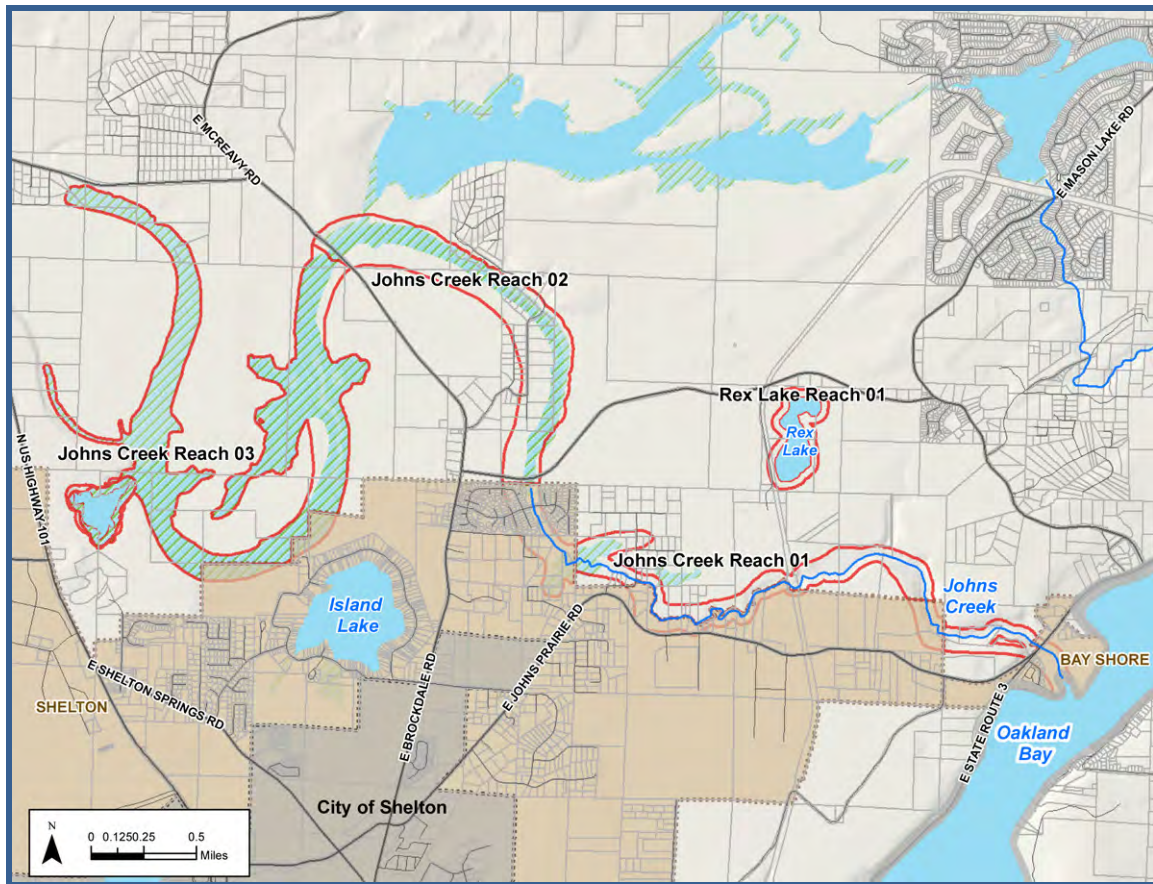
Protect high value associated wetlands and undeveloped floodplains.

Opportunity to improve public access through road easements or partnerships.

KEY MANAGEMENT ISSUES

- Control aquatic invasive species.
- Protection of high value associated wetlands and rare plant communities.
- Identify opportunities for public access and acquisition of lands for preservation.

6.7 Johns Creek, Johns Lake, and Rex Lake



6.7.1 Physical Characterization and Modifications

Johns Creek originates in sparsely populated, forest and open prairie uplands, and flows to the southeast where it discharges to Puget Sound at Oakland Bay. Johns Creek is approximately 8.3 miles long. The headwaters of Johns Creek include a large wetland complex (over 430 acres) that originates just east of US 101. This low-gradient channel flows through a glacial outwash plain before descending through a deep canyon and flowing to Oakland Bay at Bayshore. The upper Johns Creek watershed includes wetlands bordered by Christmas tree farms and forest resource lands. The lower watershed includes deciduous and coniferous trees and residential development. Some channelization and bank armoring occur in a residential area near RM 3.5.

The Wiley Mill was built at the mouth of Johns Creek in 1871. The Hama Hama Logging Company started operating adjacent to Johns Creek in 1922. Six culverts were built on Johns Creek.

In 1984, Ecology established an Instream Resources Protection Program for Water Resources Inventory Area 14 (WACH 173-514) to retain sufficient in-stream flow to protect fish and wildlife, scenic, aesthetic, and other environmental values. This rule closed Johns Creek and its tributaries to consumptive water uses every year between September 16 through November 15 and established minimum instream flows for the creek. Despite these limitations, stream flows in Johns Creek near the mouth have decreased and rarely meet the established minimum in-stream flow requirements from mid-February through September. Johns Creek is currently being studied by Ecology and the USGS to better understand the hydrogeology and groundwater interactions in the subbasin so as to develop appropriate management options (Welch and Savoca, 2011).

Rex Lake has no outlet and is located southeast of the intersection of E Oakes Road and E McEwan Prairie Road. The Johns Creek drainage basin has been extensively modified by humans. Some of the process modifications include:

- Extensive timber harvest in the subbasin and logging adjacent to the creek and associated wetlands;
- Land conversion from forest lands to developed impervious surfaces;
- Alterations to wetlands through ditching, road crossings and other modifications;
- Over consumption of water resources affecting in-stream flows; and
- Channelization and bank armoring.

6.7.2 Water Quality

One monitoring station on Johns Creek has recorded high fecal coliform bacteria concentrations, and 16 monitoring stations have recorded high water temperatures that exceed Washington State water quality standards. The stream is listed on the 303(d) list of impaired waters (Category 5 water) for the temperature parameter (Ecology, 2008a). Category 5 listings require the preparation of a TMDL to address water quality concerns. In addition, Johns Creek is also listed as a Category 4C water for instream flow. Category 4C waters are those waters impaired by a non-pollutant (Ecology, 2008a).

Ecology has initiated a temperature TMDL for Oakland Bay-Hammersley Inlet and associated tributaries including Johns Creek (Ecology, 2005). In October 2011, Ecology convened the first advisory group meeting to address temperature issues for certain Oakland Bay tributaries. This group is targeting completion of the Cranberry, Johns, and Mill Creek's Temperature TMDL Water Quality Improvement Report (WQIR) for September 2012.

(http://www.ecy.wa.gov/programs/wq/tmdl/oakland_bay/cranjohnmillcrs.html)

In addition, the north end of Oakland Bay at the mouth of Johns Creek is listed for fecal coliform, which is related to sediments entering the estuary from streams and other non-point sources of pollution. A TMDL for fecal coliform in Oakland Bay indicates that control of sediments entering the shallow north end is needed to reduce overall fecal coliform (Ahmed and Wagner, 2011).

Rex Lake is not included on Ecology's 303(d) list of impaired waters. No other water quality assessment or aquatic plant management plan was identified.

6.7.3 Critical or Priority Habitat and Species

Johns Creek

Johns Creek drains to Oakland Bay and is considered an important producer of coho and summer chum. The creek supports many state and federally-listed priority fish species as summarized in Table 6-7 (Appendix B: WDFW, 2011). Fall Chinook are occasionally observed in the lower reaches of Johns Creek but are not considered a self-sustaining population (SaSI, 2002). Summer chum stocks were supplemented with hatchery production from Johns Creek Hatchery, until 1997 when the program was discontinued (Washington Department of Fish and Wildlife and Western Washington Treaty Tribes 1994 as cited in Kuttel, 2002). The Squaxin Island Tribe is concerned about low in-stream flows adversely affecting summer chum and salmon habitat.

Table 6-7. Priority salmonid species documented for Johns Creek (Reaches 1, 2, 3)

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	T	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Spawning (Reach 1 only) and Migration	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning	T	~
Olympic mudminnow (Reach 2 only)	<i>Novumbra hubbsi</i>	Migration/Spawning	~	Sensitive

Low in-stream flows have been recorded for Johns Creek by Washington State Department of Ecology and the Squaxin Island Tribe. There is concern over impacts to flow and instream habitat resulting from groundwater drawdown due to the installation of new residential water wells (exempt wells) and industrial water uses. (<http://nwifc.org/2010/01/squaxin-island-tribe-files-second-petition-to-protect-johns-creek>).

Wetland habitat, another priority habitat, has been impacted to differing extents along the Johns Creek shoreline. Reach 1 has approximately 28 acres of wetland mapped, representing 10 percent of the reach. This reach flows through industrial and residential areas and a golf course. Reach 2 flows through residential and logged areas and has approximately 85 acres (34 percent) mapped as wetland. Reach 3 has approximately 440 acres of wetland documented, representing 88 percent of the reach, and flows through logged areas (Appendix B: USFWS, 2010). No priority plant species or vegetation communities have been documented for Johns Creek (Appendix B: DNR, 2009).

Rex Lake

Rex Lake does not support any federal or state-listed priority fish species (Appendix B: WDFW, 2011). Approximately 5 acres of wetland are mapped in the vicinity of Rex Lake, representing 17 percent of the reach (Appendix B: USFWS, 2010).

6.7.4 Land Use

Land uses along Johns Creek and Johns Lake are mostly forestry and residential. There are some industrial uses focused mostly in Shelton's Urban Growth Area (UGA). Rex Lake lies within designated forest resource lands with no mapped shoreline modifications. However, aerial photographs show that agricultural uses are occurring, including ditching and draining.

6.7.5 Land Cover

On Johns Creek, development decreases moving upstream from Reach 1 to Reach 3, while floodplain/riparian area increases (Appendix B: GAP, 2009). The downstream reaches are primarily forested (Reach 1 - 66 percent; Reach 2 - 51 percent), despite residential and industrial development. Rex Lake is largely undeveloped. Approximately 65 percent is mapped as wetland (Appendix B: GAP, 2009).

6.7.6 Summary of Key Management Issues

Key management issues for Johns Creek, Johns Lake and Rex Lake are: 1) conservation of water resources and maintenance of in-stream flows, 2) proliferation of single family residential wells adversely affecting groundwater supplies, 3) protection of cold water inputs from tributaries to Johns Creek, 4) protection of significant wetlands and wildlife habitats, 5) improvement of water quality entering Oakland Bay, 6) reductions in stream temperatures in Johns Creek to support salmon habitat, and 7) potential development in the riparian zone/floodplain.

6.7.7 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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JOHNS CREEK - REACH 01

SHORELINE LENGTH

3.7 MI

REACH AREA

291.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 61% (177 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 49% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

43% landslide

LAND COVER (MAP 15)

13% developed, 66% forest, 5% wetland, 16% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 59% forest cover, 26% non-forest, 15% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, summer chum salmon, coho salmon, winter steelhead trout, Olympic mudminnow.
Wetlands – 28.1 acres (10% of reach); habitat types are palustrine forested and scrub-shrub.

WATER QUALITY (MAP 13)

High fecal coliform concentrations; TMDL quality assurance project plan for temperature. Failure to meet in-stream flow standards.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (36%); Residential (28%); Agriculture (9%); Industrial (9%); Parks, Open Space, and Recreation Areas (8%); Vacant (7%); and remaining 5% is a mix of Aquaculture, Commercial and Transportation. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - County: Rural Residential 5 Acres (34%), Rural Natural Resource (13%), Agriculture Resource Lands (10%), Rural Tourist (5%); Shelton UGA: Industrial (9%), Mixed Use (6%), Commercial Industrial (3%), and Bay Shore hamlet: Rural Tourist (5%) and Rural Residential 5 Acres (2%).

Comp. Plan Designations – Rural (74%). Agricultural Resource Lands (15%) and Hamlet (11%). Existing SED - Rural (78%) and Urban Residential (22%).

IMPERVIOUS SURFACES (MAP 16)

22% of the reach contains mapped impervious surfaces; most of this is low-intensity developed or open space (Appendix B: NOAA CCAP, 2006).

SHORELINE MODIFICATIONS (MAP 16)

There are 3 road crossings in the northwest and eastern portions of the reach; Oak Way Rd, an unnamed road, and Johns Creek Dr. A dam is located in the southeastern portion of the reach. The BPA transmission line crosses this reach.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access in Johns Creek Reach 1.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low to moderate-high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS (MAP 22)

Restore forested riparian zones where altered by timber harvest and clear-cutting. Restore trees to riparian zones, specifically within/near BPA powerlines.

(http://www.ecy.wa.gov/programs/wq/tmdl/oakland_bay/013012OBTribsTempAdvMtgNotesFinal.pdf)

Protect high value associated wetlands along Johns Creek and tributary streams which contribute to flow.

Add LWD in canyon area.

Restore hatchery site.

Johns Creek Culvert Replacement (Appendix B: PSP, 2010); Replace Navy barrier culvert on John's Creek.

Johns Creek LWD Placement (Appendix B: PSP, 2010) – Place LWD in four reaches. Working with the TAG, identify land owners and develop preliminary designs that lead to restoration of LWD.

Possible public access opportunities at SR 3, Johns Creek Dr. and Oak Way Rd road crossings.

KEY MANAGEMENT ISSUES

- Water quality impairments include low in-stream flow. Issue with single family residential wells and water resource allocation. Investigate issues related to residential wells.
- Consider retiring Bayshore water right.
- Protect and restore Bayshore Golf Course.
- Protect cold water tributary habitat and flows.
- Lack of LWD in this reach of the stream.

JOHNS CREEK - REACH 02

SHORELINE LENGTH

2.1 MI

REACH AREA

251.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 80% (202 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 8% of the shoreline area is within the channel migration zone.

LAND COVER (MAP 15)

1% developed, 51% forest, 4% wetland, 45% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 43% forest cover, 18% non-forest, 38% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

WATER QUALITY (MAP 13)

High fecal coliform concentrations; TMDL quality assurance project plan for temperature. Failure to meet state required in-stream flow standards.

HAZARD AREAS (MAP 12)

4% erosion, 4% landslide

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, winter steelhead trout; Olympic mudminnow.

Wetlands -- 84.6 acres (34% of reach); wetland habitat types include palustrine emergent, palustrine forested, and palustrine scrub-shrub.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (66%); Residential (28%); and remaining 7% is a mix of Vacant and Transportation. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 3 road crossings in the northwest, central, and eastern portions of the reach: Brockdale Rd, Jensen Rd, and McEwan Prairie Rd.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Rural Residential 20 Acres (63%) and Rural Residential 5 Acres (37%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There are no mapped park or public access facilities in Johns Creek Reach 2.

IMPERVIOUS SURFACES (MAP 16)

3% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads, mainly in the lower part of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore forested riparian zones where altered by timber harvest and clear-cutting.

Protect high value associated wetlands along Johns Creek.

Protect tributary streams which contribute to flow.

Possible public access opportunity at McEwan Prairie Rd and Brockdale Rd road crossings.

KEY MANAGEMENT ISSUES

- Water quality impairments include low in-stream flow. Water usage in the sub-basin may be adversely affecting salmon habitat. Investigate issues related to residential wells.
- Protection of high quality associated wetlands.
- Protection of tributaries that provide cold water inputs that support salmonid habitat.

JOHNS CREEK - REACH 03

SHORELINE LENGTH

4.5 Miles

REACH AREA

518.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 54% (273 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

Less than 1% erosion, 1% landslide

LAND COVER (MAP 15)

2% open water, 15% forest, 8% wetland, 75% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 54% forest cover, 1% non-forest, 40% other natural vegetation, 5% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, winter steelhead trout.
Wetlands – 440 acres (88% of reach); wetland habitat types include palustrine emergent, forested and scrub-shrub.

WATER QUALITY (MAP 13)

High fecal coliform concentrations; TMDL quality assurance project plan for temperature. Failure to meet state required in-stream flow standards.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (98%) and Residential (2%).
Ownership – 100% Private

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - County: Rural Residential: 20 Acres (90%) and remaining 5% are a mix of Rural Residential 10 Acres, Rural Residential 5 Acres and Water and Shelton UGA: Neighborhood Residential (5%). Comprehensive Plan Designations – 100% Rural.

Existing SED – Not designated.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces. Aerial photos from 2009 show a few roads but no other development in this reach.

SHORELINE MODIFICATIONS (MAP 16)

There is one road crossing in the southeast portion of the reach at Powerline Rd.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in Johns Creek Reach 3.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to high probability of finding unknown artifacts within this reach, with a small portion of the reach in a very high probability zone.

OPPORTUNITY AREAS

Protect high quality wetlands associated with Johns Creek.

Restore riparian areas altered by timber harvest.

Protect tributary streams which contribute to flow.

Protect intact forested riparian zone surrounding Johns Lake.

Johns Creek Headwaters Conservation Initiative (Appendix B: PSP, 2010); This project will conserve over 200 acres of key habitat surrounding Johns Lake (the headwaters of Johns Creek) and parts of upper Johns Creek.

KEY MANAGEMENT ISSUES

- Protect Johns Lake and the extensive wetlands within this reach.
- Water quality impairments include low in-stream flow. Water usage in the sub-basin may be adversely affecting salmon habitat. Investigate issues related to residential wells.
- Riparian zones lack trees and need to be replanted to reduce warm stream temperatures.

REX LAKE

SHORELINE PERIMETER

1.2 MI

WATERBODY AREA

29.7 AC

REACH AREA

61.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 29% (9 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

1% developed, 16% forest, 65% wetland, 19% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 35% forest cover, 2% non-forest, 63% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

65% or more of the area is considered palustrine scrub-shrub wetland (NWI).

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

Aerial photos show the Navy railway along the western/SW edge of the lake. Also, extensive ditching and draining of associated wetlands is noted in 2010 aerial photographs. Timber harvest has occurred within 200 feet of the lake on the eastern side.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - County: 100% Rural Residential 20 Acres. Comp. Plan Designations – 100% Rural. Existing SED – Not designated.

PUBLIC ACCESS (MAP 14)

There are no parks or public access facilities in the Rex Lake shoreline. This lake is 100% privately owned.

IMPERVIOUS SURFACES (MAP 16)

1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos (2009) show a railroad crossing at the SW part of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

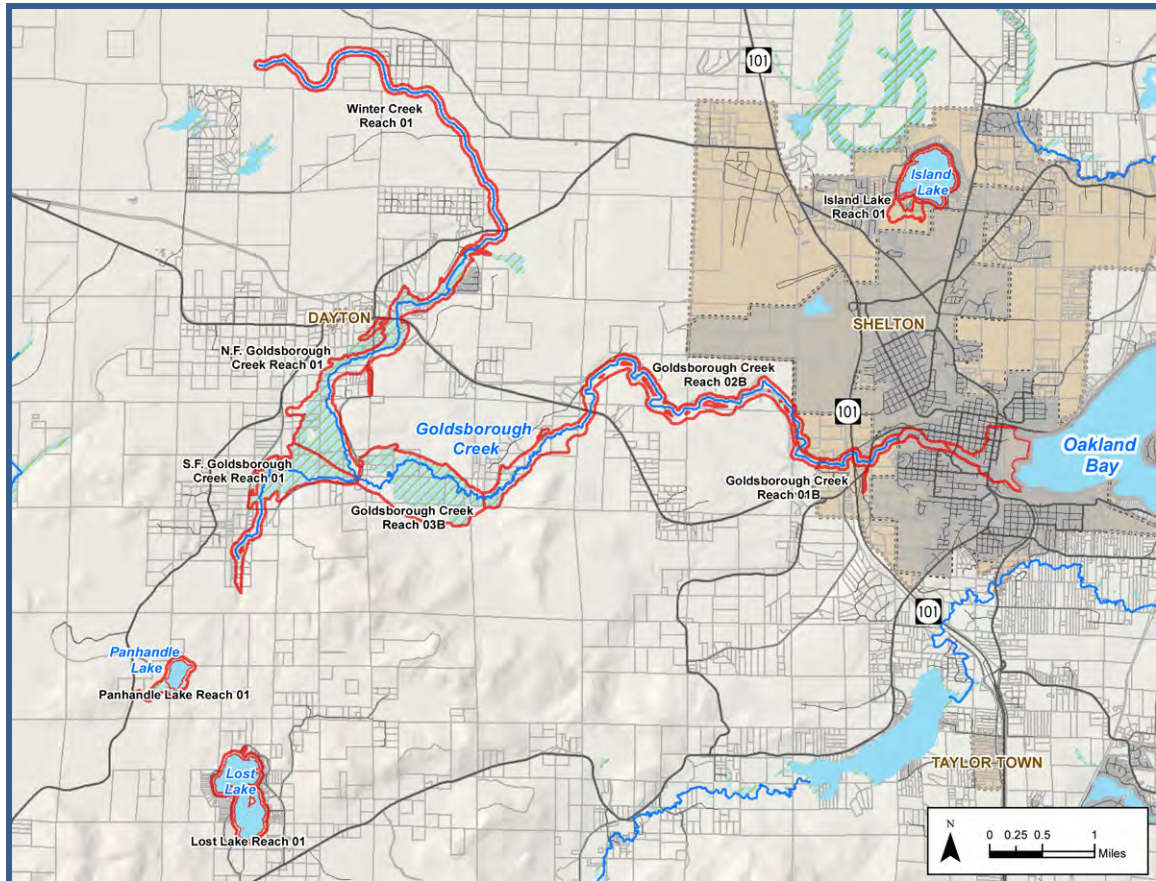
OPPORTUNITY AREAS

- Restore native trees in degraded riparian areas.
- Restore associated wetlands by removal of ditches and modifications.

KEY MANAGEMENT ISSUES

- Timber harvest within riparian zone and shoreline jurisdiction.
- Associated wetlands in agricultural uses requiring best management practices.

6.8 Goldsborough Creek and Tributaries (Island Lake, North Fork, South Fork, Winter Creek, Panhandle Lake, Lost Lake)



6.8.1 Physical Characterization and Modifications

The Goldsborough Creek drainage basin includes three other shoreline streams which are tributaries to the mainstem (South Fork, North Fork and Winter Creek) . The headwaters of Goldsborough Creek include springs, surface drainage, small lakes, and numerous smaller tributaries. Goldsborough Creek drains to Oakland Bay within the City of Shelton. Three lakes over 20 acres in size are located within this drainage basin; these are Island Lake (within the Shelton UGA), Panhandle Lake and Lost Lake.

Island Lake is located 2.5 miles north of Shelton, southeast of the upper reach of Johns Creek (JOHN_CR_03) and drains via a wetland system to Goldsborough Creek (Ecology, 2011).

The South Fork of Goldsborough Creek begins about three miles south of Dayton. Panhandle Lake is located at the headwaters of the South Fork. The South Fork drainage consists primarily of marshlands with mixed deciduous and coniferous forest on nearby hills. Lost Lake is about 120 acres in area, located about 8 miles southwest of Shelton, and drains to the South Fork of Goldsborough Creek. The lake has a drainage basin area of 1 square mile (Ecology, 2011).

The North Fork of Goldsborough Creek begins about two miles northeast of Dayton. Winter Creek joins the North Fork, about one mile north of Dayton. The North Fork drainage consists primarily of shallow gradient plateaus with second growth conifers (Kuttel, 2002). The Winter Creek drainage consists of rolling plateaus with second growth conifers.

The Goldsborough Creek drainage basin has been modified by humans. Some of the process modifications include:

- Land conversion from pervious to impervious surfaces;
- Logging adjacent to the creek;
- Railroad lines limiting channel migration; and
- Use of dams, culverts and weirs to change flow patterns.

Flood control projects to support development have disconnected the Goldsborough Creek floodplain in much of the area from RM 0 to RM 2. The railroad line limits channel migration from about RM 2 to RM 4.5.

Historically, dams have changed flow patterns in Goldsborough Creek. In the past 35 years, two of the major dams on the creek were removed. The dam located at RM 5.2 was removed by 1975. The Goldsborough Dam, which was located at Goldsborough

Creek RM 2.3, was removed in the fall of 2001 (Kuttel, 2002). A series of weirs were installed to restore the gradient of the streambed to more natural conditions.

6.8.2 Water Quality

Goldsborough Creek has documented degraded water quality and is listed on the Ecology 303(d) list of impaired waters (Category 5) for temperature and fecal coliform bacteria parameter (Ecology, 2008). One monitoring station on Goldsborough Creek, Reach 1B, has recorded high water temperatures that exceed Washington State water quality standards. However, the 303(d) listed reach for fecal coliform bacteria lies within the City of Shelton and is associated with the inner Shelton Harbor. Reaches 1B and 2B are also identified as Category 4C water for not meeting instream flow standards. Category 4C waters indicate impairment by a non-pollutant (Ecology, 2008).

Ecology has prepared a QAPP for fecal coliform bacteria with respect to the TMDL for Oakland Bay-Hammersley Inlet and associated tributaries to address fecal coliform bacteria. Goldsborough Creek is included in this report (Ecology, 2004).

Island Lake is listed as a Category 4C impaired water due to the presence of Eurasian water milfoil in past years (Ecology, 2008a). None of the other shoreline waterbodies in this drainage basin are listed on the 303(d) list of impaired waters (Ecology, 2008a).

6.8.3 Critical or Priority Habitat and Species

Goldsborough Creek

State and federally-listed priority fish species documented in the Goldsborough Creek reaches discussed in this document include the following (Appendix B: WDFW, 2011; Table 6-8). Fall Chinook are observed near the mouth of the creek but are considered hatchery strays and not documented populations (SaSI, 2002).

Table 6-8. Priority salmonid species documented for Goldsborough Creek (Reaches 1B, 2B, 3B), North Fork Goldsborough Creek, and South Fork Goldsborough Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Reach 1B only) and Migration	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Spawning (Reaches 1B, 2B, 3B, North Fork Goldsborough Creek only) and Migration	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Spawning (Reaches 1B and 2B only) and Migration	T	~

The removal of Goldsborough Dam in 2001 may increase fall chum, coho, and winter steelhead escapement by providing access to additional instream habitat. Significant coho escapements have been documented in the stream (Kuttel, 2002). Out migrating coho smolts from above the former dam site have steadily increased since dam removal. The Squaxin Island Tribe operates smolt traps on Goldsborough to monitor coho production.

In total, the three stream reaches contain 305 acres of mapped wetland (3.8 percent of the total reach area) (Appendix B: USFWS, 2010).

Reach 3B is a wide, open stretch of stream with little associated development. The stream is more incised and development occurs in close proximity along the downstream reaches, closer to the City of Shelton.

Island Lake

No priority fish species are mapped in Island Lake (Appendix B: WDFW, 2011). Island Lake has approximately 29 acres of wetland (38% of the reach). No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or vegetation communities within the Island Lake shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

North Fork Goldsborough Creek

North Fork Goldsborough Creek is mapped as supporting several species of priority fish (Appendix B: WDFW, 2011; Table 6-8). Approximately 312.0 acres of wetland (representing 79 percent of the reach) has been mapped adjacent to the stream; this area has limited impacts from development. No priority wildlife species occurrences or vegetation have been mapped near the creek (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

South Fork Goldsborough Creek

Several priority fish species have been documented in South Fork Goldsborough Creek (Appendix B: WDFW, 2011; Table 6-8). Approximately 155.5 acres of wetland, representing 70.3 percent of the reach, has been mapped in the reach (Appendix B: USFWS, 2010). Wetland habitat is narrow and forested at the upstream portion of the reach and broad and open downstream. Great blue heron, a priority species, is known to occur in the vicinity of the stream (Appendix B: WDFW, 2011).

Winter Creek

Winter Creek is mapped as supporting coastal cutthroat trout and coho salmon (Appendix B: WDFW, 2011). Coho salmon are listed as a federal species of concern. Approximately 7 acres of wetland have been mapped along the shoreline of Winter Creek, representing 3 percent of the reach (Appendix B: USFWS, 2010). Logging has taken place along the entire stream reach, impacting wetland habitat.

Panhandle Lake

Costal cutthroat trout have a documented presence in Panhandle Lake (Appendix B: WDFW, 2011). Approximately 23 acres of wetland (57 percent of the reach) is mapped in the shoreline.

Lost Lake

No priority fish species are documented in Lost Lake (Appendix B: WDFW, 2011). The Lost Lake shoreline has approximately 4 acres of wetland, representing 6 percent of the reach. Residential development surrounds much of the lake. An osprey priority species occurrence is mapped in the vicinity of Lost Lake (Appendix B: WDFW, 2011). The DNR NHP has not identified priority plant species or vegetation communities within the Lost Lake shoreline planning area (Appendix B: DNR, 2009).

6.8.4 Land Use

Within unincorporated Mason County, the shorelines of Goldsborough Creek support a mix of forestry, open space and residential uses. Residential homes and gravel mining operations are concentrated in Shelton's UGA. Simpson Lumber, Manke Lumber Company and the Port of Shelton operate in Shelton Harbor where the mouth of Goldsborough Creek enters Oakland Bay; the mouth of Goldsborough lies within the City of Shelton. The North Fork Goldsborough Creek reach is a mix of forestry and residential land uses, while South Fork is a mix of residential and vacant land uses. Residential structures are generally located outside of the shoreline planning area along both forks of the creek. Winter Creek is mostly in forestry use.

Island Lake is mostly developed with residential homes and individual docks/piers. There is a WDFW public boat launch ramp at the south end of the lake (Mason County Parks and Recreation, 2008). Panhandle Lake is mainly held in open space and recreational use with Panhandle Lake 4-H Camp including several community docks and a swimming area developed on the western shore. Lost Lake is a mix of residential and forestry uses. Many residential homes have individual docks or piers. There is a WDFW public boat launch that provides access to the lake (Mason County Parks and Recreation, 2008).

6.8.5 Summary of Key Management Issues

The Key issues for Goldsborough Creek and its tributaries are: 1) protection of significant salmonid habitat, 2) protection of cold water inputs from tributaries supporting salmon, 3) restoration of stream and lake riparian zones, 4) railroad and other modifications disrupting floodplain and channel migration, and 5) need for public access opportunities to shorelines in this drainage basin.

6.8.6 Reach Analysis

This section describes freshwater shoreline reaches within County jurisdiction. The mouth of Goldsborough Creek (Marine Reach 31, Oakland Bay) is discussed in Chapter 5 (South Puget Sound). Goldsborough Creek Reach 1A lies within the city limits of Shelton and is discussed within the Shelton Shoreline Inventory and Characterization Report (ESA and Herrera Environmental Consultants, 2011). Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

GOLDSBOROUGH CREEK - REACH 01B

SHORELINE LENGTH

1.4 MI

REACH AREA

69.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 35% (24 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 77% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

19% landslide

LAND COVER (MAP 15)

23% developed, 2% agriculture, 35% forest, 2% wetland, 38% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 47% forest cover, 28% non-forest, 21% other natural vegetation, 3% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout.

Wetlands -- 2.3 acres (3% of reach); wetland habitat types include palustrine emergent and palustrine forested.

WATER QUALITY (MAP 13)

One 303 (d) Category 5 listing for temperature; TMDL for fecal coliform bacteria; Category 4C listing for instream flow.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (54%); Commercial (19%); Vacant (12%); Residential (10%); and Mining/Transportation (5%). Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning Districts - Shelton UGA: Industrial (29%), Neighborhood Residential (27%), Commercial Industrial (23%), General Commercial (10%), and Mixed Use (11%). Comprehensive Plan Designations – 100% City.

Existing SED – 100% Urban Residential.

SHORELINE MODIFICATIONS (MAP 16)

There are 2 road crossings in the central and southern portions of the reach at E Deegan Road and U.S. Highway 101. Highway 101 is a bridge crossing.

PUBLIC ACCESS (MAP 14)

A one-mile trail system maintained by Mason County Parks and Recreation lies within this reach of Goldsborough creek, just west of US 101 and outside of Shelton.

http://www.co.mason.wa.us/forms/parks/trails_map.pdf

IMPERVIOUS SURFACES (MAP 16)

38% of the reach contains low to moderate levels of impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show most of the development focused in the lower part of the reach.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP architectural and archaeological records show three inventoried early historic sites in this reach. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach, with a small portion of the reach in a low probability zone.

OPPORTUNITY AREAS

Restoration opportunities have been identified in Combs 2010:

- Remove artificial fill causing channel constriction in the Goldsborough Creek (500 ft upstream of Hwy.101.). Add LWD and riparian vegetation, which are both lacking.
- Stabilize eroding left bank of Goldsborough Creek upstream of Hwy 101 and reduce sediment loss through installation of a crib wall and LWD. (Project #2)
- Restore riparian vegetation along Goldsborough Creek in cooperation with Mason Conservation District.
- Stabilize eroding bank on the Simpson railroad grade and add LWD to create pool habitat.

KEY MANAGEMENT ISSUES

- Bank erosion and stability in developed areas.
- Water quality issues related to forestry and agricultural uses.
- Protect and restore associated wetlands and off channel habitat.

GOLDSBOROUGH CREEK - REACH 02B

SHORELINE LENGTH

5.6 MI

REACH AREA

371.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 45% (169 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 68% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

15% landslide

LAND COVER (MAP 15)

2% agriculture, 71% forest, 4% wetland, 22% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 63% forest cover, 12% non-forest, 23% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout.

Wetlands - 44.6 acres (12% of reach); wetland habitat types include palustrine emergent, forested, and scrub-shrub.

WATER QUALITY (MAP 13)

TMDL for fecal coliform; Category 4 listing for instream flow.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (85%); and remaining 15% include a mix of Agriculture, Parks, Open Space and Recreation Areas, Residential, and Vacant; and Transportation. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - County: Rural Residential 20 Acres (50%), Long Term Commercial Forest (29%), Agricultural Resource Lands (12%), and Rural Residential 10 Acres and 5 Acres (9%). Comprehensive Plan Designations - Rural (59%), Long Term Commercial Forest (29%) and Agriculture (12%).

Existing SED – Conservancy (94%) and Urban Residential (6%).

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show limited development with a few roads in the reach.

SHORELINE MODIFICATIONS (MAP 16)

W. Shelton-Matlock Road crosses in this reach. There are two additional crossings in the north central portions of the reach at Carman Rd and Simpson Railroad.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Goldsborough Reach 2B.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS (MAP 2)

Restoration opportunities have been identified in Combs 2010:

- Reconnect Goldsborough Creek with off-channel wetlands by installing culverts beneath railroad grade (Project #5).
- Replace perched culverts (define) on tributaries to remove barriers to anadromous fish.
- Restore riparian vegetation near location of former dam.

LWD on Goldsborough Creek (Appendix B: PSP, 2010) – Installing LWD on 3 main stem reaches.

Possible public access opportunity at W. Shelton-Matlock Rd road crossing.

KEY MANAGEMENT ISSUES

- Culverts block fish passage on tributaries and limit spawning habitat.
- Bank erosion and stability in developed areas.
- Water quality issues related to forestry, agricultural, and rural residential uses.
- Protect and restore associated wetlands and off-channel habitat.

GOLDSBOROUGH CREEK - REACH 03B

SHORELINE LENGTH

2.0 MI

REACH AREA

366.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 88% (322 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 37% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

6% landslide

LAND COVER (MAP 15)

8% agriculture, 10% forest, 10% wetland, 72% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 72% forest cover, 9% non-forest, 18% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, winter steelhead trout.

Wetlands -- 258.6 acres (71% of reach); wetland habitat types include palustrine emergent, forested, and scrub-shrub.

WATER QUALITY (MAP 13):

TMDL quality assurance project plan for fecal coliform

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (40%); Parks, Open Space and Recreation Areas (28%); Vacant (19%); and remaining 13% are a mix of agriculture and Residential. Ownership - Private (100%).

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: County - Rural Residential 20 Acres (40%), Long Term Commercial Forest (31%), Agricultural Resource Lands (23%), and Rural Residential 5 Acres (6%). Comprehensive Plan Designations - Rural (45%), Long Term Commercial Forest (31%) and Agricultural Resource Lands (23%).

Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in Goldsborough Creek Reach 3.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show limited development with a few roads in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore wetland habitat, riparian vegetation, add LWD and restore habitat complexity on “Rose” property, 40 acre site in upper watershed (Combs, South Puget Sound Salmon Enhancement Group, 2010).

KEY MANAGEMENT ISSUES

- Protect and restore associated wetlands and off-channel habitat.

ISLAND LAKE

SHORELINE PERIMETER

2.0 MI

WATERBODY AREA

105 AC

REACH AREA

181.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 39% (30 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

16% developed, 52% open water, 1% beach, 13% forest, 16% wetland, 3% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 10% forest cover, 22% non-forest, 12% other natural vegetation, 57% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Wetlands – 29 acres (38% of reach); wetland habitat types include palustrine emergent, forested and scrub-shrub.

WATER QUALITY (MAP 13)

Ecology's 303 (d) listed Category 4C impaired waters; Eurasian water milfoil infestation

BUILT ENVIRONMENT AND LAND USE	
EXISTING LAND USES AND OWNERSHIP (MAP 18) Land Use – Residential (73%); Forestry (11%); and remaining 15% are a mix of Vacant, Parks, Open Space, and Recreational Areas, and Transportation. Ownership – 100% Private.	SHORELINE MODIFICATIONS (MAP 16) There are 31 mapped docks and piers within the reach. There is a public boat launch on the north end of the lake.
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22) Zoning districts – Shelton UGA: 100% Neighborhood Residential. Comprehensive Plan Designations – 100% City. Existing SED – 100% Urban Residential.	PUBLIC ACCESS (MAP 14) There is a WDFW boat launch that provides access to the north end of Island Lake. The boat launch is a 12-foot wide concrete launch. The total park size is 1 acre (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006).
IMPERVIOUS SURFACES (MAP 16) 16% of the reach contains mapped impervious surfaces, mostly low density development and developed open space (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show most of the lake shore developed with single-family residences and roads.	AREAS OF SPECIAL INTEREST According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.
CULTURAL AND ARCHAEOLOGICAL RESOURCES There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.	
OPPORTUNITY AREAS	
Protect associated wetlands to the southwest of the lake. Consider new public access opportunities.	
KEY MANAGEMENT ISSUES	
• Reduce number of new docks over time by considering joint use docks. • Continued management of invasive aquatic weeds, such as Eurasian water milfoil.	

N.F. GOLDSBOROUGH CREEK

SHORELINE LENGTH

3.5 MI

REACH AREA

394.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 55% (216 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 61% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

3% landslide

LAND COVER (MAP 15)

3% agriculture, 1% open water, 11% forest, 7% wetland, 78% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 71% forest cover, 7% non-forest, 18% other natural vegetation, 3% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, winter steelhead trout.

Wetlands – 312 acres (79% of reach); wetland habitat types includes palustrine emergent, forested, and scrub-shrub.

WATER QUALITY (MAP 13)

Not listed as a 303(d) Category 5 water

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (49%); Residential (22%); Parks, Open Space and Recreation Areas (15%); and remaining 14% are a mix of Vacant and Transportation. Ownership - Private (100%).

SHORELINE MODIFICATIONS (MAP 16)

There are two road crossings located in the northwest portion of the reach at Shelton Matlock Rd and Koku Rd.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Rural Residential 5 Acres (40%), Long Term Commercial Forest (34%), Rural Residential 10 and 20 Acres (16%), and Rural Tourist (10%). Comprehensive Plan Designations - Rural (66%) and Long Term Commercial Forest (34%). Existing SED - Rural (73%) and Conservancy (27%).

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to North Fork Goldsborough Creek.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show limited rural residential development and roads in this reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect cold water inputs from this tributary that are important to salmonid habitat.
Possible public access opportunity at W. Shelton-Matlock Rd. road crossing.

KEY MANAGEMENT ISSUES

- Major contributor of cold water to mainstem Goldsborough Creek.
- Cold water refugia below Anderson Lake for salmonid species
- Protect instream habitats supporting salmon.

S.F. GOLDSBOROUGH CREEK

SHORELINE LENGTH

2.0 MI

REACH AREA

221.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 51% (113 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 50% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

3% landslide

LAND COVER (MAP 15)

18% agriculture, 9% forest, 13% wetland, 59% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 56% forest cover, 6% non-forest, 38% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, winter steelhead trout.

Great blue heron.

Wetlands - 156 acres (70% of reach); wetland habitat types include palustrine emergent, palustrine forested, and palustrine scrub-shrub.

WATER QUALITY (MAP 13)

Not listed as a 303 (d) Category 5 water

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (40%); Residential (28%); Agriculture (18%); Forestry and Transportation (13%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There is one road crossing in the central part of the reach located at Little Egypt Rd.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Rural Residential 20 Acres (48%), Rural Residential 5 Acres (32%), and remaining 21% are a mix of Agriculture Resource Lands and Long Term Commercial Forest. Comprehensive Plan Designations – Rural (79%) and remaining 21% are a mix of Agriculture Resource Lands and Long Term Commercial Forest.

Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in this reach.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show very limited development (roads) in this reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Consider opportunities for public access since none exist.

Restore trees to the riparian corridor to protect instream temperatures.

KEY MANAGEMENT ISSUES

- Protect instream habitats important for salmon.

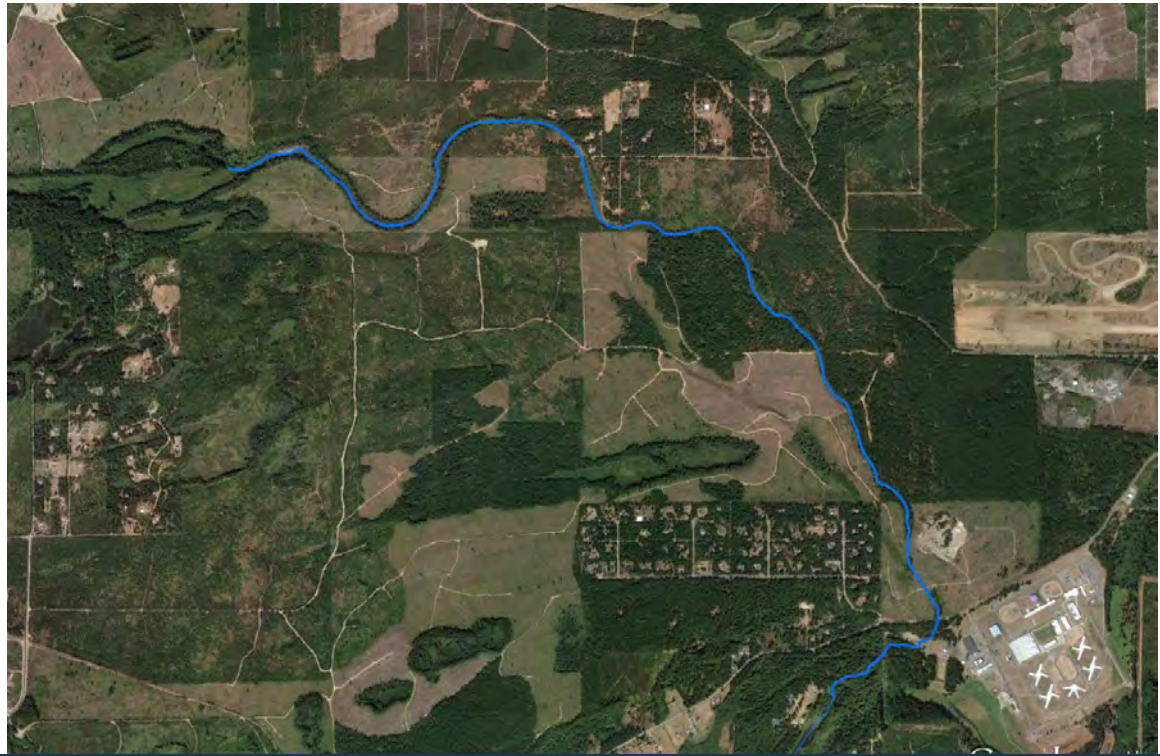
WINTER CREEK

SHORELINE LENGTH

4.1 MI

REACH AREA

203.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach. 82% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

0.8% landslide

LAND COVER (MAP 15)

65% forest, 3% wetland, 32% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 47% forest cover, 6% non-forest, 47% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon.

6.7 acres of palustrine scrub-shrub wetland (3% of reach).

WATER QUALITY (MAP 13)

Not listed as a 303 (d) Category 5 water

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (88%); and remaining 12% is a mix of Residential, Vacant, Parks, Open Space, and Recreation Areas. Ownership - Private (95%) and Public (5%).

SHORELINE MODIFICATIONS (MAP 16)

There is one road crossing located in the southeastern portion of the reach at Dayton Airport Rd.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Long Term Commercial Forest (61%), Rural Residential 20 Acres (23%), and remaining 16% is a mix of Rural Residential 5 Acres and Rural Tourist. Comprehensive Plan Designations - Long Term Commercial Forest (61%) and Rural (39%).

Existing SED – none designated.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Winter Creek.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show very limited development within this reach (roads).

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore native trees to degraded riparian zones.

KEY MANAGEMENT ISSUES

- Important ground water source of cold water for North Fork Goldsborough.
- Protect ground water.

PANHANDLE LAKE

SHORELINE PERIMETER

0.8 MI

WATERBODY AREA

22.0 AC

REACH AREA

61.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain -23% (9 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

24% open water, 41% forest, 3% wetland, 32% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 61% forest cover, 2% non-forest, 6% other natural vegetation, 31% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout.

Wetlands – 23 acres (57% of reach); wetland habitat types include palustrine forested and scrub-shrub.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Parks, Open Space, and Recreation Areas (88%) and Forestry (12%). Ownership - Private (72%) and Public (28%).

SHORELINE MODIFICATIONS (MAP 16)

There are three docks and piers on the western portion of the lake visible via 2009 aerial imagery.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Rural Tourist (65%), Inholding Lands (26%), and Long Term Commercial Forest (9%). Comprehensive Plan Designations – Rural (65%), Inholding Lands (26%), and Long Term Commercial Forest (9%).

Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

Panhandle Lake 4-H Camp operates on the western shore of the lake (<http://panhandle4-hcamp.org>). Most of the lake is owned by the 4-H Camp. WSU owns an undeveloped parcel on the northern shore.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a small area of rural residential development on the western shore of the lake.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach, with small portions of the reach in low to moderate-low probability zones.

OPPORTUNITY AREAS

Work with Panhandle Lake 4-H Camp to provide environmental education on Panhandle Lake.
Protect forested riparian areas.

KEY MANAGEMENT ISSUES

- Provide environmental education as part of recreational uses.

LOST LAKE

SHORELINE PERIMETER

3.1 AC

WATERBODY AREA

122.6 AC

REACH AREA

192.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 46% (32 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

2% developed, 59% open water, 37% forest, 1% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 13% forest cover, 20% non-forest, 66% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Osprey present.
4.4 acres of palustrine scrub-shrub wetland (6% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (47%); Forestry (33%); Vacant (11%); and remaining 10% are a mix of Parks, Open Space, Recreation Areas, and Transportation. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 90 docks and piers mapped within the reach. There is a public boat launch facility.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Rural Residential 5 Acres (93%) and Rural Tourist (7%). Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch with associated parking that provides access to Lost Lake. The boat launch is a 12-foot wide concrete launch. The total park size is about 1 acre (WDFW, 2011). YMCA Camp Bishop located on northwestern end of lake has 1,500 feet of waterfront.

IMPERVIOUS SURFACES (MAP 16)

5% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads around most of the lake shore.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach, with smaller portions of the reach in low to moderate-low probability zones.

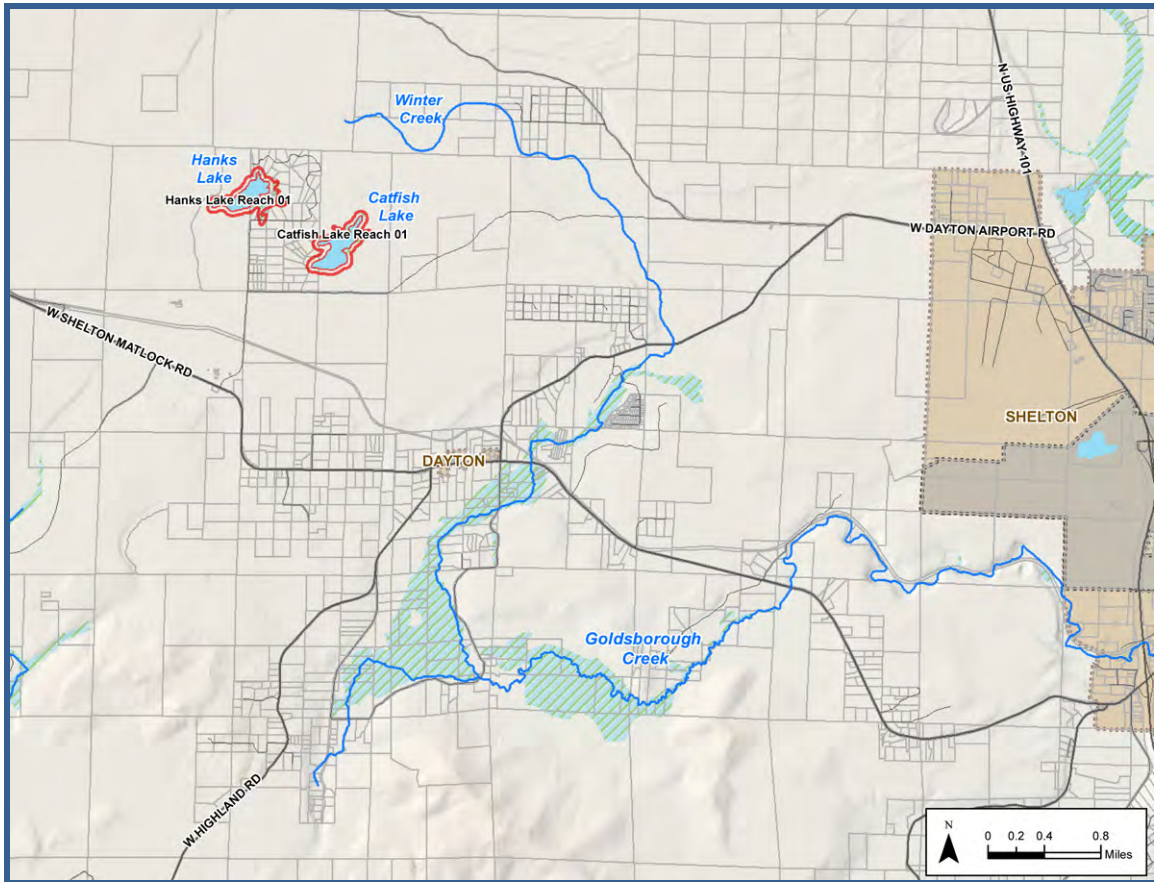
OPPORTUNITY AREAS

Work with YMCA and Elma Country Club to provide environmental education related to Lost Lake.
Restore riparian zones by planting native trees.

KEY MANAGEMENT ISSUES

- Reduce number of new docks over time by considering joint use docks.
- Reduce aerial coverage of over water structures to minimize impacts.

6.9 Lakes in Upper Watershed (Hanks, Catfish)



6.9.1 Physical Characterization and Modifications

Two of the lakes in the upper WRIA 14a watershed include Hanks and Catfish Lakes, located south of Winter Creek. Hanks and Catfish Lakes are about 21 and 25 acres in area, respectively. These lakes are located in relatively flat areas and have no surface inlets.

Some of the modifications to the upper watershed lakes include:

- Logging throughout the drainage basin; and
- Land conversion from pervious to impervious surfaces.

6.9.2 Water Quality

No water quality data or assessments were identified for these lakes. Hanks and Catfish Lakes are not included on Ecology's 303(d) list of impaired waters.

6.9.3 Critical or Priority Habitat and Species

No priority fish species are documented in either Hanks Lake or Catfish Lake (Appendix B: WDFW, 2011). Approximately 7 acres of wetland (16 percent of the reach) are mapped around Hanks Lake, whereas 16 acres (40 percent) of Catfish Lake is considered wetland (Appendix B: USFWS, 2010). No priority wildlife or plant species occurrences have been mapped in the vicinity of either of these lakes (Appendix B: WDFW, 2011).

6.9.4 Land Use

The Hanks Lake shoreline has a mix of forestry and residential uses, although there are no residential structures within the shoreline planning area per 2009 aerial imagery. Hanks Lake is zoned Long Term Commercial Forest Land; Green Diamond Timber Company is currently requesting a rezone of 187 acres (western two-thirds of the lake) from LTCF land to Rural Residential. Catfish Lake is predominately in forestry use.

6.9.5 Summary of Key Management Issues

The key management issues for Hanks Lake and Catfish Lake are: 1) increasing residential development due to rezoning, 2) lack of trees in the riparian zone due to timber harvest, and 3) potential for water quality degradation.

6.9.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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HANKS LAKE

SHORELINE PERIMETER

1.2 MI

WATERBODY AREA

21.5 AC

REACH AREA

62.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 34% (14 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

27% open water, 4% beach, 49% forest, 20% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 32% forest cover, 4% non-forest, 28% other natural vegetation, 36% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

6.5 acres of palustrine forested wetland (16% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE	
EXISTING LAND USES AND OWNERSHIP (MAP 18) Land Use - Forestry (47%); Residential (31%); and Vacant (22%). Ownership – 100% Private.	SHORELINE MODIFICATIONS (MAP 16) No shoreline modifications are mapped in the reach.
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22) Zoning districts: Rural Residential 5 Acres (54%) and Long Term Commercial Forest (46%). Comprehensive Plan Designations - Rural (54%) and Long Term Commercial Forest (46%). Existing SED – 100% Rural.	PUBLIC ACCESS (MAP 14) There are no mapped public access facilities to Hanks Lake. Green Diamond is proposing rezone of Hanks Lake from Long Term Commercial Forest to Rural Residential; this may provide opportunities for public access.
IMPERVIOUS SURFACES (MAP 16) Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped except for one road crossing.	AREAS OF SPECIAL INTEREST According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.
CULTURAL AND ARCHAEOLOGICAL RESOURCES There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.	

OPPORTUNITY AREAS

Restore trees in the riparian area where removed through timber harvest.
Provide public access as residential development occurs.

KEY MANAGEMENT ISSUES

- Potential for water quality degradation resulting from development and shallow lake depths.

CATFISH LAKE

SHORELINE PERIMETER

1.4 MI

WATERBODY AREA

25.1 AC

REACH AREA

64.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 35% (14 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

63% forest, 37% wetland (Appendix B: GAP, 2009).
Riparian vegetation: 33% forest cover, 3% non-forest, 64% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Wetlands -- 16 acres (40% of reach); wetland habitat types include palustrine emergent and forested.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (89%) and Residential (11%).
Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: County - Rural Residential 20 Acres (89%) and Rural Residential 5 Acres (11%).
Comprehensive Plan Designations - Rural (100%).
Existing SED - None designated.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Catfish Lake.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped except for one road that intersects the SW edge of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

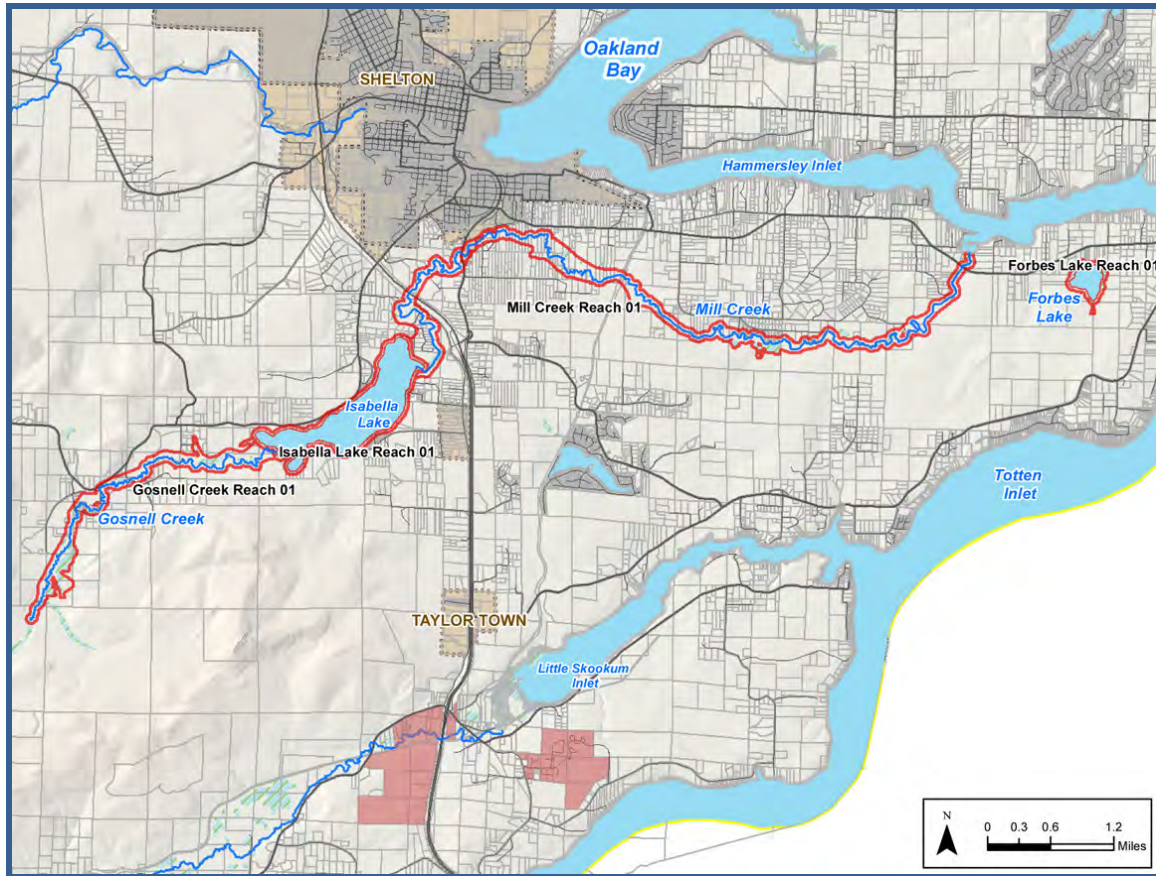
OPPORTUNITY AREAS

Restore trees in the riparian area where removed through timber harvest.
Provide public access as residential development occurs.

KEY MANAGEMENT ISSUES

- Potential for water quality degradation from development and shallow lake depths.

6.10 Mill Creek and Tributaries (Forbes Lake, Isabella Lake, Gosnell Creek)



6.10.1 Physical Characterization and Modifications

The Mill Creek drainage basin provides about 16 miles of low gradient stream habitat (Kuttel, 2002). The headwaters of Mill Creek primarily include Lake Isabella at RM 10.7 and Gosnell Creek, located upstream of the lake. A large wetland is located at the inlet to Lake Isabella.

Forbes Lake is located near Hammersley Inlet and provides a small amount of flow. Mill Creek enters the south shore of Hammersley Inlet between Shelton and Arcadia.

The Mill Creek drainage basin has been modified over time. Some of the process modifications include:

- Culverts and other stream crossing structures;
- Land conversion of forested to agricultural land;
- Land conversion from pervious to impervious areas;
- Water diversions, flumes and historic impoundments; and
- Timber harvest in the drainage basin and in riparian zones.

The lower two miles of the Gosnell Creek drainage basin is dominated by agricultural land. The land adjacent to Mill Creek RM 2 through RM 6 is primarily agricultural. Both of these creeks experience bank erosion due to agricultural activities being conducted too close to the stream bank. In 1853, the first mill in Mason County was built on Mill Creek (Kuttel, 2002). Extensive logging has occurred throughout this drainage basin. Additionally, there has been some development along Mill Creek, near the southern part of Shelton.

6.10.2 Water Quality

Mill Creek is listed on the 303(d) list of impaired waters (Category 5 water) for the temperature parameter (Ecology, 2008a). Gosnell Creek contains no 303(d) listed reaches for any parameter; no other water quality assessments or aquatic plant management plans were identified for this stream. Mill Creek contains a Category 4C listing for instream flow immediately downstream of US 101. Category 4C listings indicate impairment by non-pollutants (Ecology, 2008a). Mill Creek also contains one Category 2 listed reach for fecal coliform bacteria, which indicates there is some evidence of water quality issues for that parameter (Ecology, 2008a).

Ecology has developed a temperature TMDL for Oakland Bay-Hammersley Inlet and associated tributaries. Mill Creek is included in this report (Ecology, 2005). In October 2011, Ecology convened the first advisory group meeting to address temperature issues for certain Oakland Bay tributaries. This group is targeting

completion of the Cranberry, Johns, and Mill Creek's Temperature TMDL WQIR for September 2012.

No water quality data or assessments were identified for Forbes Lake and Isabella Lake. Neither is included on Ecology's 303(d) list of impaired waters.

6.10.3 Critical or Priority Habitat and Species

Mill Creek

Mill Creek, which drains to Oakland Bay, supports many priority state and federally-listed fish species (Appendix B: WDFW, 2011; Table 6-9). The stream has high fall chum escapement of natural spawning fish (Kuttel, 2002). Fall Chinook are observed in the lower reaches of the stream but are considered hatchery strays and not part of a sustainable population.

Table 6-9. Priority salmonid species documented for Mill Creek, Isabella Lake, and Gosnell Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Mill Creek and Isabella Lake only) and Migration	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Spawning (Mill Creek and Isabella Lake only) and Migration	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Spawning (Mill Creek and Isabella Lake only) and Migration	T	~

Approximately 42 acres of wetland (7 percent of the reach) is mapped in the vicinity of Mill Creek (Appendix B: USFWS, 2010). The stream flows adjacent to residential development that is concentrated along the upstream portion of the stream. Several priority species occurrences and priority habitats are mapped around and in the stream, including: bald eagle, western pearlshell, mink, and an Estuarine Zone (Appendix B: WDFW, 2011). The DNR NHP has not identified priority plant species or vegetation communities within the Mill Creek shoreline planning area (Appendix B: DNR, 2009).

Forbes Lake

Forbes Lake does not support any state and federally-listed priority fish species (Appendix B: WDFW, 2011). Approximately 18 acres of wetland are mapped adjacent to Forbes Lake, representing 55percent of the reach (Appendix B: USFWS, 2010). Wetland habitat along the southern and southeastern portions of the lake has not been impacted by development, but logging and residential development exists to the north and west. Bald eagle has been mapped in the vicinity of the lake (Appendix B: WDFW, 2011). The DNR NHP has not identified priority plant species or vegetation communities within the Forbes Lake shoreline planning area (Appendix B: DNR, 2009).

Gosnell Creek

Several fish species are mapped in Gosnell Creek (Appendix B: WDFW, 2011; Table 6-9). Approximately 74.8 acres, representing 24 percent of the reach, are mapped as wetland along the shoreline of the stream (Appendix B: USFWS, 2010). No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or vegetation communities within the Gosnell Creek shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

Isabella Lake

Due its association with Mill Creek and Gosnell Creek, Isabella Lake is documented as supporting several priority fish species (Appendix B: WDFW, 2011; Table 6-9). The shoreline of Isabella Lake has 43.3 acres (35 percent of the reach) of mapped wetland, mainly at the northern and southwestern portions of the lake (Appendix B: USFWS, 2010). Osprey and mink priority species and priority habitat are mapped in the area of the lake (Appendix B: WDFW, 2011). The DNR NHP has identified approximately 9.5 acres of blunt-leaved pondweed within the Mill Creek shoreline planning area (Appendix B: DNR, 2009).

6.10.4 Land Use

Mill Creek has a mix of residential, forestry and vacant land uses. Residential land uses are concentrated near Isabella Lake. Gosnell Creek is also a mix of forestry and residential land uses but there are some agriculture uses as well.

Isabella Lake is mostly undeveloped with some residential homes and individual docks/piers. There is a WDFW public boat launch at the south part of the lake (Mason County Parks and Recreation, 2008). Washington State Parks owns a total of 194 acres of undeveloped land near Isabella Lake (Mason County Parks and Trails, 2006). Planning for development of Isabella Lake State Park is underway.

Public comments were solicited in 2010 as part of the park Classification and Management Plan (CAMP) process. Trails through the state park currently provide public access (http://www.co.mason.wa.us/forms/parks/trails_map.pdf). Forbes Lake has a mix of forestry and residential land uses.

6.10.5 Summary of Key Management Issues

The key management issues for the Mill Creek drainage basin and its shoreline tributaries are: 1) need for public access to shorelines within the basin, 2) balance of recreational and forestry uses with environmental protection of natural resources, 3) significant salmon habitat in Mill Creek, 4) restore trees in riparian areas to maintain cool stream temperatures, and 5) protection of existing cultural and historical resources.

6.10.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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MILL CREEK

SHORELINE LENGTH

10.7 MI

REACH AREA

627.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 60% (375 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 70% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

9% landslide

LAND COVER (MAP 15)

2% developed, 3% agriculture, 42% forest, 4% wetland, 49% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 63% forest cover, 18% non-forest, 17% other natural vegetation, 2% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead.

Bald eagle, western pearlshell, mink, and Estuarine Zone.

Wetlands – 42.3 acres (7% of reach); wetland habitats include palustrine emergent, shrub, and forested, and riverine upper perennial flat.

WATER QUALITY (MAP 13)

303(d) impairment for temperature; Category 4C listing for instream flow; TMDL for temperature

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (38%); Forestry (28%); Vacant (19%), and remaining 14% are a mix of Agriculture, Parks, Open Space, Recreation Areas and Transportation. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: County – Rural Residential 5 Acres (81%), remaining 18% are a mix of Rural Residential 10 Acres, Agricultural Resource Lands and Rural Commercial 1, and Shelton UGA – 2% General Commercial. Comprehensive Plan Designations – Rural (100%).

Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in Mill Creek Reach 01.

IMPERVIOUS SURFACES (MAP 16)

4.4% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads, mainly in the upper part of the reach.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore native trees to degraded riparian zones.

Possible public access opportunities at SE Arcadia Rd, SR 3, SR 101 road crossings.

KEY MANAGEMENT ISSUES

- Stream temperatures exceed water quality standards due to inadequate riparian shade. Plant native trees in riparian zones.
- Deficient in large woody debris.
- Land management activities cause bank erosion and fine sediment input.

FORBES LAKE

SHORELINE PERIMETER

1.0 MI

WATERBODY AREA

37.6 AC

REACH AREA

70.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 32% (10 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas

LAND COVER (MAP 15)

44% open water, 5% beach, 15% forest, 17% wetland, 19% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 27% forest cover, 9% non-forest, 7% other natural vegetation, 57% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Bald eagle.

Wetlands – 17.7 acres (55% of reach); wetland habitat types include palustrine emergent and scrub-shrub.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (48%); Residential (37%); and Vacant (15%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are several docks located in the northwestern portion of the reach visible by 2009 aerial imagery. Privately owned vacation cabins are built near the NE side of the lake.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: 100% Rural Residential 5 Acres. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Forbes Lake.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be largely undeveloped.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low to high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian buffer and good water quality.

• KEY MANAGEMENT ISSUES

- Forested riparian areas on the south eastern side of lake provide vegetative cover.

GOSNELL CREEK

SHORELINE LENGTH

4.7 MI

REACH AREA

307.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 58% (178 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 69% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

2% landslide

LAND COVER (MAP 15)

7% agriculture, 44% forest, 13% wetland, 36% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 34% forest cover, 41% non-forest, 25% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout

Wetlands – 74.8 acres (24% of reach); wetland habitat types include palustrine emergent, forested and scrub-shrub.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Agriculture (33%); Forestry (28%); Residential (15%); Parks, Open Space, and Recreation Areas (12%); and remaining 9% are a mix of Vacant and Transportation. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 3 road crossings located within the southwestern portion of the reach; Bolling Rd, Elson Rd, and privately owned Loertscher Rd.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Agricultural Resource Lands (55%), Rural Residential 5 Acres (33%), and remaining 12% are a mix of Rural Residential 20 Acres and Long Term Commercial Forest. Comprehensive Plan Designations – Agricultural Resource Lands (55%), Rural and Long Term Commercial Forest (45%). Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in Gosnell Creek Reach 01.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered rural residential development in portions of the reach.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore native trees to degraded riparian zones.

KEY MANAGEMENT ISSUES

- Maintain thermal refugia (cool water temperatures) for juvenile salmonids.

ISABELLA LAKE

SHORELINE PERIMETER	WATERBODY AREA	REACH AREA
5.1 MI	338.0 AC	462.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 40% (50 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 11% of the shoreline area is within the channel migration zones of Gosnell Creek or Mill Creek.

HAZARD AREAS (MAP 12)

7% landslide

LAND COVER (MAP 15)

1% developed, 41% open water, 9% forest, 3% wetland, 45% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 41% forest cover, 6% non-forest, 8% other natural vegetation, 45% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout. Osprey and mink; blunt-leaved pondweed.

Wetlands – 43 acres (35% of reach); habitat types include palustrine emergent, forested, and riverine upper perennial flat. Extensive wetlands to the N and SW of the lake

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Vacant (44%); Residential (20%); Agriculture and Forestry (19%); and Parks, Open Space, and Recreation Areas (17%).

Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 22 docks and piers and one boat launch mapped within the reach. BPA transmission lines cross associated wetlands 350 feet west of the lake.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Rural Residential 5 Acres (88%), and remaining 12% are a mix of Long Term Commercial Forest, Agricultural Resource Lands and Rural Residential 20 Acres. Comprehensive Plan Designations – Rural (90%) and remaining 10% are a mix of Long Term Commercial Forest and Agricultural Resource Lands.

Existing SED – Conservancy (78%) and Urban Residential (22%).

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch that provides access to Isabella Lake from the SE shore off W Delight Park Rd. The boat launch is a 12-foot wide concrete pad. The WDFW parcel is about 1½ acres (WDFW, 2011; Mason County Parks and Trails, 2006).

Washington State Parks owns 194 acres of undeveloped land (Isabella Lake State Park) on the eastern shore. In 2010, State Parks began planning for future development of the park (<http://www.parks.wa.gov/plans/lowerhoodcanal>).

IMPERVIOUS SURFACES (MAP 16)

3% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 W Cloquallum Road parallels west side of lake near 200 foot shoreline jurisdiction.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP architectural and archaeological records show one inventoried early historic site in this reach. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Reduce number of new docks over time by considering joint use docks

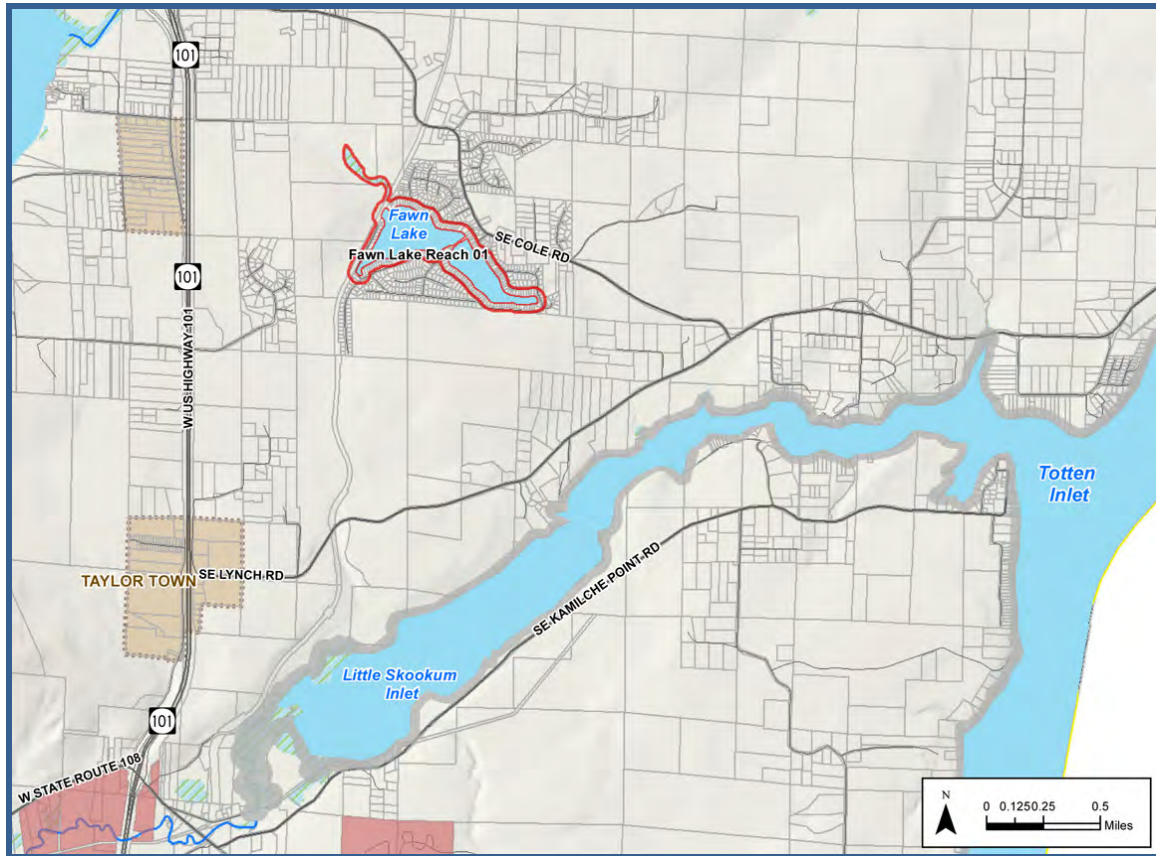
Opportunities to improve public access through Isabella Lake State Park.

Opportunities for public access through acquisition of other undeveloped lands.

KEY MANAGEMENT ISSUES

- Non-native predator fish in lake.
- Park Classification and Management Plan (CAMP) identified management issues for Lake Isabella State Park: 1) desire for off-leash dog park as well as concern for this use near Isabella Lake, 2) recreational uses versus protection for natural resources, 3) public access to the water, and 4) regional trail.
- Protection of existing archaeological and historical resources.
- Restoration of extensive associated wetlands.

6.11 Fawn Lake



6.11.1 Physical Characterization and Modifications

The Fawn Lake drainage basin is approximately 0.6 mile and flows into Lynch Creek, which drains into the Little Skookum Inlet. Fawn Lake is part of the Totten/Little Skookum Inlet Subbasin that drains 80 square miles. In the 1960s, Fawn Lake was created by damming open water wetlands. The water levels in the lake are managed to prevent flooding of adjacent homes (Fawn Lake Maintenance Commission, 2010).

The Fawn Lake drainage basin has been modified by humans. The process modifications include:

- Land conversion of pervious to impervious surfaces;
- Management of water flows to prevent flooding; and
- Dam operations.

6.11.2 Water Quality

No water quality data or assessments were identified for Fawn Lake and it is not included on Ecology's 303(d) list of impaired waters.

6.11.3 Critical or Priority Habitat and Species

Fawn Lake is not known to support any priority federal or state-listed fish species (Appendix B: WDFW, 2011).

Approximately 7 acres of wetland, another priority habitat, representing 11 percent of the reach, have been mapped in the area adjacent to the lake (Appendix B: USFWS, 2010). Residential development surrounds the lake, but a spur of undeveloped land extends from the northwestern portion of the lake. No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or vegetation communities within the Fawn Lake shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

6.11.4 Land Use

Fawn Lake is mostly developed with residential homes and individual docks/piers.

6.11.5 Summary of Key Management Issues

See reach sheet for key management issues.

6.11.6 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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FAWN LAKE

SHORELINE PERIMETER

2.3 MI

WATERBODY AREA

56.7 AC

REACH AREA

120.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 38% (24 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

2% landslide

LAND COVER (MAP 15)

20% developed, 37% open water, 30% forest, 5% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 15% forest cover, 33% non-forest, 4% other natural vegetation, 48% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout.

6.7 acres of palustrine scrub-shrub wetland (11% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Vacant (57%); Residential (25%); and remaining 18% are a mix of Transportation, Forestry, and Parks, Open Space, and Recreation Areas. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

A dam is located in the southeastern portion of the reach. A total of 72 residential docks were observed on the lake along with 42 residential floats (Google Earth, 2011).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - County: 100% Rural Residential 5 Acres Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in Fawn Lake Reach 01.

IMPERVIOUS SURFACES (MAP 16)

23% of the reach is mapped as containing impervious surfaces, mostly in low-intensity development (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show most of the lake shore is developed with single-family residences and roads.

AREAS OF SPECIAL INTEREST

No contaminated sites listed.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

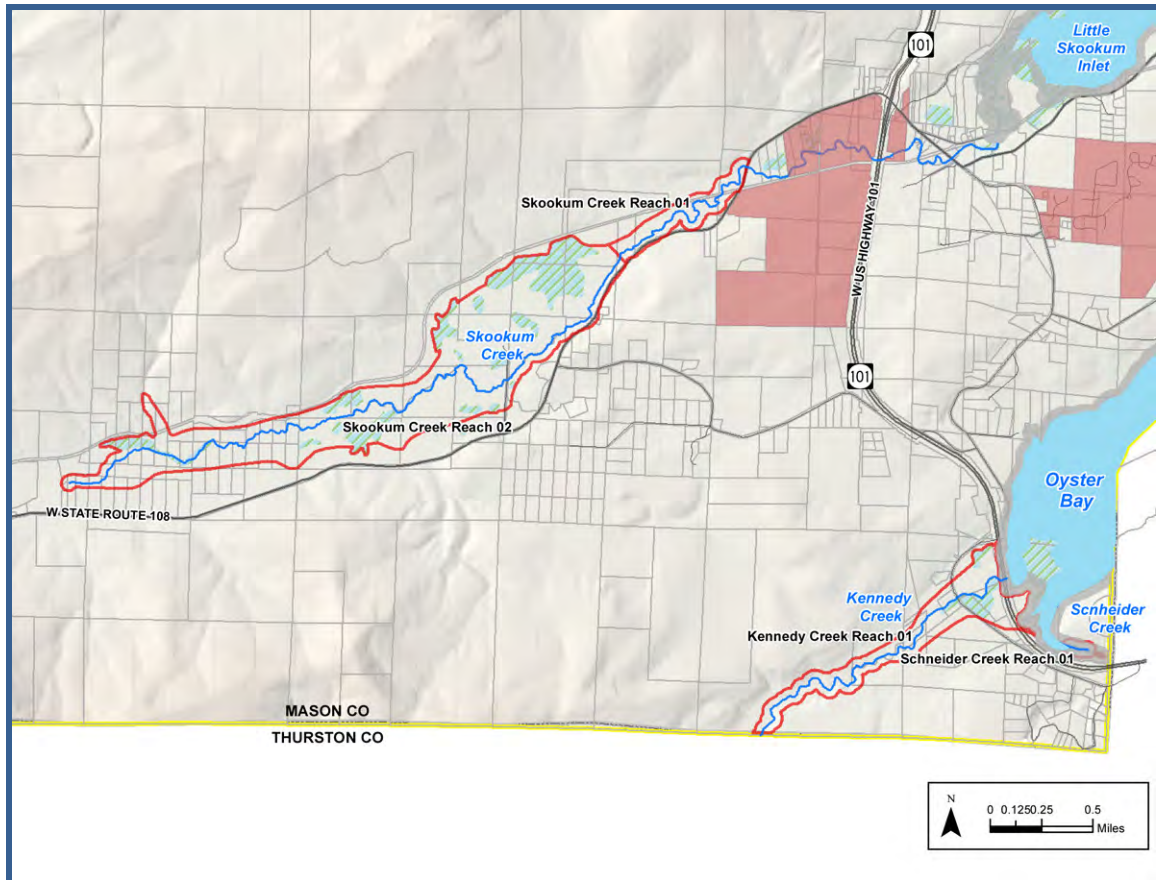
Reduce number of new docks over time by considering joint use docks.

Consider alternatives for operation of the Fawn Lake dam to address low flow problems in the creek.

KEY MANAGEMENT ISSUES

- Failing septic systems contributing to water quality degradation.
- Source of fecal coliform in Little Skookum Inlet.
- Control of invasive Scot's broom visible on 2009 aerial photographs just outside shoreline zone.

6.12 Skookum Creek, Kennedy Creek and Schneider Creek



6.12.1 Physical Characterization and Modifications

The Skookum, Kennedy, and Schneider Creek drainage basins are located in the Totten/Little Skookum Inlet Subbasin. The headwaters of Skookum Creek result from groundwater seepage near Stimson Station on the Northern Pacific Railroad (Kuttel, 2002). The creek flows northwesterly through the Kamilche Valley and drains into Skookum Inlet. The headwaters of Kennedy Creek are Summit Lake and several small tributaries in the northern Black Hills, which flows more than 10 miles to Oyster Bay. The headwaters of Kennedy Creek are forested with conifers, while deciduous trees and pastures dominate the broad valley bottom. Schneider Creek begins on Schneider's Prairie northeast of Summit Lake in Thurston County.

The drainage basins of the Skookum, Kennedy, and Schneider Creeks have been modified. Some of the process modifications include:

- Culverts and other creek crossings;
- Land conversion of forest to agriculture;
- Use of shallow aquifers that are connected with the creeks; and
- Diversion of water for agriculture and other uses.

A culvert is located at the mouth of a tributary entering Skookum Creek at RM 3.3 (Kuttel, 2002). Two culverts are located on tributaries of Kennedy Creek downstream of the falls at RM 2.5. On the mainstem of Skookum and Schneider Creeks there has been extensive removal of riparian vegetation and grazing for agriculture use. Most of the groundwater wells use shallow aquifers that are hydraulically connected with the creeks (Kuttel, 2002).

6.12.2 Water Quality

Although Skookum Creek does not appear at the Category 5 level of water quality impairment, the creek is listed on Ecology's 303(d) list for temperature, fecal coliform bacteria, instream flow, and dissolved oxygen (Ecology, 2008a). Ecology has published a TMDL for fecal coliform bacteria and temperature to address water quality concerns within Skookum Creek (Ecology, 2007; Ahmed and Hempleman, 2006). Skookum Creek contains a Category 4C listing for instream flow between Highway 101 and State Route 108. Category 4C listings indicate impairment by non-pollutants (Ecology, 2008a). Skookum Creek also contains one Category 2 listed reach for fecal coliform bacteria and dissolved oxygen within Squaxin Island Reservation Trust Lands; however, water quality impairment likely extends downstream. Category 2 listings indicate there is some evidence of water quality problems for that parameter (Ecology, 2008a).

Schneider Creek is listed on Ecology's 303 (d) Category 5 list of impaired waters for dissolved oxygen (Ecology, 2008a). Ecology has also published a TMDL for fecal coliform bacteria to address water quality concerns for Schneider Creek (Ecology, 2007).

Kennedy Creek is listed on the 303(d) list of impaired waters (Category 5 water) for the dissolved oxygen parameter (Ecology, 2008). Ecology has published a TMDL for fecal coliform bacteria to address water quality concerns within Kennedy Creek. A TMDL for temperature is being deferred pending implementation of the Green Diamond Resource Company Habitat Conservation Plan (Ecology, 2007). Kennedy Creek also contains two Category 2 listings for fecal coliform bacteria and pH located upstream and outside of Mason County; however, water quality impairment likely extends downstream.

6.12.3 Critical or Priority Habitat and Species

Skookum Creek

Skookum Creek is divided into two reaches that drain to Totten Inlet. The following state and federally-listed priority fish species have been mapped in the stream (Appendix B: WDFW, 2011; Table 6-11).

Table 6-10. Priority salmonid species documented for Skookum Creek, Kennedy Creek and Schneider Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Spawning (Skookum Reach 1, Kennedy Creek, and Schneider Creek only) and Migration	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Spawning (Skookum Reach 1 and Reach 2, Kennedy Creek only) and Migration	Concern	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Spawning (Skookum Reach1 and Reach 2 only)and Migration	T	~

In total, the two Skookum Creeks reaches contain 122 acres of mapped wetland, (20 percent of the total reach area) (Appendix B: USFWS, 2010). The downstream portion of the stream has been more impacted by commercial and residential development. Priority habitats and species mapped along Skookum Creek include waterfowl concentrations, Olympic mudminnow, and Roosevelt elk (Appendix B: WDFW, 2011). The DNR NHP has not identified priority plant species or vegetation communities within the Skookum Creek shoreline planning area (Appendix B: DNR, 2009).

Kennedy Creek

Kennedy Creek drains to Totten Inlet and supports several species of federal and state-listed priority fish (Appendix B: WDFW, 2011; Table 6-10). Natural spawning in the stream results in the majority of fall chum production from Totten Inlet (Kuttel, 2002). Fall Chinook occur occasionally near the mouth of Kennedy Creek but these are considered hatchery strays and not a self-sustaining population (SaSI, 2002).

Approximately 16 acres of wetland are mapped in the vicinity of Kennedy Creek, representing 12 percent of the reach (Appendix B: USFWS, 2010). No priority wildlife species occurrences have been mapped in the vicinity of the stream (Appendix B: WDFW, 2011). The DNR NHP has identified the following priority wetland plant species and vegetation communities within the Kennedy Creek shoreline planning area (Appendix B: DNR, 2009):

- Lyngby's Sedge
- Mixed-fine and Mud: Partly Enclosed, Eulittoral, Mesohaline (Marsh)
- Organic: Partly Enclosed, Backshore, Polyhaline (Marsh)
- Tufted Hairgrass - Pacific Silverweed

Schneider Creek

Several species of priority federal and state-listed fish are mapped in Schneider Creek, which drains to Totten Inlet (Appendix B: WDFW, 2011; Table 6-10).

Approximately 4 acres (46 percent of the reach) is mapped as wetland for Schneider Creek (Appendix B: USFWS, 2010). A priority habitat, Estuarine Zone, is also mapped for the stream (Appendix B: WDFW, 2011).

No priority wildlife species occurrences have been mapped in the vicinity of the stream. The DNR NHP has not identified priority plant species or vegetation

communities within the Schneider Creek shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

6.12.4 Land Use

Land use along Skookum Creek is predominantly agriculture. Kennedy Creek has an even mix of open space, agriculture, and vacant land uses. Schneider Creek within Mason County's shoreline lies entirely within marine tideland area.

6.12.5 Summary of Key Management Issues

The key management areas for Skookum Creek, Kennedy Creek and Schneider Creek are: 1) protection and improvement of water quality to support salmonid habitat and other aquatic uses, 2) protection of significant aquaculture resources in Skookum Inlet and Totten Inlet, 3) restoration and protection of estuarine and freshwater wetlands, and 4) control of upstream sediments and nutrients that contribute to water quality degradation.

6.12.6 Reach Analysis

An analysis by freshwater reach is given in the following section. Schneider Creek reach data is included as Marine Reach 39 in Chapter 5. Reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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SKOOKUM CREEK - REACH 01

SHORELINE LENGTH

2.8 MI

REACH AREA

72.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 64% (47 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 25% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

Less than 1% erosion, 5% landslide

LAND COVER (MAP 15)

2% agriculture, 10% forest, 5% wetland, 82% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 69% forest cover, 12% non-forest, 19% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout; waterfowl concentrations.
4.0 acres of palustrine forested wetland (6% of reach).

WATER QUALITY (MAP 13)

Not on 303 (d) Category 5 list; TMDL water quality implementation plan for fecal coliform bacteria and temperature; Category 4C listing for instream flow.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (68%); Residential (18%); and remaining 14% are a mix of Transportation, Vacant, and Agriculture. Ownership – 100% Private.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 20 Acres (60%) and Rural Residential 5 Acres (40%).
Comprehensive Plan Designations – Rural (99%) and Agricultural Resource Lands (1%).
Existing SED – 100% Conservancy.

SHORELINE MODIFICATIONS (MAP 16)

There is one road crossing in the northeastern portion of the reach at SR 108.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Skookum Creek Reach 1.

IMPERVIOUS SURFACES (MAP 16)

1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show rural residential development in the lower part of the reach.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect and improve water quality to protect downstream resources.

KEY MANAGEMENT ISSUES

- Culverts impeding transport of spawning gravels.
- Protect Little Creek and other tributaries for salmon spawning.

SKOOKUM CREEK - REACH 02

SHORELINE LENGTH

3.7 MI

REACH AREA

552.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 88% (483 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 43% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

2% erosion, 2% landslide

LAND COVER (MAP 15)

32% agriculture, 11% forest, 25% wetland, 32% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 22% forest cover, 56% non-forest, 22% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout; Olympic mudminnow, waterfowl concentrations, and Roosevelt elk.

Wetlands – 118.2 acres (22% of reach); wetland habitat types include palustrine emergent, forested and scrub-shrub.

WATER QUALITY (MAP 13)

Not on 30 (d) Category 5 list; TMDL water quality implementation plan for fecal coliform bacteria and temperature.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Agricultural Resource Lands (80%) and Forestry and Vacant (20%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

There are 2 road crossings located in the eastern portion of the reach at Eich Rd and SR 108. Eich Rd is a bridge crossing.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Agriculture Resource Lands (74%) and remaining 26% are a mix of Rural Residential 20 Acres and Long Term Commercial Forest. Comprehensive Plan Designations – Agricultural Resource Lands (76%) and Rural (24%). Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities to Skookum Creek Reach 2.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show very limited rural residential development in this reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP architectural and archaeological records show two inventoried early historic sites in this reach. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Possible public access opportunities at Eich Rd and SR 108 road crossings.
Restore native trees to degraded riparian zones.

KEY MANAGEMENT ISSUES

- Protect entire upper reach and tributaries for salmon spawning.
- Riparian corridor in middle portion of reach is significantly deficient in vegetation/riparian shade.
- Monitor land management activities to maintain cool water temperatures important to salmonid habitat.

KENNEDY CREEK

SHORELINE LENGTH

1.8 MI

REACH AREA

137.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 68% (93 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 77% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

3% landslide

LAND COVER (MAP 15)

3% developed, 6% agriculture, 31% forest, 17% wetland, 43% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 52% forest cover, 10% non-forest, 38% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout. Several priority vegetation communities mapped; see text.

Wetlands -- 16.6 acres (12% of reach); wetland habitat types include estuarine intertidal emergent, palustrine forested and scrub-shrub.

WATER QUALITY (MAP 13)

One 303 (d) Category 5 listing for dissolved oxygen; TMDL water quality implementation plan for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE	
EXISTING LAND USES AND OWNERSHIP (MAP 18) Land Use - Forestry (38%); Parks, Open Space, and Recreation Areas (18%); Agriculture (17%); Vacant (17%) and Residential (9%). Ownership – Private (98%) and Public (2%).	SHORELINE MODIFICATIONS (MAP 16) No shoreline modifications are mapped in the reach.
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22) Zoning districts - Rural Residential 20 Acres (42%), Agriculture Resource Lands (32%), and Rural Residential 5 Acres (26%). Comprehensive Plan Designations - Rural (68%) and Agricultural Resource Lands (32%). Existing SED – 100% Conservancy.	PUBLIC ACCESS (MAP 14) The Kennedy Salmon Trail provides viewing of chum salmon spawning along a 0.5 mile trail. The interpretive trail was developed by the South Puget Sound Salmon Enhancement Group with assistance from numerous partners. Open on weekends in November.
IMPERVIOUS SURFACES (MAP 16) 4% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads in the eastern section of the reach.	AREAS OF SPECIAL INTEREST No Ecology listed facilities or contaminated sites.
CULTURAL AND ARCHAEOLOGICAL RESOURCES There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very high probability of finding unknown artifacts within this reach.	

OPPORTUNITY AREAS

Protect and restore forested riparian zones.

KEY MANAGEMENT ISSUES

- Protection of existing riparian buffers during timber harvest.
- Improve water quality through TMDL

6.13 Data Gaps

The inventory and characterization report relies on GIS data, review of aerial photographs, existing technical reports, existing map products, information from Mason County planning staff, the Joint Technical Advisory Committee (JTAC), and the Mason County Citizens Advisory Committee (CAC) as well as input from the Mason County residents.

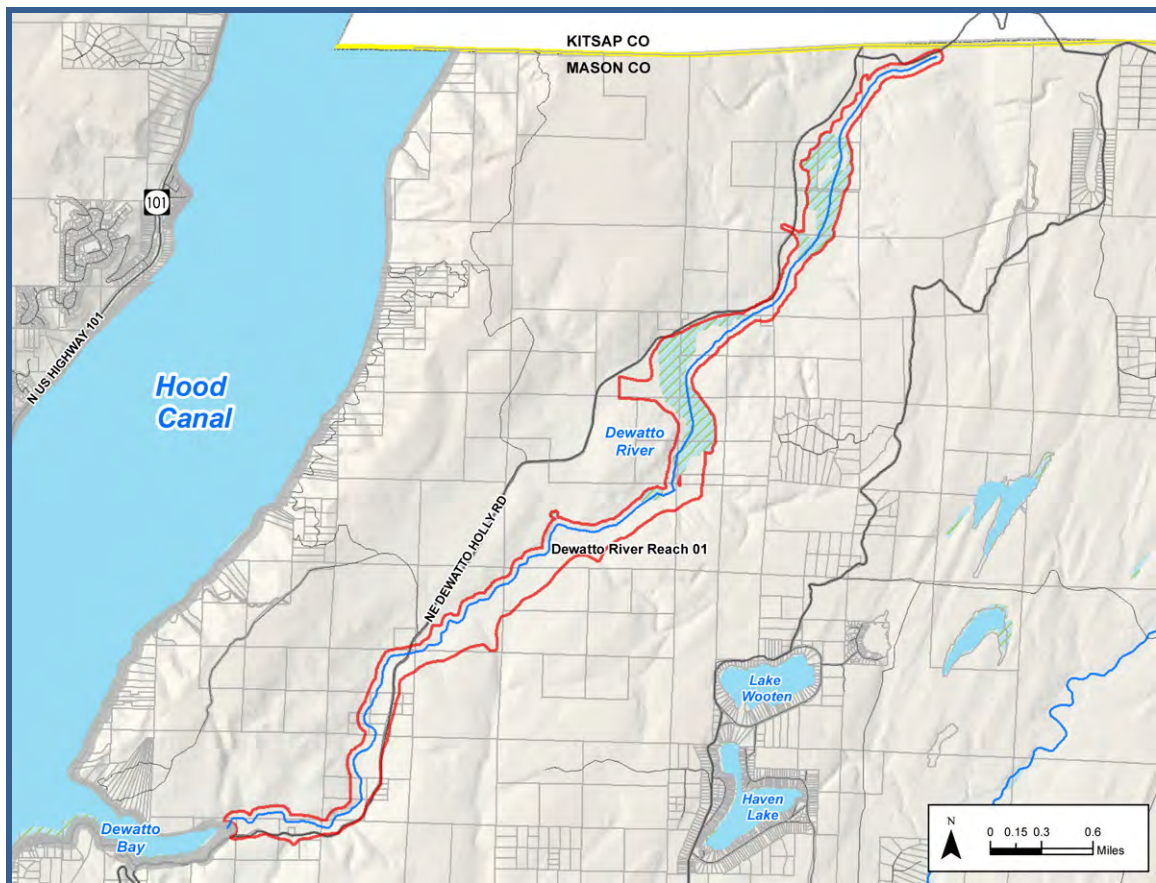
The following gaps in data or information were identified during this inventory and characterization of the Kennedy-Goldsborough (WRIA 14a) watershed:

- Current quantifiable data on channel modifications;
- Current data on shoreline modifications such as linear feet of hard shore armoring; and
- Countywide information on wetland type and extent in the shoreline.

CHAPTER 7.

WRIA 15: TAHUYA PENINSULA

7.1 Dewatto River



7.1.1 Process and Channel Modifications

Dewatto Creek discharges to Dewatto Bay on the eastern shore of Hood Canal. The mouth of the Dewatto River is located approximately 5.5 miles north of The Great Bend of Hood Canal (Kuttel, 2003). The river flows to the southwest, roughly parallel to the marine shore. The stream is considered a shoreline for approximately 7.4 miles in length, which is fed by roughly 30 miles of tributaries that drain approximately 23 square miles of land (Ames et al., 2000). Dewatto Creek estuary is located in Marine Reach 12 and is discussed in Chapter 4.

Limited development has occurred in the Dewatto River watershed and the drainage basin is in relatively good condition compared to other watersheds in western WRIA 15. The Dewatto River watershed has been modified by historic and current timber production (Kuttel, 2003). Several culverts located on tributaries to the river are partial fish barriers. Floodplain connectivity along the river and all tributaries has been rated as good (May and Peterson, 2002).

The Dewatto River drainage basin has been modified by logging and limited residential development. Some of the process modifications include:

- Timber harvest adjacent to the stream;
- Residential development along the lower portion of the stream; and
- Culverts and other structures that change the flow patterns and disrupt fish passage.

7.1.2 Water Quality

The Dewatto River is listed on the 303(d) list of impaired waters (Category 5 water) for the fecal coliform bacteria parameter; however, this listing is for a reach just outside of Mason County, within Kitsap County (Ecology, 2008a). Category 5 listings require the preparation of a Total Maximum Daily Load (TMDL) to address water quality concerns for the waterbody.

7.1.3 Critical or Priority Habitat and Species

The Dewatto River is mapped as supporting many state and federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 7-1).

Table 7-1. Priority salmonid species documented for the Dewatto River

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning/Rearing	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Migration/Spawning/Rearing	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	Threatened	Candidate
Pink salmon	<i>Oncorhynchus gorbuscha</i>	Migration/Spawning	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning/Rearing	Concern	~
winter Steelhead	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	Threatened	~

Summer chum are documented in the Dewatto River, but the stock was considered extinct by the 2002 SaSI update. The update declared the fall chum stock as healthy and the winter steelhead stock as depressed (WDFW, 2003). In addition, the Hood Canal Salmon Enhancement Group has conducted instream habitat and steelhead surveys to assist in overall salmon recovery in the Dewatto River. Steelhead smolts have been introduced annually to the Dewatto River as part of the Hood Canal Steelhead Supplementation Project (<http://www.hcseg.org/index.xml>).

Critical habitat has been designated for the Hood Canal Evolutionarily Significant Unit (ESU) summer-run chum salmon within the lower reach of Dewatto River extending downstream to the confluence with Hood Canal (Appendix B: USFWS, 2010; Table 7-2).

Table 7-2. Critical Habitat documented for Dewatto River

Stream	Reach	Species Common Name	Scientific Name
Dewatto River	01	chum salmon	<i>Oncorhynchus keta</i>

Approximately 210 acres of wetland, representing 28 percent of the reach, are mapped within the Mason County shoreline jurisdiction of the stream (Appendix B: USFWS, 2010). Wetland habitat types included palustrine emergent, palustrine

forested, palustrine scrub-shrub, estuarine, and lacustrine (referred to as open water within reach sheets).

Priority wildlife species occurrences are mapped for mountain quail and osprey in area adjacent to the river (Appendix B: WDFW, 2011).

The Washington Department of Natural Resources (DNR) Natural Heritage Program (NHP) has not identified priority plant species or vegetation communities within the Dewatto River shoreline planning area (DNR, 2009).

7.1.4 Land Use

Land uses in the Dewatto River shoreline are primarily timber and forest resource. Large tracts of land are owned by Manke Timber Company and Pope Resources. Other land uses include single family residential and parks. The Port of Dewatto, one of the smallest ports in Washington, was formed in 1927 and manages park land near Dewatto Bay.

See reach sheet for land use information.

7.1.5 Land Cover

Land cover within the reach is described on the reach sheet.

7.1.6 Summary of Key Management Issues

See reach sheet for key management issues.

7.1.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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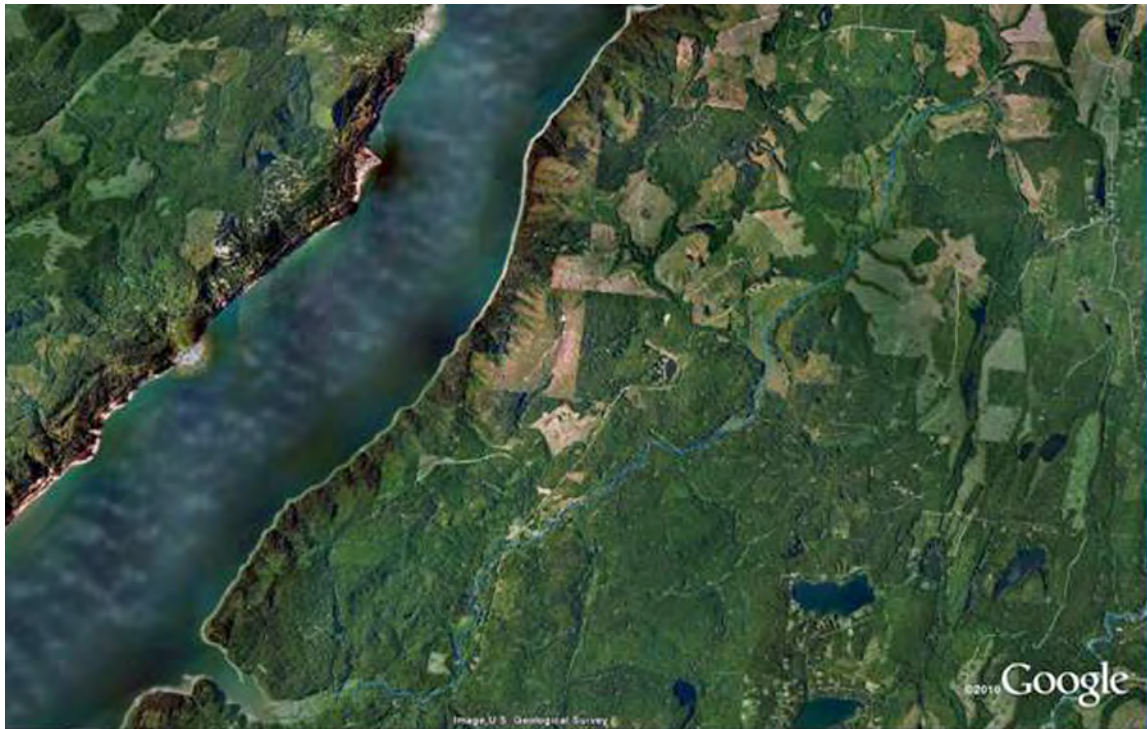
DEWATTO RIVER

SHORELINE LENGTH

7.4 MI

REACH AREA

760.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 64% (484 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 67% of the shoreline area is within the channel migration zone.

LAND COVER (MAP 15)

39% forest, 4% wetland, 56% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 64% forest cover, 6% non-forest, 28% other natural vegetation, 2% water (Appendix B: PNPTC, 2011).

HAZARD AREAS (MAP 12)

29% erosion, 18% landslide

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, summer chum salmon, pink salmon, coho salmon, winter steelhead. Critical habitat for summer-run chum salmon. Mountain quail and osprey.

Wetlands – 210 acres (28% of reach); wetland habitat types include palustrine emergent, palustrine forested and palustrine scrub-shrub

WATER QUALITY (MAP 13)

No 303(d) listings within Mason County. One 303(d) listing for fecal coliform bacteria; however, this is within Kitsap County.

BUILT ENVIRONMENT AND LAND USE	
EXISTING LAND USES AND OWNERSHIP (MAP 18) Land Use – Forestry (98%) with remaining 2% a mix of Residential and Vacant. Ownership – 100% Private.	SHORELINE MODIFICATIONS (MAP 16) One road crossing in the southwestern portion of the reach: Holly Dewatto Rd.
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22) Zoning districts - Rural Residential 20 Acres (95%) and Rural Residential 10 Acres (5%). Comprehensive Plan Designation -100% Rural. Existing Shoreline Environmental Designations (SED) – 100% Conservancy.	PUBLIC ACCESS (MAP 14) Dewatto River Campground, managed by the Port of Dewatto, has 60 campsites, a picnic area, and access to the water for fishing and trails (Mason County Department of Parks and Trails, 2006).
IMPERVIOUS SURFACES (MAP 16) Less than 1% of the reach contains mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a very low level of rural residential development in this reach.	AREAS OF SPECIAL INTEREST No Ecology listed facilities or contaminated sites.
CULTURAL AND ARCHAEOLOGICAL RESOURCES There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach, with smaller portions of the reach in low and moderate-low zones.	

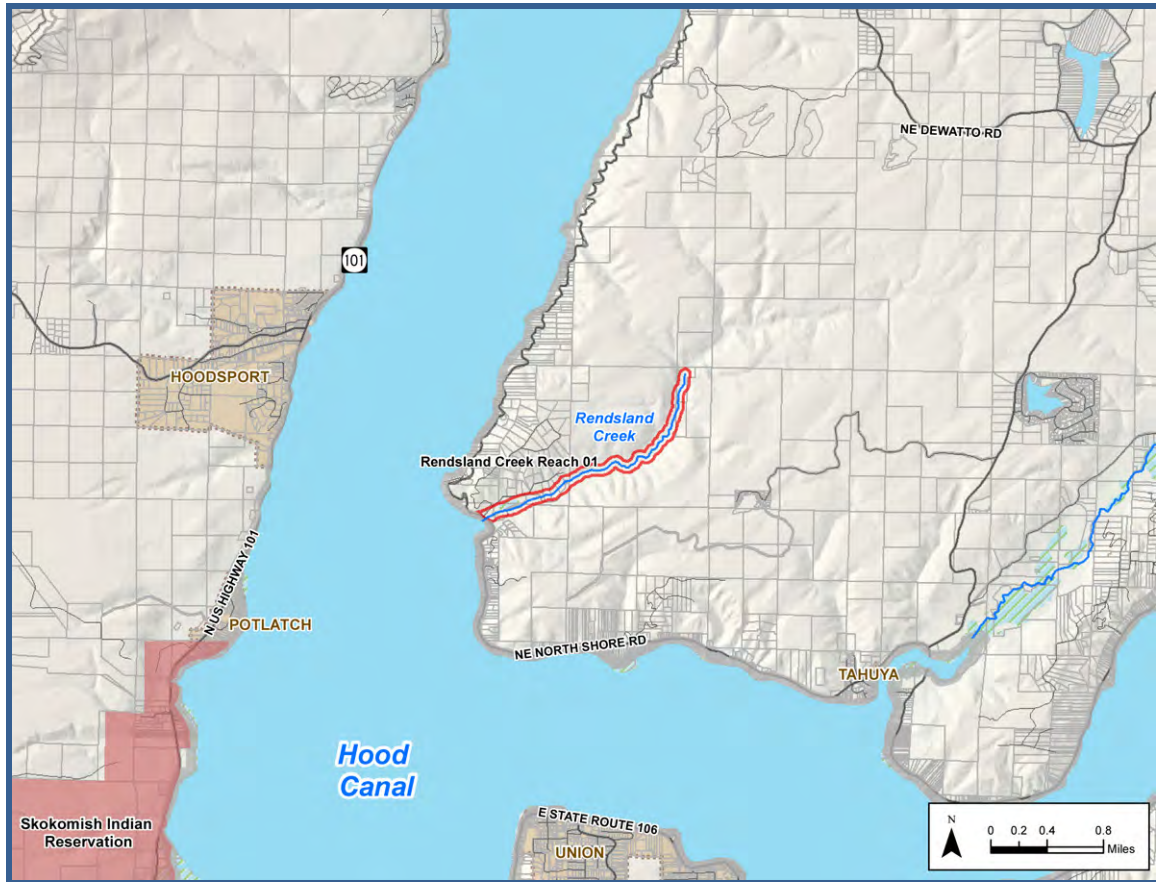
OPPORTUNITY AREAS

Improve public access at existing Dewatto River Campground
Restore fish passage through culvert removal or replacement
Restore riparian habitat through forest rehabilitation and invasive plant control

KEY MANAGEMENT ISSUES

- Control of invasive plants in the riparian zone (i.e., knotweed)
- Culverts blocking salmonid fish passage in the drainage basin

7.2 Rendsland Creek



7.2.1 Process and Channel Modifications

The headwaters of Rendsland Creek are at Tee Lake, which drains approximately 5.3 miles to The Great Bend of Hood Canal via a well developed delta. In addition to Tee Lake, which has a seasonal outlet, roughly 4.4 miles of tributaries contribute to the stream flow including a dozen small lakes and ponds. Upstream reaches receive perennial flow, while flow becomes intermittent downstream (Kuttel, 2003).

Limited development is present along the stream, with the exception of residences at the mouth of Rendsland Creek (Kuttel, 2003). A culvert near the headwaters of the stream has been repaired to allow fish passage (WDFW, 2011) and several of the tributaries to Rendsland Creek contain culverts. In addition, the residents of Tee Lake manipulate lake levels, which may limit fish movement. The floodplain connectivity of the stream has been rated as fair (May and Peterson, 2002).

The Rendsland Creek drainage basin has been modified by logging and limited residential development. Some of the process modifications include:

- Land conversion from pervious to impervious surfaces, primarily at the mouth of the stream;
- Logging adjacent to the stream at the upstream extent;
- Road crossings; and
- Culverts and other structures that change the flow patterns.

7.2.2 Water Quality

Rendsland Creek is not included on the 303(d) list of impaired waters (Category 5) (Ecology, 2008a).

7.2.3 Critical or Priority Habitat and Species

Rendsland Creek supports several state and federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 7-3).

Table 7-3. Priority salmonid species documented for Rendsland Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning/Rearing	~	~
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning/Rearing	Concern	~

Approximately 4.9 acres of wetland (representing 5 percent of the reach) are mapped within the Rendsland Creek shoreline (Appendix B: USFWS, 2010). No priority wildlife species occurrences have been mapped in the vicinity of the stream and the DNR NHP has not identified priority plant species or vegetation communities within the Rendsland Creek shoreline planning area (Appendix B: WDFW, 2011; Appendix B: DNR, 2009).

7.2.4 Land Use

The State of Washington owns major land area within the Rendsland Creek shoreline. See reach sheet for land use information.

7.2.5 Land Cover

Land cover is mainly forested and forest resource lands, with single family residential uses at the mouth. See reach sheet for land cover areas.

7.2.6 Summary of Key Management Issues

See reach sheet for key management issues.

7.2.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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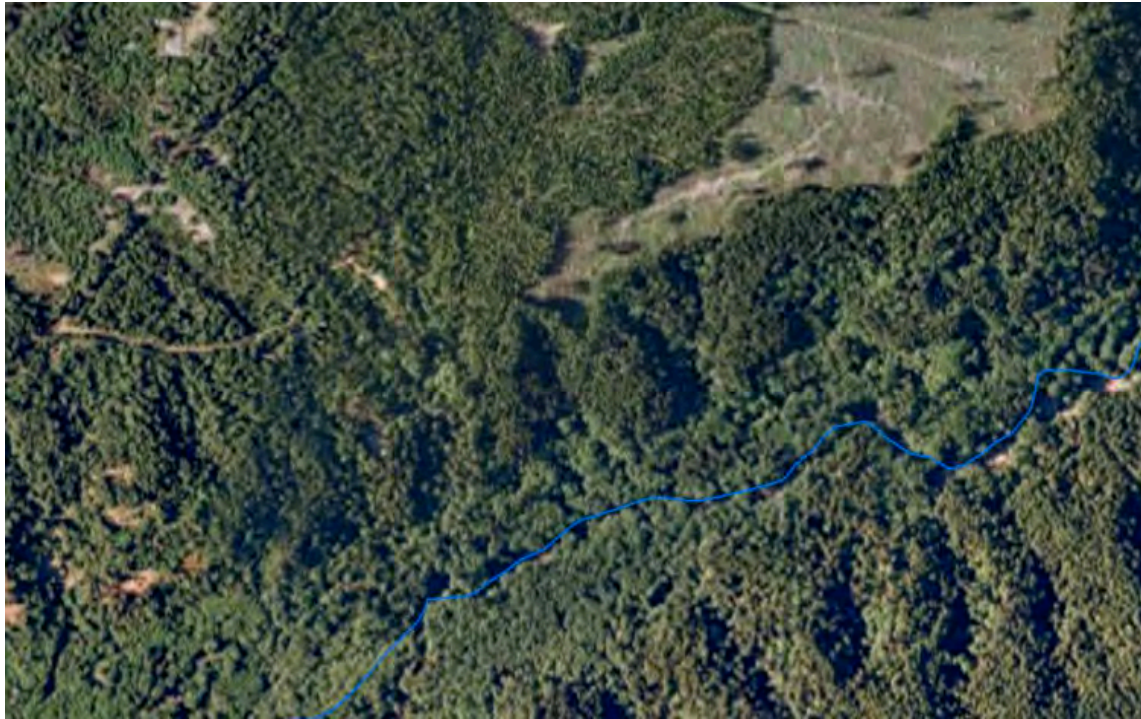
RENDSLAND CREEK

SHORELINE LENGTH:

2.0 MI

REACH AREA:

105.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 27% (28 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 94% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

21% erosion, 28% landslide

LAND COVER (MAP 15)

71% forest, 3% wetland, 26% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 85% forest cover, 1% non-forest, 13% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon.

5 acres of palustrine emergent wetland (5% of reach).

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (63%); Vacant (25%); and remaining 12% is a mix of Parks, Open Space, Recreation Areas and Residential. Ownership – Public (70%) and Private (30%).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 20 Acres (63%) and Rural Residential 5 Acres (37%).
Comprehensive Plan Designations: 100% Rural.
Existing SED: 100% Conservancy.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show one road crossing the lower part of the reach.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach. NE North Shore Road crosses Redlands Creek near the mouth of the inlet from Hood Canal.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities for Rendsland Creek. However, Menard's Landing Park, operated by the Port of Tahuya, adjoins Rendsland Creek and has picnic tables, a gazebo and a small hand-carry boat/kayak launch site.

Public clam and oyster recreational harvest areas at the mouth of Rendsland Creek.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Opportunity for new public access to majority of waterbody. State of Washington is major land owner.

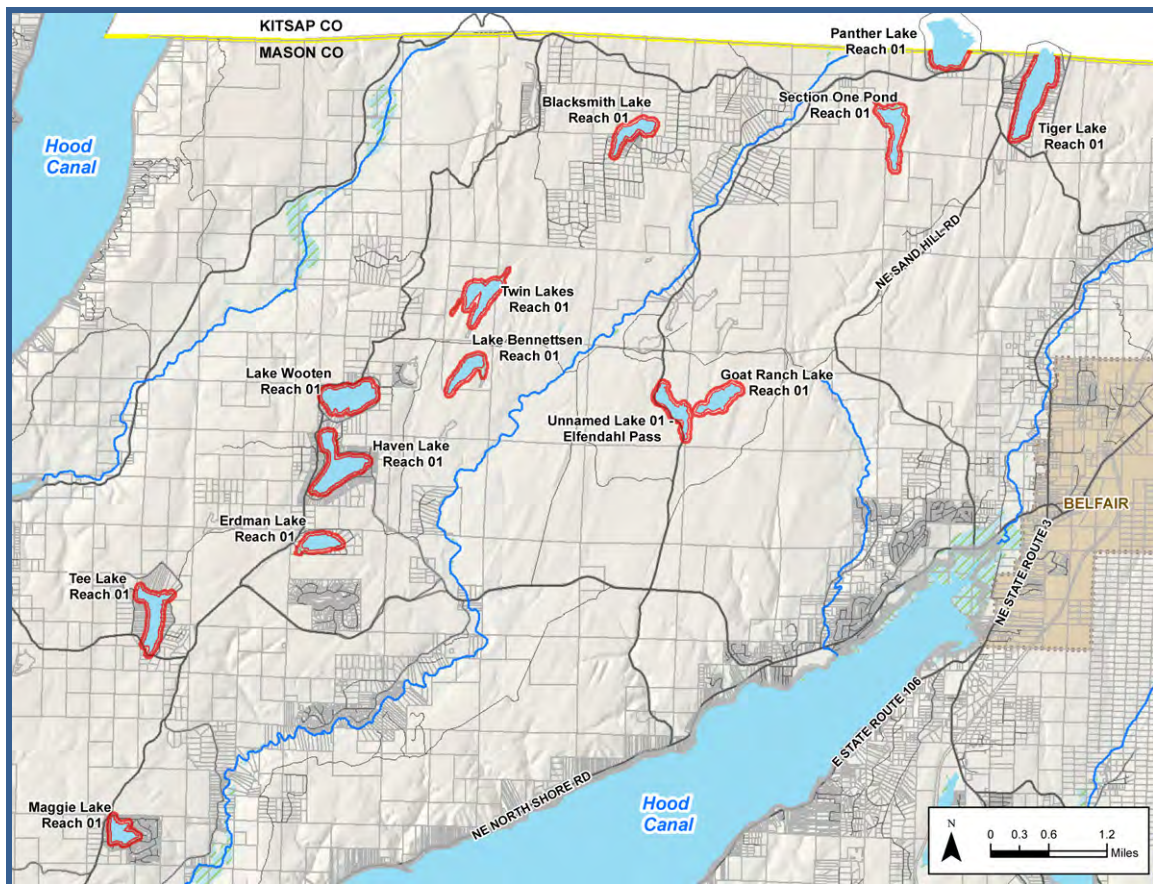
Protect forested riparian areas where trees are intact.

Protect existing water quality in Rendsland Creek.

KEY MANAGEMENT ISSUES

- Timber harvest in the watershed resulting in increased surface water runoff.
- Alterations at the mouth of Rendsland Creek in the nearshore areas (see Chapter 5).

7.3 Lakes on Kitsap Peninsula (Blacksmith, Twin, Bennettsen, Wooten, Haven, Goat Ranch, Erdman, Tee, Maggie, Tiger, Panther, Unnamed, Section 1 Pond)



7.3.1 Physical Characterization and Modifications

Thirteen lakes on the Tahuya Peninsula in Mason County meet the definition of shorelines of the state and are included in this chapter of the inventory and characterization report. Lakes located west of the Tahuya River are: Maggie Lake, Tee Lake, Erdman Lake, Haven Lake, Wooten Lake, Lake Bennettsen, Twin Lakes and Blacksmith Lake. Lakes to the east of the Tahuya River include: Goat Ranch Lake, Unnamed Lake, Scarification Lake, Section 1 Lake, Panther Lake and Tiger Lake. Numerous other lakes occur on the Kitsap Peninsula within Mason County; however, these are less than 20 acres in size and are not considered shorelines of the state.

In addition to residential development along the shorelines of many of these lakes, logging practices are common on the lands adjacent to the lakes and the upper watershed in general.

Lakes West of the Tahuya River

Lakes located west of the Tahuya River are surrounded by residential development with piers and floats typically associated with lake-side residences. Notable exceptions to this include: Erdman Lake, Lake Bennettsen and Twin Lake that have limited to no development along their shorelines. Tee Lake is the headwaters for Rendsland Creek and Wooten Lake drains to Haven Lake. Erdman Lake, Haven Lake, Bennettsen Lake and Blacksmith Lake all drain to the Tahuya River. Culverts are common along the inlet and/or outlet streams to many of these lakes (Kuttel, 2003).

Lakes East of the Tahuya River

Residential development is generally more limited or not present on lakes located east of the Tahuya. Exceptions include Panther Lake and Tiger Lake, which are located near the Mason-Kitsap County border; these lakes are developed. Goat Ranch Lake, Unnamed Lake and Panther Lake all drain to the Tahuya River, while Section 1 Pond drains to Mission Creek. Scarification Pond was evaluated in the field by Ecology staff and determined to be less than 20 acres in size and therefore not a shoreline of the state. Culverts are less common on the inlet and/or outlets of these lakes (Kuttel, 2003).

Lakes in the Mason County portion of WRIA 15 have been altered by development and timber harvest. Some of the process modifications include:

- Logging practices;
- Water diversion/storage use;

- Adjacent residential development;
- Pier, ramps and floats;
- Culverts and other structures that alter flow regime;
- Bank armoring; and
- Conversion of pervious to impervious surfaces.

7.3.2 Water Quality

No water quality assessment information was identified for Blacksmith, Twin, Bennettsen, Wooten, Goat Ranch, Erdman, Tee, Maggie, Tiger, Unnamed and Panther Lakes. They are not included on Ecology's 2008 303(d) list of impaired (Category 5) waters.

Haven Lake is included on the 303(d) list due to elevated PCB and Hexachlorobenzene levels. Fish tissue samples collected from Haven Lake in 2005 had concentrations of PCBs (as total PCB congeners) and hexachlorobenzene higher than the National Toxics Rule Criteria (Ecology, 2008c). The source of PCBs and Hexachlorobenzene in Haven Lake is uncertain. Because the source(s) of pollutants is uncertain, additional monitoring of water quality and assessment to identify and subsequently reduce pollutant sources are potential restoration opportunities for Haven Lake.

Haven Lake was assessed as oligo-mesotrophic (Ecology, 1997) in the 1990s and would have been considered at that time to have good water quality. This assessment was based on several conditions including abundant macrophyte growth and elevated chlorophyll concentrations. An IAVMP for plant management is currently under development for Haven Lake.

In the 1990s, Tiger Lake was assessed as oligo-mesotrophic, while Wooten Lake was assessed as oligotrophic (Ecology, 1997), which would have related to good and excellent water quality, respectively. No recent water quality data were identified.

7.3.3 Critical or Priority Habitat and Species

Nine of the fourteen shoreline lakes on the Tahuya Peninsula are mapped as supporting state and federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 7-4). Cutthroat trout and coho salmon are the more commonly occurring priority salmonids in these lakes.

Table 7-4. Priority salmonid species documented for shoreline lakes on the Tahuya Peninsula (WRIA 15)

Lake	Reach	Coastal Cutthroat Trout	Fall Chum Salmon	Coho Salmon (federal species of concern)	Rainbow Trout	Winter Steelhead (federally listed as threatened)
Blacksmith Lake	01	P/M	~	~	P/M	~
Wooten Lake	01	P/M	~	P/M	~	~
Haven Lake	01	P/M	P/M	J, S, P/M	~	J, P/M
Goat Ranch Lake	01	P/M	~	J, P/M	~	~
Erdman Lake	01	P/M	P/M	J, S, P/M	~	~
Tee Lake	01	P/M	~	J, P/M	~	~
Panther Lake	01	P/M	~	J, P/M	~	~
Unnamed Lake	01	P/M	~	J, P/M	~	~
Section 1 Pond	01	P/M	~	P/M	~	~

*J=Known juvenile rearing; S=Known spawning; P/M=Presence/Migration

In addition to the priority fish species listed above, many of the lakes contain warmwater game fish and other sport fishes that support recreational fisheries similar to other lakes in Mason County.

The following approximate wetland areas have been mapped within the Mason County shoreline jurisdiction for the lakes discussed in this section. The corresponding percentage of lake reach occupied by wetland habitat is also listed (Appendix B: USFWS, 2010; Table 7-5).

Table 7-5. Approximate wetland area in the vicinity of lakes on Kitsap Peninsula

Lake	Reach	Approximate Area of Mapped Wetlands (acres)	Percent of Reach
Blacksmith Lake	01	8.8	24%
Twin Lake	01	11.9	23%

Lake	Reach	Approximate Area of Mapped Wetlands (acres)	Percent of Reach
Lake Bennettsen	01	12.6	37%
Wooten Lake	01	2.8	7%
Haven Lake	01	5.4	10%
Goat Ranch Lake	01	2.0	6%
Erdman Lake	01	6.0	21%
Tee Lake	01	2.3	5%
Maggie Lake	01	2.6	9%
Tiger Lake	01	2.7	5%
Panther Lake	01	0.4	3%
Unnamed Lake	01	5.7	14%
Section 1 Pond	01	8.7	19%

Goat Ranch Lake has other priority wildlife species occurrences for Pacific pond turtle and western toad. Maggie Lake has a purple martin priority species occurrence and Unnamed Lake has a priority species occurrence for western toad (Appendix B: WDFW, 2011). The DNR NHP has identified the following priority plant species and vegetation communities (i.e. bog) within the Twin Lakes shoreline planning area (Appendix B: DNR, 2009):

- Few-flowered Sedge;
- Beakrush - (Bog Cranberry) / Sphagnum Spp.;
- Bog Labrador-tea - Bog-laurel / Sphagnum Spp.; and
- Low Elevation Sphagnum Bog PTN.

7.3.4 Land Use

Twins Lake, Lake Bennettsen, Section 1 Pond, Goat Ranch Lake and Unnamed Lake are entirely within commercial forestry use. Public access is available at three lakes: a WDFW boat launch and a DNR boat launch provide access to Twins Lake; DNR trail provides access to Lake Bennettsen and Unnamed Lake; and Elfendahl Pass Staging Area provides access to Unnamed Lake (Mason County Parks and Recreation Department, 2008; Appendix B: DNR, 2010). Elfendahl Pass Staging Area

is a 5 acre RV campground managed by DNR (Mason County Department of Parks and Trails, 2006). Twin Lakes, Section One Pond, Goat Ranch Lake and Unnamed Lake are part of the Tahuya State Forest lands.

Tahuya State Forest, located generally between Dewatto River and Belfair, is a 23,000-acre working forest and recreational area. DNR manages this forest for timber production, wildlife habitat and recreation. Recreation and public access opportunities must be compatible with overall forest and trust management objectives to be allowed within the state forest lands. More than 200,000 recreational users visit the forest each year. Tahuya offers numerous recreation opportunities, such as off-road vehicle (ORV) riding, horseback riding, mountain biking, fishing, hunting, camping, hiking and recreational mushroom harvesting. There are approximately 170 miles of trails in the Tahuya State Forest (DNR, 2008 and 2011). All shoreline lakes are located outside the Tahuya State Forest except for Twins Lake, Section One Pond, Goat Ranch Lake and Unnamed Lake (DNR Engineering Division Resource Mapping Cartography, 2005).

Wooten Lake, Haven Lake, Tee Lake, Maggie Lake and Tiger Lake are predominately in rural residential use. Remaining lands surrounding the lakes in Mason County section of WRIA 15 are mapped as vacant. A WDFW boat launch provides access to each of these lakes. There is a proliferation of individual docks/piers at each of these five lakes except for Haven Lake.

Erdman Lake has an almost even mix of residential and vacant land uses. There is a DNR trail that runs adjacent to the western portion of Erdman Lake for about 1,000 feet. The trail is part of the DNR Tahuya State forest lands. There are several individual docks and piers associated with existing residences.

Blacksmith Lake and Panther Lake have a mix of forestry, residential and vacant land uses. A WDFW boat launch provides access to Panther Lake. There is no public access to Blacksmith Lake. There are numerous individual docks/piers associated with existing residences in Panther Lake while Blacksmith Lake only has 6 docks/piers.

7.3.5 Land Cover

Much of the land cover surrounding these lakes is related to forest resource lands; therefore, most of the lakes have land cover dominated by forest. Of the thirteen lakes in WRIA 15 (Kitsap), nine of these have forested land cover that occupies 60 percent or more of the shoreline area (Appendix B: GAP, 2009). Only Twin Lake, Wooten Lake, Haven Lake, Tiger Lake and Panther Lake have forested land cover less than 50 percent. Goat Lake, Twin and Unnamed have substantial wetland area as land cover (over 20%).

7.3.6 Summary of Key Management Issues

The key management issues for lakes on the Tahuya Peninsula are related to: 1) preservation of good water quality, 2) appropriate control and management of invasive aquatic plants, 3) limiting the construction of new over-water structures (i.e., docks, floats, etc) so as to avoid and minimize adverse affects on aquatic and fish habitat and 4) minimizing the need for construction of new shoreline armoring.

7.3.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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BLACKSMITH LAKE

SHORELINE PERIMETER

1.4 MI

WATERBODY AREA

27.2 AC

REACH AREA

63.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 32% (11 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

26% open water, 5% playa, 70% forest (Appendix B: GAP, 2009).

Riparian vegetation: 45% forest cover, 7% non-forest, 4% other natural vegetation, 43% water (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and rainbow trout.

No vegetated wetlands are mapped in this reach; all acres are considered open water.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (53%), Residential (29%) and Vacant (18%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to aerial imagery (2011), there are 6 docks/piers present. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential 5 Acres. Comprehensive Plan Designations: 100% Rural. Existing Shoreline Environment Designation (SED) – not designated.

PUBLIC ACCESS (MAP 14)

There are no mapped parks or public access facilities in the Blacksmith Lake shoreline.

IMPERVIOUS SURFACES (MAP 16)

1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2012 show scattered residential development along the southern part of the lake.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.
Identify public access points where none currently exist.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian zone.
- Provide public access or identify goals for public access in County's park planning documents.

TWIN LAKES

SHORELINE PERIMETER

1.8 MI

WATERBODY AREA

40.5 AC

REACH AREA

92.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 23% (12 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

16% open water, 41% forest, 44% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 46% forest cover, 1% non-forest, 28% other natural vegetation, 25% water (Appendix B: PNPTC, 2011).

PRIORITY HABITATS AND SPECIES (MAP 8)

See Section 7.3.3 for list of priority plant species and vegetation communities.

Wetlands – 19 acres (37% of reach); wetland habitat types include lacustrine littoral aquatic bed, palustrine unconsolidated bottom, and palustrine emergent. Open water (lacustrine littoral aquatic bed) accounts for approximately 16 additional acres.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters in 2008

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – Private (95%) and Public (5%).
4 acres are within the DNR Tahuya State Forest lands.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there is 1 dock and 1 public boat launch. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Rural Residential 20 Acres (86%) and Rural Tourist (14%). Comprehensive Plan Designations – 100% Rural.
Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

A County owned dock exists on the northwest side of the eastern body of water and a WDFW gravel boat launch that provides access on the southeastern side of the same body of water. The total park size is about 4 acres and includes a small parking lot (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006). As part of the Tahuya State Forest, DNR has camping facilities and a hand boat launch at Twin Lakes (Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show forestry roads on the NW shore of the lake and no other development.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Consider interpretative signage at boat launches related to lake water quality and habitat protection.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

LAKE BENNETTSEN

SHORELINE PERIMETER

1.1 MI

WATERBODY AREA

26.9 AC

REACH AREA

61.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 35% (12 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

33% open water, 1% beach, 2% playa, 64% forest (Appendix B: GAP, 2009).

Riparian vegetation: 43% forest cover, 1% non-forest, 56% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Wetlands: 8 acres (23% of reach) of lacustrine littoral emergent.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE	
EXISTING LAND USES AND OWNERSHIP (MAP 18) Land Use – 100% Forestry. Ownership – Private (93%) and Public (7%).	SHORELINE MODIFICATIONS (MAP 16) According to aerial imagery (2011), there is 1 floating platform, 1 overwater structure and 5 docks. No other shoreline modifications are mapped in the reach.
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22) Zoning districts – Rural Tourist (85%) and Long Term Commercial Forest (15%). Comprehensive Plan Designations - Rural (85%) and Long Term Commercial Forest (15%). Existing SED – 100% Conservancy.	PUBLIC ACCESS (MAP 14) A DNR trail that runs adjacent to the southwestern and eastern portions of Lake Bennettsen for about 600 feet. The State of Washington owns 1 parcel of undeveloped, noncommercial forest land and the other parcel is owned by the Totem Girl Scout Council.
IMPERVIOUS SURFACES (MAP 16) No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a few single-family residences on large lots on the northern shore of the lake.	AREAS OF SPECIAL INTEREST No listed facilities or contaminated sites.
CULTURAL AND ARCHAEOLOGICAL RESOURCES There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.	

OPPORTUNITY AREAS

Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

LAKE WOOTEN

SHORELINE PERIMETER

1.6 MI

WATERBODY AREA

68.0 AC

REACH AREA

107.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 29% (12 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

2% erosion, 2% landslide

LAND COVER (MAP 15)

1% developed, 55% open water, 1% beach, 2% playa, 39% forest, 2% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 15% closed canopy, 20% non-forest, 65% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon.

No vegetated wetlands are mapped in this reach. Wetland identified as lacustrine unconsolidated bottom and open water accounts for approximately 68 acres.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (87%) and Vacant (13%).
Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are individual docks/piers associated with most residences; approximately 68 docks/piers and 9 unattached floating platforms. NE Mountain View Drive/NE Tahuya Blacksmith Road encircles the lake and crosses into the shoreline area at several locations. There is 1 public boat launch.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts –100% Rural Residential 20 Acres.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch with associated parking that provides access to Wooten Lake. The boat launch is a 12-foot wide concrete launch. The total park is 1 acre in size (WDFW Lands, 2011; Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

4% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads surrounding much of the lake.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Consider interpretative signage at boat launches related to lake water quality and habitat protection.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.
- Introduction of non-native fish species.
- Reduce armoring.
- Reduce impervious surface areas to minimize stormwater runoff and pollutant loading.
- Increase native plants and construction rain gardens to reduce stormwater runoff.

HAVEN LAKE

SHORELINE PERIMETER

2.2 MI

WATERBODY AREA

69.5 AC

REACH AREA

124.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 42% (23 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

Less than 1% erosion, Less than 1% landslide

LAND COVER (MAP 15)

1% developed, 46% open water, 3% beach, 3% playa, 47% forest (Appendix B: GAP, 2009).
Riparian vegetation: 21% forest cover, 19% non-forest, 60% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon and winter steelhead.
No vegetated wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Listed on Ecology's 303 (d) list of impaired waters for PCBs and hexachlorobenzene; integrated aquatic vegetation management plan under development

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (77%) and Vacant (23%).
Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are individual docks/piers associated with most residences; approximately 150 docks/piers and 28 floating platforms. There is 1 public boat launch. An unnamed road crossing is located on the southwestern portion of the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (93%) and Rural Residential 20 Acres (7%).
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There are 2 County owned parcels bordering the lake. One parcel that provides access to the lake contains a WDFW gravel boat launch, associated parking and restrooms. The total park size is about 4 acres (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

3% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences surrounding most of the lake.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach, with a small portion of the reach in moderate to moderate-high probability zones.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks and obtain accurate count of existing docks.
- Protection of existing forested riparian zone.
- Protect wetlands.
- Retain aquatic plant cover used by salmonid fry.
- Control introduced bass that prey on salmonid fry.

ERDMAN LAKE

SHORELINE PERIMETER

0.9 MI

WATERBODY AREA

26.8 AC

REACH AREA

54.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 19% (5 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

7% erosion, 7% landslide

LAND COVER (MAP 15)

32% open water, 2% beach, 3% playa, 59% forest, 5% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 38% forest cover, 7% non-forest, 10% other natural vegetation, 45% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon and coho salmon.

Wetlands – 14 acres (50% of reach); wetland habitat types include palustrine forested and palustrine scrub-shrub.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (50%), Residential (45%) and remaining 5% is a mix of Parks, Open Space, Recreation Areas and Forestry. Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are 9 docks/piers associated with residences. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential 5 Acres. Comprehensive Plan Designations – 100% Rural. Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

There is a DNR trail that runs adjacent to the western portion of Erdman Lake for about 1,000 feet (Appendix B: DNR, 2010).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered single-family residences surrounding the lake.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect wetlands associated with Erdman Lake.
Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Protection of associated wetlands.
- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

TEE LAKE

SHORELINE PERIMETER

2.0 MI

WATERBODY AREA

47.5 AC

REACH AREA

97.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 43% (21 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

1% erosion, 1% landslide

LAND COVER (MAP 15)

2% developed, 36% open water, 1% beach, 2% playa, 60% forest (Appendix B: GAP, 2009).
Riparian vegetation: 29% forest cover, 21% non-forest, 2% other natural vegetation, 49% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon.
Wetland: Less than 1 acres of palustrine scrub-shrub wetland (less than 1% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (69%), Vacant (22%) and remaining 9% is a mix of Forestry, Parks, Open Space and Recreation Areas. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are approximately 47 individual docks/piers associated with residences and about 5 floating platforms. There is 1 state owned public boat launch. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (97%) and Rural Residential 20 Acres (3%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW gravel boat launch with associated parking that provides access to Tee Lake. The total park size is about 4 acres (WDFW Lands, 2011; Mason County f Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

5% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered single-family residences and roads around most of the lake.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

MAGGIE LAKE

SHORELINE PERIMETER

1.1 MI

WATERBODY AREA

22.5 AC

REACH AREA

50.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 44% (12 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

6% developed, 32% open water, 1% beach, 3% playa, 57% forest (Appendix B: GAP, 2009).
Riparian vegetation: 29% forest cover, 24% non-forest, 4% other natural vegetation, 43% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Purple martin.
No vegetated wetlands are mapped in this reach.
Maggie Lake consists entirely of open water habitat.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (66%), Vacant (20%), remaining 14% is a mix of Parks, Open Space, Recreation Areas and Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are approximately 30 individual docks/piers and 5 floating platforms associated with most residences. There is 1 public park with a boat launch, 2 docks and 1 floating platform. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (98%) and Rural Residential 20 Acres (2%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW gravel boat launch with associated parking that provides access to the north end of Phillips Lake. The park is 1 acre in size (WDFW Lands, 2011; Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

15% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered single-family residences and roads surrounding most of the lake.

AREAS OF SPECIAL INTEREST

No state listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.
Protect floodplain from alteration or fill.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

PANTHER LAKE

SHORELINE PERIMETER

0.9 MI

WATERBODY AREA

26.9 AC

REACH AREA

41.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 31% (5 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

65% open water, 1% playa, 34% forest (Appendix B: GAP, 2009).

Riparian vegetation: 20% forest cover, 9% non-forest, 72% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon.
No vegetated wetlands are mapped in this reach.
Panther Lake consists entirely of open water habitat.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (47%), Forestry (36%) and Vacant (17%). Ownership – 100% Private.
Panther Lake

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are approximately 50 individual docks/ and 10 floating platforms piers associated with residences around the perimeter of the lake. Public access includes 1 state owned public boat launch. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential 5 Acres.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is a WDFW gravel boat launch with associated parking at the southern part of the lake. The total park size is about 4 acres (WDFW Lands, 2011; Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show approximately half of the reach developed with single-family residences.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-high to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

TIGER LAKE

SHORELINE PERIMETER

2.2 MI

WATERBODY AREA

98.0 AC

REACH AREA

148.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 68% (34 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

1% erosion, 1% landslide

LAND COVER (MAP 15)

2% developed, 58% open water, 2% beach, 3% playa, 34% forest, 1% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 14% forest cover, 16% non-forest, 70% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

No vegetated wetlands are mapped in this reach. Tiger Lake consists entirely of open water habitat.

WATER QUALITY (MAP 13)

Good water quality; not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (88%), remaining 12% is a mix of Vacant, Forestry, Transportation, Parks, Open Space and Recreation Areas. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerial imagery, there are approximately 75 individual docks/piers and 15 floating platforms associated with residences. Public access includes 1 state owned gravel boat launch located on the north end of the lake in Kitsap County. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential 5 Acres.
Comprehensive Plan Designations – 100% Rural.
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

The WDFW gravel boat launch provides access to the north end of Tiger Lake in Kitsap County (WDFW Lands, 2011).

IMPERVIOUS SURFACES (MAP 16)

6% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads surrounding the lake.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect floodplain from alteration or fill.
Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Limit proliferation of single family residential docks.
- Protection of existing forested riparian zone.

SECTION 1 POND

SHORELINE PERIMETER

1.7 MI

WATERBODY AREA

38.7 AC

REACH AREA

84.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 33% (15 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

95% forest, 5% wetland (Appendix B: GAP, 2009).
Riparian vegetation: 58% forest cover, 2% other natural vegetation, 40% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon.
Wetlands – 7 acres of wetland (15% of reach) mapped; wetland habitat types include palustrine emergent and forested.

WATER QUALITY (MAP 13)

No water quality data available

BUILT ENVIRONMENT AND LAND USE	
EXISTING LAND USES AND OWNERSHIP (MAP 18) Land Use – 100% Forestry. Ownership – Public (84%) and Private (16%). 37 acres are mapped within the Tahuya State Forest.	SHORELINE MODIFICATIONS (MAP 16) No shoreline modifications are mapped in the reach.
ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22) Zoning districts – Long Term Commercial Forest (85%) and Rural Residential 20 Acres (15%). Comprehensive Plan Designations - Long Term Commercial Forest (85%) and Rural (15%). Existing SED – not designated.	PUBLIC ACCESS (MAP 14) There is no mapped public access to Section 1 Pond. Approximately 84 percent of the surrounding land is forested and owned by the State of Washington. Washington State owned land is half is documented as undeveloped, un-commercial forested land or under general services. The rest is privately owned forest land.
IMPERVIOUS SURFACES (MAP 16) No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show forestry roads in the NW part of the reach.	AREAS OF SPECIAL INTEREST No listed facilities or contaminated sites.
CULTURAL AND ARCHAEOLOGICAL RESOURCES There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.	

OPPORTUNITY AREAS

Protect floodplain from alteration or fill.
 Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian zone.

GOAT RANCH LAKE

SHORELINE PERIMETER

1.3 MI

WATERBODY AREA

32.1 AC

REACH AREA

65.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 19% (6 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

6% open water, 63% forest, 30% wetland (Appendix B: GAP, 2009).

Riparian vegetation: 42% forest cover, 12% other natural vegetation, 46% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon. Pacific pond turtle and western toad are documented.

Wetlands – the majority of Goat Ranch Lake is open water with 2 acres of associated lacustrine littoral aquatic bed and palustrine scrub-shrub (6% of reach). The lake is connected to a long, linear 16 acre palustrine forested wetland extending to the NE tip of the open water habitat.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Public.

Thirty-three acres are mapped within the Tahuya State Forest.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations - 100% Long Term Commercial Forest.

Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities at Goat Ranch Lake.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped except for forestry roads.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Public access facilities could be developed.

KEY MANAGEMENT ISSUES

Protection of existing forested riparian zone

UNNAMED LAKE

SHORELINE PERIMETER

1.6 MI

WATERBODY AREA

32.7 AC

REACH AREA

73.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 28% (11 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

82% forest, 17% wetland (Appendix B: GAP, 2009).
Riparian vegetation: 49% forest cover, 6% non-forest, 8% other natural vegetation, 37% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon. Western toad.

Wetlands – approximately 10 acres (24% of reach); wetland habitat types include lacustrine littoral aquatic bed, palustrine emergent, scrub-shrub. The remainder of the habitat is open water.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Public.
41 acres are mapped within the Tahuya State Forest.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations - 100% Long Term Commercial Forest.
Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

Washington State DNR maintains Elfendahl Pass Staging Area at the north end of Unnamed Lake, a 5 acre RV campground with a picnic area (Mason County Department of Parks and Trails, 2006). A DNR trail is mapped in the southern portion of the reach for about 200 feet extending towards Unnamed Lake.

IMPERVIOUS SURFACES (MAP 16)

2% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show 1 road following the western shore of the lake.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

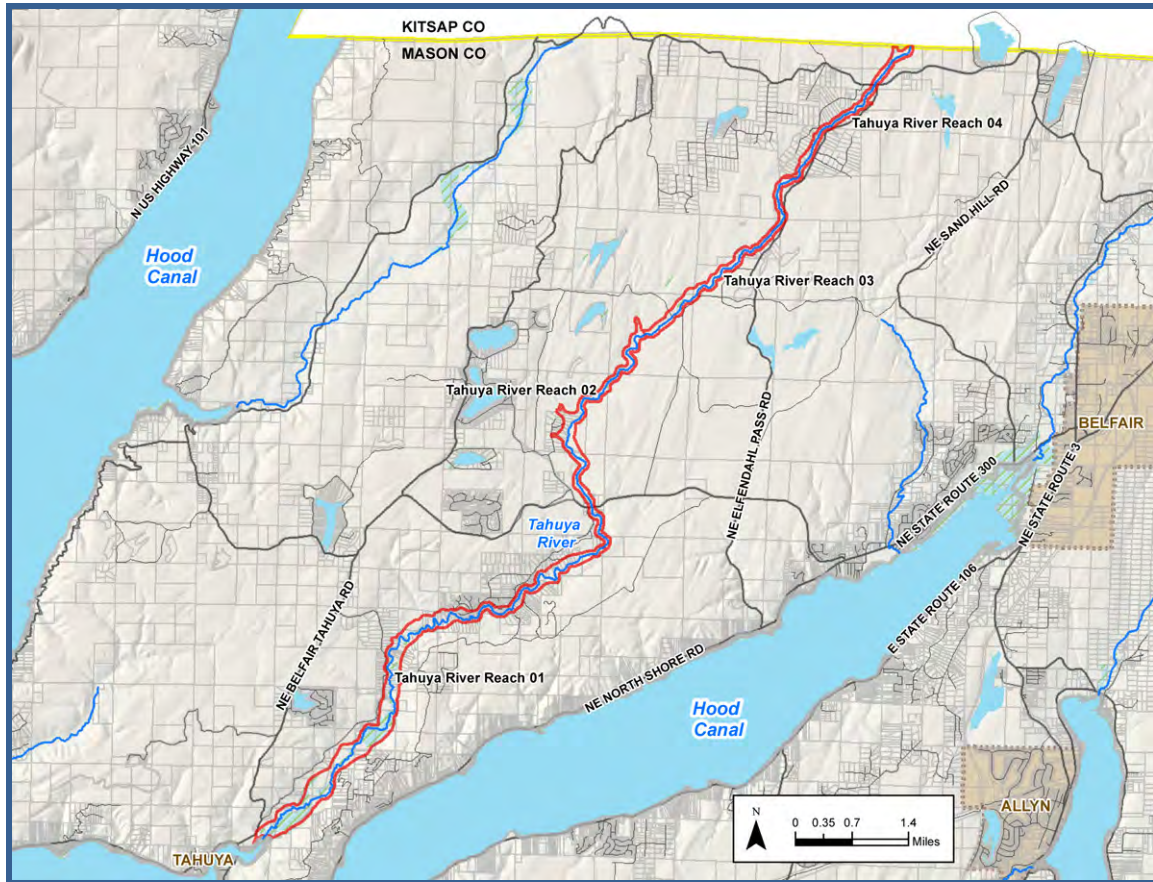
OPPORTUNITY AREAS

Protect floodplain from alteration or fill.
Protect existing forested riparian zone.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian zone.

7.4 Tahuya River



7.4.1 Physical Characterization and Modifications

The Tahuya River is the largest river on the Tahuya Peninsula in WRIA 15 and drains approximately 45 square miles of land (Kuttel, 2003). Many of the shoreline lakes described above in Section 7.3 drain to the Tahuya. The mainstem measures approximately 32 miles long and tributaries account for an additional 65 miles (Ames et al., 2000). The headwaters of the river are at Tin Mine Creek, Gold Creek and wetlands. The river drains to The Bend of Hood Canal. The Tahuya River has been described in this section as four reaches with a total of 17.1 linear miles designated as shorelines of the state within Mason County.

Development is intense along the shorelines of some waterbodies within the drainage basin (Ames et al., 2000). In addition, timber production has historically been and currently is a dominant land use in the drainage basin (Kuttel, 2003). Several complete and partial barriers located on tributaries along the lower reaches of the river have been repaired to allow fish passage; however, a complete barrier still exists on one of these tributaries near the mouth of the river (WDFW, 2011). In addition, development has resulted in diking and bank armoring along numerous portions of the river. Floodplain connectivity was rated as fair for the lower reaches of the river (May and Peterson, 2002).

The Tahuya River drainage basin has been extensively modified in the past. Some of the process modifications include:

- Timber harvest in the watershed;
- Adjacent residential development;
- Culverts and other structures that alter flow regime; and
- Channelization and bank armoring.

7.4.2 Water Quality

Tahuya River is included on the 303(d) list of impaired waters (Category 5 water) for the dissolved oxygen parameter (Ecology, 2008a). Water sampled in the Tahuya was found to be impaired for dissolved oxygen concentrations near the Mason-Kitsap County line in Reach 4. A Category 5 listing requires the preparation of a TMDL to address water quality concerns for that parameter. The Tahuya River also has three Category 2 listings for fecal coliform bacteria, pH and bioassessment.

The Tahuya drains into a portion of Hood Canal that is experiencing severe hypoxia (low dissolved oxygen) resulting in fish kills and harm to marine organisms in the late summer. Eutrophication in the lower reaches of the canal such as Lynch Cove has been linked to phytoplankton growth and nutrients (primarily nitrogen) that

enter the canal from various sources. The US Geological Services (USGS) and others have been studying the sources of nutrients, specifically nitrogen, in Hood Canal, investigating both surface and groundwater sources.

As part of a study by the US Geological Service (USGS), sampling for nutrient levels was undertaken in the Tahuya River. Water quality testing for nutrients in the surface water drainages discharging into lower Hood Canal was conducted in 2004 (Franz et al., 2006). This testing included Tahuya River, Mission Creek and Union River among other surface water drainages. Base-flow samples were also collected. Concentrations of nutrients at all sites were low.

7.4.3 Critical or Priority Habitat and Species

As the largest river on the Kitsap Peninsula, Tahuya River is mapped as supporting several state and federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 7-6). Fish use and presence are described below by shoreline reach.

**Table 7-6. Priority salmonid species documented for Tahuya River
(Reaches 1, 2, 3, 4)**

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning/rearing	~	~
fall Chinook salmon (Reaches 1 and 2 only)	<i>Oncorhynchus tshawytscha</i>	Migration/Spawning/Rearing	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning (Reach 1 only)	~	~
summer Chum salmon (Reaches 1 and 2 only)	<i>Oncorhynchus keta</i>	Migration/Spawning	Threatened	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning/Rearing	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	~	~
winter Steelhead	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	Threatened	~

Summer chum were considered extinct in the Tahuya River by Washington Department of Fish and Wildlife in 2003; however, the stock has been reestablished through supplementation from the Union River stock by the Hood Canal Salmon Enhancement Group. The Tahuya River is one of the main production areas for fall chum and the stock is considered healthy (WDFW 2003). The river supports a small number of spawning fall Chinook salmon, but the number was below the escapement goal for the stream in 2003. The stock status of winter steelhead was considered depressed in 2002 (WDFW, 2003).

Critical habitat has been designated for the Hood Canal ESU summer-run chum salmon within the lower reach of the Tahuya River downstream to the confluence with Hood Canal (Appendix B: USFWS, 2010; Table 7-7).

Table 7-7. Critical Habitat documented for Tahuya River

Stream	Reach	Species Common Name	Scientific Name
Tahuya River	01	Summer chum salmon	<i>Oncorhynchus keta</i>
Tahuya River	02	Summer chum salmon	<i>Oncorhynchus keta</i>

The total area of wetland within the four reaches of the Tahuya River, located in the Mason County shoreline jurisdiction of the stream, is 217.1 acres (Appendix B: USFWS, 2010). This represents 17.5 percent of the total reach area.

No priority wildlife species occurrences have been mapped in the vicinity of the river (Appendix B: WDFW, 2011). The DNR NHP has identified shore pine-Douglas fir/salal as a priority vegetation community within the Tahuya River, Reach 4, shoreline planning area (Appendix B: DNR, 2009).

7.4.4 Land Use

Land uses along Tahuya River are a mix of forestry, vacant and residential lands. There is limited agriculture in Reach 1. The Tahuya River meanders in and out of the Tahuya State Forest, with Reaches 02 and 03 mainly located within the DNR Tahuya State Forest.

There are three sites that provide public access to Tahuya River: 1) fishing access on WDFW land, 2) Tahuya River Horse Camp, and 3) Camp Spillman. Tahuya River Horse Camp and Camp Spillman are part of the Tahuya State Forest and managed by DNR.

Tahuya River Horse Camp has 10 campsites and 1,200 feet of water access. The total size of the campsite is 12 acres. Each year, two or three horseback riding and mountain bike riding events are organized out of this facility. The campsite has a horse ramp, hitching post and large corral that can hold multiple horses. The Hood Canal Salmon Enhancement Group assisted DNR with bank stabilization to diminish the effects of river migration at this site (Mason County Department of Parks and Trails, 2006; DNR, 2008).

Camp Spillman has 10 campsites and provides 800 feet of water access. The total size of the campsite is 10 acres. The campground has an amphitheater and a covered picnic area. The site is used mostly by people with recreational vehicles (RVs) who ride the trails with their ORVs (Mason County Department of Parks and Trails, 2006; DNR, 2008).

7.4.5 Land Cover

Land cover is mainly forested and forest resource lands, including forested floodplain. See reach sheet for land cover areas.

7.4.6 Summary of Key Management Issues

Key management issues for the Tahuya River include: 1) protection of instream and critical habitats for federally-listed Hood Canal summer chum and fall Chinook, 2) preservation of forested riparian areas as land develops, and 3) improvement of water quality and reductions of fecal coliform bacteria.

7.4.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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TAHUYA RIVER - REACH 01

SHORELINE LENGTH

7.8 MI

REACH AREA

677.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 75% (510 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

5% erosion, 5% landslide

LAND COVER (MAP 15)

2% developed, 2% agriculture, 26% forest, 12% wetland, 58% floodplain/forest (Appendix B: GAP, 2009).

Riparian vegetation: 52% forest cover, 14% non-forest, 28% other natural vegetation, 7% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, winter steelhead. Critical habitat for summer-run chum salmon.

Wetlands – 180 acres (NWI mapped) (27% of reach); habitat types include palustrine emergent, forested, and scrub-shrub.

WATER QUALITY (MAP 13)

One Category 2 listing for pH, which indicates some evidence of water quality problems. No 303(d) listings for water quality impairment within Reach 1. Additional water testing is necessary downstream of the animal farm.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (39%), Forestry (33%), Residential (15%) and Agriculture (13%). Ownership - Private (99%) and Public (1%).

DNR Tahuya State Forest Lands – 5 acres.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach. NE North Shore Road crosses the river at the inlet from Hood Canal and another small wooden bridge further upstream associated with farmland.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (69%), Rural Residential 20 Acres (19%) and Agriculture Resource Lands (12%). Comprehensive Plan Designations - Rural (88%) and Agriculture Resource Lands (12%).

Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is WDFW fishing access along 4,400 feet of undeveloped waterfront. Limited parking available. Total park size is 3 acres (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

3% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show rural residential development and a horse farm in this reach.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Restore degraded riparian zones.

Knotweed Control - Mission and Tahuya Year 1 (12-05-000) (Habitat Work Schedule, 2011); Sponsor: Hood Canal Salmon Enhancement Group- Identify all infestations and treat on a worksite by worksite (subbasin) determined by funding availability.

Lower Tahuya LWD Phase 1 Placement (12-01-002) (Habitat Work Schedule, 2011); Sponsor: Hood Canal Salmon Enhancement Group- Reach 6, the upper storage reach, has undergone the most extensive widening and gravel aggradation, is just upstream of the upper extent of summer chum spawning and had the highest average rating of function restored by site and so was selected as the initial starting point for restoration.

Lower Tahuya LWD Phase 2 Placement (12-01-003) (Habitat Work Schedule, 2011); Sponsor: Hood Canal Salmon Enhancement Group- The goal of the project is to improve rearing, spawning and egg-incubating habitat for all salmonid species in the Tahuya River, while the objective outlined in the assessment is to provide sufficient quantities of long-lasting coniferous wood to improve channel stability and protect/improve habitat quality.

KEY MANAGEMENT ISSUES

- Culvert on NE Tahuya River Road tributaries documented as a fish passage barrier.
- Protection of existing forested riparian zones.
- Prevent further degradation of water quality.

TAHUYA RIVER - REACH 02

SHORELINE LENGTH:

3.8 MI

REACH AREA:

246.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 47% (115 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

8% erosion, 16% landslide

LAND COVER (MAP 15)

1% developed, 61% forest, 4% wetland, 34% floodplain/forest (Appendix B: GAP, 2009).
Riparian vegetation: 68% forest cover, 4% non-forest, 21% other natural vegetation, 7% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, summer chum salmon, coho salmon, rainbow trout, winter steelhead.

Critical habitat for summer-run chum salmon.

10 acres of palustrine scrub-shrub wetland (4% of reach).

WATER QUALITY (MAP 13)

No 303(d) listings for water quality impairment within Reach 2.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18):

Land Use –Forestry (66%), Vacant (18%) and Residential (16%). Ownership - Public (63%) and Private (37%).

DNR Tahuya State Forest Lands – 156 acres.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22):

Zoning districts – Long Term Commercial Forest (63%), Inholding Lands (34%) and Rural Residential 5 Acres (3%). Comprehensive Plan Designations - Long Term Commercial Forest (63%), Inholding Lands (34%) and Rural (3%).

Existing SED – Conservancy (95%) and Urban Residential (5%).

SHORELINE MODIFICATIONS (MAP 16)

A road crossing exists in the southern portion of the reach at NE Belfair Tahuya Rd.

PUBLIC ACCESS (MAP 14)

Washington State DNR manages Tahuya River Horse Camp. Tahuya River Horse Camp has 10 campsites available. It also provides 1,200 feet of water access on 12 acre site (Mason County Department of Parks and Trails, 2006; DNR, 2008). About 30 feet of DNR trails are mapped in the northeast portion of the reach.

IMPERVIOUS SURFACES (MAP 16)

2% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered rural residential development throughout the reach.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zone.

Restore degraded riparian zones.

• KEY MANAGEMENT ISSUES

- Protection of existing forested riparian area.
- Protection of current good water quality.

TAHUYA RIVER - REACH 03

SHORELINE LENGTH

3.2 MI

REACH AREA

185.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 55% (102 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

1% erosion, 3% landslide

LAND COVER (MAP 15)

78% forest, 2% wetland, 21% floodplain/forest (Appendix B: GAP, 2009).
Riparian vegetation: 66% forest cover, 3% non-forest, 30% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, rainbow trout, winter steelhead.
Wetlands –12 acres (7% of reach); wetland habitat types include palustrine emergent and scrub-shrub.

WATER QUALITY (MAP 13)

No 303(d) listings for water quality impairment within Reach 3.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (88%) and Residential (12%).
Ownership - Public (72%) and Private (28%).
DNR Tahuya State Forest Lands – 133 acres.

SHORELINE MODIFICATIONS (MAP 16)

One unnamed road crosses this reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - Long Term Commercial Forest (57%), Rural Residential 20 Acres (23%) and Rural Residential 5 Acres (20%). Comprehensive Plan Designations – Long Term Commercial Forest (57%) and Rural (43%).
Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

Washington State DNR manages Camp Spillman, a 10 acre campsite. The campsite provides 800 feet of water access, 10 campsites, an amphitheater and a covered picnic area (Mason County of Parks and Trails, 2006; DNR, 2008). Over 1,200 feet of DNR trails are mapped in the central portion of the reach, crossing Tahuya River twice.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show very limited rural residential development in this reach.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact forested riparian areas.
Restore degraded riparian areas.

KEY MANAGEMENT ISSUES

- Protection of forested riparian areas.
- Protection of current good water quality.

TAHUYA RIVER - REACH 04

SHORELINE LENGTH

2.3 MI

REACH AREA

129.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 50% (64 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

71% forest, 1% wetland, 28% floodplain/forest (Appendix B: GAP, 2009)
Riparian vegetation: 61% forest cover, 8% non-forest, 31% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, rainbow trout, winter steelhead. Shore pine-Douglas fir/salal.
Wetland: 14 acres of palustrine scrub-shrub wetland (11% of reach).

WATER QUALITY (MAP 13)

One 303(d) Category 5 listing for dissolved oxygen impairment and 2 Category 2 listings for fecal coliform bacteria and bioassessment, which indicates some evidence of water quality problems.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use –Residential (44%); Vacant (33%); Forestry (21%); and Parks, Open Space and Recreation Areas (2%). Ownership – Private (77%) and Public (23%).

DNR Tahuya State Forest Lands – 30 acres.

SHORELINE MODIFICATIONS (MAP 16)

According to aerial imagery (2011), NE Bear Creek Dewatto Road crosses the river in the northern part of the reach. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (56%), Rural Residential 20 Acres (44%). Comprehensive Plan Designations – 100% Rural.

Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There are no mapped public access facilities in the reach.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces. Aerial photos from 2009 show limited rural residential development and roads in this reach.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact forested riparian areas.

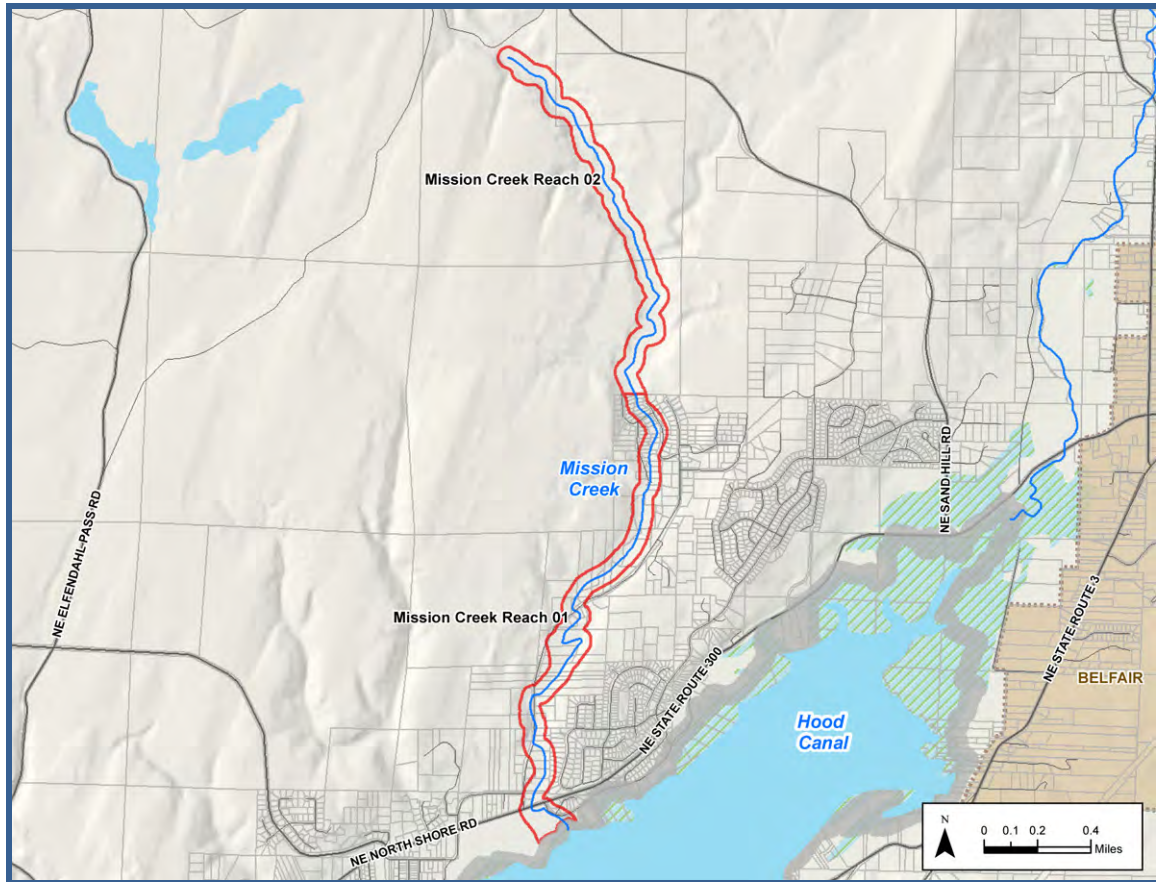
Restore degraded riparian areas.

KEY MANAGEMENT ISSUES

Protection of forested riparian areas.

Protection of current good water quality.

7.5 Mission Creek



7.5.1 Process and Channel Modifications

The mouth of Mission Creek is located approximately two miles west of the mouth of Union River and three miles west of the City of Belfair. The stream drains about 13.7 square miles of land and includes approximately 10 miles of mainstem and 10 miles of tributaries (Hood Canal Coordinating Council [HCCC], 2005). The headwaters of the stream are located above Mission Lake and at a wetland located northwest of the lake; the channels join downstream of Mission Lake (Kuttel, 2003).

The upper portions of the drainage basin, including Mission Creek Reach 2, are dominated by industrial forests, while residential development and park land are located near the mouth. Several culverts located on Mission Creek and its tributaries have been repaired to allow fish passage (WDFW, 2011). Floodplain connectivity was rated as fair for the lower 0.5 mile of stream and good upstream of this location (May and Peterson, 2002). Several major flood events have caused washouts and erosion near the mouth of Mission Creek in Belfair State Park. Most recently, the creek flooded in 2010 resulting in damage to the camping area.

The Mission Creek drainage basin has been extensively modified by humans. Some of the process modifications include:

- Logging adjacent to the stream;
- Land conversion from pervious to impervious surfaces;
- Culverts and other structures that change the flow patterns;
- Channelization and bank armoring; and
- Adjacent residential development.

7.5.2 Water Quality

Mission Creek is not included on the 303(d) list of impaired waters (Category 5) (Ecology, 2008). However, Mason County Public Health and the Hood Canal Salmon Enhancement Group (HCSEG) have also been monitoring water quality since 2006. Mission Creek exceeded state water quality standards for fecal coliform during low flow months in the summer and fall (HCSEG and Mason County Public Health, 2009). Washington State Department of Health (WDOH) collects fecal coliform data in the marine waters of Hood Canal near the mouth of Big Mission Creek (station number 268). This potential shellfish growing area is classified as prohibited to shellfish harvest due to a history of poor water quality. While a direct link to failing septic systems has not been established, the fecal coliform issue in Mission Creek is likely related to the development along the stream and may be related to domestic animals (HCSEG and Mason County Public Health, 2009). Currently, DOH water

quality measurements at this area are within the allowed levels for shellfish harvest, but DOH plans to keep the area closed to shellfish harvest until the Belfair sewer is in operation.

7.5.3 Critical or Priority Habitat and Species

Mission Creek is divided into two reaches that are mapped as supporting several state and federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 7-5).

Table 7-5. Priority salmonid species documented for Mission Creek (Reaches 1 and 2)

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning/Rearing	~	~
fall Chinook salmon (Reach 1 only)	<i>Oncorhynchus tshawytscha</i>	Migration/Spawning/Rearing	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Rearing (Reach 2 only) and Migration/Spawning	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning/Rearing	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	~	~
winter Steelhead	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	Threatened	~

Less than one percent of the reach within the Mason County shoreline jurisdiction of the stream is mapped as wetland; it is located at the mouth of the stream (Appendix B: USFWS, 2010). Priority waterfowl concentrations are mapped in the vicinity of the stream (Appendix B: WDFW, 2011). The DNR NHP has not identified priority plant species or vegetation communities within the Mission Creek shoreline planning area (Appendix B: DNR, 2009).

7.5.4 Land Use

See reach sheet for land use information.

7.5.5 Land Cover

See reach sheet for land cover information.

7.5.6 Summary of Key Management Issues

Key management issues for Mission River include: 1) protection of instream and critical habitats for federally-listed fall Chinook and other salmon, 2) preservation of forested riparian areas as land develops, and 3) improvement of water quality and reductions of fecal coliform bacteria.

7.5.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

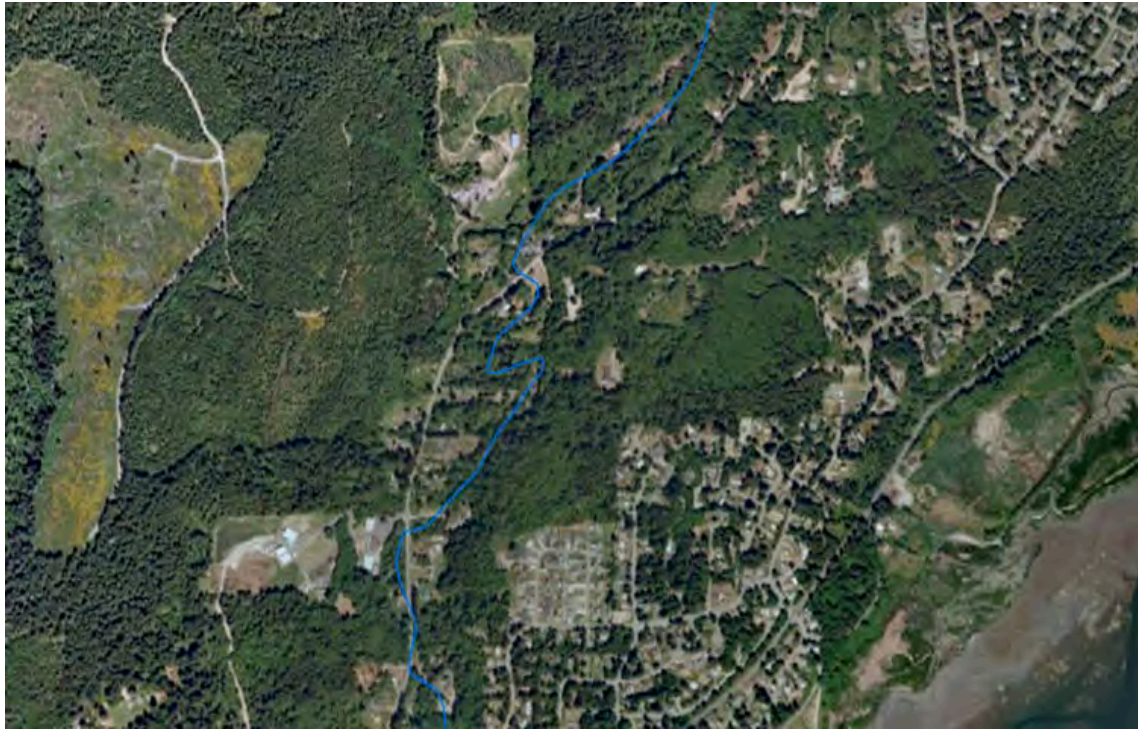
MISSION CREEK - REACH 01

SHORELINE LENGTH

2.1 MI

REACH AREA

105.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 31% (33 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 89% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

20% landslide

LAND COVER (MAP 15)

8% developed, 57% forest, 2% wetland, 28% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 51% forest cover, 30% non-forest, 1% off-shore, 18% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, coho salmon, winter steelhead. Waterfowl concentrations.
Wetland: 1 acres of estuarine intertidal aquatic bed wetland (1% of reach).

WATER QUALITY (MAP 13)

No 303(d) listings for water quality impairment within Reach 1. However, there are documented issues with fecal coliform especially during summer low flow and in the fall of each year.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Residential (66%); Vacant (22%); remaining 12% is a mix of Parks Open Space and Recreation Areas; Commercial; and Transportation. Ownership - Private (89%) and Public (11%).

SHORELINE MODIFICATIONS (MAP 16)

A road crossing exists in the southwestern portion of the reach at SR 300.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (77%), Rural Residential 10 Acres (20%) and Industrial (3%). Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Urban Conservancy.

PUBLIC ACCESS (MAP 14)

Washington State Parks manages Belfair State Park, providing trail access and about 3,800 feet of nearby tidelands access. The total park size is over 63 acres (Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

16% of the reach is mapped as containing impervious surfaces, mostly low intensity development (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences and roads scattered throughout most of the reach.

AREAS OF SPECIAL INTEREST

No Ecology listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate to high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian zones.

Restore riparian vegetation where degraded.

Knotweed Control - Mission and Tahuya Year 1 (12-05-000) (Habitat Work Schedule, 2011); Sponsor: Hood Canal Salmon Enhancement Group- Identify all infestations and treat on a worksite by worksite (subbasin) determined by funding availability.

KEY MANAGEMENT ISSUES

- Protection of forested riparian zones.
- Prevent further degradation of water quality.

MISSION CREEK - REACH 02

SHORELINE LENGTH

1.6 MI

REACH AREA

79.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach. 90% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

36% landslide

LAND COVER (MAP 15)

77% forest, 11% wetland, 11% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 82% forest cover, 18% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, rainbow trout, winter steelhead. Waterfowl concentrations.

No mapped wetlands.

WATER QUALITY (MAP 13):

No 303(d) listings for water quality impairment within Reach 2.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations - 100% Long Term Commercial Forest.
Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Washington State DNR manages Mission Creek Trailhead which has a 1 acre staging area for trail access (Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped.

AREAS OF SPECIAL INTEREST

No listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

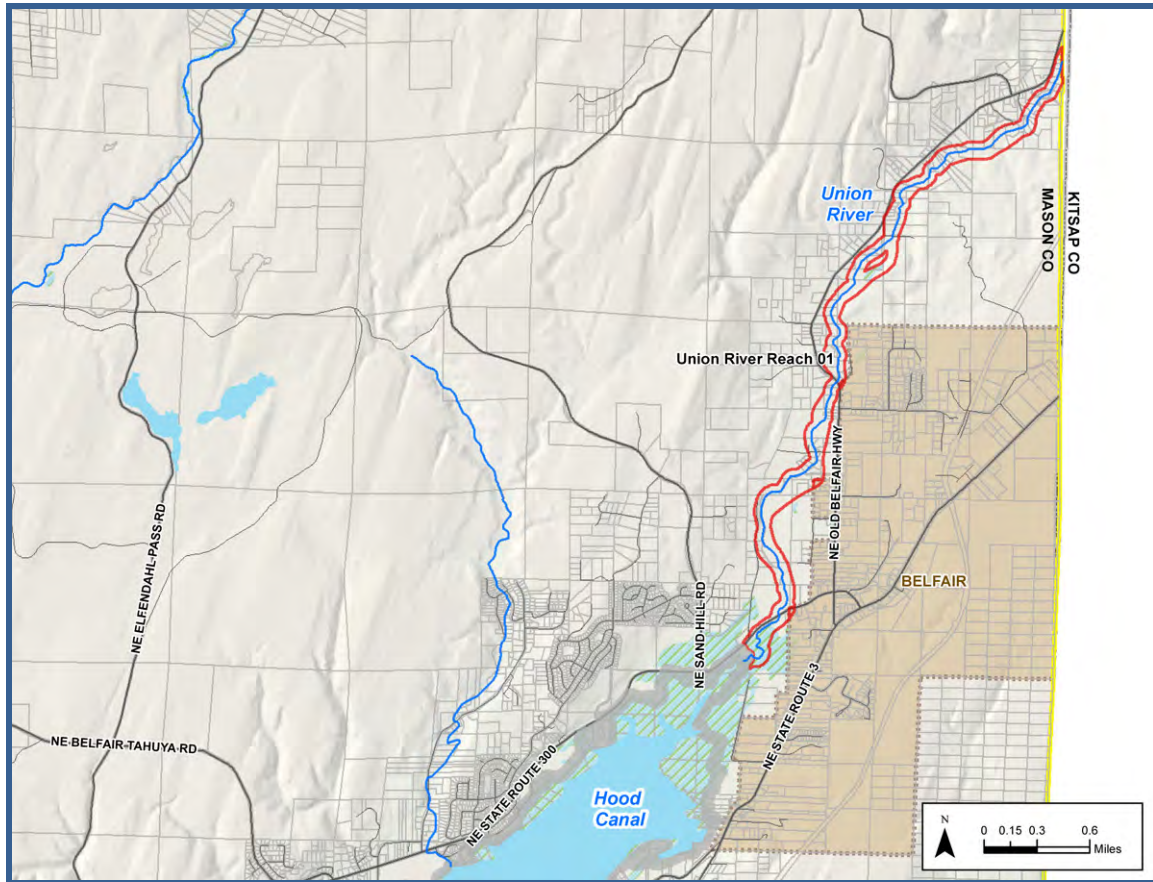
Protect existing forested riparian zones.

KEY MANAGEMENT ISSUES

Protection of forested riparian zones.

Prevent further degradation of water quality.

7.6 Union River



7.6.1 Process and Channel Modifications

The Union River drains approximately 24 square miles of land via 10 miles of mainstem and 30 miles of tributaries (Ames et al., 2000). The mouth of the stream drains to Hood Canal at Lynch Cove, which is located about 0.5 miles west of the City of Belfair. The river originates upstream of Union River Reservoir, which was completed in 1957 and supplies water to the City of Bremerton and the Puget Sound Shipyard (Kuttel, 2003). The stream flows through Kitsap and Mason Counties.

The upper drainage basin is modified by industrial forestry and water diversion/storage, while the lower basin is used for residential development, small farms and some forestry (Kuttel, 2003). Several tributaries have culverts that act as complete fish barriers (Appendix B: WDFW, 2011); however, efforts have been made to remove blockages on larger tributaries. Floodplain connectivity was rated as fair on the lower mile of Union River and good upstream of this location (May and Peterson, 2002).

The Union River drainage basin has been historically modified. Some of the process modifications include:

- Logging practices;
- Water diversion/storage use;
- Adjacent residential development;
- Adjacent agriculture;
- Culverts;
- Channelization and bank armoring; and
- Conversion of forest lands to impervious surfaces.

7.6.2 Water Quality

Two monitoring stations on Union River have recorded low dissolved oxygen concentrations that do not meet Washington State water quality standards. The stream is listed on the 303(d) list of impaired waters (Category 5 water) for dissolved oxygen (Ecology, 2008).

A TMDL is already in place for the Union River, which addresses water quality impairment due to fecal coliform bacteria. Ecology has conducted a water quality implementation plan and water quality effectiveness monitoring study for the fecal coliform bacteria TMDL in Union River and its tributaries. Fecal coliform bacteria concentrations have not shown significant improvement at target locations since the

TMDL study (Ecology, 2008a). Union River drains directly into Lynch Cove, a waterbody that has had significant issues with low dissolved oxygen. Low dissolved oxygen levels are linked to high nutrient levels. The Union River also contains several Category 2 listings for pH; however, these reaches lie outside of Mason County and within Kitsap County (Ecology, 2008a).

7.6.3 Critical or Priority Habitat and Species

Union River is mapped as supporting many state and federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 7-8).

Table 7-8. Priority salmonid species documented for Union River

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Migration/Spawning/Rearing	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Migration/Spawning/Rearing	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Migration/Spawning	Threatened	Candidate
Pink salmon	<i>Oncorhynchus gorbuscha</i>	Migration/Spawning	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Migration/Spawning/Rearing	Concern	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	~	~
winter Steelhead	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	Threatened	~

The Summer Chum Salmon Conservation Initiative, prepared by the Washington Department of Fish and Wildlife and the Point No Point Treaty Tribes, was adopted as an implementation plan to recover summer chum in this region.

(<http://wdfw.wa.gov/publications/00155/wdfw00155.pdf>) As part of the plan, HCSEG began working with WDFW to supplement the Union River Summer chum run in 2000.

To determine the abundance, timing, and population structure of returning adult salmon, a fish trap at the mouth of the Union River has been operational from mid-

August to mid-October every year since 2000. The trap structure has allowed for the selective collection of Wild adult salmon in order to supplement the natural population.

Based on the early success of the supplementation project, summer chum populations was considered healthy enough by 2003 to become a donor stock for reintroducing Summer chum to the Tahuya River. At this point, Summer chum in the Tahuya River were classified as locally extinct. HCSEG started releasing Summer chum fry into the Tahuya River from Union River brood stock in 2004. Since the first return of project fish to the Tahuya River in 2006, between 200 and 1000 Summer chum have been counted annually (Dan Hannafious, Pers. Comm, 2012).

Based on a strong partnership between WDFW, HCSEG, and local community volunteers, the restoration of Summer chum is showing signs of success. It is anticipated the Dewatto River will be included in future supplementation plans.

In addition, Union River is one of the main production streams of winter steelhead in the area (Kuttel, 2003), but the stock status was characterized as depressed in 2002 (WDFW 2003).

Critical habitat has been designated for the Hood Canal ESU summer-run chum salmon on the Union River, within the lower reach of Union River downstream to the confluence with Hood Canal (Appendix B: USFWS, 2010; Table 7-9).

Table 7-9. Critical Habitat documented for Union River

Stream	Reach	Species Common Name	Scientific Name
Union River	01	Chum salmon	<i>Oncorhynchus keta</i>

Wetland habitat covers 18.5 acres, or 7 percent of the reach, within the Mason County shoreline jurisdiction of the stream (Appendix B: USFWS, 2010). Priority species occurrences and habitats have been mapped along the stream, including: bald eagle, bald eagle buffer, waterfowl concentrations and Estuarine Zone (Appendix B: WDFW, 2011).

The DNR NHP has not identified priority plant species or vegetation communities within the Union River shoreline planning area (Appendix B: DNR, 2009).

7.6.4 Land Use

See reach sheet for land use information.

7.6.5 Land Cover

See reach sheet for land cover information.

7.6.6 Summary of Key Management Issues

See reach sheet for key management issues.

7.6.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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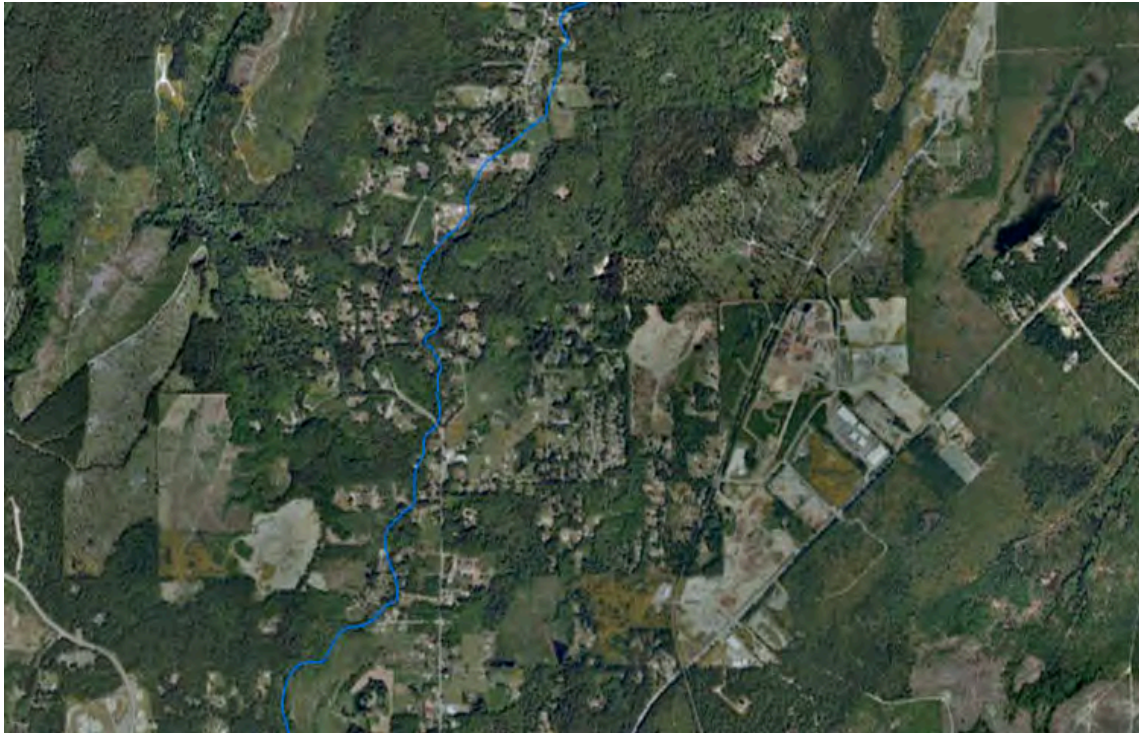
UNION RIVER

SHORELINE LENGTH

4.6 MI

REACH AREA

285.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 44% (126 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 82% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

4% erosion, 5% landslide

LAND COVER (MAP 15)

11% developed, 10% agriculture, 26% forest, 12% wetland, 41% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 49% forest cover, 34% non-forest, 16% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, summer chum salmon, pink salmon, coho salmon, rainbow trout, winter steelhead.

Critical habitat for summer-run chum salmon. Bald eagle, bald eagle buffer, waterfowl concentrations and estuarine zone.

Wetlands – 19 acres (7% of reach); habitat includes palustrine emergent, forested, and scrub-shrub.

WATER QUALITY (MAP 13)

303(d) listed for the dissolved oxygen parameter and a TMDL is in place to address fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (45%), Forestry (18%), Vacant (17%), Agriculture (17%) and remaining 3% a mix of Industrial, Parks, Open Space and Recreational Areas. Ownership – Private (98%) and Public (2%).

SHORELINE MODIFICATIONS (MAP 16)

There is 1 mapped road crossing located in the southern portion of the reach at SR 300. According to aerial imagery (2009) there appear to be multiple road crossings associated with residential development throughout the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (55%), Rural Residential 20 Acres (26%), Agricultural Resource Lands (11%) and Rural Residential 10 Acres (10%). Comprehensive Plan Designations – Rural (89%) and Agricultural Resource Lands (11%). Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

WDFW manages over 8,000 feet of riverfront fishing access along Union River. There is limited parking available (Mason County Department of Parks and Trails, 2006; WDFW Lands, 2011).

IMPERVIOUS SURFACES (MAP 16)

21% of the reach is mapped as containing impervious surfaces, most of which is low intensity development or developed open space (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show single-family residences, roads, agricultural and commercial uses throughout the reach.

AREAS OF SPECIAL INTEREST

The Ecology-listed facilities and sites include a Leaking Underground Storage Tank.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists 2 inventoried early historic sites and 1 inventoried pre-contact village within this reach. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach, with a smaller portion of the reach in moderate to moderate-high zones.

OPPORTUNITY AREAS

Protect existing forested riparian areas.

KEY MANAGEMENT ISSUES

- Protection of forested riparian zones.
- Prevent further degradation of water quality.
- Control invasive plant infestations such as Japanese knotweed.
- Re-establishment of summer chum populations.

7.7 Data Gaps

The following data gaps have been identified for the WRIA 15 Freshwater Shorelines:

- Comprehensive wetland data is lacking; there is no countywide wetland inventory for Mason County;
- Bulkheads on lakes and levees along stream have not been consistently quantified; and
- Current condition of riparian zone is lacking.

CHAPTER 8.

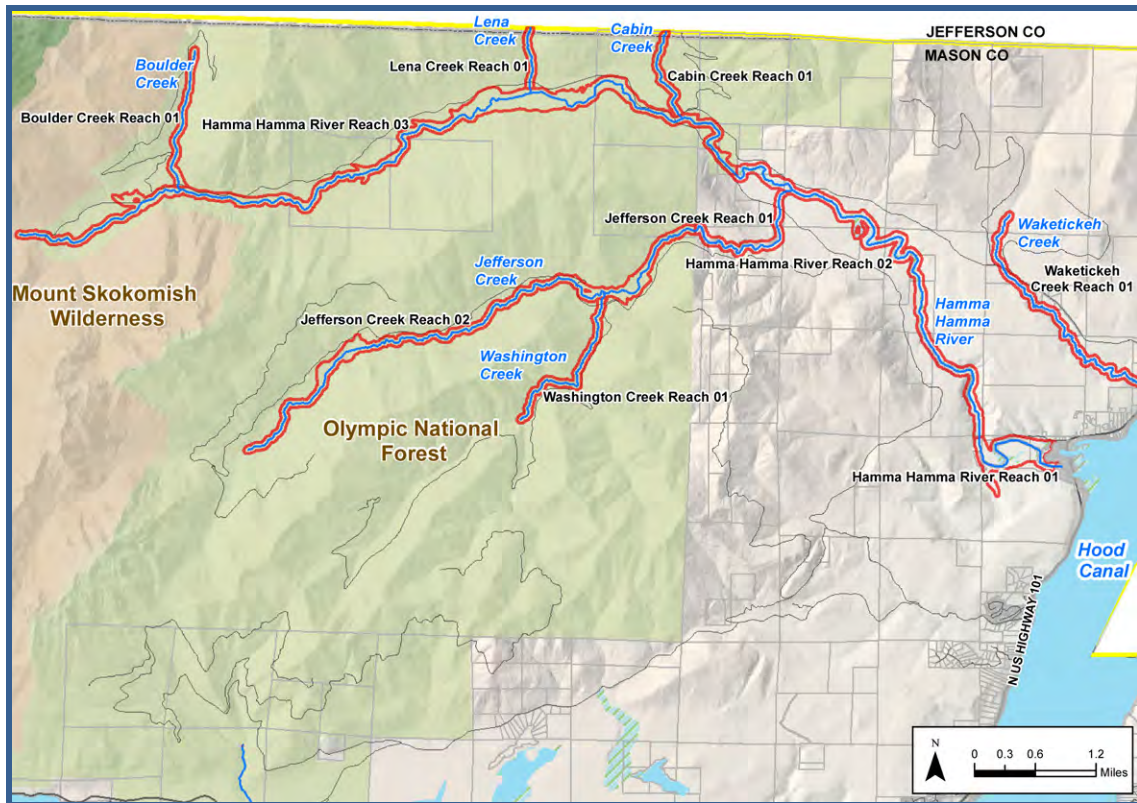
WRIA 16 / 14B: SKOKOMISH-DOSEWALLIPS

Chapter 8 provides a discussion of the freshwater shoreline waterbodies located within the Mason County portion of Skokomish-Dosewallips Water Resource Inventory Area (WRIA) 16 and drainage to the South Shore of Hood Canal (WRIA 14b). See Map 1 (Appendix A) for the location of WRIA 16/14b. This chapter covers six natural lakes, two lake reservoirs and 21 streams that are considered to be shorelines of the state. The Skokomish River and Lake Cushman are considered freshwater “shorelines of statewide significance” designated in WRIA 16/14a. Marine shorelines of Hood Canal are characterized in Chapter 4.

Waterbodies within this chapter are grouped based on drainage patterns and watersheds beginning with rivers and lakes near the Mason-Jefferson County line (Hamma Hamma River) moving south. Within each section, the streams are generally ordered in geographic order moving from the river mouth upstream and the lakes from North to South.

After an overall description of the waterbodies, the reaches have been described in two-page reach sheets that provide a summary of data pertinent to each shoreline reach. Information displayed in the reach sheets is largely based upon GIS data taken from state and county sources (See Chapter 2). Data sources are described in Chapter 2. A Glossary of Terms is provided in Appendix C.

8.1 Hamma Hamma River and Tributary (Jefferson Creek)



This section describes Hamma Hamma River and its shoreline tributaries within Mason County jurisdiction. Therefore, this section describes a total of 11.4 miles of river designated as shorelines of the state within the Hamma Hamma River sub-basin. Reach sheets are provided for Hamma Hamma and its main tributary - Jefferson Creek. A Reach sheet is also provided for Waketickeh Creek – a tributary draining directly to Hood Canal.

While shorelines outside of the County lands in National Forest are part of the inventory, no reach sheets have been provided for these streams or sections of streams. Streams in the Olympic National Forest are therefore only generally described; these streams are a portion of Jefferson Creek (Reach 2 only), Washington Creek, Cabin Creek, Lena Creek, Boulder Creek, and Hamma Hamma River Reach 3. Hamma Hamma Reach 3 lies within both the National Forest and the Mount Skokomish Wilderness.

8.1.1 Process and Channel Modifications

Hamma Hamma River (Jefferson Creek)

The Hamma Hamma River originates in the Olympic National Park and enters Hood Canal at the community of Eldon (Correa, 2003). The mainstem extends approximately 17.8 miles with an additional 209 miles of tributaries (Correa, 2003). Jefferson Creek enters the Hamma Hamma River at river mile 5.7. Below river mile 1.5, the stream gradient is more gradual as it enters a broad floodplain. The lower 0.6 mile of stream is tidally influenced (Correa, 2003).

Managed forest is the primary land use in the upper watershed with aquaculture practiced within the estuary and adjacent nearshore (WDFW and PNPTT, 2000). A dredged channel is present in the river's delta and fill, riprap/armoring, and dikes are located at the mouth of the river in association with multiple residential developments and US 101. A utility corridor crosses the stream in the middle portion of Reach 2. An impassable falls is located at river mile 2.5, with no known artificial barriers downstream of this location (Correa, 2003).

The Hamma Hamma River sub-basin has been altered by development, mostly in the lower reaches. Some of the process modifications include:

- Timber harvest and runoff from logging roads causing downstream sedimentation;
- Alteration in the estuary;
- Adjacent residential development in the lower reach;
- Culverts and other structures that alter flow regime; and
- Fill and bank armoring in the lower reach.

Waketick Creek

Waketick Creek and its major tributary total 8.2 miles and drain a watershed of 5,772 acres (Correa, 2003). The stream enters Hood Canal about a mile north of Eldon and the mouth of the Hamma Hamma River.

Logging and a utility corridor occur in the upper portion of the reach. Fill and riprap/armoring are present on both sides of the lower floodplain and US 101 has filled floodplain subject to tidal influence (Correa, 2003). In addition, a residence with associated parking area is located at the mouth of the stream. A culvert is located downstream of the confluence of the stream and its main tributary; however, there are no known artificial barriers to anadromous fish migration (Correa, 2003).

Waketick Creek has been altered to a limited extent. Some of the process modifications include:

- Alterations to forested cover due to timber harvest;
- Culverts and other structures that alter flow regime; and
- Fill and bank armoring.

8.1.2 Water Quality

The Hamma Hamma River, Jefferson Creek, and Waketick Creek are not listed on the 303(d) list of impaired waterbodies (Category 5) for exceeding any surface water quality standards (Ecology, 2008a). Long-term trends in water quality are monitored by Ecology on the Hamma Hamma River at the Lena Creek Campground; this sampling indicates overall good water quality in the river (Ecology, 2011, see Ecology site at: <http://www.ecy.wa.gov/apps/watersheds/wriapages/16.html>).

8.1.3 Critical or Priority Habitat and Species

Hamma Hamma River

According to the Priority Habitat and Species data, the Hamma Hamma River supports many state or federally-listed priority salmonid species (Appendix B: WDFW, 2011; Table 8-1).

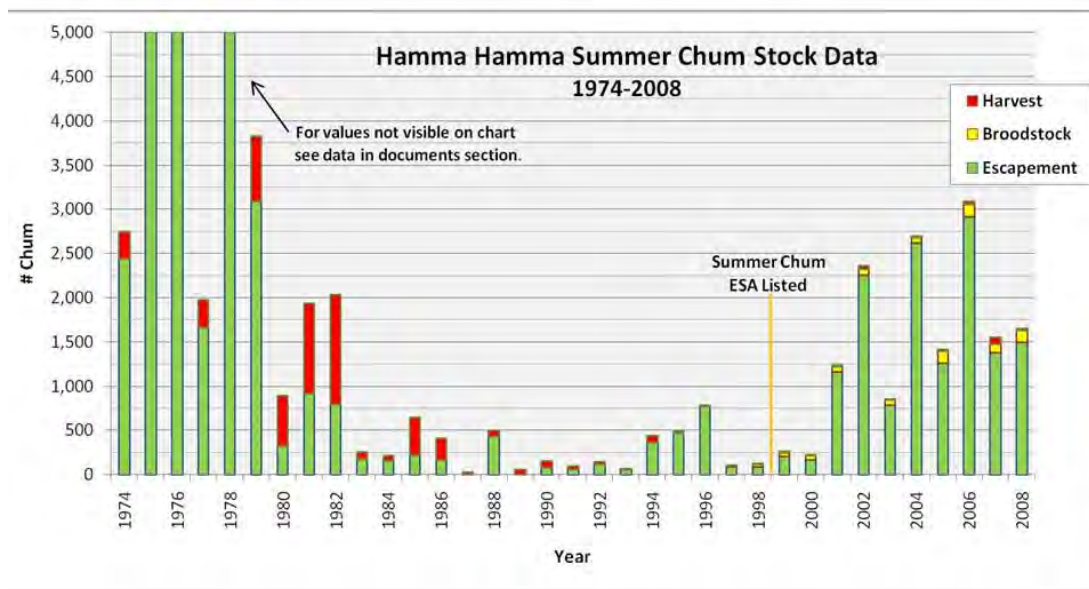
Table 8-1. Priority salmonid species documented for Hamma Hamma River (Reaches 1 and 2) and Jefferson Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon (Hamma Hamma only)	<i>Oncorhynchus tshawytscha</i>	Migration/Spawning/Rearing	Threatened	Candidate
fall Chum salmon (Hamma Hamma River only)	<i>Oncorhynchus keta</i>	Migration/Spawning	~	~
summer Chum salmon (Hamma Hamma only)	<i>Oncorhynchus keta</i>	Migration/Spawning	Threatened	Candidate
Coho salmon (Hamma Hamma River only)	<i>Oncorhynchus kisutch</i>	Migration/Spawning/rearing	Concern	~

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Dolly Varden/Bull trout	<i>Salvelinus confluentus</i>	Migration	Threatened	Candidate
kokanee salmon	<i>Oncorhynchus nerka</i>	Migration/Spawning	~	~
Pink salmon (Hamma Hamma River only)	<i>Oncorhynchus gorbuscha</i>	Migration/Spawning	~	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	~	~
winter Steelhead trout (Hamma Hamma only)	<i>Oncorhynchus mykiss</i>	Migration/Spawning/Rearing	Threatened	~

Chinook salmon, summer chum and coho salmon spawn and rear in the lower two miles of the river and in a tributary located at river mile 1.4. Stock charts for summer chum (see Figure 8-1 below) indicate depressed chum salmon stock through the 1990s and recovery since.

Figure 8-1. Hamma Hamma Summer Chum Stock



For exact values see the stock data files in the documents section or visit WA State Dept. of Fish and Wildlife's website: <http://wdfw.wa.gov/fish/chum/index.htm>

Critical habitat has been designated for the Puget Sound Evolutionarily Significant Unit (ESU) Chinook salmon and the Hood Canal ESU summer-run chum salmon for Reaches 1 and 2 of the Hamma Hamma River (Appendix B: USFWS, 2010).

Table 8-2. Critical habitat for Chinook salmon and summer-run chum salmon in Hamma Hamma River and Jefferson Creek

Stream	Reach	Species Common Name	Scientific Name
Hamma Hamma River	01	Chinook salmon and summer-run chum salmon	<i>Oncorhynchus tshawytscha</i> and <i>O. keta</i>
Hamma Hamma River	02	Chinook salmon and summer-run chum salmon	<i>Oncorhynchus tshawytscha</i> and <i>O. keta</i>

Approximately 40 acres of wetland (28 percent of the reach) is mapped in Reach 1 and 97 acres (32 percent of the reach) is identified in Reach 2, within the Mason County shoreline jurisdiction of the river (Appendix B: NWI, 1989).

Other priority habitat/wildlife species are documented to occur within both reaches and include: bald eagle buffer, bald eagle, harlequin duck, and Roosevelt elk (Appendix B: WDFW, 2011). Reach 1 also has osprey mapped while Reach 2 has cliff/bluffs mapped (Appendix B: WDFW, 2011). Marbled murrelet and northern spotted owl are mapped in Reach 2 (Appendix B: USFWS, 2010).

The Washington Department of Natural Resources (DNR) Natural Heritage Program (NHP) has identified the following priority plant species or vegetation communities within the Hamma Hamma River, Reach 1, shoreline planning area (Appendix B: WNHP, 2010):

- 18.5 acres of Freshwater Tidal Surge Plain Wetland PTN;
- 1.7 acres of Lyngby's Sedge;
- 1.7 acres of Lyngby's Sedge - Pacific Silverweed; and
- 18.5 acres of Sitka Spruce / Slough Sedge – Skunkcabbage.

Approximately 142.1 acres of chain-fern habitat are mapped in Reach 2.

Jefferson Creek

Several priority salmonid species also occur in Jefferson Creek (Appendix B: WDFW, 2011; see Table 8.1). No wetlands are mapped within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). A priority species occurrence for harlequin duck is recorded in the reach (Appendix B: WDFW, 2011). Marbled murrelet and northern spotted owl are also documented (Appendix B: USFWS, 2010). The NHP has identified the following priority plant species within the Jefferson Creek shoreline planning area (Appendix B: WNHP, 2010): 52.4 acres of chain-fern.

Waketick Creek

According to the PHS data, Waketick Creek also supports a few priority salmonid species (Appendix B: WDFW, 2011; Table 8-3).

Table 8-3. Priority salmonid species documented for Waketick Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Known spawning and Presence/Migration	Threatened	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Known spawning and Presence/Migration	Concern	~

No wetlands are mapped within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). Other priority habitats/ wildlife species that occur in the vicinity of Waketick Creek include: bald eagle buffer, bald eagle, and Roosevelt elk (Appendix B: WDFW, 2011).

8.1.4 Land Use

Approximately 95% of the watershed is in public ownership with 60% in managed forest (Aspect Consulting, 2009). Land use along Hamma Hamma River, Jefferson Creek and Waketick Creek is primarily resource lands associated with commercial and non-commercial timber harvest. There are two campgrounds in the Olympic National Forest that provide public access to the shorelines: Hamma Hamma Campground and Lena Creek Campground.

Lands within the National Forest are also in forestry use along Hamma Hamma River and Jefferson Creek. Land use information is not available for Washington Creek, Cabin Creek, Lena Creek, and Boulder Creek.

8.1.5 Land Cover

Except in Reach 1 of the Hamma Hamma River, forest cover is found in the majority (70 percent or greater) of the shoreline jurisdiction within the Hamma Hamma drainage (Appendix B: GAP, 2009). The mouth and lower sections of the Hamma Hamma River contain limited residential development, with farming and aquaculture practiced in the vicinity. US Highway 101 crosses the mouth of the river. Much of the Hamma Hamma River is forested with logging activity at several locations adjacent to the river. Jefferson Creek is primarily forested along its length. Waketickeh Creek has a forested riparian corridor and is crossed by a power line corridor and national park road. Logging has removed forested cover in the upstream portion of the stream.

8.1.6 Summary of Key Management Issues

The key management issues for Hamma Hamma River, Jefferson Creek and Waketickeh Creek are: 1) fine sediment loading due to timber harvest and logging roads affecting downstream water quality, 2) important healthy runs of salmon and significant salmon spawning, 3) undeveloped watershed mostly within public ownership, 4) alterations and modifications related to US 101 crossing the Hamma Hamma estuary, and 5) significant commercial aquaculture in the estuary (see Hood Canal Marine Reach 2).

8.1.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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HAMMA HAMMA RIVER - REACH 01

SHORELINE LENGTH

1.5 MI

REACH AREA

141.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 66% (94 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 93% of reach within the CMZ.

HAZARD AREAS (MAP 12)

97% landslide

LAND COVER (MAP 15)

0% developed, 24% forest, 28% wetland, 23% floodplain/riparian, 18% agriculture (Appendix B: GAP, 2009);
Riparian vegetation: 42% forest cover, 31% non-forest, 17% other natural vegetation, 10% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon (critical habitat), fall chum salmon, summer chum salmon (critical habitat), coho salmon, Dolly Varden/bull trout, kokanee salmon, pink salmon, rainbow trout, winter steelhead trout. Other species include bald eagle, harlequin duck, osprey, and Roosevelt elk.
Wetland habitat: 13 acres (9% of reach) habitats include: estuarine intertidal emergent, palustrine emergent, scrub-shrub, and riverine tidal flat.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters. Testing by Ecology indicates overall good water quality. Excessive fine sediment loading due to landslides in the upper watershed (WRIA 16 Planning Unit, 2006).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (79%); remaining 21% is a mix of Agriculture, Aquaculture, and Vacant. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Agricultural Resource Lands (53%), Long Term Commercial Forest (28%), and Rural Residential 5 Acres (19%). Comprehensive Plan Designations – Agricultural Resource Lands (53%), Long Term Commercial Forest (28%), and Rural (19%). Existing SED – Rural (87%) and Conservancy (13%).

PUBLIC ACCESS (MAP 14)

Hamma Hamma River Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show very limited rural residential development; the reach is dominated by forest and pastureland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic site within this reach. Resource probability mapping suggests there is a high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Hamma Hamma River Engineered Log Jam (ELJ) and Off-channel Restoration (08-03-000) - (Habitat Work Schedule, 2011); Adding log jams and LWD to the lower channel and estuary to improve salmon habitat.

Skokomish Estuary Restoration Phase III, River Delta: Mason Conservation District and Skokomish Tribe. Funded through RCO. This phase will reconnect 300 acres of wetland complex to the Skokomish Estuary, with the goal of restoring the total hydrologic connection between wetlands in the estuary.

http://wdfw.wa.gov/grants/ps_marine_nearshore/funded_projects.html

Skokomish River Basin GI Study. The Skokomish River Basin Ecosystem Restoration / Flood Risk Management General Investigation (GI) will address ecosystem restoration and flooding in the watershed. Mason County, Skokomish Tribal Nation, Corps of Engineers along with other state, federal, and local governmental entities are working to develop a plan for restoring the watershed.

<http://www.nws.usace.army.mil/Missions/CivilWorks/ProgramsandProjects/Projects/SkokomishRiverBasin.aspx>

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Roads, residential development, and agriculture have degraded and limited fish access to habitat in the estuary and instream.
- Continue to decommission forest roads to reduce downstream sedimentation.
- Excessive fine sediment loading due to landslides in the upper watershed (WRIA 16 Planning Unit, 2006).
- Significant commercial aquaculture downstream in the estuary.

HAMMA HAMMA RIVER - REACH 02

SHORELINE LENGTH

5.1 MI

REACH AREA

298.8 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 34% (100 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 90% of the reach within the CMZ.

HAZARD AREAS (MAP 12)

49% landslide

LAND COVER (MAP 15)

0% developed, 68% conifer forest, 5% deciduous forest, 24% floodplain/riparian, (Appendix B: GAP, 2009).

Riparian vegetation: 76% forest cover, 9% other natural vegetation, 15% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon (critical habitat), fall chum salmon, summer chum salmon (critical habitat), coho salmon, Dolly Varden/bull trout, kokanee salmon, pink salmon, rainbow trout, winter steelhead trout. Other species include: bald eagle, harlequin duck, Roosevelt elk, marbled murrelet, and northern spotted owl.

Wetland habitat: 14 acres of palustrine forested wetland (5% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters. Testing by Ecology indicates good water quality. Excessive fine sediment loading due to landslides in the upper watershed (WRIA 16 Planning Unit, 2006).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – Public (77%) and Private (23%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, there are overhead electrical transmission lines that cross the creek. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Hamma Hamma River Reach 2 has no formal public access or parks facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-high to high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian habitat.
Protect existing high quality fish and wildlife habitats.
Identify public access opportunities on state forest lands.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Conservation of high quality fish and wildlife habitats.
- Protection of channel migration zone (CMZ).
- Identify upstream sources of sedimentation and address issues.
- Continue long-term water quality monitoring.
- Significant commercial and tribal aquaculture in the estuary.

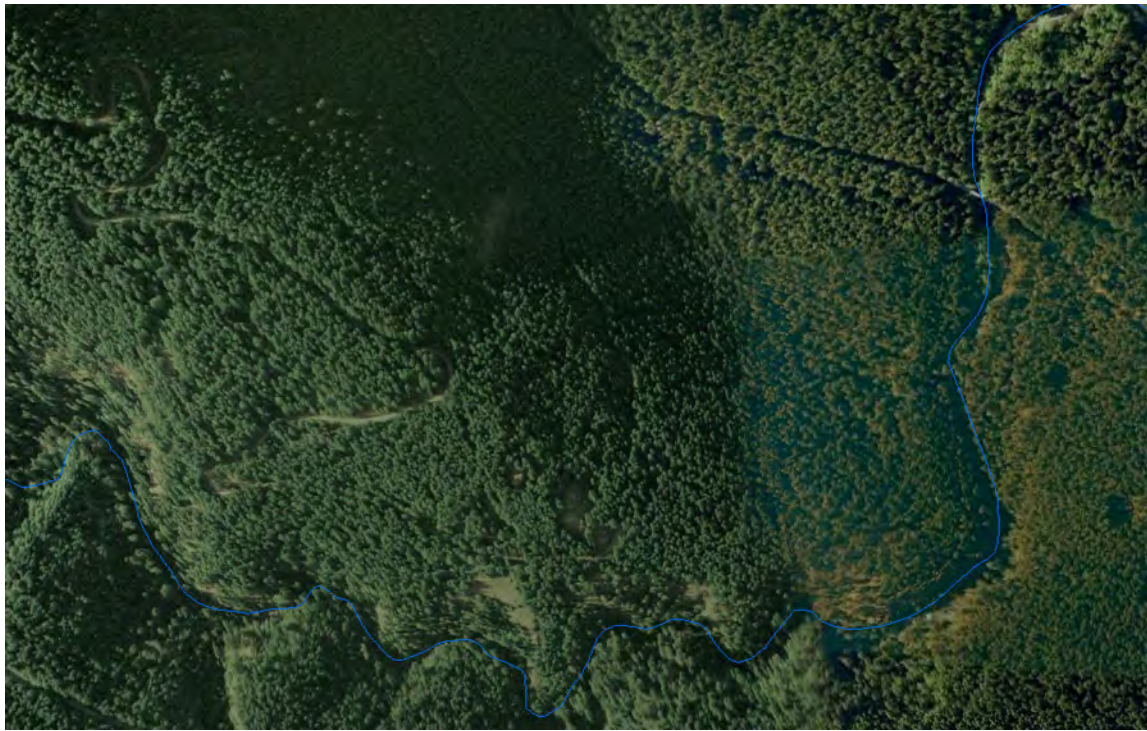
JEFFERSON CREEK - REACH 01

SHORELINE LENGTH

1.7 MI

REACH AREA

83.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 30% (25 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 86% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

0% developed, 75% conifer forest, 13% deciduous forest, 9% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 70% forest cover, 1% non-forest, 29% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, Dolly Varden/bull trout, kokanee salmon, rainbow trout, Harlequin duck, marbled murrelet, and northern spotted owl.

No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters. Excessive fine sediment loading due to landslides in the upper watershed (WRIA 16 Planning Unit, 2006).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, a road crosses the creek in Reach 01. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Jefferson Creek Reach 01 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic sites within this reach. Resource probability mapping suggests there is a very low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect existing forested riparian areas and fish and wildlife habitat.

KEY MANAGEMENT ISSUES

- Protection of existing forested riparian areas.
- Conservation of high quality fish and wildlife habitats.
- Protection of channel migration zone (CMZ).
- Identify upstream sources of sedimentation and address issues.

WAKETICKEH CREEK

SHORELINE LENGTH

3.1 MI

REACH AREA

144.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach

HAZARD AREAS (MAP 12)

Less than 1% erosion, 94% landslide

LAND COVER (MAP 15)

0% developed, 68% forest, 0% wetland, 7% floodplain/riparian, 24% harvested forest (Appendix B: GAP, 2009)

Riparian vegetation: 79% forest cover, 1% non-forest, 20% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, coho salmon, bald eagle buffer, bald eagle, and Roosevelt elk.

No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (94%) and remaining 6% is a mix of Parks, Open Space, Recreation Areas, and Residential. Ownership – Private (72%) and Public (28%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, a forest road and Tacoma Power overhead electrical transmission lines cross the creek. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Long Term Commercial Forest (64%), Rural Residential 20 Acres (23%), and remaining 13% is a mix of Rural Residential 5 Acres and Inholding Lands. Comprehensive Plan Designations – Long Term Commercial Forest (64%) and remaining 36% is a mix of Rural and Inholding Lands. Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

Waketick Creek Reach 01 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland with a few forest roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a high probability of finding unknown artifacts within this reach.

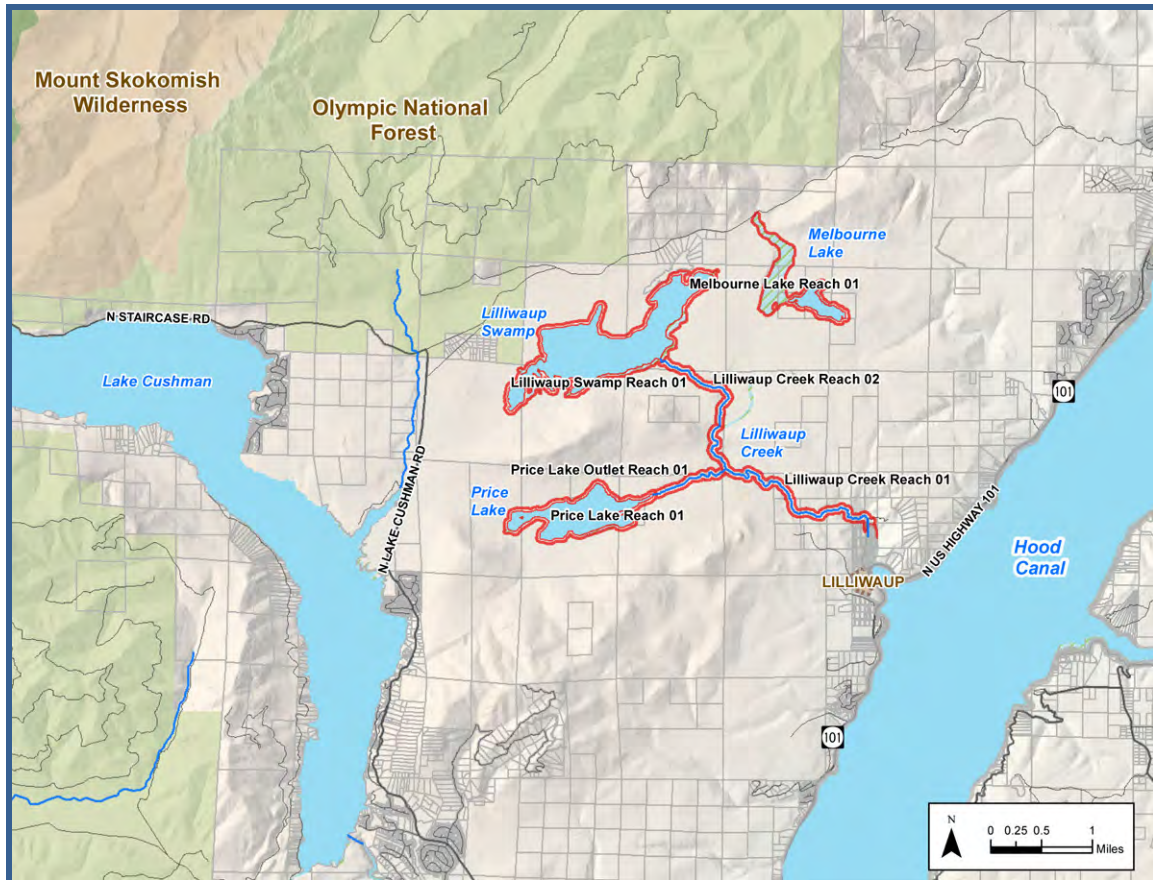
OPPORTUNITY AREAS

Restore forested cover in riparian zones.

KEY MANAGEMENT ISSUES

- Restoration of degraded riparian zones.
- Stabilize areas prone to landslide to protect downstream water quality and ecological functions.

8.2 Lilliwaup Creek and Tributaries (Lilliwaup Swamp, Price Lake, Melbourne)



8.2.1 Physical Characterization and Modifications

Lilliwaup Creek, Price Lake, Price Lake Outlet, and Lilliwaup Swamp

The Lilliwaup Creek mainstem extends approximately 7 miles with an additional 6.3 mile of tributaries draining 17.8 square miles of land (Correa, 2003). Extensive wetlands, associated with Lilliwaup Swamp and Price Lake contribute flow to Lilliwaup Creek. Lilliwaup Swamp is a 466-acre wetland and considered a shoreline of the state by Ecology due to its overall size. A large falls is located at river mile 0.7 on Lilliwaup Creek (WDFW and PNPTC, 2000).

The upper Lilliwaup Creek watershed is dominated by forested lands and much of the lower stream reach contains residential development. US Highway 101 crosses the stream at its mouth via a causeway. The causeway has been targeted for removal by Puget Sound Nearshore Ecosystem Restoration to restore the estuary (PSNERP 2011). A utility corridor crosses the stream in the middle portion of the reach. Riprap, hard armoring and fill have been placed along the lower portion of the stream to support residential and transportation uses. There are no known artificial barriers located below the falls.

Lilliwaup Creek and associated waterbodies have been altered by development, especially along the lower reaches. Some of the process modifications include:

- Logging practices causing upstream sedimentation;
- Landslides and streambank erosion;
- Adjacent residential development in the lower reach;
- Culverts and other structures that alter flow regime; and
- Fill and bank armoring in the lower reach.

Melbourne Lake

Melbourne Lake and its associated wetlands drain to Eagle Creek and was dammed in the 1950s for Coho production (Correa, 2003). Although fish are no longer supplemented from the lake, the dam is still there. Logging dominates the land adjacent and is the primary process modification to Melbourne Lake.

8.2.2 Water Quality

Lilliwaup Creek is listed on the Ecology 303(d) list of impaired waterbodies (Category 5) for fecal coliform bacteria (Ecology, 2008a). Lilliwaup Bay (MR 04,

Hood Canal) is also impaired for fecal coliform. Lilliwaup Creek upstream of Lilliwaup Swamp is listed as a Category 2 stream for fecal coliform; however, the listed reach is outside the shoreline jurisdiction. No water quality data or assessments were identified for Lilliwaup Swamp, Price and Melbourne Lakes. None of these lakes are included on Ecology's 303(d) list of impaired waters.

8.2.3 Critical or Priority Habitat and Species

Lilliwaup Creek

Several species of state or federally-listed priority salmonids are found within Lilliwaup Creek (Appendix B: WDFW, 2011; Table 8-4).

Table 8-4. Priority salmonid species documented for Lilliwaup Creek (Reaches 1 and 2)

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon (Reach 1 only)	<i>Oncorhynchus tshawytscha</i>	Presence/Migration	Threatened	Candidate
fall Chum salmon (Reach 1 only)	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	~	~
summer Chum salmon (Reach 1 only)	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	Threatened	Candidate
Coho salmon (Reach 1 only)	<i>Oncorhynchus kisutch</i>	Known spawning and Presence/Migration	Concern	~
Pink salmon (Reach 1 only)	<i>Oncorhynchus gorbuscha</i>	Known spawning and Presence/Migration	~	~
Rainbow trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~
winter Steelhead trout (Reach 1 only)	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~

Estuarine degradation and a lack of riparian vegetation limit habitat quality for salmonids in the lower reach of Lilliwaup Creek (Erickson and Gulick, 2006).

Summer-run chum primarily spawn in the lower mile of the river. Critical habitat has been designated for the Hood Canal ESU summer-run chum salmon in Reach 1 of Lilliwaup Creek (Appendix B: USFWS, 2010).

Table 8-5. Critical habitat for summer-run chum salmon in Lilliwaup Creek

Stream	Reach	Species Common Name	Scientific Name
Lilliwaup Creek	01	summer-run chum salmon	<i>Oncorhynchus keta</i>

Less than 0.5 acre of wetland is mapped in Reach 1 and 3.2 acres (6 percent of the reach) is mapped in Reach 2, within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). Priority habitat/species documented in the vicinity of Reaches 1 and 2 of the stream include bald eagle and elk (Appendix B: WDFW, 2011). Marbled murrelet is also recorded in Reach 2 of the stream (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Lilliwaup Creek shoreline planning area (Appendix B: WNHP, 2010).

Lilliwaup Swamp

Coastal cutthroat trout and rainbow trout are known to occur in Lilliwaup Swamp (Appendix B: WDFW, 2011). Approximately 465 acres (55 percent of the reach) are mapped as wetland according to NWI. Priority habitat and species recorded in the vicinity of Reaches 1 of the swamp includes old growth/mature forest, elk, pileated woodpecker, marbled murrelet and western toad (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Lilliwaup Swamp shoreline planning area (Appendix B: WNHP, 2010).

Price Lake

Coastal cutthroat trout and rainbow trout are known to occur in Price Lake (Appendix B: WDFW, 2011). Approximately 19 acres (18 percent of the reach) is mapped as wetland within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). Priority species occurrences for elk and western toad are found in the vicinity of the lake (Appendix B: WDFW, 2011).

Price Lake Outlet

Coastal cutthroat trout and rainbow trout are mapped as occurring in Price Lake Outlet (Appendix B: WDFW, 2011). No wetlands are mapped within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). A priority species occurrence for Roosevelt elk is mapped in the vicinity of the Price Lake Outlet (Appendix B: WDFW, 2011).

Melbourne Lake

Melbourne Lake has recorded use by two priority salmonid species – coastal cutthroat trout and rainbow trout (Appendix B: WDFW, 2011). Approximately 109 acres (representing 74 percent of the reach) is mapped as wetland within the Mason County shoreline jurisdiction of the lake (Appendix B: NWI, 1989). Occurrences for elk and marbled murrelet are recorded on the PHS data for the vicinity (Appendix B: WDFW, 2011).

8.2.4 Land Use

Land use in the Lilliwaup Creek and Lilliwaup Swamp basin is primarily resource lands associated with commercial and non-commercial timber harvest. Land ownership is predominantly State of Washington or DNR. In the lower sections of Lilliwaup Creek, private tree farms and timber companies are the major landowners along with single-family residential properties (Golder Associates, 2003). In the upper watershed, land uses are timber harvest on USFS lands in the Olympic National Forest. Commercial and residential development is concentrated along the shore of Hood Canal in the town of Lilliwaup, near the mouth of Lilliwaup Creek.

Public access is only available to Melbourne Lake. Melbourne Lake Park, managed by Washington State Department of Natural Resources, provides camping facilities and 1,000 feet of water access (Mason County Department of Parks and Trails, 2006). Lilliwaup Campground, upstream of Lilliwaup Swamp in the Olympic National Forest, provides public access as well.

8.2.5 Land Cover

Forest cover is the dominant land cover (75 percent or greater) in the shoreline jurisdiction within the Lilliwaup Creek drainage (Appendix B: PNPTC, 2011). The mouth of Lilliwaup Creek contains limited residential development and is crossed by US Highway 101. Lilliwaup Creek has a forested riparian corridor along much of its length and is traversed by a Tacoma Power utility corridor.

Lilliwaup Swamp is a large, undeveloped wetland complex with a narrow forested riparian zone. Price Lake is also undeveloped and the outlet stream has a forested riparian corridor. Melbourne Lake is undeveloped with a large forested wetland extending west and north of the lake. Logging occurs adjacent to the lake. Logging is commonly practiced adjacent to these waterbodies.

8.2.6 Summary of Key Management Issues

The key management issues for Lilliwaup Creek watershed are: 1) sediment loading due to timber harvest and logging roads affecting instream habitats, 2) important salmon and critical habitat in the lower reaches affected by sedimentation, 3) erosion and streambank instability due to a lack of riparian vegetation, 4) significant wetlands in the upper watershed (Lilliwaup Swamp), 5) undeveloped watershed mostly within Olympic National Forest and long-term commercial timber, 6) culverts blocking fish passage to off-channel habitats and 7) alterations and modifications related to US 101 crossing the Lilliwaup estuary.

8.2.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

LILLIWAUP CREEK - REACH 01

SHORELINE LENGTH

2.6 MI

REACH AREA

126.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - Less than 1% (0.5 acre) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 16% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

72% landslide

LAND COVER (MAP 15)

0% developed, 75% conifer forest, 6% deciduous forest, 16% floodplain/riparian, (Appendix B: GAP, 2009);

Riparian vegetation: 76% forest cover, 2% non-forest, 22% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, summer chum salmon (critical habitat), coho salmon, pink salmon, rainbow trout, winter steelhead trout, bald eagle buffer, and elk.
Wetland habitats: palustrine scrub-shrub habitat contributes less than 1 acre (less than 1% of reach).

WATER QUALITY (MAP 13)

Listed on Ecology's 303(d) list of impaired waters for fecal coliform bacteria

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Forestry (97%); remaining 3% is a mix of Residential and Vacant. Ownership – Public (57%) and Private (43%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, there are overhead electrical transmission lines that cross the creek. No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Long Term Commercial Forest (57%), remaining 43% is a mix of Rural Residential 10 Acres, Rural Residential 20 Acres, and Rural Residential 5 Acres. Comprehensive Plan Designations – Long Term Commercial Forest (57%) and Rural (43%). Existing SED – Conservancy (77%) and Urban Residential (23%).

PUBLIC ACCESS (MAP 14)

Lilliwaup Creek Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be almost entirely undeveloped forestland; a small treatment plan is located at the lower end of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Lilliwaup Causeway Replacement and Restoration (PSNERP 2011) (see Chapter 4, Hood Canal)

Restoration design sponsored by Long Live the Kings is underway (Moore et al., 2011) at:

<http://www.lltk.org/rebuilding-populations/lilliwaup-hatchery/lilliwaup-creek-restoration-project>:

- Stabilize upstream sources of sediment related to timber roads and landslides.
- Restore off-channel habitat.
- Analyze sediment transport and restore lower stream sections where sediment aggradation (build up) has occurred.
- Restore large woody debris and riparian forested habitats.

KEY MANAGEMENT ISSUES

- Sediment transport from the basin has caused aggradation (i.e. build up) of gravels in the lower reaches affecting salmonid habitats.
- Roads and residential development have degraded fish access to habitat in the estuary and in riparian areas.
- Culverts and other structures limit fish passage in tributaries and block transport of woody debris.
- Population growth and future development may further strain limited water resources in the sub-basin.
- Lack of riparian vegetation contributes to bank instability.

LILLIWAUP CREEK - REACH 02

SHORELINE LENGTH

1.1 MI

REACH AREA

54.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - less than 1% (0.1 acre) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 67% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

79% landslide

LAND COVER (MAP 15)

0% developed, 60% forest, 34% floodplain/riparian, (Appendix B: GAP, 2009);

Riparian vegetation: 79% forest cover, 21% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, rainbow trout, bald eagle buffer, elk, and marbled murrelet.

Wetland habitat: approximately 3 acres of palustrine scrub-shrub wetland (6% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, a road crosses the creek. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest.
Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Lilliwaup Creek Reach 2 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland with one road crossing.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restoration design by Long Live the Kings is underway (Moore et al., 2011) at: <http://www.ltk.org/rebuilding-populations/lilliwaup-hatchery/lilliwaup-creek-restoration-project>:

- Stabilize upstream sources of sediment related to timber roads and landslides.
- Restore off-channel habitat.
- Analyze sediment transport and restore lower stream sections where sediment aggradation (build up) has occurred.
- Restore large woody debris and riparian forested habitats.

KEY MANAGEMENT ISSUES

- Roads in the upper watershed have caused sediment transport.
- Culverts and other structures limit fish passage in tributaries and block transport of woody debris.
- Population growth and future development may further strain limited water resources in the sub-basin.

LILLIWAUP SWAMP

SHORELINE PERIMETER

7.9 MI

WATERBODY AREA

465.5 AC

REACH AREA

206.6 AC (*SHORELANDS
ABOVE THE OHWM)

PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 12% (24 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

Less than 1% landslide

LAND COVER (MAP 15)

0% developed, 21% forest, 39% wetland, 39% floodplain/riparian, %mud flat (Appendix B: GAP, 2009);

Riparian vegetation: 80% forest cover, 20% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, rainbow trout, old growth/mature forest, elk, pileated woodpecker, western toad, and marbled murrelet.

Wetland habitats: palustrine aquatic bed, forested, scrub-shrub, and emergent (60 to 70% of reach). Open water accounts for only 12 of the 465 acres of wetland area.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – Public (84%) and Private (16%).

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Long Term Commercial Forest (86%) and In-holding Lands (14%). Comprehensive Plan Designations – Long Term Commercial Forest (86%) and In-holding Lands (14%). Existing SED – Natural (99%) and Conservancy (1%).

PUBLIC ACCESS (MAP 14)

Informal public access through logging roads.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland with a few forest roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties.

OPPORTUNITY AREAS

Protect associated wetland areas

KEY MANAGEMENT ISSUES

- Protection of significant associated wetlands.
- Protection of water sources for summer baseflows in Lilliwaup Creek.
- Protection of forested riparian zones to support wetland and aquatic habitats.

PRICE LAKE

SHORELINE PERIMETER

4.4 MI

WATERBODY AREA

192.3 AC

REACH AREA

295.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 18% (18 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 2% of the shoreline area is within the Price Lake Outlet channel migration zone.

HAZARD AREAS (MAP 12)

8% landslide

LAND COVER (MAP 15)

0% developed, 27% forest, 9% wetland, 45% floodplain/riparian, 18% open water (Appendix B: GAP, 2009);
Riparian vegetation: 69% forest cover, 10% other natural vegetation, 21% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, rainbow trout, elk, and western toad.
Wetland habitat: 131 acres of palustrine emergent, forested, and scrub-shrub wetland types. Open water accounts for approximately 61 additional acres.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (95%) and Vacant (5%).
Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Natural.

PUBLIC ACCESS (MAP 14)

Price Lake has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Public ownership may present opportunity for public access.

KEY MANAGEMENT ISSUES

- No data available this shoreline lake.

PRICE LAKE OUTLET

SHORELINE LENGTH

0.8 MI

REACH AREA

37.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – less than 1% (0.01 acre) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 74% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

91% landslide

LAND COVER (MAP 15)

0% developed, 75% conifer forest, 12% deciduous forest, 13% floodplain/riparian, (Appendix B: GAP, 2009);

Riparian vegetation: 80% forest cover, 20% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, rainbow trout, and elk. No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts - 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Price Lake Outlet has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Consider decommissioning forest roads to reduce sediment delivery and fish passage issues.

KEY MANAGEMENT ISSUES

- Little data available for this small stream.

MELBOURNE LAKE

SHORELINE PERIMETER

1.8 MI

WATERBODY AREA

38.7 AC

REACH AREA

146.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 7% (10 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

16% landslide

LAND COVER (MAP 15)

0% developed, 28% forest, 18% open water, 50% floodplain/riparian (Appendix B: GAP, 2009);
Riparian vegetation: 69% forest cover, 7% other natural vegetation, 24% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, rainbow trout, elk, and marbled murrelet.
Wetland habitats include 145 acres of palustrine emergent, scrub-shrub, and forested wetland habitat types. Open water accounts for approximately 45 additional acres.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (94%) and Parks, Open Space and Recreation Areas (6%). Ownership – Public (84%) and Private (16%).

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Melbourne Lake Park, managed by Washington State Department of Natural Resources, provides camping facilities and 1,000 feet of water access (Mason County Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forestland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

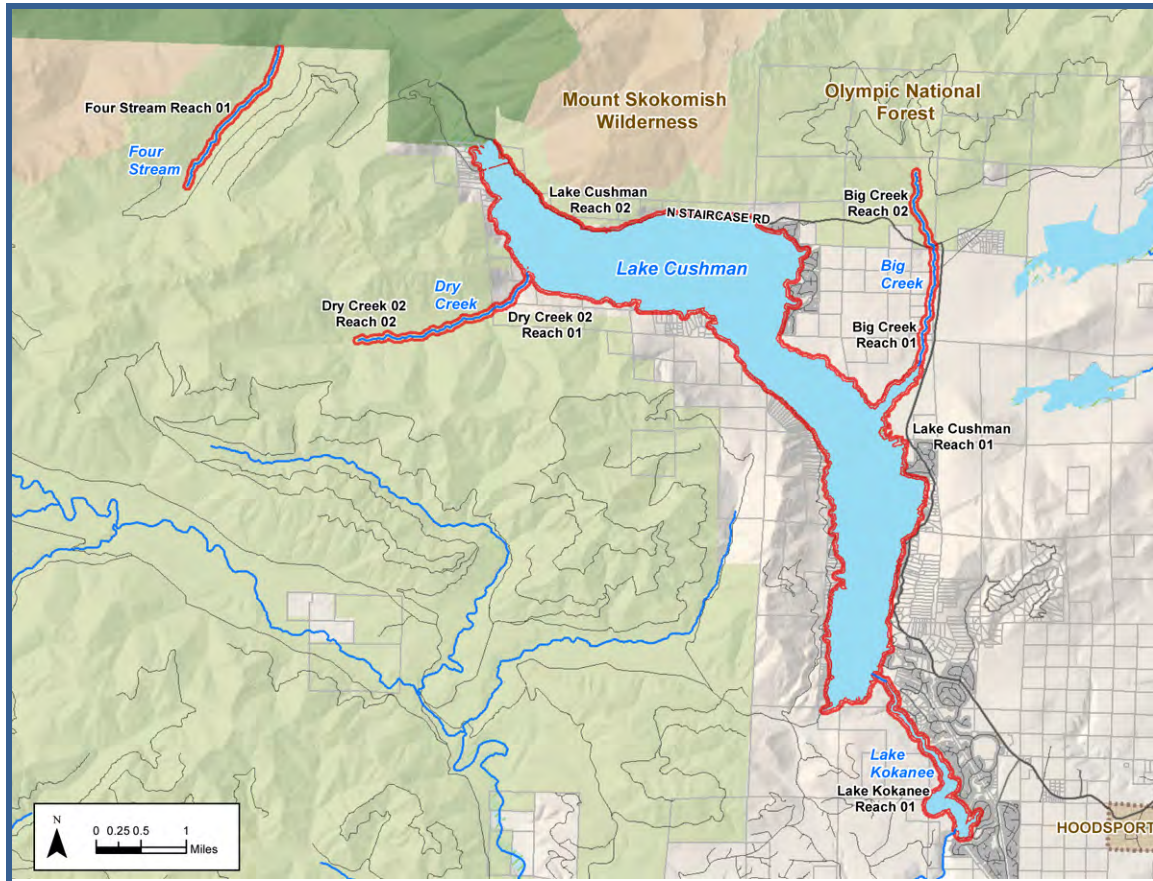
OPPORTUNITY AREAS

Public ownership may allow expansion of public access.

KEY MANAGEMENT ISSUES

- Little data available about this shoreline lake.

8.3 Lake Cushman, Dry Creek, Big Creek, and Lake Kokanee



This section describes Lake Cushman, its tributaries, and Lake Kokanee within Mason County jurisdiction. Therefore, this section describes a total of 38.8 miles of river and lake designated as shorelines of the state. Reach sheets are provided for Lake Cushman, Dry Creek, Big Creek, and Lake Kokanee.

While shorelines outside of the County lands in the National Forest are part of the inventory, no reach sheets have been provided for these streams or sections of streams. Streams in National Forest lands are therefore only generally described; these streams are a portion of Big Creek (Reach 2 only), Dry Creek 02 (Reach 2 only) and Four Stream.

8.3.1 Physical Characterization and Modifications

Lake Cushman is a 4,010 acre reservoir behind Cushman Dam and an impoundment of the North Fork of the Skokomish River. Lake Cushman and the dam are owned and operated by Tacoma Power. Due to its size over 1,000 acres, Lake Cushman is considered a shoreline of statewide significance. This reservoir is 8.5 miles in length running from the upper dam to the southeastern corner of the Olympic National Park (Correa, 2003).

Two shoreline tributaries enter Lake Cushman: Dry Creek and Big Creek. Dry Creek enters the reservoir's southwestern shore. The stream is undisturbed by logging or development, but contains one culvert. Big Creek drains to Lake Cushman on its eastern shoreline. Logging is common on the lands adjacent to the stream and one culvert is mapped on the reach. From the upper dam on Lake Cushman, limited flows travel approximately 1.5 miles downstream to another reservoir, Lake Kokanee, which is 150 acres in surface area. The downstream end of the reservoir is located at river mile 17.3 on the North Fork Skokomish River and acts as a barrier to anadromous fish passage (Correa, 2003).

Dams are located at the downstream ends of Lake Cushman and Lake Kokanee. Residential development and roadways are located along the eastern and southern shorelines of Lake Cushman, with many associated pier, ramps, and floats to support recreational boating. Across the northern extent of Lake Cushman, a road has been built on fill, with a small span that allows flow to enter the lake. Logging is common on the lands adjacent to Lake Cushman, concentrated around the middle and southern portions of Lake Cushman Reach 1. Residential development is located along the eastern and southern shorelines of Lake Kokanee, with logging practiced on lands west of the lake.

Lake Cushman and Lake Kokanee have been altered by historic development. Some of the process modifications include:

- Dams on the North Fork Skokomish;
- Timber harvest and logging practices in the watershed;
- Logging roads crossing tributaries and causing sediment transport;
- Water diversion/storage use;
- Adjacent residential development;
- Pier, ramps, and floats;
- Fill and bank armoring; and
- Conversion of pervious to impervious surfaces.

8.3.2 Water Quality

Water quality in Lake Cushman and Lake Kokanee was not tested by Ecology for the 303(d) list (Ecology, 2008). These reservoirs are subject to the FERC Settlement Agreement for the Cushman Relicensing Project signed by Tacoma Power in 2009. This settlement agreement outlines that a water quality enhancement plan will be developed to enhance downstream habitats for fish and wildlife. Dissolved nitrogen gases will be monitored at the outfalls and spillways to ensure that dissolved gases are within state standards (Tacoma Power, 2009).

Based upon a recent study on selected lakes, Lake Cushman was found to meet a 303 (d) Category 2 listing for dioxin toxic equivalency quantity (TEQ) in fish tissue. (Johnson et al, 2010). Lake Cushman also exhibits distinct temperature stratification during summer months, ranging from about 6 degrees Celsius (°C) near the lake bottom to 18 °C near the surface. Waters are typically well oxygenated and rarely drop below the state standard of 9.5 mg/l (FERC 1996).

No water quality data is recorded for Big Creek or Dry Creek; or Four Stream Reach in the Olympic National Forest (Ecology, 2008a).

8.3.3 Critical or Priority Habitat and Species

Lake Cushman and Lake Kokanee

Lake Cushman and Lake Kokanee lie upstream of Cushman Dam, which blocks natural migration of anadromous fish. Salmonscape still indicates that these reservoirs support several species of state or federally-listed priority salmonids (Appendix B: WDFW, 2011; Table 8-6).

Table 8-6. Priority salmonid species documented for Lake Cushman (Reaches 1 and 2), Big Creek, and Lake Kokanee

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon (Lake Cushman and Lake Kokanee only)	<i>Oncorhynchus tshawytscha</i>	Presence/Migration	Threatened	Candidate

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
fall Chum salmon (Lake Kokanee only)	<i>Oncorhynchus keta</i>	Presence/Migration	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Potential presence	Concern	~
Dolly Varden/Bull trout	<i>Salvelinus confluentus</i>	Known juvenile rearing (Reach 2 only) and Presence/Migration	Threatened	Candidate
kokanee salmon	<i>Oncorhynchus gorbusha</i>	Presence/Migration	~	~
Rainbow trout (Lake Cushman and Lake Kokanee only)	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~
Sockeye salmon	<i>Oncorhynchus nerka</i>	Historic use	~	~
summer Steelhead trout	<i>Oncorhynchus mykiss</i>	Potential presence	Threatened	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Potential presence	Threatened	~

A land-locked sockeye salmon (Kokanee) population is present in Lake Cushman and Lake Kokanee and is supplemented by a hatchery (Erickson and Gulick, 2006).

Critical habitat has been designated for the Puget Sound ESU Chinook salmon and Coastal-Puget Sound Distinct Population Segment (DPS) Dolly Varden/bull trout for Reaches 1 and 2 of Lake Cushman (Appendix B: USFWS, 2010; Table 8-7).

Table 8-7. Critical habitat for Chinook salmon and Dolly Varden/bull trout in Lake Cushman (Reaches 1 and 2) and Lake Kokanee

Stream	Reach	Species Common Name	Scientific Name
Lake Cushman	01	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>
Lake Cushman	02	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>

In addition to the salmonids and Dolly Varden/bull trout, Salish sucker is mapped in Reach 1 of Lake Cushman (Appendix B: WDFW, 2011).

Approximately 61.4 acres (15 percent of the reach) of wetland are mapped in Reach 1 within the Mason County shoreline jurisdiction of the lake. Approximately 13.5 acres (8 percent of the reach) of wetland are mapped in Reach 2 (Appendix B: NWI, 1989). According to PHS data, harlequin duck, northern spotted owl and marbled murrelet are documented in the vicinity of Lake Cushman (Appendix B: USFWS, 2010; Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Lake Cushman shoreline planning area (Appendix B: WNHP, 2010).

Table 8-8. Critical habitat for Chinook salmon and Dolly Varden/bull trout in Lake Kokanee

Stream	Reach	Species Common Name	Scientific Name
Lake Kokanee	01	Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Lake Kokanee	01	Dolly Varden/bull trout	<i>Salvelinus confluentus</i>

Approximately 9.9 acres (representing 7 percent of the reach) of wetland have been mapped within the Mason County shoreline jurisdiction of the lake (Appendix B: NWI, 1989). A priority species occurrence for osprey has been mapped in the vicinity of Lake Kokanee (Appendix B: WDFW, 2011).

Big Creek

Big Creek is mapped as supporting a few priority salmonid species (Appendix B: WDFW, 2011; Table 8.3). No wetlands are mapped within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). An elk priority species occurrence is mapped in the vicinity of Big Creek (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Big Creek shoreline planning area (Appendix B: WNHP, 2010).

Dry Creek

Dry Creek is not mapped as supporting any priority salmonid species (Appendix B: WDFW, 2011). No wetlands are mapped within the Mason County shoreline jurisdiction of Dry Creek (Appendix B: NWI, 1989). Marbled murrelet and northern spotted owl are mapped in the vicinity of the stream (Appendix B: USFWS, 2010; Appendix B: WDFW, 2011).

8.3.4 Land Use

Land uses in the shorelines of Lake Cushman include hydroelectric facilities, public recreation and single-family residential. Based upon an inventory done by Tacoma Power, Lake Cushman has 260 mapped docks and piers, as well as breakwaters and a marina. Lands surrounding Lake Cushman are owned by the City of Tacoma, Green Diamond Resource Company, and US Forest Service.

The Lake Cushman Park Site, managed by the Skokomish Tribe, has a boat launch and associated parking that is open to the public between Memorial Day and Labor Day weekends. The camp is located at the mouth of Big Creek. The Camp was transferred from Tacoma Power to the Skokomish Tribe as part of the 2009 settlement agreement. The agreement concluded two years of negotiations and several years of litigation, including lawsuits for past damages of \$5.8 billion and trespass damages for the utility's transmission line (Tacoma Power, 2011). Public access is also available along developed and informal recreation sites off of Staircase Road and from the Dry Creek Trail. Public access along the Dry Creek Trail is the preferred access point .

Lake Kokanee has a mix of parks, open space and recreation, utilities, residential and vacant land uses. There is a concrete boat launch operated by Tacoma Power that provides access to Lake Kokanee.

Land uses along Big Creek are predominately timber resources. Land ownership includes Skokomish Tribe (Lake Cushman Park Site), Manke Timber Resources, State of Washington and US Forest Service (National Forest lands). Big Creek campground provides public access and is located in the Olympic National Forest. The campground is operated by the USFS.

Dry Creek 02 is predominately in forestry use. City of Tacoma and USFS are the main land owners along Dry Creek 02. Public access is available along the Dry Creek Trail.

Land use along Big Creek in the National Forest is mostly open space. Land use information is not available for Dry Creek 02 Reach 2 and Four Stream.

8.3.5 Land Cover

Much of the Lake Cushman shoreline is forested. The lake has a road along its northern shoreline that crosses its northern extent. Aside from the road, the northern portion of the lake is primarily undeveloped. The western shoreline contains sparse residential development. The eastern shoreline contains substantial residential development with associated docks and piers. Logging is common on the

land east of the lake. Tacoma power operates a dam at the southern extent of the lake. Dry Creek has a forested riparian corridor along its length. Big Creek also has a forested riparian corridor, but logging is practiced on both sides of the stream, outside of the corridor. Lake Kokanee has a forested shoreline and extensive residential development is located east of the lake. No docks or piers are on the lake, with the exception of a dock located at a park near the south end of the lake. Logging is practiced near the western shoreline. Tacoma Power operates a dam at the south end of the lake.

8.3.6 Summary of Key Management Issues

The key management issues for Lake Cushman and Lake Kokanee are: 1) preservation of habitats and water quality while achieving the goals of the hydroelectric facility, 2) maintenance of instream flows to sustain fish habitat as per the FERC licensing agreement, 3) fine sediment loading due to timber harvest and logging roads affecting downstream water quality, 4) maintaining instream flows to support downstream salmon populations and critical habitat, and 5) residential development on eastern shore and 6) recreational uses and public access.

8.3.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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LAKE CUSHMAN - REACH 01

SHORELINE PERIMETER

18.8 MI

WATERBODY AREA

2,613.3 AC

REACH AREA

3,026.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 44% (180 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain.

HAZARD AREAS (MAP 12)

2% landslide

LAND COVER (MAP 15)

80% open water, 5% playa, 14% forest, 1% wetland (Appendix B: GAP, 2009)

Riparian vegetation: 10% forest cover, 2% non-forest, 1% other natural vegetation, 87% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon (critical habitat), coho salmon, Dolly Varden/bull trout (critical habitat), kokanee salmon, rainbow trout, sockeye salmon, summer steelhead, winter steelhead trout, and marbled murrelet. Wetland habitat: 38 acres (9 % of reach) of lacustrine aquatic bed, littoral flat, palustrine emergent, forested, and scrub-shrub .

WATER QUALITY (MAP 13)

Not sampled for Ecology's 303(d) list; subject to the Settlement Agreement for the Cushman Relicensing Project signed by Tacoma Power in 2009; a water quality enhancement plan will be developed to enhance downstream habitats for fish and wildlife; dissolved nitrogen gases will be monitored at the outfalls and spillways to ensure that they are within state standards; found to meet a 303(d) Category 2 listing for dioxin toxic equivalency quantity (TEQ) in fish tissue; exhibits distinct temperature stratification during summer.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Residential (66%), Parks, Open Space, and Recreation Areas (18%), and remaining 16% is a mix of Vacant, Utilities, and Forestry. Ownership – Private (96%)* and Public (4%).

SHORELINE MODIFICATIONS (MAP 16)

There are 260 docks/piers, 10 floating platforms and one buoy mapped throughout the reach in addition to 3 public parks with 2 gravel associated boat ramps, a marina, a spillway and a dam. According to 2011 aerial imagery there is approximately 2,000 linear feet of breakwaters.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (67%), Rural Residential 20 Acres (25%), and remaining 8% is a mix of Rural Residential 10 Acres, Rural Tourist, and Long Term Commercial Forest. Comprehensive Plan Designations – 100% Rural. Existing SED – Rural 43%, Urban Residential (30%), and Conservancy (27%).

PUBLIC ACCESS (MAP 14)

There are 3 parks owned by the City of Tacoma in this reach. Two of the public parks contain a gravel boat launch with associated parking.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show limited residential development and roads in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

Lake Cushman Resort is a private camping resort that provides tent and RV sites and cabin rentals. The resort has a marina and fuel dock (Lake Cushman Resort, 2011).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried early historic sites and four inventoried pre-contact sites within this reach. The reach also includes the Cushman No. 1 Hydroelectric Power Plant, which is a registered historic site. Resource probability mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

*Leased from Tacoma Power for residential development.

OPPORTUNITY AREAS

Restore forested riparian zone.

Provide for public access opportunities where not in conflict with other uses..

KEY MANAGEMENT ISSUES

- Settlement Agreement (2009) dictates flow regime to improve instream habitat for fish.

LAKE CUSHMAN - REACH 02

SHORELINE PERIMETER	WATERBODY AREA	REACH AREA
12.5 MI	1,396.6 AC	1,577.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – 27% (48 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 73% of the shoreline area is within the North Fork Skokomish River channel migration zone.

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

1% developed, 73% open water, 11% playa, 11% forest, 4% wetland (Appendix B: GAP, 2009)
Riparian vegetation: 7% forest cover, 1% non-forest, 3% other natural vegetation, 88% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon (critical habitat), coho salmon, Dolly Varden/bull trout (critical habitat), kokanee salmon, rainbow trout, sockeye salmon, summer steelhead, winter steelhead trout, harlequin duck, marbled murrelet, and northern spotted owl.

Wetland habitats include 73 acres (5% of reach) of lacustrine aquatic bed, littoral flat, palustrine emergent, forested, and scrub-shrub.

PHYSICAL AND ECOLOGICAL FEATURES

WATER QUALITY (MAP 13)

Not sampled for Ecology's 303(d) list; subject to the Settlement Agreement for the Cushman Relicensing Project signed by Tacoma Power in 2009; a water quality enhancement plan will be developed to enhance downstream habitats for fish and wildlife; dissolved nitrogen gases will be monitored at the outfalls and spillways to ensure that they are within state standards; found to meet a 303 (d) Category 2 listing for dioxin toxic equivalency quantity (TEQ) in fish tissue; exhibits distinct temperature stratification during summer.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Utilities (83%). remaining 17% is a mix of Vacant and Residential. Ownership – Private (94%)* and Public (6%).

SHORELINE MODIFICATIONS (MAP 16)

There are 5 fill areas, 2 upland bridges, and Dry Creek Trail bridge that cross the lake at the north end of the reach. The Dry Creek Trail crossing accounts for approximately 1,600 linear feet of breakwater. Approximately 60 docks/piers are located along with 2 public access beaches with gravel boat launches and associated parking lots.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Rural Residential: 20 Acres (58%), 5 Acres and 10 Acres (19%), remaining 3% is Olympic National Park and Olympic National Forest. US Forest Service: Olympic National Forest (14%), and Rural Residential 20 Acres (6%). Comprehensive Plan Designations – Rural (84%), remaining 16% is Olympic National Forest and Olympic National Park. Existing SED – County: Rural (51%) and Natural (29%). US Forest Service: 20% Natural.

PUBLIC ACCESS (MAP 14)

There are over 4,700 feet of Department of Natural Resources (DNR) trails mapped throughout the reach and 2 public parks with boat launches, parking and other facilities. Informal access through national forest or park lands.

IMPERVIOUS SURFACES (MAP 16)

1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested. SR 119 runs parallel to the lake shore within the northern part of the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried early historic site within this reach.

*Leased from Tacoma Power for residential development.

OPPORTUNITY AREAS

Protect intact riparian areas where forested canopy exists.

KEY MANAGEMENT ISSUES

- Protection of riparian areas for conservation of wildlife.

LAKE KOKANEE

SHORELINE PERIMETER

5.6 MI

WATERBODY AREA

105.3 AC

REACH AREA

244.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 28% (38 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 28% of the reach is within the CMZ.

HAZARD AREAS (MAP 12)

50% landslide

LAND COVER (MAP 15)

30% open water, 67% forest, 3% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 47% forest cover, 3% non-forest, 3% other natural vegetation, 47% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon (critical habitat), fall chum salmon, coho salmon, Dolly Varden/bull trout (critical habitat), rainbow trout, sockeye salmon, summer steelhead, winter steelhead trout, and osprey.

No wetlands are mapped.

WATER QUALITY (MAP 13)

Not sampled for Ecology's 303(d) list; subject to the Settlement Agreement for the Cushman Relicensing Project signed by Tacoma Power in 2009; a water quality enhancement plan will be developed to enhance downstream habitats for fish and wildlife; dissolved nitrogen gases will be monitored at the outfalls and spillways to ensure that dissolved gases are within state standards.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Parks, Open Space, and Recreation Areas (42%); Utilities (22%), Residential (18%); Vacant (17%) and Forestry (2%). Ownership – 100% Private (Leased from Tacoma Power for residential development.)

SHORELINE MODIFICATIONS (MAP 16)

Approximately 600 linear feet have been modified as part of the dam, spillway, and bulkhead at the southern end of the lake. Lower Lake Road also crosses the lower portion of the lake and accounts for 200 linear feet of an overwater structure. 2 docks/piers are located on this lake.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (80%), remaining 20% is a mix of Rural Residential 20 Acres and Long Term Commercial Forest. Comprehensive Plan Designations – Rural (93%) and Long Term Commercial Forest (7%).

Existing SED – Urban Residential (52%) and Natural (48%).

PUBLIC ACCESS (MAP 14)

The majority of the eastern shoreline is designated recreational park; the western shoreline is almost entirely undeveloped forested land owned by the City of Tacoma. A WDFW gravel boat launch, with parking, and facilities provides direct access to Lake Kokanee at the southern end (WDFW Lands, 2011).

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show limited residential development in the reach.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The reach includes a portion of the Cushman No. 2 Hydroelectric Power Plant, which is a registered historic site. Resource probability mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian areas where forested canopy exists.

KEY MANAGEMENT ISSUES

- Protection of riparian areas for conservation of wildlife and habitats.

BIG CREEK - REACH 01

SHORELINE LENGTH

1.3 MI

REACH AREA

65.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach. 91% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

32% landslide

LAND COVER (MAP 15)

28% forest, 72% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 74% forest cover, 26% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, coho salmon, Dolly Varden/bull trout, kokanee salmon, sockeye salmon, summer steelhead, winter steelhead trout, and elk. No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (80%) and Parks, Open Space, and Recreation Areas (20%). Ownership – Private (67%) and Public (33%).

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 20 Acres (80%) and Long Term Commercial Forest (20%)
Comprehensive Plan Designations – Rural (80%) and Long Term Commercial Forest (20%).
Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Camp Cushman, located at the mouth of Big Creek, provides public access to a boat launch and associated parking between Memorial Day and Labor Day weekends. Camp Cushman is owned by the Skokomish Tribe (Tacoma Power, 2011).

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forest land with a few forest roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian areas where forested canopy exists.

KEY MANAGEMENT ISSUES

- Protection of riparian areas for conservation of wildlife and habitats.

DRY CREEK 02 - REACH 01

SHORELINE LENGTH

0.6 MI

REACH AREA

27.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

88% forest, 12% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 84% forest cover, 16% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal and resident cutthroat trout. Marbled murrelet and northern spotted owl. No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (80%) and Parks, Open Space, and Recreation Areas (20%). Ownership – Private (67%) and Public (33%).

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – US Forest Service: Rural Residential 20 Acres (69%) and Olympic National Forest (31%). Comprehensive Plan Designations – Rural (69%) and Olympic National Forest (31%). Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

About 210 feet of DNR trails are mapped in the northeast portion of the reach.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forest land.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low to moderate-low probability of finding unknown artifacts within this reach.

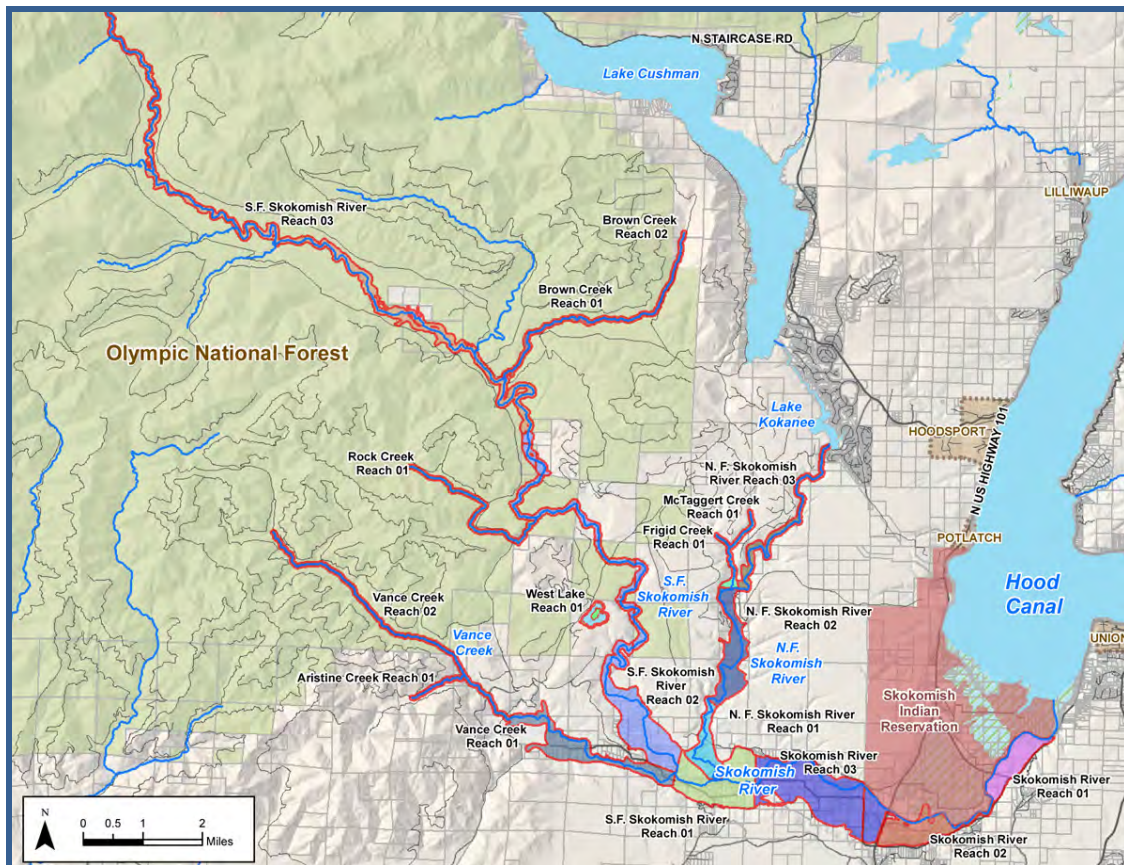
OPPORTUNITY AREAS

Protect intact riparian areas where forested canopy exists.

KEY MANAGEMENT ISSUES

- Protection of riparian areas for conservation of wildlife and habitats.

8.4 Skokomish River and Tributaries (North Fork, McTaggart, Frigid Creek, South Fork, West Lake, Brown Creek, Vance Creek, Aristine Creek)



This section describes Skokomish River and its shoreline tributaries within Mason County jurisdiction. Therefore, this section describes a total of 38.1 miles of river and lake designated as shorelines of the state within the Skokomish River sub-basin. Reach sheets are provided for Skokomish River, North Fork and South Fork Skokomish Rivers, McTaggart Creek, Frigid Creek, Brown Creek, West Lake, Vance Creek and Aristine Creek.

While shorelines outside of the County lands in National Forest are part of the inventory, no reach sheets have been provided for these streams or sections of streams. Streams in National Forest lands are therefore only generally described; these streams are a portion of South Fork Skokomish River (Reach 3 only), a portion of Brown Creek (Reach 1 only), Lebar Creek, Cedar Creek, Pine Creek, Church Creek, Rule Creek, South Fork Skokomish River Unnamed Tributary, Rock Creek and a portion of Vance Creek (Reach 2 only).

8.4.1 Physical Characterization and Modifications

The Skokomish River empties to The Great Bend of Hood Canal and is the largest river system draining to the canal. At its mouth, the river has created a large sub-estuary and intertidal delta in the Hood Canal Basin (Correa, 2003). The watershed is approximately 240 square miles, with 80 miles of mainstem and more than 260 miles of tributaries (WDFW and PNPTT, 2000). The mainstem extends from the mouth to river mile 9.0 (Correa, 2003) where the river splits into the North Fork and South Fork Skokomish River.

The North Fork is a continuance of the mainstem and drains through Lake Cushman and Lake Kokanee (Correa, 2003). McTaggart Creek is a tributary to the North Fork at river mile 13.3 and extends approximately 5.6 miles (Correa, 2003). Frigid Creek is a tributary to McTaggart Creek. Logging is common on the lands adjacent to both tributaries.

The South Fork is the largest tributary to the river at 27.5 miles (Correa, 2003). West Lake is a tributary that is located west of the South Fork and drains to the lower portion of the reach. Brown Creek is one of the tributaries to the South Fork that is located upstream of the confluence with West Lake. Only a small reach of Brown Creek is located outside of the National Forest and is covered in this section. Vance Creek is the largest tributary to the South Fork and is located just upstream of the confluence of the North Fork and South Fork Skokomish. Logging and agriculture are common on lands adjacent to Vance Creek. Aristine Creek is a tributary to Vance Creek, merging with Vance Creek at the upstream portion of the reach. Aristine Creek drains Haven Lake. Logging is common on lands adjacent to the South Fork and waterbodies associated with the river.

Hydropower production, timber, and agriculture uses dominate the watershed. Channelization of the mainstem for agriculture and residential development, limited flows on the North Fork due to dams, and extensive timber harvest on the South Fork have greatly impacted the rivers, increasing aggradation beyond natural conditions (Correa, 2003). There are no known artificial barriers to fish migration in the mainstem; however, numerous culverts are located on all waterbodies discussed above.

The Skokomish River and its tributaries have been extensively altered. Barriers, channelization, loss of riparian habitat and sediment build-up (aggradation) have occurred along the main stem. A majority of the main stem river has been diked and channelized resulting in a reduction of side channel habitat. Over half of the mainstem is sparsely vegetated and cleared for agriculture. Some of the process modifications include:

- Logging practices resulting in downstream sedimentation;
- Water diversion/storage use affecting stream flow and reducing salmonid habitat values;
- Adjacent residential development;
- Agricultural practices;
- Pier, ramps, and floats;
- Culverts and other structures that alter flow regime;
- Excessive sedimentation;
- Fill and bank armoring;
- Conversion of pervious to impervious surfaces; and
- Modification and loss of riparian function.

8.4.2 Water Quality

The Skokomish River is on the 303(d) list of impaired waterbodies (Category 5 water) for fecal coliform bacteria (Ecology, 2008a). Several impaired reaches are outside of Mason County's shoreline jurisdiction; however, one monitoring stations shows exceedances for fecal coliform bacteria concentrations near the mouth of the river. Category 5 waters require the preparation of a TMDL to address water quality concerns for that parameter. A TMDL has been established for the Skokomish River for fecal coliform bacteria.

A TMDL has also been established for Reaches 1 through 3 of the North Fork Skokomish River for the temperature parameter. In addition, Reach 3 of the North Fork Skokomish River is designated as Category 4C water for instream flow. Category 4C waters indicate impairment by a non-pollutant (Ecology, 2008a). North fork tributaries, McTaggart and Frigid Creeks, are not identified as having water quality problems at this time.

Reach 2 of the South Fork Skokomish River, immediately upstream of the confluence with Rock Creek, is on the 303(d) list of impaired waterbodies (Category 5 water) for temperature (Ecology, 2008a). Category 5 waters require the preparation of a TMDL to address water quality concerns for that parameter. The South Fork Skokomish River also contains two Category 2 listings for temperature within Reach 3. Category 2 listings indicate some evidence of water quality problems associated with that parameter.

Reach 1 of Lebar Creek, a tributary to the South Fork Skokomish River is also 303(d) listed for the temperature parameter. Other tributaries including Aristine, Vance, Rock, Brown, Cedar, Pine, Church, Rule, and an unnamed tributary have not been

identified as having water quality problems at this time. No water quality data or assessments were identified for West Lake and it is not included on Ecology's 303(d) list of impaired waters.

8.4.3 Critical or Priority Habitat and Species

Skokomish River

Skokomish River is mapped as supporting many priority salmonid species that are state or federally-listed (Appendix B: WDFW, 2011).

Table 8-9. Priority salmonid species documented for Skokomish River Mainstem (Reaches 1, 2, and 3)

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Known juvenile rearing (Reaches 2 and 3 only), Known spawning, and Presence/Migration	Threatened	Candidate
fall Chum salmon	<i>Oncorhynchus keta</i>	Known juvenile rearing (Reaches 2 and 3 only), Known spawning, and Presence/Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Presence/Migration	Threatened	Candidate
Coho salmon	<i>Oncorhynchus kisutch</i>	Known juvenile rearing (Reach 1 only), Known spawning, and Presence/Migration	Concern	~
Dolly Varden/Bull trout	<i>Salvelinus confluentus</i>	Presence/Migration	Threatened	Candidate
Pink salmon	<i>Oncorhynchus gorbuscha</i>	Known juvenile rearing (Reaches 1 and 2 only), Known spawning, and Presence/Migration	~	~
Sockeye salmon	<i>Oncorhynchus nerka</i>	Presence/Migration	~	~
summer Steelhead trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Known juvenile rearing (Reach 1 only), Known spawning, and Presence/Migration	Threatened	~

Historically, the river produced the largest runs of salmon and steelhead in Hood Canal, primarily in the North Fork, but these runs have been impacted due to development. The fluvial-type of sockeye salmon are present in the river mainstem, but the population is not considered viable (Erickson and Gulick, 2006).

Critical habitat has been designated for the Puget Sound ESU Chinook salmon, the Hood Canal ESU summer-run chum salmon, and Coastal-Puget Sound DPS Dolly Varden/bull trout for all reaches of the Skokomish River (Appendix B: USFWS, 2010).

Table 8-10. Critical habitat for Chinook salmon, summer-run chum salmon, and Dolly Varden/bull trout in Skokomish River

Stream	Reach	Species Common Name	Scientific Name
Skokomish River	01	Chinook salmon, summer-run chum salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>O. keta</i> , <i>Salvelinus confluentus</i>
Skokomish River	02	Chinook salmon, summer-run chum salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>O. keta</i> , <i>Salvelinus confluentus</i>
Skokomish River	03	Chinook salmon, summer-run chum salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>O. keta</i> , <i>Salvelinus confluentus</i>

Approximately 105 acres (representing 29 percent of the reach) of wetland are mapped in Reach 1, 230 acres (64 percent of the reach) in Reach 2, and 190.3 acres (20.5 percent of the reach) in Reach 3, all within the Mason County shoreline jurisdiction of the river (Appendix B: NWI, 1989). The following priority habitats or species are mapped in the vicinity of the river: bald eagle buffer in all reaches, estuarine zone and waterfowl concentrations in Reach 1, fisher in Reaches 2 and 3, and bald eagle, harlequin duck, and wood duck in Reach 3 (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Skokomish River shoreline planning area (Appendix B: WNHP, 2010).

North Fork Skokomish

The North Fork Skokomish River supports the same ten species of priority salmonids as shown in the main stem river listed in Table 8-9 (Appendix B: WDFW, 2011). The early spawning Chinook salmon group is extinct in the North Fork Skokomish River. Efforts are currently underway to restore this group in the river system (Skokomish Indian Tribe and Appendix B: WDFW, 2011). Reticulate sculpin, a priority fish species, is also mapped in Reach 2 of the river (Appendix B: WDFW, 2011).

Critical habitat has been designated for the Puget Sound ESU Chinook salmon and Coastal-Puget Sound DPS Dolly Varden/bull trout for all reaches of the Skokomish River (Appendix B: USFWS, 2010; Table 8-12).

Table 8-11. Critical habitat for Chinook salmon and Dolly Varden/bull trout in North Fork Skokomish River

Stream	Reach	Species Common Name	Scientific Name
N.F. Skokomish River	01	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>
N.F. Skokomish River	02	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>
N.F. Skokomish River	03	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>

Approximately 86.4 acres (representing 37.1 percent of the reach) of wetland in Reach 1 and 4.9 acres (2.0 percent of the reach) of wetland in Reach 3 are mapped within the Mason County shoreline jurisdiction of the river (Appendix B: NWI, 1989). The following priority habitats or species are mapped in the vicinity of the river: bald eagle buffer, bald eagle, harlequin duck, and Roosevelt elk in Reaches 1 and 2 (Appendix B: WDFW, 2011).

McTaggart Creek

McTaggart Creek is mapped as supporting many priority salmonid species (Appendix B: WDFW, 2011; Table 8-13).

Table 8-12. Priority fish species documented for McTaggart Creek and Frigid Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon (McTaggart Creek only)	<i>Oncorhynchus tshawytscha</i>	Known spawning and Presence/Migration	Threatened	Candidate
fall Chum salmon (McTaggart Creek only)	<i>Oncorhynchus keta</i>	Known spawning and Presence/Migration	~	~
summer Chum salmon	<i>Oncorhynchus keta</i>	Presence/Migration	Threatened	Candidate

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
(McTaggart Creek only)				
Coho salmon	<i>Oncorhynchus kisutch</i>	Known spawning (McTaggart Creek only) and Presence/Migration	Concern	~
Dolly Varden/Bull trout	<i>Salvelinus confluentus</i>	Presence/Migration	Threatened	Candidate
Sockeye salmon (McTaggart Creek only)	<i>Oncorhynchus nerka</i>	Presence/Migration	~	~
summer Steelhead trout (McTaggart Creek only)	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Known spawning (McTaggart Creek only) and Presence/Migration	Threatened	~

Critical habitat has been designated for the Puget Sound ESU Chinook salmon and Coastal-Puget Sound DPS Dolly Varden/bull trout in McTaggart Creek (Appendix B: USFWS, 2010; Table 8-14).

Table 8-13. Critical habitat for Chinook salmon and Dolly Varden/bull trout in McTaggart Creek

Stream	Reach	Species Common Name	Scientific Name
McTaggart Creek	01	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>

Approximately 1.9 acres of wetland, representing 2.1 percent of the reach, are mapped in the Mason County Shoreline jurisdiction of the stream (Appendix B: NWI, 1989). No priority habitats or species are mapped in the vicinity of the stream (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the McTaggart Creek shoreline planning area (Appendix B: WNHP, 2010).

Frigid Creek

Several priority salmonid species are mapped as occurring in Frigid Creek (Appendix B: WDFW, 2011; Table 8.14). No wetlands are mapped within the Mason

County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). No priority habitats or wildlife species occurrences have been mapped in the vicinity of the stream (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Frigid Creek shoreline planning area (Appendix B: WNHP, 2010).

South Fork Skokomish River

Similar to the North Fork, the South Fork Skokomish River supports all of the same priority salmonid species (Appendix B: WDFW, 2011; Table 8-9). In addition, rainbow trout is known to occur in Reach 2. Three races of native salmonids (spring Chinook, pink, and early chum salmon) that utilize the South Fork Skokomish River have been nearly extirpated and fall spawning species (coho, chum, and fall Chinook) are at risk due to limited habitat availability (DNR, 2004). Efforts are currently underway to restore the early timed spawning Chinook salmon group in the river system (Skokomish Indian Tribe and Appendix B: WDFW, 2011).

Critical habitat has been designated for the Puget Sound ESU Chinook salmon and Coastal-Puget Sound DPS Dolly Varden/bull trout in South Fork Skokomish River (Appendix B: USFWS, 2010; Table 8-14).

Table 8-14. Critical habitat for Chinook salmon and Dolly Varden/bull trout in South Fork Skokomish River

Stream	Reach	Species Common Name	Scientific Name
South Fork Skokomish River	01	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>
South Fork Skokomish River	02	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>

Approximately 118 acres (20 percent of the reach) of wetland are mapped in Reach 1 and 257 acres (22 percent of the reach) are mapped in Reach 2, within the Mason County shoreline jurisdiction of the river (Appendix B: NWI, 1989). Priority habitat and species occurrences mapped in the vicinity of the river include: bald eagle buffer and harlequin duck in Reaches 1 and 2, bald eagle and Roosevelt elk in Reach 1, and Cascade frog and elk in Reach 2 (Appendix B: WDFW, 2011). Marbled murrelet is mapped in Reach 2 (Appendix B: USFWS, 2010; Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the South Fork Skokomish River shoreline planning area (Appendix B: WNHP, 2010).

Brown Creek

Several priority salmonid species are mapped in Brown Creek (Appendix B: WDFW, 2011; Table 8-15).

Table 8-15. Priority fish species documented for Brown Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
Dolly Varden/Bull trout	<i>Salvelinus confluentus</i>	Presence/Migration	Threatened	Candidate
Rainbow trout	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~

Critical habitat has been designated for Coastal-Puget Sound DPS Dolly Varden/bull trout in Brown Creek (USFWS 2010; Table 8-16).

Table 8-16. Critical habitat for Dolly Varden/bull trout in Brown Creek

Stream	Reach	Species Common Name	Scientific Name
Brown Creek	02	Dolly Varden/bull trout	<i>Salvelinus confluentus</i>

Approximately 0.9 acre (2.9 percent of the reach) of wetland is mapped in Reach 2 within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). No priority habitats or species occurrences are mapped in the vicinity of Reach 2 of the stream and the NHP has not identified any priority plant species or vegetation communities within the Brown Creek shoreline planning area (Appendix B: WDFW, 2011; Appendix B: WNHP, 2010).

West Lake

There are no documented priority salmonids in West Lake (Appendix B: WDFW, 2011). Approximately 24.3 acres (49.6 percent of the reach) of wetland are mapped in the Mason County shoreline jurisdiction of the lake (Appendix B: NWI, 1989). No priority habitats or species occurrences are mapped in the vicinity of the lake and the NHP has not identified any priority plant species or vegetation communities within the West Lake shoreline planning area (Appendix B: WDFW, 2011; Appendix B: WNHP, 2010).

Vance Creek

Vance Creek is mapped as supporting many priority salmonid species (Appendix B: WDFW, 2011; Table 8-17).

Table 8-17. Priority salmonid species documented for Vance Creek and Aristine Creek

Common Name	Scientific Name	Habitat Use	Federal Listing	State Listing
Coastal cutthroat trout	<i>Oncorhynchus clarki clarki</i>	Presence/Migration	~	~
fall Chinook salmon (Vance Creek only)	<i>Oncorhynchus tshawytscha</i>	Known spawning and Presence/Migration	Threatened	Candidate
fall Chum salmon (Vance Creek only)	<i>Oncorhynchus keta</i>	Known juvenile rearing, Known spawning, and Presence/Migration	~	~
Coho salmon	<i>Oncorhynchus kisutch</i>	Known juvenile rearing, Known spawning (Vance Creek only), and Presence/Migration	Concern	~
Dolly Varden/Bull trout (Vance Creek only)	<i>Salvelinus confluentus</i>	Presence/Migration	Threatened	Candidate
Pink salmon	<i>Oncorhynchus gorbuscha</i>	Known spawning and Presence/Migration	~	~
Rainbow trout (Vance Creek only)	<i>Oncorhynchus mykiss</i>	Presence/Migration	~	~
Sockeye salmon (Vance Creek only)	<i>Oncorhynchus nerka</i>	Presence/Migration	~	~
summer Steelhead trout (Vance Creek only)	<i>Oncorhynchus mykiss</i>	Presence/Migration	Threatened	~
winter Steelhead trout	<i>Oncorhynchus mykiss</i>	Known spawning (Vance Creek only) and Presence/Migration	Threatened	~

Reticulate sculpin and riffle sculpin, priority fish species, are also mapped in Vance Creek (Appendix B: WDFW, 2011).

Critical habitat has been designated for the Puget Sound ESU Chinook salmon and Coastal-Puget Sound DPS Dolly Varden/bull trout for Vance Creek (Appendix B: USFWS, 2010; Table 8.-20).

Table 8-18. Critical habitat for Chinook salmon and Dolly Varden/bull trout in Vance Creek

Stream	Reach	Species Common Name	Scientific Name
Vance Creek	01	Chinook salmon, Dolly Varden/bull trout	<i>Oncorhynchus tshawytscha</i> , <i>Salvelinus confluentus</i>

Approximately 80.4 acres, representing 14.2 percent of the reach, of wetland is mapped within the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). A priority species occurrence for harlequin duck is mapped in the vicinity of the stream (Appendix B: WDFW, 2011). The NHP has not identified any priority plant species or vegetation communities within the Vance Creek shoreline area (Appendix B: WNHP, 2010).

Aristine Creek

Several priority salmonid species are mapped in Aristine Creek (Appendix B: WDFW, 2011; Table 8.4.9). No wetlands are mapped in the Mason County shoreline jurisdiction of the stream (Appendix B: NWI, 1989). No priority habitats or species occurrences are mapped in the vicinity of the lake and the NHP has not identified any priority plant species or vegetation communities within the Aristine Creek shoreline planning area (Appendix B: WDFW, 2011; Appendix B: WNHP, 2010).

8.4.4 Land Use

Land uses along Skokomish River are a mix of agriculture and vacant lands with some residential use located in the uppermost reach. There are two WDFW boat launches that provide access to the river. Both boat launches are gravel bars. The boat launch in the uppermost reach has parking facilities and is associated with a 64 acre park (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006).

North Fork Skokomish River, McTaggart Creek, Frigid Creek, West Lake and Aristine Creek are predominately in forestry land use. No public access is available to these shorelines.

South Fork Skokomish River has a mix of forestry, agriculture, vacant, and residential land uses. National Forest Develop Rd 2353 provides access to Brown Creek Campground in the Olympic National Forest; located at the confluence between Brown Creek and S.F. Skokomish River Reach 03 (USFS, 2011).

Land use in the National Forest along South Fork Skokomish River Reach 3 is mostly vacant. Land use along Rock Creek and Vance Creek Reach 2 is entirely in forestry use. Land use information is not available for Brown Creek Reach 1, Lebar Creek, Cedar Creek, Pine Creek, Church Creek, Rule Creek, and South Fork Skokomish River Unnamed Tributary.

8.4.5 Land Cover

Farming dominates the mainstem of the Skokomish River as do extensive floodplain and riparian areas. Highway 101 crosses a lower reach of the river. The shoreline of the North Fork Skokomish River is forested, except for the lower reach which is farmed with sparse forested riparian cover. McTaggart and Frigid creeks are heavily forested along their shorelines. Farming and sparse residential development are on the banks of the South Fork Skokomish River, which has a very wide channel. Vance Creek is farmed on both banks and has a fairly wide channel with forested riparian cover. West Lake is undeveloped, but nearly surrounded by cleared land. Aristine Creek and Brown Creek have forested riparian corridors along most of their lengths. Logging is commonly practiced in the vicinity of most of these waterbodies.

8.4.6 Summary of Key Management Issues

The key management issues for the Skokomish River watershed are summarized from the WRIA 16 Planning Unit (2006) and in the Skokomish River General Investigation (GI) Study by the Corps (2010).

These issues are: 1) concerns about water quantity and water right allocations, 2) South Fork of the Skokomish River experiences significant sediment aggradation (build-up) and apparently upstream landslides and road failures are sources of this sediment ; 3) critical habitat for salmon and several salmonid species are at risk; 4) construction of dikes, channelization, armoring and other modifications have reduced habitat quality; 5) roads, residential development and agricultural uses have degraded riparian areas and impacted fish access; 6) fecal coliform bacteria is a water quality concern and animal waste is a contributor; and 7) warm water temperatures in Lebar Creek and South Fork exceed water quality standards.

8.4.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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SKOKOMISH RIVER - REACH 01

SHORELINE LENGTH

1.7 MI

REACH AREA

300.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – 99% (299 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. Channel Migration Zone - 14% (43 acres) of the reach, including open water, is mapped as CMZ.

HAZARD AREAS (MAP 12)

5% erosion, 5% landslide

LAND COVER (MAP 15)

1% developed, 16% agriculture, 1% open water, 1% playa, 3% forest, 73% wetland, 5% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 19% forest cover, 49% non-forest, 21% other natural vegetation, 11% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, summer-run chum salmon, and Dolly Varden/bull trout. Coho salmon, sockeye, steelhead trout, coast resident cutthroat, pink salmon, and concentrations of waterfowl.
Wetlands – 72 acres (24% of reach); wetland habitat types include palustrine (emergent, forested, scrub-shrub), estuarine intertidal, and riverine tidal flat.

WATER QUALITY (MAP 13)

A TMDL is in place to address water quality concerns for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Agriculture (97%), remaining 3% is a mix of Transportation and Forestry. Ownership – Private (97%) and Public (3%).

SHORELINE MODIFICATIONS (MAP 16)

One road crossing exists in northeast portion of the reach: State Route 106.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Agriculture (97%) and Rural Residential 20 Acres (3%). Comprehensive Plan Designations – Agricultural Resource Lands (97%) and Rural Residential 20 Acres (3%). Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

Skokomish River Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

2% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be mostly in pastureland, with limited rural residential development and SR 106.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists one inventoried pre-contact village site and one inventoried early historic site within this reach. Resource probability mapping suggests there is a moderate-low to moderate-high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Remove ditches, dikes and drainage features to restore floodplain functions.

Continue to work with farmers and landowners to implement best management practices during agricultural use.

KEY MANAGEMENT ISSUES

- Significant floodplain area and associated wetlands.
- Critical habitat for ESA listed Chinook salmon, Hood Canal summer chum and Dolly Varden/bulltrout.
- Restoration of floodplain and wetland functions by removing ditches, dikes or other modifications.
- Implementation of best management practices during agricultural use.

SKOKOMISH RIVER - REACH 02

SHORELINE LENGTH

1.4 MI

REACH AREA

357.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 92% (329 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. Channel Migration Zone - 22% (80 acres) of the reach, including open water, is mapped as CMZ.

HAZARD AREAS (MAP 12)

7% erosion, 5% landslide

LAND COVER (MAP 15)

1% agriculture, 4% forest, 88% wetland, 7% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 49% forest cover, 7% non-forest, 37% other natural vegetation, 7% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, summer-run chum salmon, and Dolly Varden/bull trout. Coho salmon, sockeye, steelhead trout, coast resident cutthroat, pink salmon, river lamprey, reticulate sculpin, Bald eagle, other waterfowl, fisher. Wetlands -- 203 acres (57% of reach); wetland habitat types include palustrine emergent, forested, scrub-shrub, and riverine upper perennial flat

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Vacant (84%), remaining 16% are a mix of Forestry, Commercial, and Residential. Ownership – Private (73%) and Public (27%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, US 101 crosses the river in the northern part of the reach. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential: 10 Acres (68%), Rural Residential 5 Acres (20%), and remaining 12% is a mix of Indian Reservation, Rural Residential 20 Acres, and Rural Natural Resource. Comprehensive Plan Designations – 100% Rural. Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch that provides access to Skokomish River. Access is south of Skokomish River Bridge on the east side of Hwy 101. The launch type is a rough gravel bar (WDFW Lands, 2011).

IMPERVIOUS SURFACES (MAP 16)

4% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be undeveloped forest and wetlands, with roads including SR 101.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists two inventoried early historic sites within this reach. Resource probability mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach, with small portions of the reach in moderate to moderate-high zones.

OPPORTUNITY AREAS

Remove ditches, dikes and drainage features to restore floodplain functions.

Continue to work with farmers and landowners to implement best management practices during agricultural use.

KEY MANAGEMENT ISSUES

- Significant floodplain area and associated wetlands.
- Critical habitat for ESA listed Chinook salmon, Hood Canal summer chum and Dolly Varden/bulltrout.
- Restoration of floodplain and wetland functions by removing ditches, dikes or other modifications.
- Implementation of best management practices during agricultural use.

SKOKOMISH RIVER - REACH 03

SHORELINE LENGTH

3.0 MI

REACH AREA

1,093.2 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 95% (1034 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. Channel Migration Zone - 31% (340 acres) of the reach, including open water, is mapped as CMZ.

HAZARD AREAS (MAP 12)

8% erosion, 2% landslide

LAND COVER (MAP 15)

1% developed, 48% agriculture, 1% beach, 10% forest, 8% wetland, 32% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 26% forest cover, 57% non-forest, 14% other natural vegetation, 3% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, summer-run chum salmon, and Dolly Varden/bull trout. Coho salmon, sockeye, steelhead trout, coast resident cutthroat, pink salmon, river lamprey, reticulate sculpin, Bald eagle, other waterfowl, fisher. Wetlands - 128 acres (12% of reach); wetland habitat types include palustrine emergent, palustrine forested, palustrine scrub-shrub, and riverine upper perennial flat

WATER QUALITY (MAP 13)

A TMDL is in place to address water quality concerns for fecal coliform bacteria.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Agriculture (62%), Residential (16%) Vacant (14%), remaining 8% are a mix of Forestry, Aquaculture, and Parks, Open Space, and Recreation Areas. Ownership – Private (95%) and Public (5%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, there are overhead electrical transmission lines that cross the river. No other mapped shoreline modifications are found in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Agricultural Resource Lands (65%), Rural Residential 20 Acres (21%), and remaining 14% is a mix of Rural Residential 10 Acres, Rural Residential 20 Acres, and Long Term Commercial Forest. Comprehensive Plan Designations – Agricultural Resource Lands (65%), Rural (33%), and Long Term Commercial Forest (2%). Existing SED – 100% Rural.

PUBLIC ACCESS (MAP 14)

There is a Washington Department of Fish and Wildlife (WDFW) boat launch in the northern part of the reach that provides access to Skokomish River. The boat launch is gravel bar with about 31 feet of riverfront access. The total park size is 64 acres. Parking facilities are available (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

2% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be largely agricultural with scattered rural residential development.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

The DAHP database lists five inventoried early historic sites within this reach. Resource probability mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

- Re-vegetation of riparian areas
- Opportunities for additional public access through WDFW boat launch.

KEY MANAGEMENT ISSUES

- Use of agricultural best management practices.
- Protection of active channel migration zone.
- Restoration of degraded riparian areas.

NORTH FORK SKOKOMISH RIVER - REACH 01

SHORELINE LENGTH

2.0 MI

REACH AREA

232.9 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 85% (199 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 83% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

15% erosion, 7% landslide

LAND COVER (MAP 15)

11% agriculture, 1% beach, 37% forest, 8% wetland, 44% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 26% forest cover, 45% non-forest, 23% other natural vegetation, 6% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, Dolly Varden/bull trout. Coast resident cutthroat, steelhead trout, chum salmon, coho salmon, pink, Harlequin duck, Roosevelt elk, Bald eagle, and gray wolf.
Wetlands – 86 acres (37% of reach); wetland habitat types include palustrine emergent, forested, and river upper perennial flat

WATER QUALITY (MAP 13)

A TMDL is in place to address water quality concerns for temperature.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (98%) and Agriculture (2%).
Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to 2009 aerial imagery, Sunnyside Road crosses the river in the middle of the reach. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Agricultural Resource Lands (87%) and Long Term Commercial Forest (13%).
Comprehensive Plan Designations – Agricultural Resource Lands (87%) and Long Term Commercial Forest (13%). Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

North Fork Skokomish River Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the upper part of the reach to be forested, with agricultural land and roads in the lower part.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low to moderate-high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

North Fork Skokomish Pond Reconnection (10-01-001) (Habitat Work Plan, 2011); Sponsor: Mason Conservation District-This project involves the assessment, design, and restoration of certain habitats along with fish passage opportunities within the North Fork Skokomish River lower floodplain, located within Skokomish Farms, Inc.

KEY MANAGEMENT ISSUES

- Use of agricultural best management practices.
- Protection of active channel migration zone.

NORTH FORK SKOKOMISH RIVER - REACH 02

SHORELINE LENGTH

2.8 MI

REACH AREA

390.5 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 78% (304 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 94% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

3% erosion, 26% landslide

LAND COVER (MAP 15)

60% forest, 2% wetland, 38% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 84% forest cover, 13% other natural vegetation, 2% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, Dolly Varden/bull trout. Coast resident cutthroat, steelhead trout, chum salmon, coho salmon, reticulate sculpin, Harlequin duck, Bald eagle, Roosevelt elk, and Northern spotted owl.
No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

A TMDL is in place to address water quality concerns for temperature.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

North Fork Skokomish River Reach 2 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested with a few forestry roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Replant trees in degraded riparian zones.

KEY MANAGEMENT ISSUES

- Use of agricultural best management practices.
- Protection of active channel migration zone.

NORTH FORK SKOKOMISH RIVER - REACH 03

SHORELINE LENGTH

4.1 MI

REACH AREA

246.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 36% (89 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 86% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

Less than 1% erosion, 68% landslide

LAND COVER (MAP 15)

1% agriculture, 62% forest, 37% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 87% forest cover, 11% other natural vegetation, 2% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, Dolly Varden/bull trout. Coast resident cutthroat, steelhead trout, chum salmon, coho salmon, and Northern spotted owl. Wetland habitats – 4 acres (2% of reach); wetland habitat types include palustrine forested and scrub-shrub

WATER QUALITY (MAP 13)

A TMDL is in place to address water quality concerns for temperature. This reach has also been identified as a Category 4C water for being impaired by a non-pollutant (in-stream flow).

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (97%) and Utilities (3%).
Ownership – Private (98%) and Public (2%).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Long Term Commercial Forest (82%), remaining 18% is a mix of Rural Residential: 20 Acres and Rural Residential 5 Acres.
Comprehensive Plan Designations – Long Term Commercial Forest (82%) and Rural (18%). Existing SED – 100% Natural.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested with a few forestry roads.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

PUBLIC ACCESS (MAP 14)

North Fork Skokomish River Reach 3 has no formal public access or park facilities.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

This reach includes the Cushman No. 2 Hydroelectric Power Plant, which is a registered historic site. Resource probability mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Replant trees in degraded riparian zones.

KEY MANAGEMENT ISSUES

- Protection of active channel migration zone.
- Decommission forest roads to minimize sediment transport.

McTAGGERT CREEK

SHORELINE LENGTH

1.7 MI

REACH AREA

92.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 24% (22 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 13% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

22% erosion, 72% landslide

LAND COVER (MAP 15)

33% forest, 66% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 93% forest cover, 6% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon, and Dolly Varden/bull trout. Coast resident cutthroat, chum (fall/summer), coho salmon, sockeye, steelhead trout (summer/winter) and northern spotted owl.

No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

McTaggart Creek Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested with a few forestry roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Replant trees in degraded riparian zones.

KEY MANAGEMENT ISSUES

- Decommission forest roads to minimize sediment transport.

FRIGID CREEK

SHORELINE LENGTH

0.3 MI

REACH AREA

15.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach.

HAZARD AREAS (MAP 12)

100% landslide

LAND COVER (MAP 15)

60% forest, 40% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 100% forest cover (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Dolly Varden/bulltrout, coast resident cutthroat, coho salmon, winter steelhead trout, gray wolf, and northern spotted owl. No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters..

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

Frigid Creek Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource probability mapping suggests there is a very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect intact riparian areas where forested canopy exists

KEY MANAGEMENT ISSUES

- Decommission forest roads to minimize sediment transport.

SOUTH FORK SKOKOMISH RIVER - REACH 01

SHORELINE LENGTH

1.6 MI

REACH AREA

605.1 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 94% (569 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 7% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

15% erosion, 4% landslide

LAND COVER (MAP 15)

16% agriculture, 4% open water, 7% beach, 29% forest, 6% wetland, 37% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 41% forest cover, 29% non-forest, 27% other natural vegetation, 2% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat Chinook salmon and Dolly Varden/bull trout. Coast resident cutthroat, steelhead trout, sockeye, chum salmon, pink salmon, Bald eagle, Harlequin duck, Roosevelt elk, and gray wolf. Wetlands – 89 acres (15% of reach); wetland habitat types include palustrine emergent, forested, scrub-shrub, and riverine upper perennial flat

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (37%), Agriculture (28%), Vacant (22%), and Residential (12%). Ownership – Private (97%) and Public (3%).

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (48%), Agricultural Resource Lands (40%), and remaining 12% is a mix of Long Term Commercial Forest and Industrial. Comprehensive Plan Designations – Rural (49%), Agricultural Resource Lands (41%), and Long Term Commercial Forest (10%). Existing SED – Conservancy (56%) and Rural (44%).

IMPERVIOUS SURFACES (MAP 16)

1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of pastureland and forest in the reach, with some rural residential development and a small treatment plant.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

PUBLIC ACCESS (MAP 14)

South Fork Skokomish River Reach 1 has no formal public access or park facilities.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Skokomish River Floodplain Acquisition & Restoration (10-02-007) (Habitat Work Schedule, 2011); Sponsor: Mason Conservation District-This proposal identifies properties in the Skokomish River floodplain that are being investigated for acquisition and implementation of site-specific habitat conservation and restoration practices.

KEY MANAGEMENT ISSUES

- Significant floodplain area and associated wetlands.
- Upstream sedimentation caused by mass wasting and landslides.
- Critical habitat for ESA listed Chinook salmon and Dolly Varden/bulltrout.

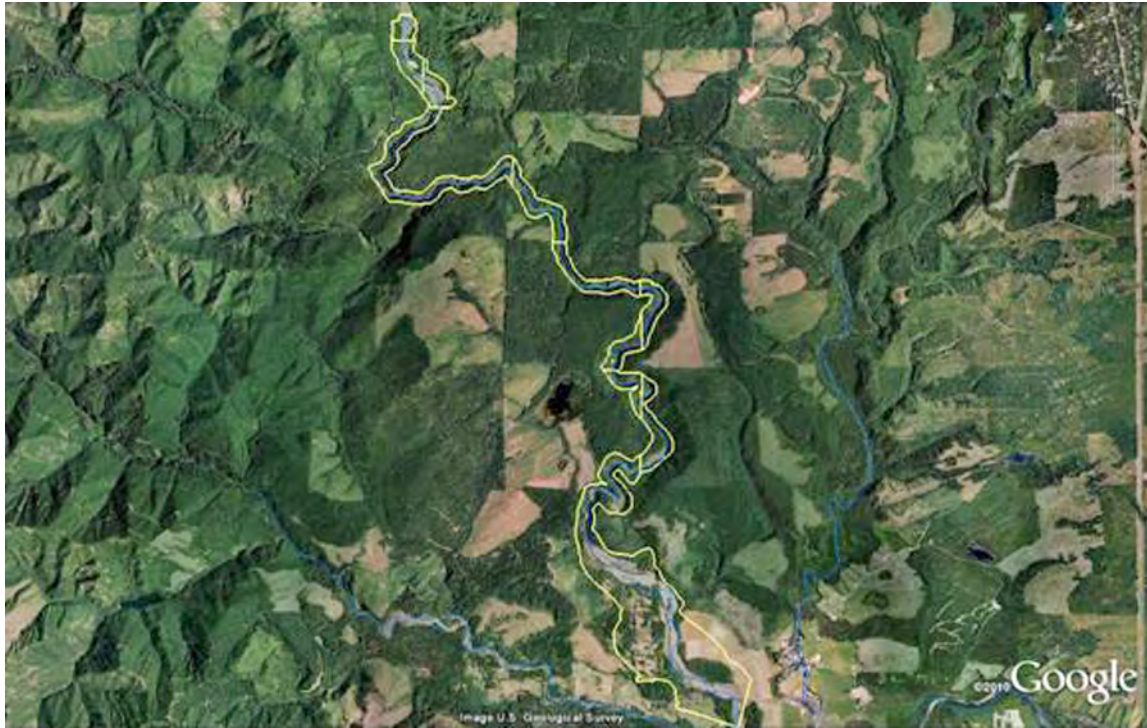
SOUTH FORK SKOKOMISH RIVER - REACH 02

SHORELINE LENGTH

10.8 MI

REACH AREA

1,157.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 69% (799 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain. 23% of the shoreline area is within the channel migration zone.

HAZARD AREAS (MAP 12)

15% erosion, 11% landslide

LAND COVER (MAP 15)

1% agriculture, 2% open water, 9% beach, 63% forest, 11% wetland, 13% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 49% forest cover, 15% non-forest, 29% other natural vegetation, 7% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat Chinook salmon and Dolly Varden/bull trout. Coast resident cutthroat, steelhead trout, chum salmon, pink salmon, rainbow trout, elk, gray wolf, Marbled murrelet, Harlequin duck, and northern spotted owl. Wetlands – 207 acres (18% of reach); wetland habitat types include palustrine emergent and scrub-shrub, and riverine upper perennial flat

WATER QUALITY (MAP 13)

303(d) listed for the temperature parameter, which requires the preparation of a TMDL to address water quality concerns for that parameter. .

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (46%), Residential (23%), Vacant (14%), and remaining 17% is a mix of Agriculture, Utilities, and Parks, Open Space, and Recreational Areas. Ownership – Private (73%) and Public (27%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2006 aerial imagery, a national forest road crosses the river. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – County: Long Term Commercial Forest (30%), Rural Residential 5 Acres (28%), and remaining 15% is a mix of Agricultural and Rural Residential 20 Acres. US Forest Service: 27% Olympic National Park. Comprehensive Plan Designations – County: Rural (33%), Long Term Commercial Forest (30%), and Agriculture Resources Lands (10%). US Forest Service: Olympic National Forest (27%). Existing SED – County: Conservancy (39%) and Natural (35%). US Forest Service: Conservancy (14%) and Natural (12%).

PUBLIC ACCESS (MAP 14)

S.F. Skokomish River Reach 02 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show forest in the upper part of the reach, with agriculture and rural residential development in the lower part.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

This reach includes the High Steel Bridge, which is a registered historic site. Resource probability mapping suggests there is a moderate-low to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Replant trees in degraded riparian zones.

KEY MANAGEMENT ISSUES

- Significant floodplain area.
- Sedimentation caused by mass wasting and landslides.
- Critical habitat for ESA listed Chinook salmon and Dolly Varden/bulltrout.

BROWN CREEK - REACH 02

SHORELINE LENGTH

0.6 MI

REACH AREA

31.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach.

HAZARD AREAS (MAP 12)

3% landslide

LAND COVER (MAP 15)

92% forest, 8% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 94% forest cover, 6% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Dolly Varden/bull trout. Coast resident cutthroat, rainbow trout, gray wolf, northern spotted owl. Wetlands: 1 acres of riverine upper perennial flat wetland (3% of reach)

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Tax Exempt. Ownership – 100% Public.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Rural Residential 20 Acres. Comprehensive Plan Designations – 100% Rural. Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

Brown Creek Reach 2 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 indicate that the reach is forested with a forestry road running parallel to the creek.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties.

OPPORTUNITY AREAS

Protect intact riparian areas where forested canopy exists.

KEY MANAGEMENT ISSUES

- Protection of critical habitat for ESA listed salmonids.
- Conservation of existing habitat for priority species.

WEST LAKE

SHORELINE PERIMETER

1.9 MI

WATERBODY AREA

56 AC

REACH AREA

83.6 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach

HAZARD AREAS (MAP 12)

No mapped hazard areas.

LAND COVER (MAP 15)

32% open water, 42% forest, 24% wetland, 2% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 32% forest cover, 12% other natural vegetation, 55% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

No documented priority salmonids. Western bluebird, gray wolf, and northern spotted owl. Wetland habitat includes 35 acres (71% of reach) of palustrine emergent and forested. The remainder 21 acres are considered open water.

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach. Large tracks of land surrounding the majority of the lake have been cleared within 70 to 300 feet of the open waters edge.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

West Lake has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested and wetland.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Protect associated wetland areas.

KEY MANAGEMENT ISSUES

- Restoration of degraded riparian zones.

VANCE CREEK - REACH 01

SHORELINE LENGTH

5.2 MI

REACH AREA

564.4 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 68% (384 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

14% erosion, 11% landslide

LAND COVER (MAP 15)

2% agriculture, 4% beach, 53% forest, 4% wetland, 37% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 58% forest cover, 20% non-forest, 20% other natural vegetation, water 2% (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Critical habitat: Chinook salmon and Dolly Varden/bull trout. Sculpin (riffle/reticulate), coho salmon, coast resident cutthroat, chum salmon, steelhead trout, pink salmon, sockeye, rainbow trout, Harlequin duck, and gray wolf.

Wetlands – 80 acres (14% of reach); wetland habitat types include palustrine emergent, forested and scrub-shrub, and riverine upper perennial flat

WATER QUALITY (MAP 13)

Not included on Ecology's 303 (d) list of impaired waters..

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Forestry (52%), Residential (28%), and remaining 20% is a mix of Agriculture and Vacant. Ownership –Private (75%) and Public (25%).

SHORELINE MODIFICATIONS (MAP 16)

According to 2006 aerial imagery, there are four road crossings: unnamed road, national forest road, and W. Skokomish Valley Rd (crosses creek twice). No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Rural Residential 5 Acres (54%) and Long Term Commercial Forest (46%). Comprehensive Plan Designations – Rural (54%) and Long Term Commercial Forest (46%). Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Vance Creek Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the upper part of the reach to be forested, with agricultural and rural residential development in the lower part.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

This reach includes the Vance Creek Bridge, which is a registered historic site. Resource probability mapping suggests there is a moderate to very high probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Conservation of existing habitats for priority fish and wildlife species.

KEY MANAGEMENT ISSUES

- Critical habitat for ESA listed Chinook salmon and Dolly Varden/bulltrout.

ARISTINE CREEK**SHORELINE LENGTH**

1.0 MI

REACH AREA

50.4 AC

**PHYSICAL AND ECOLOGICAL FEATURES****HYDROLOGY (MAPS 4, 10 AND 25)**

Floodplain - 4% (2 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

23% landslide

LAND COVER (MAP 15)

92% forest, 7% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 67% forest cover, 2% non-forest, 31% other natural vegetation (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Pink salmon, coho, coast resident cutthroat, winter steelhead, gray wolf, and northern spotted owl.
No wetlands are mapped in this reach.

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – 100% Forestry. Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

No shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – 100% Long Term Commercial Forest. Comprehensive Plan Designations – 100% Long Term Commercial Forest. Existing SED – not designated.

PUBLIC ACCESS (MAP 14)

Aristine Creek Reach 1 has no formal public access or park facilities.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the reach to be forested.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Restore degraded riparian areas.

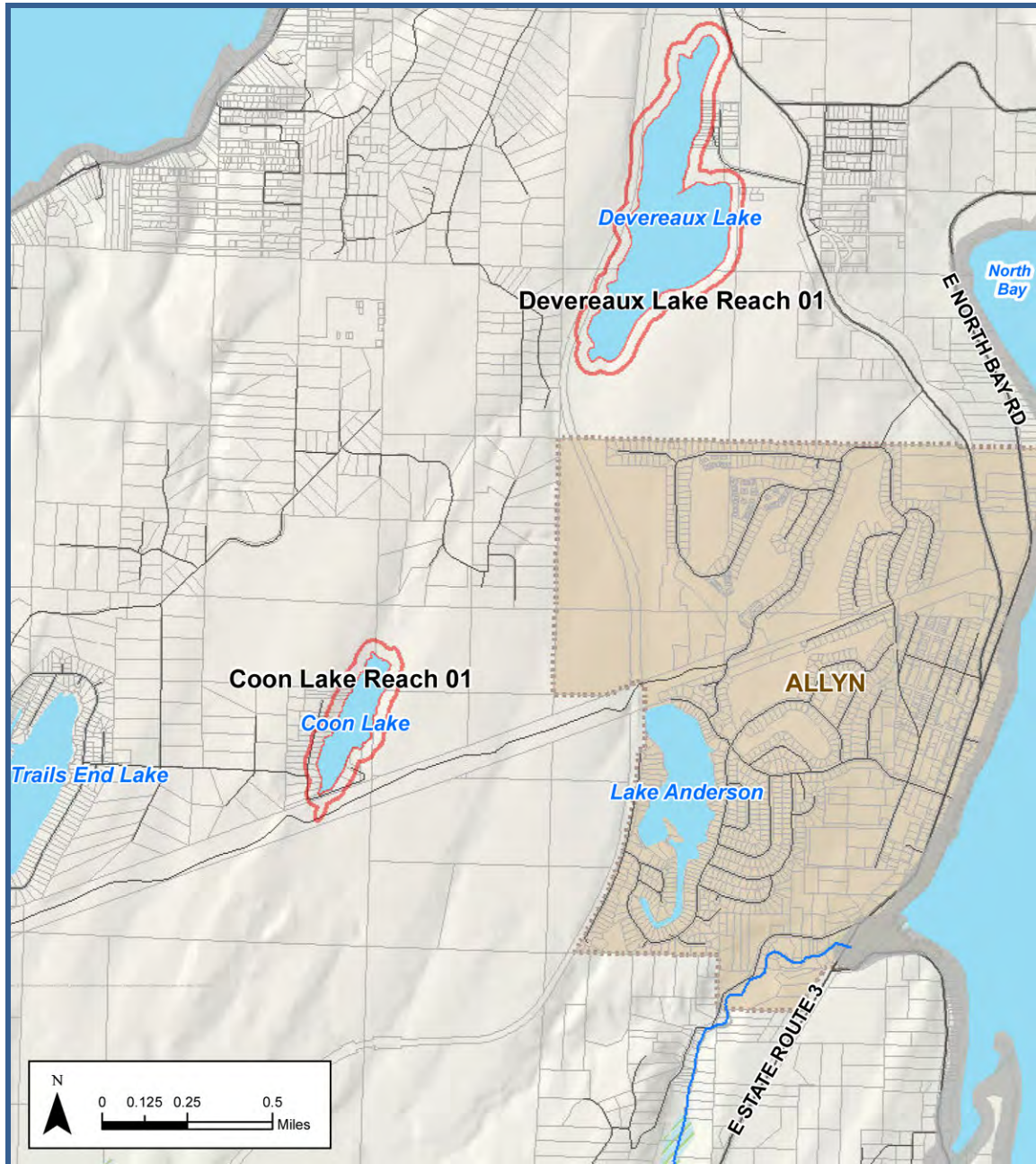
Decommission timber roads to reduce sedimentation.

Conserve existing habitat for priority species.

KEY MANAGEMENT ISSUES

- Timber harvest and logging roads causing downstream sedimentation.
- Conservation of existing habitat for priority species.

8.5 Devereaux Lake and Coon Lake



8.5.1 Physical Characterization and Modifications

Two lakes near Allyn, listed from north to south include Devereaux Lake and Coon Lake. Devereaux and Coon Lake cover an area of approximately 98 and 20 acres respectively. Coon Lake has a relatively small drainage area whereas a significant portion of the West Drainage Basin of the Allyn Urban Growth Area drains into Devereaux Lake (Otak, 2007).

The areas around Devereaux and Coon Lake have been modified by development to varying degrees. Some of the process modifications include:

- Land conversion from pervious to impervious surfaces:
 - o Overwater structures found along portions of the shoreline, primarily for recreational use
 - o Shoreline areas are mostly surrounded by trees and parks; and
- Logging adjacent to lakes.

8.5.2 Water Quality

Devereaux Lake and Coon Lake are not included on Ecology's 303 (d) list of impaired waters (Ecology, 2008). No other water quality assessments or aquatic plant management plans were identified for these lakes. Critical or Priority Habitat and Species

8.5.3 Critical or Priority Habitat and Species

Devereaux Lake

Coastal cutthroat trout have been identified as occurring in Devereaux Lake (Appendix B: WDFW, 2011). Approximately 2.3 acres of wetland have been mapped along the lake, representing 3.7 percent of the reach (Appendix B: NWI, 1989). A common loon priority species occurrence is mapped in the vicinity of the lake (Appendix B: WDFW, 2011). The DNR NHP has not identified priority plant species or vegetation communities within the Devereaux Lake shoreline planning area (DNR, 2009).

Coon Lake

No priority salmon or trout species have been documented in Coon Lake (Appendix B: WDFW, 2011). Approximately 2.8 acres of wetland is mapped along the shoreline of the lake. This area represents 10.0 percent of the reach (Appendix B: NWI, 1989).

No priority wildlife species occurrences have been mapped in the vicinity of the lake, and the DNR NHP has not identified priority plant species or vegetation (DNR, 2009).

8.5.4 Land Use

Devereaux Lake has a small residential community with docks/piers in the northern part of the lake. There is also a WDFW public boat launch (Mason County Parks and Recreation Department, 2008). Coon Lake has limited residential development with docks/piers and a small private marina. Most of Devereaux and Coon Lakes are classified by Mason County assessor's data as open space.

8.5.5 Summary of Key Management Issues

Key management issues related to Devereaux and Coon Lakes include: 1) overwater structures affecting in-water habitat for fish and aquatic life, 2) loss of riparian habitat, 3) balancing recreational uses with environmental stewardship, and 4) finding opportunities for public access.

8.5.6 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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DEVEREAUX LAKE

SHORELINE PERIMETER

2.6 MI

WATERBODY AREA

98.1 AC

REACH AREA

161.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 48% (30 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

5% landslide

LAND COVER (MAP 15)

46% open water, 4% beach, 44% forest, 1% wetland, 4% floodplain/riparian (Appendix B: GAP, 2009).

Riparian vegetation: 35% forest cover, 4% non-forest, 8% other natural vegetation, 53% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and common loon.

Wetland: Palustrine emergent wetland habitat accounts for 5 acres of (8% of reach). The remainder of the lake is open water.

WATER QUALITY (MAP 13):

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use - Parks, Open Space, and Recreation Areas (73%); Transportation (11%); Vacant (11%); and remaining 6% is a mix of Forestry and Residential. Ownership – 100% Private.

Girl Scout Camp St. Albans (414 acres) on eastern shore.

SHORELINE MODIFICATIONS (MAP 16)

9 docks/piers are located along the eastern shore, along with a public boat launch. No other shoreline modifications are mapped in the reach.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts –Rural Tourist (80%); Rural Residential 5 Acres (17%) and Rural Residential 10 Acres (3%). Comprehensive Plan Designations – 100% Rural.

Existing SED - Conservancy (94%) and Urban Residential (6%).

PUBLIC ACCESS (MAP 14)

The majority of the shoreline is recreational park owned by the Tacoma Girl Scouts. A WDFW boat launch provides access located near the middle of the eastern shore. The boat launch park area is about 1 acre (WDFW Lands, 2011; Mason County Department of Parks and Trails, 2006).

IMPERVIOUS SURFACES (MAP 16)

Less than 1% of the reach contains mapped impervious surfaces (NOAA CCAP 2006). Aerial photos from 2009 show a few single-family residences along the NE shoreline of the lake.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a low to moderate probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Work with Girl Scouts of Washington to identify restoration opportunities in Camp St. Alban.

KEY MANAGEMENT ISSUES

- Determine hydraulic connectivity to Lake Anderson and Lakeland Village and determine if Devereaux Lake drains to Hood Canal (WRIA 14b) and also North Bay (WRIA 14a).

COON LAKE

SHORELINE PERIMETER

1.0 MI

WATERBODY AREA

20.4 AC

REACH AREA

48.3 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - There is no mapped FEMA 1% annual chance floodplain for the reach

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas.

LAND COVER (MAP 15)

18% open water, 11% beach, 63 % forest, 9% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 39% forest cover, 9% non-forest, 11% other natural vegetation, 41% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

No documented priority salmon or trout species, or priority wildlife species.
3 acres of palustrine scrub-shrub wetland habitat are located around the lake (10% of reach).

WATER QUALITY (MAP 13)

Not included on Ecology's 303(d) list of impaired waters.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES AND OWNERSHIP (MAP 18)

Land Use – Parks, Open Space, and Recreation Areas (34%); Vacant (24%); Residential (23%); Forestry (13%); and Utilities (6%). Ownership – 100% Private.

SHORELINE MODIFICATIONS (MAP 16)

According to aerial imagery (2011), there are 6 docks/piers and 5 floating platforms. Of the docks, one is a small, private marina owned by the Church of Latter Day Saints. Approximately 230 linear feet of Crest Drive crosses at the southern end of the lake between associated wetland and open water. No other shoreline modifications are mapped.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22):

Zoning districts – County: Rural Residential 5 Acres (70%) and Rural Tourist (30%). Comprehensive Plan Designations – 100% Rural.
Existing SED – Not designated.

PUBLIC ACCESS (MAP 14):

The Church of Latter Day Saints owns the majority of the eastern shore along with the small marina and associated dock/pier and small boat access. There is no mapped public access to Coon Lake.

IMPERVIOUS SURFACES (MAP 16)

3% of the reach contains a low level of mapped impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show scattered single-family residences and roads, mainly along the south part of the lake shore.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-high to high probability of finding unknown artifacts within this reach,

OPPORTUNITY AREAS

Protect intact forested riparian areas.

KEY MANAGEMENT ISSUES

Protection of existing intact riparian zones.

8.6 Data Gaps

The inventory and characterization report relies on GIS data, review of aerial photographs, existing technical reports, existing map products, information from Mason County planning staff, the Joint Technical Advisory Committee (JTAC), and the Mason County Citizens Advisory Committee (CAC) as well as input from Mason County residents.

The following gaps in data or information were identified during this inventory and characterization of the Skokomish-Dosewallips (WRIA 16/14b) watershed:

- Wetland information is lacking (a county-wide wetland inventory has not been undertaken);
- Current quantifiable data on channel modifications; and
- Current data on shoreline modifications, such as linear feet of diking and armoring along rivers.

CHAPTER 9.

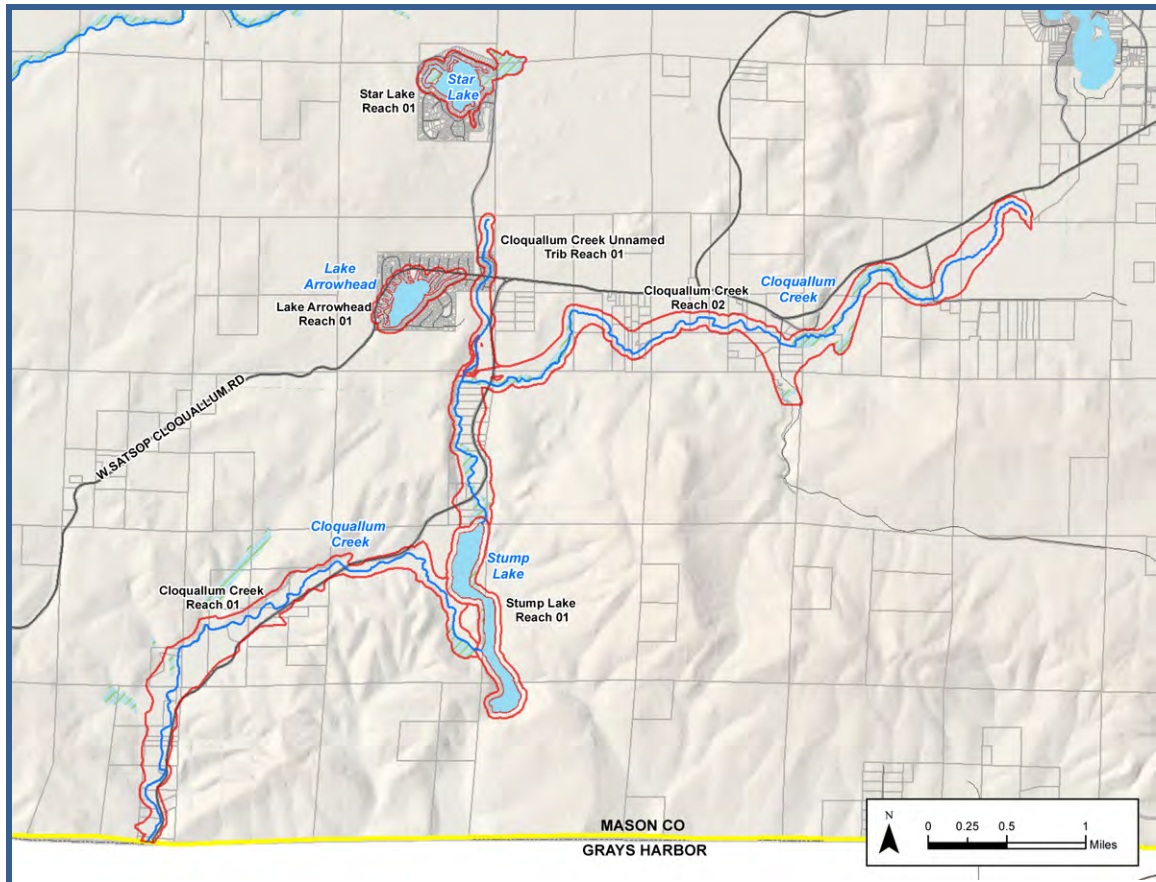
WRIA 22: LOWER CHEHALIS

Chapter 9 provides a discussion of the freshwater shoreline waterbodies located within the Mason County portion of the Lower Chehalis River Water Resource Inventory Area (WRIA) 22. See Map 1 (Appendix A) for the location of WRIA 22. This chapter covers four lakes, the Cloquallum River, East Fork Satsop River, Middle Fork Satsop River and the numerous tributaries flowing to each of these rivers that are considered to be shorelines of the state.

Waterbodies within this chapter are grouped based on drainage patterns and watersheds beginning with rivers and lakes to the east of the WRIA moving west. Within each section, the streams are generally ordered in geographic order moving from the river mouth upstream and the lakes from North to South.

After an overall description of the waterbodies, the reaches have been described in two-page reach sheets that provide a summary of data pertinent to each shoreline reach. Information displayed in the reach sheets is largely based upon GIS data taken from state and county sources. Data sources are described in Chapter 2 and listed in Appendix B. A Glossary of Terms is provided in Appendix C.

9.1 Cloquallum Creek and Tributaries (Star Lake, Arrowhead Lake, Stump Lake)



9.1.1 Physical Characterization and Modifications

Cloquallum Creek and its tributaries have a drainage area of about 70 square miles starting from the low hills of the southern Olympic mountains east of the Satsop River near the town of Elma (Smith and Wenger, 2001; Chehalis River Basin Plan, 2010). The main tributaries are Wildcat Creek and Rock Creek. Land use in the watershed is primarily rural residential in the lower Cloquallum Creek floodplain, with some small livestock pastures. Land use in the upper basin is private timberland management of second growth forest (Smith and Wenger, 2001). Much of the commercial forests have been previously harvest in this basin.

The three main tributary lakes to Cloquallum Creek are Stump, Star, and Arrowhead lakes. The creek flows through Stump Lake near RM 12. Star (aka Lystair) and Arrowhead (aka Simpson) lakes are located in a small drainage that enters Cloquallum Creek at RM 14 (Chehalis Basin Partnership, 2010). Stump Lake is undeveloped with some private logging activity. Star and Arrowhead lakes have been heavily developed for recreation and residential development (Smith and Wenger, 2001).

Cloquallum Creek, tributaries, and lakes have been altered by historic land uses and resource extraction. Some of the process modifications include:

- Logging practices in the upper watershed resulting in removal of trees from riparian areas and an increase in sedimentation from logging roads;
- Adjacent single-family rural residential development;
- Agricultural practices causing removal of native vegetation and use by livestock; and
- Conversion of pervious to impervious surfaces.

9.1.2 Water Quality

No data on water quality were available for Cloquallum Creek, Stump Lake, Arrowhead Lake, or Star Lake (Ecology, 2008a). These waterbodies have not been tested by Ecology as part of the 303(d) list testing in 2008. However, there is a TMDL for Wildcat Creek, a tributary to Cloquallum Creek. The TMDL for Wildcat is for ammonia, BOD (biological oxygen demand), and fecal coliform.

Simpson Northwest Timberlands are part of a temperature TMDL targeting long term commercial timber land in Mason, Thurston, and Grays Harbor counties (Ecology, 2000). Measures to restore stream water quality and maintain fish habitat

in these timberlands are being implemented to improve high stream temperatures and reduce sediment loading.

9.1.3 Critical or Priority Habitat and Species

The entire 20.2 mile length of the Cloquallum mainstem is low gradient and accessible to salmon (Smith and Wenger, 2001). Cloquallum Creek supports significant runs of chum, fall Chinook and coho Salmon. The lower 10 miles of the creek provide spawning habitat for Chinook and chum (Appendix B: WDFW, 2010). The majority of coho spawn in the upper reaches of the creek and its tributaries. Cloquallum also supports cutthroat trout and winter steelhead and the state sensitive species, Olympic mudminnow. Lakes in the subbasin are known to contain rainbow and Eastern brook trout.

Limiting factors for salmon in the Cloquallum River drainage are: fish passage barriers due to culverts under logging roads; degraded riparian habitats due to timber harvest and agriculture; and water quality and quantity issues (Chehalis Basin Partnership 2010).

9.1.4 Land Use

Land uses in the Cloquallum watershed are a mix of forestry, residential and vacant lands. Rural residential uses are located in the lower floodplain and private timber land in the upper watershed. The confluence of the Cloquallum River and the Chehalis River (in Grays Harbor County) has a high density of agricultural land uses. Commercial timber lands occur largely upstream of RM 7 on the Cloquallum River (Chehalis Basin Partnership 2010). Star Lake and Arrowhead Lake have been mostly developed with residential land uses. Stump Lake is mostly in forestry use.

9.1.5 Land Cover

Riparian areas are predominantly alder regrowth with sparse distribution of conifers because there were no forest practice guidelines for streamside buffers until the 1980s (Smith and Wenger, 2001). Land cover in the Cloquallum watershed is mostly mixed deciduous and coniferous forest. Land cover within the shoreline jurisdiction of Cloquallum River is a mix of closed canopy (53 percent), non-forested (19 percent) and other natural vegetation (19 percent) (Appendix B: PNPTC, 2011).

9.1.6 Summary of Key Management Issues

The key management issues for Cloquallum River subbasin include: restoration of degraded riparian areas, protection of significant salmonid habitats and species, protection of water quality, and use of best management practices in agricultural and commercial timber harvest activities.

9.1.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheets included below are based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

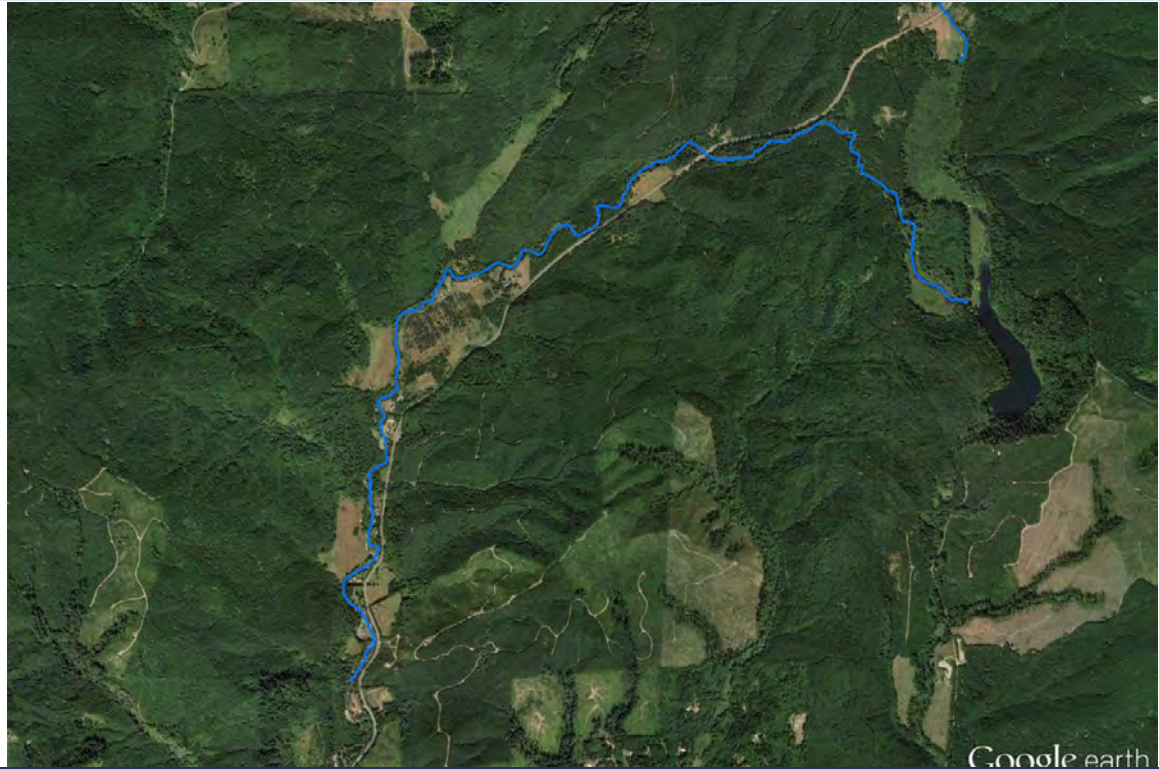
CLOQUALLUM CREEK - REACH 01

SHORELINE LENGTH

4.3 MI (FROM RM 9.6 TO RM 13.9)

REACH AREA

361.0 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 71% (255 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

3% Erosion.

LAND COVER (MAP 15)

20% agriculture, 40% forest, 40% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 50% forest cover, 26% non-forest, 23% other natural vegetation, 1% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

PHS data show priority habitat for coastal cutthroat trout, fall Chinook salmon, fall chum salmon, coho salmon, winter steelhead trout;

Wetland-14 acres (4% of the reach); wetland habitats include palustrine scrub-shrub and emergent

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES (MAP 18)

Land Use – Forestry (71%), Vacant (12%), remaining 17% is a mix of Residential; Transportation; Parks, Open Space, and Recreational Areas; and Agriculture.

SHORELINE MODIFICATIONS (MAP 16)

There are 8 road crossings ranging from the southwestern to northeastern portions of the reach, 6 along W Cloquallum Rd and 1 each at GD 3500 and GD 3620.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: County - Inholding Lands (58%) and Long Term Commercial Forest (42%).
Comprehensive Plan Designations - Inholding Lands (58%) and Long Term Commercial Forest (42%).
Existing SED: 100% Conservancy.

PUBLIC ACCESS (MAP 14)

No formal parks or public access.

IMPERVIOUS SURFACES (MAP 16)

3% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of agricultural land and forest in the reach, with some rural residential development and roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a very low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Public access opportunities could be provided at public road crossings.
Restore degraded riparian areas.

KEY MANAGEMENT ISSUES

- Use of best management practices in forestry and agricultural practices.
- Restoration of degraded riparian zones.

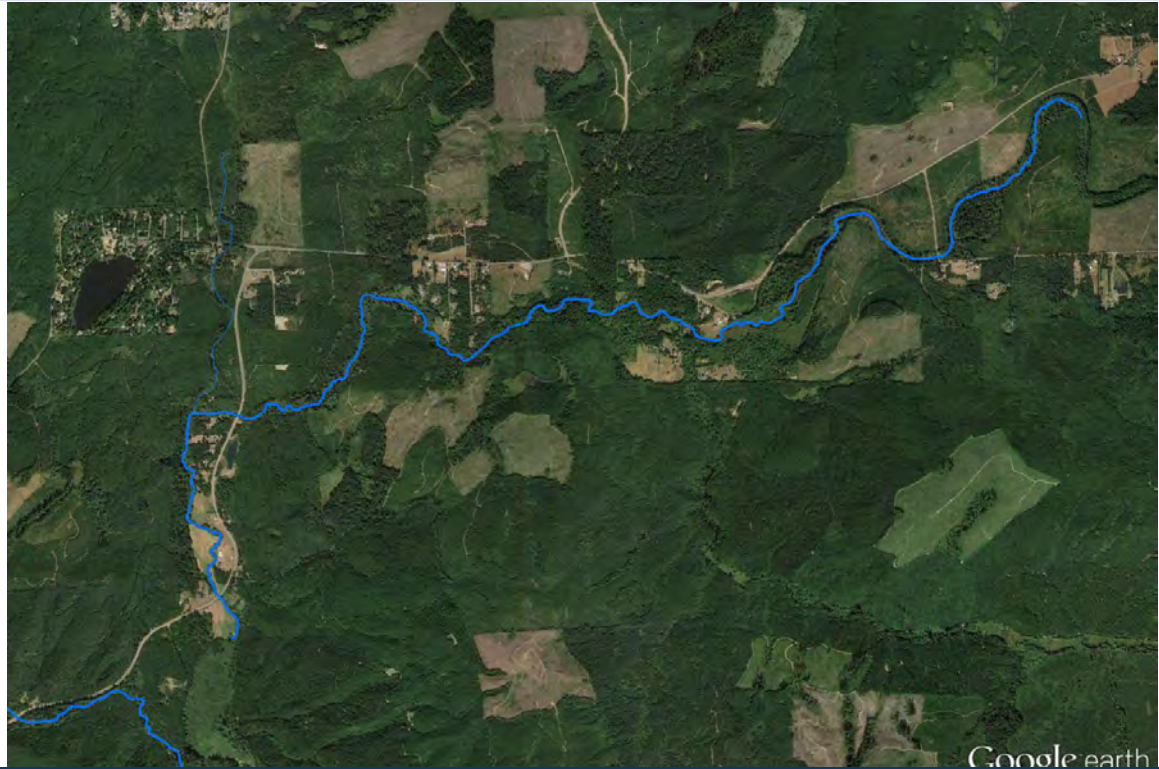
CLOQUALLUM CREEK - REACH 02

SHORELINE LENGTH

6.6 MI (FROM RM 15.0 TO RM 21.6)

REACH AREA

537AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 63% (337 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas.

LAND COVER (MAP 15)

7% agricultural, 32% forest, 2% wetland, 59% floodplain/riparian (Appendix B: GAP, 2009)
Riparian vegetation: 59% forest cover, 17% non-forest, 23% other natural vegetation, 2% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall chum salmon, coho salmon, winter steelhead trout, reticulate sculpin; wetland-114 acres (21% of the reach); wetland habitats include palustrine forested, scrub-shrub, and emergent

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES (MAP 18)

Land Use – Forestry (63%), Residential (18%), remaining 19% is a mix of Vacant; Agricultural; Parks, Open Space, and Recreation Areas; and Transportation.

SHORELINE MODIFICATIONS (MAP 16)

There are 2 road crossings in the eastern portion of the reach at W Cloquallum Truck Trail and W Bulb Farm Rd.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Long Term Commercial Forest (54%), Inholding Lands (42%), and Agricultural Resource Lands (4%). Comprehensive Plan Designations - Long Term Commercial Forest (54%), Inholding Lands (42%), and Agricultural Resource Lands (4%).

Existing SED – 100% Conservancy.

PUBLIC ACCESS (MAP 14)

Washington State DNR trails are mapped in the northwestern portion of the reach.

IMPERVIOUS SURFACES (MAP 16)

2% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of agricultural land and forest in the reach, with some rural residential development, wetland, and a road.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Public access opportunities could be provided at public road crossings.

Restore degraded riparian areas.

KEY MANAGEMENT ISSUES

- Use of best management practices in forestry and agricultural practices.
- Restoration of degraded riparian zones.

STUMP LAKE

SHORELINE PERIMETER

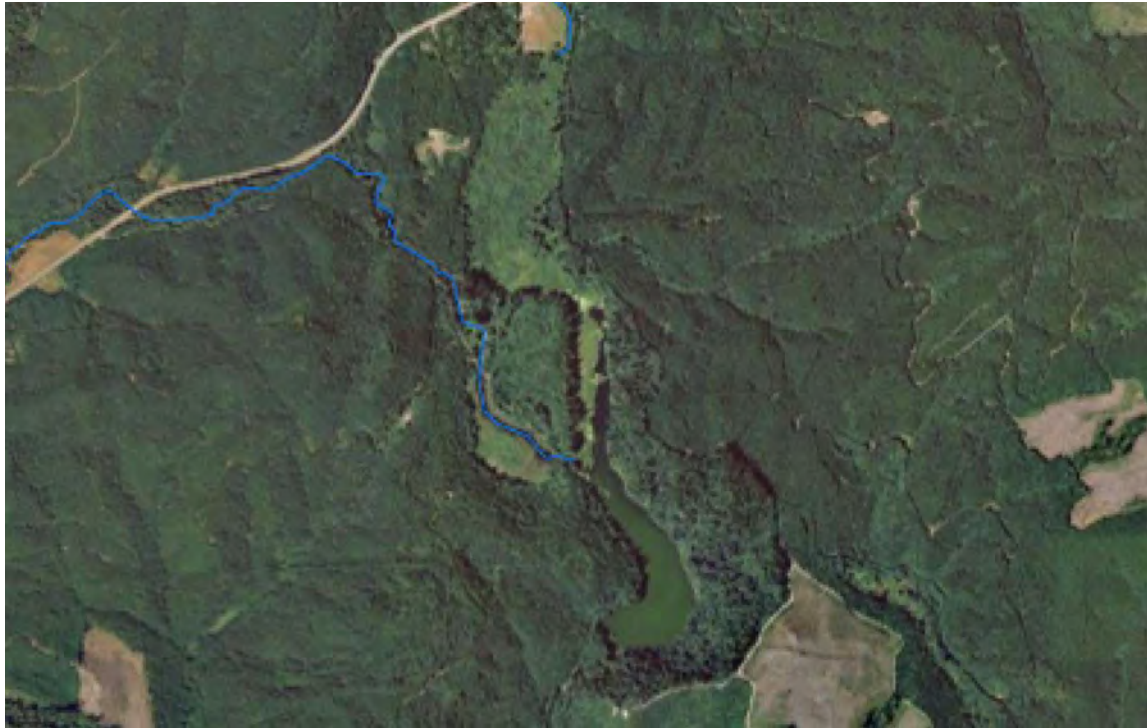
3.1 MI

WATERBODY AREA

30 AC

REACH AREA

151.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – 59% (45 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

26% Landslide.

LAND COVER (MAP 15)

10% open water, 39% forest, 4% wetland, 46% floodplain/riparian (Appendix B: GAP, 2009).
Riparian vegetation: 60% forest cover, 2% non-forest, 17% other natural vegetation, 20% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout, fall Chinook salmon, fall chum salmon, coho salmon, and winter steelhead trout. Wetland – 75 acres (20% of the reach); wetland habitats include palustrine forested, scrub-shrub, and emergent

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES (MAP 18)

Land Use – Forestry (63%), Residential (18%), remaining 19% is a mix of Vacant; Agricultural; Parks, Open Space, and Recreation Areas; and Transportation.

SHORELINE MODIFICATIONS (MAP 16)

Aerial imagery from 2011 shows Bush Creek Road intersecting wetland areas in the northwest and continuing south along the western shoreline; the road appears to cross a drainage at the southern end. All surrounding land is designated forested land.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Long Term Commercial Forest (98%) and Inholding Lands (2%). Comprehensive Plan Designations – Long Term Commercial Forest (98%) and Inholding Lands (2%). Existing SED – Natural (51%) and Conservancy (49%).

PUBLIC ACCESS (MAP 14)

A primitive dirt boat launch for hand-carried boats or boat launch with small trailer exists on the northwest side of the lake off Bush Creek Road.

IMPERVIOUS SURFACES (MAP 16)

No impervious surfaces are mapped in this reach (Appendix B: NOAA CCAP, 2006). Aerial photos from 2011 show the reach to be forested with forestry roads.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Public access opportunities could be improved at lake.
Restore degraded riparian areas.

KEY MANAGEMENT ISSUES

- Restoration of riparian zones.
- Protection of associated wetlands.

LAKE ARROWHEAD

SHORELINE PERIMETER

2.9 MI

WATERBODY AREA

34 AC

REACH AREA

89 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain - 50% (27 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

11% Landslide.

LAND COVER (MAP 15)

7% developed, 26% open water, 59% forest, 2% wetland, 6% floodplain/riparian (Appendix B: GAP, 2009) Riparian vegetation: 35% forest cover, 29% non-forest, 3% other natural vegetation, 33% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

No fish presence mapped; blunt-leaved pondweed. Wetland – 5 acres of palustrine forested habitat (9% of the reach) is mapped along the southwestern shoreline.

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES (MAP 18)

Land Use – Residential (31%), Vacant (29%), Transportation (25%), remaining 15% is a mix of Parks, Open Space, Recreation Areas, and Forestry.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerials, 13 docks/piers and 1 floating platform are located around the shoreline or on Lake Arrowhead. The entire shoreline consists of residential parcels; some parcels along the southeastern shoreline remain mostly undeveloped and forested.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Inholding Lands (96%) and Long Term Commercial Forest (4%). Comprehensive Plan Designations – Inholding Lands (96%) and Long Term Commercial Forest (4%). Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

There is no public access. Two designated park areas on the lake (several parcels each) are owned privately by the Lake Arrowhead Community Club. A community center with associated dock is located along the northern shoreline, and a boat launch with a dock and associated parking, is located along the southern shoreline.

IMPERVIOUS SURFACES (MAP 16)

20% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2011 show rural residential development and associated roads with some forest.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites. Lake Arrowhead Community Club
<http://www.lakearrowheadcommunityclub.com/>

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties.

OPPORTUNITY AREAS

Restore degraded riparian areas.

KEY MANAGEMENT ISSUES

- Issues with invasive aquatic vegetation; vegetation has been treated with herbicide.
- Restoration of degraded riparian areas.

STAR LAKE (LYSTAIR LAKE)

SHORELINE PERIMETER

2.1

WATERBODY AREA

40 AC

REACH AREA

103AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – 17% (11 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No hazard areas mapped.

LAND COVER (MAP 15)

10% agricultural, 29 open water, 13% forest, 19% wetland, 28% floodplain/riparian (Appendix B: GAP, 2009)

Riparian vegetation: 27% forest cover, 25% non-forest, 9% other natural vegetation, 39% water (Appendix B: PNPTC, 2011)

PRIORITY HABITATS AND SPECIES (MAP 8)

PHS data contains documented coho salmon. Wetland – 138 acres (22% of the reach); wetland habitats include lacustrine limnetic aquatic bed, palustrine forested and emergent. Vegetated wetland extends northward off northeastern end.

WATER QUALITY (MAP 13)

Not listed as a 303(d) impaired waterbody. Tests for lead exceeded health limits in 2005 and 2006; copper and nitrate were also detected <http://projects.nytimes.com/toxic-waters/contaminants/wa/mason/wa5383680-star-lake-community-club>

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES (MAP 18)

Land Use – Residential (40%), Forestry (29%), Vacant (25%), remaining 6% is a mix of Transportation, Parks, Open Space, and Recreation Areas.

SHORELINE MODIFICATIONS (MAP 16)

According to 2011 aerials, 35 docks/piers are shown along Star Lake. West Star Lake Drive and 2 dirt roads cross the associated wetland to the north. Former dredging of wetlands to create channels for boat access. Majority of shoreline is built residential parcels.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts – Inholding Lands (75%) and Long Term Commercial Forest (25%). Comprehensive Plan Designations – Inholding Lands (75%) and Long Term Commercial Forest (25%). Existing SED – 100% Urban Residential.

PUBLIC ACCESS (MAP 14)

1 undeveloped parcel with no listed owner in the southwest, contains a parking lot with dock and boat access. No formal parks or public access is mapped.

IMPERVIOUS SURFACES (MAP 16)

17% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show a mixture of rural residential and associated roads, wetland, and forest.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed facilities or contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

OPPORTUNITY AREAS

Consider opportunities to provide public or community access.

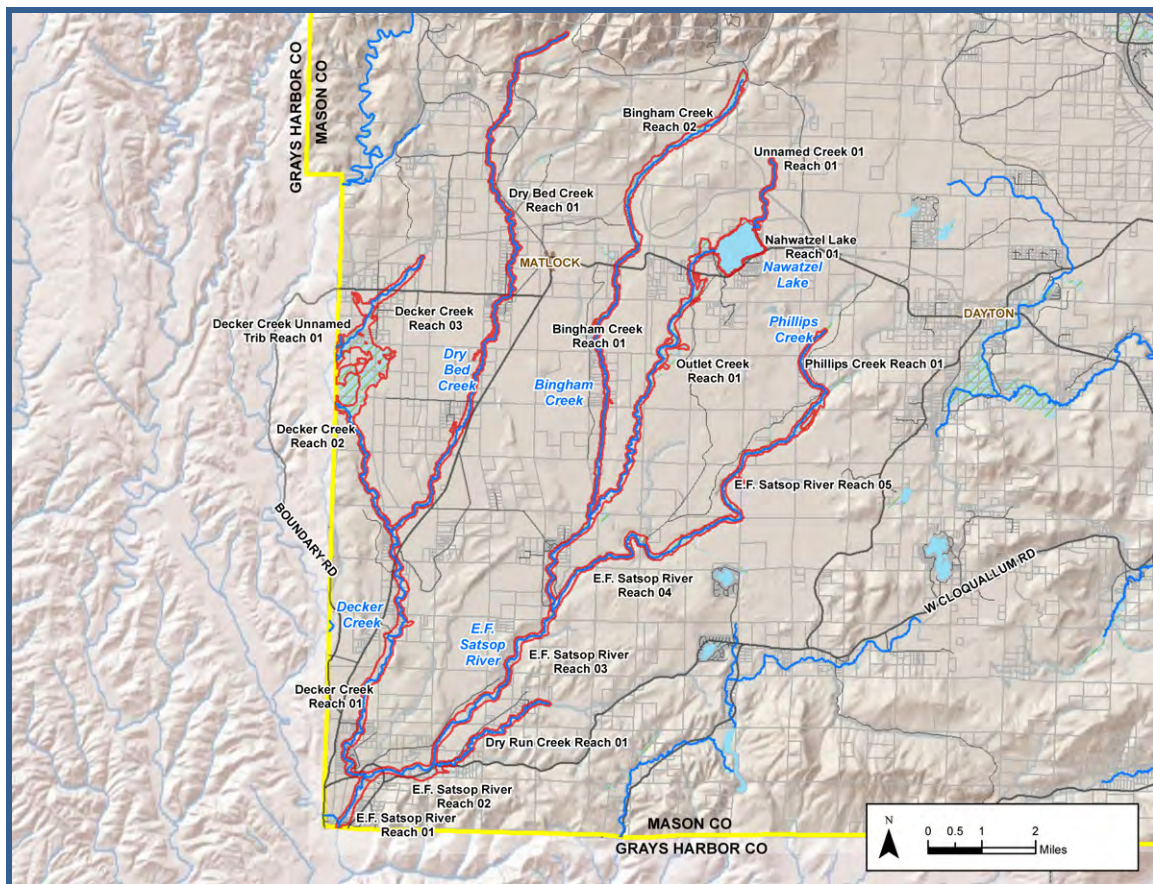
Restore forested wetlands where appropriate.

Encourage lake stewardship to protect water quality through use of best management practices.

KEY MANAGEMENT ISSUES

- Lack of public access to the shoreline.
- Improve tree cover along the shoreline.
- Protect associated wetlands.

9.2 East Fork Satsop River and Tributaries (East Fork, Dry Run Creek, Outlet Creek, Nahwatzel Lake, Unnamed Creek, Bingham Creek, Dry Bed Creek, Dry Creek, Decker Creek)



9.2.1 Physical Characterization and Modifications

The East Fork Satsop River flows from the southern hills of the Olympic Mountains and forms one of the major tributaries to the Satsop River. The East Fork is considered a continuation of the Satsop River mainstem (Smith and Wenger, 2001). The upper East Fork originates at the confluence of Stillwater and Phillips creeks.

The river has several major tributaries, such as Decker Creek, Dry Run Creek, and Bingham Creek (RM 17.4). The following table outlines the major lakes and tributaries to East Fork Satsop that are also considered shorelines of the state.

Table 9-1. Tributaries to East Fork Satsop River Meeting the Definition of Shorelines of the State

Name	Tributary to
Decker Creek	E Fork Satsop, Reach 1
Dry Bed Creek	Decker Creek
Decker Creek Unnamed Tributary	Decker Creek
Dry Run Creek	E Fork Satsop, Reach 2
Bingham Creek	E Fork Satsop, Reach 3
Outlet Creek	Bingham Creek
Nahwatzel Lake	Outlet Creek
Unnamed Creek	Nahwatzel
Phillips Creek	E Fork Satsop, Reach 3

Outlet Creek joins Bingham Creek at RM 2.2 and drains Nahwatzel Lake. The lake is about 269 acres and located 11 miles west of Shelton (Ecology, 2011a). Historically, screens were placed in Outlet Creek to keep trout in the lake for fishing. These screens prevented the use of the lake for rearing by coho and changed the flow of water in the vicinity. Recently, the screens were removed (Smith and Wenger, 2001). The East Fork Satsop River, including many of the tributaries, and lake have experienced a significant reduction in tree canopy within the 200 foot zone from the water's edge due to past logging and timber harvest. Despite this, natural off-channel wetland habitat is abundant in the East Fork Satsop (Owen, 1989). Historically, splash dams were located along the East Fork Satsop River.

The East Fork Satsop River, tributaries, and Nahwatzel Lake have been altered. Some of the process modifications include:

- Timber harvest within the riparian zone reducing tree cover;
- Construction and use of logging roads increasing sedimentation ;
- Culverts that block fish passage; and
- Splash dams or other alterations.

9.2.2 Water Quality

No recent water quality data exists for the East Fork Satsop River or its shoreline tributaries within Mason County (Ecology, 2008a). Unpublished data from the Olympic National Forest (submitted by Dale Hom on 15 January 2003) show elevated temperatures in the East Fork Satsop in August 2001. The East Fork Satsop River is not currently included on the 2008 303d list of impaired waters in Mason County likely due to lack of testing and monitoring.

Much of WRIA 22 in private timber ownership is the subject of a temperature TMDL (Cleland et al, 2000). This TMDL has been developed to address fisheries concerns on several tributaries of the lower Chehalis and includes waters located on land formerly owned by Simpson Timber Company (now Green Diamond). Excessive summer water temperatures in some of these streams reduce the quality of rearing habitat for coho salmon as well as for steelhead and cutthroat trout.

According to data collected in the 1990s, Nahwatzel Lake was considered to be oligotrophic (Ecology, 1997) and therefore would have had excellent water quality. No recent data was identified. No water quality data or assessments were identified for Star (Lystair) Lake, Simpson Lake, or Stump Lake. None of these lakes are included on Ecology's 303(d) list of impaired waters.

9.2.3 Critical or Priority Habitat and Species

The East Satsop River basin supports Fall Chinook, summer Chinook salmon, coho salmon, cutthroat trout, winter steelhead, chum salmon and bull trout (Appendix B: WDFW, 2010). Many of the tributaries to the East Fork Satsop, including Decker Creek, Dry Run Creek and Bingham, each support salmon populations. Bingham Creek is documented to provide spawning areas for chum, coho and coastal steelhead.

Stillwater Creek provides steelhead spawning and rearing habitat for a one mile section up and downstream of its confluence with Phillips Creek. East Fork Satsop

River has documented Chinook spawning and rearing habitat (Appendix B: WDFW, 2010).

Approximately 79% of the mainstem Satsop River riparian corridor is lacking vegetation or is dominated by hardwoods only (i.e., no conifers) (Chehalis Basin Partnership, 2010). This condition is attributed to past land use practices associated with agriculture and forestry, occurring both in Mason and Grays Harbor Counties. In addition, numerous road crossings have undersized culverts that do not allow for adequate fish passage (Mason Conservation District, 2004). These undersized structures inhibit the movement of streambed sediments downstream as well as block fish passage upstream.

9.2.4 Land Use

Land uses in the East Satsop River area are predominantly long term commercial forestry with some limited areas with rural residential. Green Diamond Resource Company is the primary landowner of the timber lands surrounding the East Satsop River subbasin. Most of the timber has been harvested in the last few decades and the remaining forest is 30 years old or younger. Nahwatzel Lake is partially developed with single-family residential structures on the east, southeast and southwestern shores. A recent rezone request by Green Diamond Resource Company has been submitted to rezone the northern half of the lake from LTCF to Rural Residential 5 (Brewer, June 2012). Most existing residential houses on Nahwatzel Lake have a private dock/pier. The shores of East Fork Satsop River and Decker Creek contain rural residential development near the confluence of these two streams.

Transportation corridors include the Decker Creek Bridge on Matlock-Brady Road. The Shelton-Matlock Road crosses Bingham Creek Reach 2 and Outlet Creek Reach 1. To the south, a bridge crosses over the East Fork Satsop River in Reach 2.

Schaefer State Park is located near the confluence of East Fork Satsop and Dry Run Creek in East Fork Satsop River Reach 02. Schaefer State Park is a 119-acre camping park on the Satsop River, in between Olympia and Ocean Park. The park provides abundant fishing for steelhead, cutthroat trout and salmon on the Satsop River. Wading and swimming are important recreational features (Washington State Parks, 2011). There is a public boat launch managed by WDFW that provides access to Nahwatzel Lake.

9.2.5 Land Cover

Land cover along East Fork Satsop River, Decker Creek and their tributaries is primarily second growth timber or clearcut. Forest cover and trees are generally

limited to narrow zones within the riparian area and clearcuts are observed outside of those set aside zones. Riparian areas in the NW Simpson ownership are managed under a 50 year Habitat Conservation Plan (Simpson Timber, 2000). A general conversion of coniferous forest to deciduous trees has been noted along Middle and East Fork Satsop Rivers due to historic logging practices. Very limited impervious surface is found in this basin. Land cover is mostly a mix of closed canopy (57 percent) and other natural vegetation (27 percent) (Appendix B: PNPTC, 2011).

9.2.6 Summary of Key Management Issues

Several key management issues are identified for East Fork Satsop River, its tributaries, and Decker Creek and tributaries:

- Lack of coniferous forest in riparian zones as a result of timber harvest and conversion to hardwoods.
- Significant instream habitat for priority salmonids.
- Sedimentation due to upstream culverts and logging roads.
- Control of invasive noxious weeds, primarily knotweed.

9.2.7 Reach Analysis

An analysis by freshwater reach is given in the following section. The reach sheet included below is based on the data sources provided in Chapter 2 and further described in Appendix D: Reach Sheet Guide.

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NAHWATZEL LAKE

SHORELINE PERIMETER

3.0 MI

WATERBODY AREA

280 AC

REACH AREA

361.7 AC



PHYSICAL AND ECOLOGICAL FEATURES

HYDROLOGY (MAPS 4, 10 AND 25)

Floodplain – 40% (32 acres) of the reach, excluding open water, is mapped as FEMA 1% annual chance floodplain

HAZARD AREAS (MAP 12)

No listed erosion or landslide areas.

LAND COVER (MAP 15)

2% developed, 75% open water, 18% forest, 4% wetland (Appendix B: GAP, 2009)
Riparian vegetation: 12% forest cover, 9% non-forest, 78% water (Appendix B: PNPTC, 2011).
Based upon 2011 aerial photographs, a band of forested habitat up to 200 feet wide is found on the northwestern and northern undeveloped shores.

PRIORITY HABITATS AND SPECIES (MAP 8)

Coastal cutthroat trout and coho salmon; purple martin; water lobelia. Wetland – 14 acres (17% of the reach); wetland habitats include palustrine forested and scrub-shrub. Open water accounts for 280 additional acres.

WATER QUALITY (MAP 13)

According to data collected in the 1990s Nahwatzel Lake was considered to be oligotrophic (Ecology 1997) and had excellent water quality. No more recent data was identified.

BUILT ENVIRONMENT AND LAND USE

EXISTING LAND USES (MAP 18)

Land Use – Residential (46%), Forestry (33%), Vacant (16%), and remaining 5% is a mix of aquaculture and transportation.

SHORELINE MODIFICATIONS (MAP 16)

There is 1 road crossing in the northeastern portion of the reach at W Nahwatzel Beach Dr. According to 2011 aerials, there are 106 docks/piers and 8 floating platforms associated with residences. Approximately 75 percent of the shoreline is surrounded by residential parcels; the rest is designated forest land.

ZONING AND COMPREHENSIVE PLAN DESIGNATIONS (MAPS 21 AND 22)

Zoning districts: Rural Residential 5 Acres (65%) and Long Term Commercial Forest (35%). Comprehensive Plan Designations – Rural (65%) and Long Term Commercial Forest (35%). Currently being considered for rezoning to RR 5. Existing SED: 100% Conservancy.

PUBLIC ACCESS (MAP 14)

There is a WDFW boat launch that provides access to Nahwatzel Lake from the eastern shore. The boat launch is a 12-foot wide launch off of W Shelton-Matlock Road (WDFW, 2011). A potential hiking trail through Green Diamond land along the northwestern shoreline has been identified by the County Regional Trail plan (Mason Co Parks, 2008).

IMPERVIOUS SURFACES (MAP 16)

2% of the reach is mapped as containing impervious surfaces (Appendix B: NOAA CCAP, 2006). Aerial photos from 2009 show the northwestern side of the lake as undeveloped forest and the remaining shoreline containing rural residential development.

AREAS OF SPECIAL INTEREST

According to the Ecology facilities/sites database, there are no listed contaminated sites.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are no listed cultural resources or state or federally listed historic properties. Resource mapping suggests there is a moderate-low probability of finding unknown artifacts within this reach.

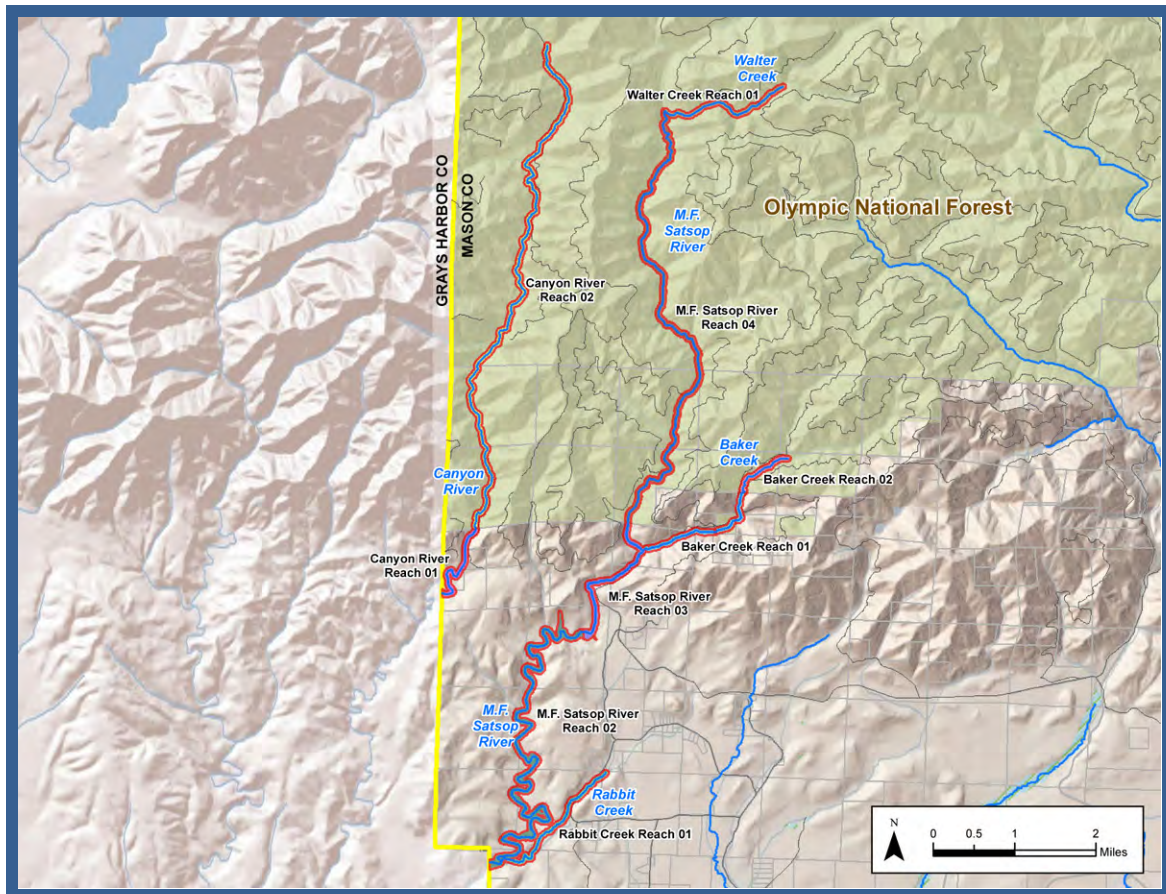
OPPORTUNITY AREAS

Preserve forested habitat in the northwestern and northern shore during residential development. Provide hiking trail and public access to the northwestern shore through trail development (Mason Co Parks, 2008)

KEY MANAGEMENT ISSUES

- Protection of existing habitat for coastal cutthroat trout and coho salmon.
- Protection of water quality during residential development.
- Limiting dock proliferation.

9.3 Middle Fork Satsop River and Tributaries (Rabbit Creek, Baker Creek, Walter Creek, Canyon River)



9.3.1 Physical Characterization and Modifications

The Middle Fork Satsop River flows from the foothills of the Olympic Mountains southerly through canyons and steep valleys from the confluence with Walter Creek (RM 30.2) to Baker Creek (RM 23.8). Downstream of Baker Creek, the surrounding land changes to valleys and prairies. The confluence of Middle Fork Satsop River with Rabbit Creek (RM 16.6) is located near the western boundary of Mason County. The Middle Fork Satsop River joins the East Fork Satsop River (RM 11), which is located approximately 5.6 miles downstream of Rabbit Creek. Canyon River joins the West Fork Satsop River at RM20. The West Fork and Middle Fork Satsop River flow into the Satsop River.

The Middle Fork Satsop River, Rabbit Creek, Baker Creek, Walter Creek, and Canyon River have been altered by historic land uses and roads. Some of the process modifications include:

- Splash dams changing flow patterns, increase channel instability, and channel incision; and
- Logging practices in the upper watershed resulting in removal of trees from riparian areas and an increase in sedimentation from logging roads.

9.3.2 Water Quality

No 303(d) data exists for the Middle Fork Satsop River and its tributaries. There is no water quality testing underway by Ecology in this area.

9.3.3 Critical or Priority Habitat and Species

The Middle Fork Satsop River contains numerous salmonid species listed as priority species by WDFW. These are Chinook salmon, steelhead, coastal resident cutthroat trout, and coho salmon. Healthy runs of fall Chinook salmon, coho and chum are recorded for the Middle Fork Satsop River (Chehalis Basin Partnership, 2010). Breeding areas for golden eagle are recorded for the Middle Fork Satsop River drainage in the upper watershed (WDFW, 2011). Western toad, a federal species of concern, is also recorded. Northern spotted owl have documented habitat in the forested areas.

9.3.4 Land Use

Land use is almost entirely in forestry. According to 2006 aerials, shoreline modifications are limited to one road crossing in Canyon River Reach 02, located in the National Forest. There are no parks or public access facilities. Green Diamond

Timber Resources is the primary landowner of the timber lands surrounding the Middle Fork Satsop River subbasin.

9.3.5 Land Cover

Land cover is mostly a mix of forest cover (71 percent) and other natural vegetation (22 percent) (Appendix B: PNPTC, 2011).

9.3.6 Summary of Key Management Issues

The key management issues in the Middle Fork Satsop River sub-basin include sedimentation from forest roads and upstream timber harvest, degradation of riparian zones, culverts that may block fish passage on minor tributaries, and significant instream habitat for priority salmonids.

9.4 Data Gaps

There are numerous data gaps for waterbodies within WRIA 22; these include:

- Water quality data and monitoring. Many of the rivers and lakes in WRIA 22 are not part of the Ecology 303(d) list and have not been tested;
- Habitats and fish passage. Less information is available regarding fish passage in these streams; and
- Instream flow data. Much of the data on the rivers in WRIA 22 in Mason County is collected by private timber industries and is not available to the public.

CHAPTER 10.

LAND USE ANALYSIS

State guidelines for SMP updates require that local jurisdictions analyze current and projected shoreline use patterns and trends and identify potential conflicts (WAC 173-26-2013)(d)(ii)). Previous chapters of this report characterize the following:

- Current shoreline land use patterns;
- Public access opportunities;
- Future land use as defined by the county’s comprehensive plan; and
- Characterization of shoreline ecological processes, functions, and opportunities for restoration.

The general policy goals of the SMA provide for protection of shoreline ecological functions while allowing for “all reasonable and appropriate uses.” The Act states:

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 90.58.020).

This chapter focuses on trends and projected demand for shoreline uses in Mason County and identifying potential use conflicts that might occur. Potential conflicts in this context are focused on competing objectives or planning priorities inherent in the overall SMA policy intent (e.g., preference for water-dependent uses, public access, and ecological protection and restoration). Potential conflicts may also occur through differences between SMA policy objectives and other interests or regulatory requirements affecting shoreline resources (e.g., levee vegetation maintenance vs. restoration of riparian vegetation).

The chapter begins with a brief summary of Mason County history, beginning with Native American settlement. This is intended to provide greater historical context to land use trends and projected demand.

10.1 History of Mason County

10.1.1 Native American Settlement and Historic Land Use

Mason County is within the territory of the Skokomish and Squaxin peoples. The Skokomish, also known as the Twana people, historically lived along the Hood Canal shorelines and along major rivers, including the Skokomish, and were unified across tribal villages by a common language and culture.

The Skokomish primarily subsisted on salmon harvested in Hood Canal's tributary rivers, including the Union River and Mission Creek. Fishing techniques included the use of fish traps and dipping nets, at which point fish were prepared for immediate fresh consumption or dried for winter consumption. Shellfish, including clams, crab, and oysters, were harvested from Hood Canal shorelines during summer months. Some hunting of terrestrial animals, as well as root, berry, and other plant resource collection, also occurred.

Structures of the Twana Culture (Elmendorf and Collins, 1974) provides an ethnographic history of the Skokomish Tribe's pre-contact and historical use throughout the Mason County area. The Skokomish lived in summer season hunting and fishing camps as smaller family units and gathered during winter months in larger family-based winter villages. The winter villages consisted of one or more larger plank houses, constructed of split Western red cedar. All Skokomish structures were of a cedar lodge construction style. Many camp sites along the lower and North Fork reaches of the Skokomish River are documented in *Structures of the Twana Culture* as well as several along the west shoreline of the Hood Canal. During summer months, these camp sites were formed for their proximity to migrating salmon and to other coastal and upland food resources.

The Skokomish signed the Treaty of Point-No-Point in 1855 along with several other area peoples. The U.S. government was eager to clear title to the lands for logging and Euro-American settlement purposes. As a result, the Skokomish moved out of many historic villages to reside within the Skokomish Reservation, located around the lower Skokomish River and extending along the Hood Canal shoreline north to the Potlatch Vicinity.

Adjoining the Skokomish people to the southeast were the Squaxin people, a group that predominantly inhabited the shorelines and rivers surrounding North Bay, Case Inlet, and other south Puget Sound shorelines within and outside of Mason County. The Squaxin lived in similar cedar plank lodges to the Skokomish, and also similarly subsisted on a combination of salmon, land mammals, some birds, and native edible

vegetation. The Squaxin, however, used a different dialect and had differing cultural customs.

The Squaxin signed the Medicine Creek Treaty in 1854. The treaty, signed along with the Nisqually and Puyallup Tribes, was the first of the Washington Territory, and ceded ancestral Squaxin Island lands to the U.S. government. As a result the Squaxin moved out of historic villages to reside within the Squaxin Island Reservation between Peale Passage and Squaxin Passage. Over time, individuals living on the reservation began leaving the island to move to surrounding areas in the vicinity of their original homes. By 1959, only four Squaxin Island tribal members remained on Squaxin Island, and today there are no full time residents on the island (Squaxin Island Tribe, 2011). Squaxin Island tribal headquarters have been established in Kamilche, a community approximately 5 miles south of Shelton along Highway 101. Significant portions of Kamilche and the surrounding area are part of the Squaxin Island Indian Reservation. The reservation area of Squaxin Island is actively used for fishing, hunting, camping, and other activities. Access to Squaxin Island is restricted to tribal members and others invited by tribal members (Squaxin Island Tribe, 2011).

10.1.2 Euro-American Settlement and Historic Land Use

The first non-native presence in Mason County occurred in 1792 when George Vancouver of the British Royal Navy explored and mapped Hood Canal. In the 1830s, fur traders built a camp where the Skokomish River empties into Hood Canal, the site that would later become Union City. In 1842, Lieutenant Charles Wilkes explored and mapped South Puget Sound as part of a U.S. exploring expedition (Wilma, 2006).

Americans settled the Puget Sound region beginning in the 1840s. Settlers arrived at Cota Valley in 1853 and opened a sawmill on Hammersley Inlet (Wilma, 2006). Settlement along Hood Canal did not occur until the 1850s, following the 1855 Treaty of Point-No-Point. The first settlers came to the area seeking to find fertile farmland, but quickly discovered that much of the area lacked ideal soil conditions for successful farming. The Skokomish Valley was used for limited agricultural activity at that time, with the earliest settlers arriving between 1859 and 1870. Successful agricultural activities in the area included the production of large hay crops, poultry and eggs. Throughout Mason County, the main industries were logging and, to a lesser extent, oyster farming.

The County was formed as Sawamish County in 1854 and was renamed Mason County in 1864. Shelton was founded in the Cota Valley in 1885 and became the county seat (center of the county government) in 1888. The timber industry

continued to grow and thrive in the County until the timber supply began to diminish in the 1930s. In 1946, the U.S. Forest Service signed an agreement with Simpson Mills to manage the forest as a single unit until the timber could be replenished.

Beginning in the 1920s, recreation became a major industry in the County as several resorts were established along Hood Canal. In 1964, a State Corrections facility opened and became a major employer in the County. The logging industry started to decline again in the early 1980s. The same decade saw an increase in jobs at the State Corrections facility and in the recreation industry. In the 1980s and 1990s, there was an increase in citizens who commuted from their homes in Mason County to jobs in Olympia and Tacoma (Wilma, 2006).

When oysters became a popular food item in Seattle and San Francisco, settlers in Mason County started harvesting shellfish at low tides. When Washington became a state, the legislature allowed purchase of tidelands. This allowed both harvesting and cultivation of oysters, including methods such as top floats and dikes (Wilma, 2006). By the early 20th century, oysters were in decline due to over-harvesting, industrial development, human occupation, and logging-related pollution. Oakland Bay oyster beds were particularly damaged by red liquor discharged by the Rainier Pulp mill (Wilma, 2006). Oakland Bay shellfish production stopped until the 1970s when Taylor Shellfish Incorporated repurchased the tidelands from the mill (Cascade Land Conservancy, 2010). Eventually, *Ostrea gigas* oysters were transplanted from Japan and came to dominate the market (Wilma, 2006). Manila Clam was also introduced accidentally into Puget Sound in the 1920s. Eventually, residents of Mason County began harvesting the Manila Clam, and the county is now the largest producer of Manila Clams in the nation (Cascade Land Conservancy, 2010).

In the 1980s, the Boldt Decision granted tribes sovereign rights to fish species, but the decision was not clear about shellfish. The tribes filed a federal lawsuit which was resolved in 2006, granting tribes rights to 50 percent of shellfish on state lands and unfarmed private lands (Cascade Land Conservancy, 2010).

Shellfish farming remains a very important industry in Mason County, and an annual celebration called Oyster-Fest, started in the 1980s, takes place at the Mason County fairgrounds in Shelton each year (Wilma, 2006).

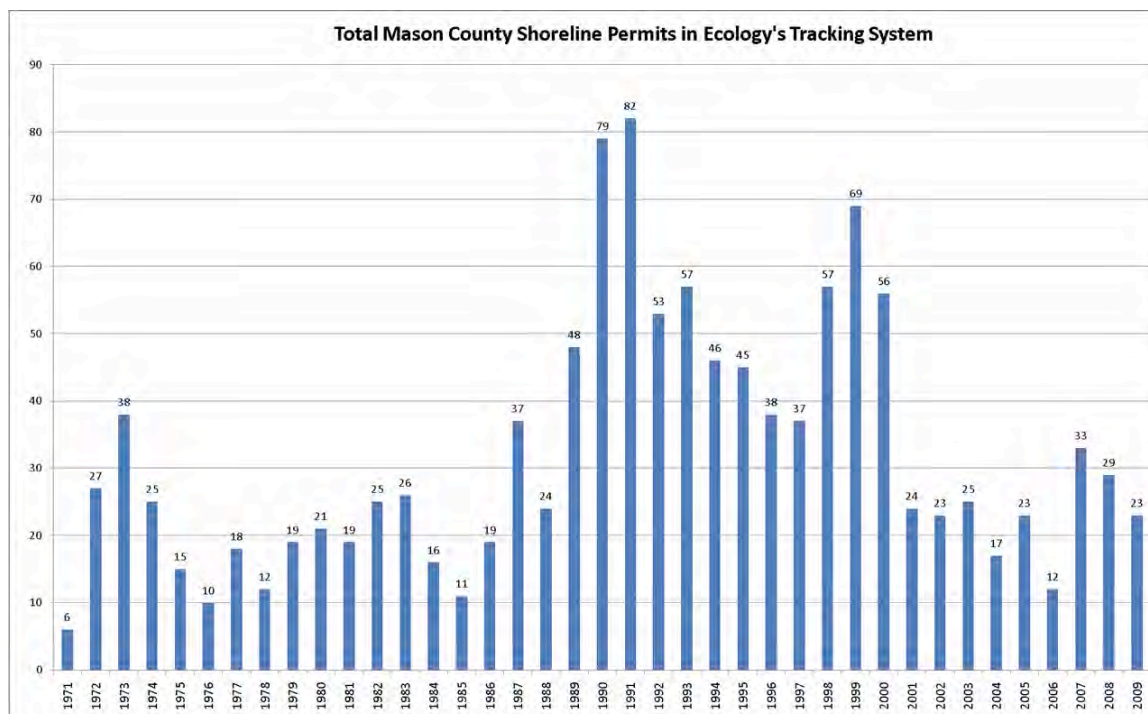
10.2 Trends and Future Demand

10.2.1 Shoreline Development and Trends

Permit History

The current Mason County Shoreline Master Program was adopted in 1975. Under the requirements of the current program, certain types of proposed development in the shoreline area must obtain a Shoreline Substantial Development Permit, Conditional Use Permit and/or a Shoreline Variance. Developments that are exempt from having to obtain Shoreline Substantial Development Permits include single-family developments, single-family docks/piers, and single-family bulkheads. The Washington State Department of Ecology (Ecology) has a permit-tracking database of shoreline permits the County has submitted to Ecology for review or approval. Figure 10-1 below illustrates the total amount of shoreline permits received by Ecology for each year between 1971 and 2009.

Figure 10-1. Mason County Shoreline Permits – Total Permits by Year

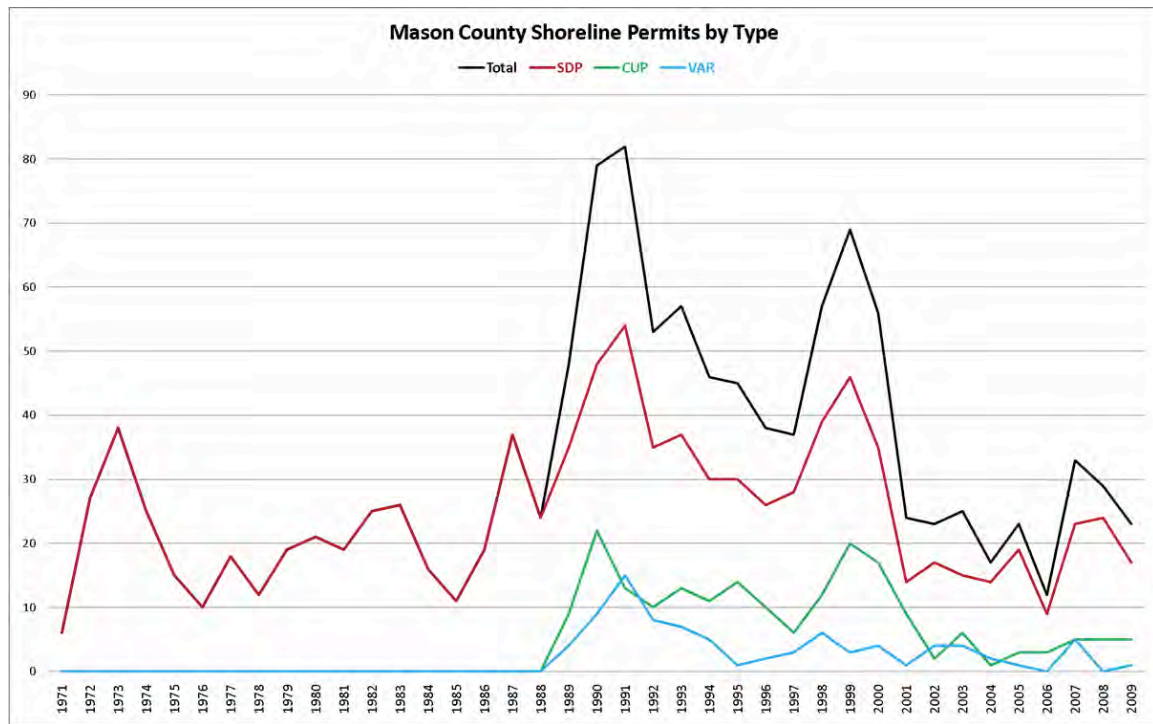


The total number of shoreline permits peaked in 1989 and 1990 with 82 permits submitted to Ecology. There was a gradual drop in permits until another peak in

permits occurred in 1999 with a total of 69 permits submitted. The number of permits has been on a gradual decline, on average, since the late '90s.

Figure 10-2 below also shows the number of permits submitted to Ecology by year but differentiates between the different types of shoreline permits.

Figure 10-2. Mason County Shoreline Permits – Permit Types by Year



Shoreline Substantial Development Permits (SDP) have historically been the most common type of shoreline permit requested for county approval. Conditional Use Permits (CUP) and Variances (VAR) are requested much less often and only began to be processed in the late 1980s. Recently, very few variances or CUPs have been sought, possibly because there are fewer construction projects due to the Great Recession.

Land Capacity Analysis

To determine future growth in the shoreline area, the 2003 shoreline guidelines suggest that the County's land capacity analysis be reviewed and documented. Mason County prepared a land capacity analysis as part of the 2005 Comprehensive Plan Update (Mason County, 2005). The analysis was based on parcel data and zoning districts and was used to determine the population potential should each parcel be developed to its fullest residential capacity, as allowed under the zoning district. Although the analysis was prepared more than five years ago and the

County's population has grown by 12.6 percent since 2005 - from 53,884 in 2005 to 60,699 in 2010, the analysis is the most readily available information (U.S. Census, 2011a and 2011b).

Table 10-1 shows the distribution of existing land uses within Mason County's rural areas according to the Mason County Assessor's data (December 2004). The table excludes parcel data from Allyn, Belfair, and Shelton urban growth areas.

Table 10-1. Mason County Rural Areas Land Use

Existing Land Use	Improved		Unimproved		Timber		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
Residential	27,700	89%	3,410	11%	0	0%	31,110	7%
Vacant	9,200	18%	41,524	81%	245	<1%	50,969	11%
Commercial	1,144	39%	1,801	61%	20	1%	2,965	1%
Industrial	121	86%	19	14%	0	0%	140	<1%
Agriculture/Aquaculture	8,716	93%	660	7%	0	0%	9,376	2%
Forestry	1,870	1%	8,931	6%	128,346	92%	139,147	31%
Long Term Commercial Forest	710	0%	46,507	23%	152,373	76%	199,590	45%
Mineral Extraction	103	77%	30	23%	0	0%	133	<1%
Transportation	1,385	87%	200	13%	0	0%	1,585	<1%
Utilities	161	8%	1,773	92%	1	<1%	1,935	<1%
Tax Exempt	2,893	29%	7,107	71%	4	<1%	10,004	2%
Total	54,003	12%	71,962	16%	280,989	63%	446,954	100%

Note: Percentages in table have been derived based on acreage values shown in Table IV.3-7 of the 2005 Mason County Comprehensive Plan.

The land use categories listed in Table 10-1 above are described in more detail in the Mason County Comprehensive Plan (2005) and summarized briefly below:

1. Residential – properties that have any type of dwelling unit except those with an improvement value of less than \$20,000.
2. Vacant – properties that have been determined to be vacant by the Mason County Assessor and properties with an improvement value of less than \$20,000.
3. Commercial – properties used for wholesale and retail trade, service industries, health care providers, warehouses, and privately owned open space and recreation facilities.

4. Forestry – properties in open space forest lands, classified forests, designated forest lands, forest-related activities, and Christmas tree farms.
5. Long Term Commercial Forests – lands designated as Long Term Commercial Forests under Mason County’s Resource Ordinance (Ordinance number 77-93).
6. Mineral Extraction – properties that are associated with mining activities and services.
7. Transportation – all parcels related to transportation uses including railroads, rights-of-way, motor vehicle transportation, aircraft runways and parking lots.
8. Utilities – parcels used for utility-related purposes including communications, electrical, natural gas, and sewage related uses.
9. Tax Exempt – parcels used for public purposes including government, civic, schools, and publicly owned recreation uses.

The columns in Table 10-1 show the total number of acres by land use category and distinguishes between improved, unimproved and timber (forested) properties for each category. The percentages associated with the improved, unimproved and timber columns are based on the total acreage for each land use category. The percentages in the far right column (Total) are taken from the total acreage of all land use categories combined.

Once the County determined the existing distribution of land uses in the rural areas, the zoning classification for each parcel was established. The purpose of this step was to illustrate what the land use was currently being used for (e.g., transportation, forestry) and what its potential residential use was based on its zoning. For example, if a property has an existing land use code of vacant and is located within a Rural Commercial zoning district which allows one dwelling unit per acre, the vacant parcel could have at least one dwelling unit built on it, resulting in the addition of at least 2.54 new residents (2.5 is the approximate number of people that may occupy a dwelling unit as specified by the U.S. Census). Table 10-2 below summarizes the analysis conducted for each of the land use categories based on the zoning district (not shown).

Table 10-2. Rural Land Capacity Summary

Existing Land Use	# of Parcels	# of Existing Dwelling Units (DU)	# of Potential Additional DU¹	Total DU (existing DU + potential additional DU)	# of Additional Residents (2.5 people x potential additional DU)	Total Estimated Maximum Population (2.5 people x total DU)
Residential	18,809	18,787	543	19,340	1,358	48,350
Vacant	18,932	0	20,789	20,789	51,973	51,973
Commercial	356	0	481	481	1,203	1,203
Industrial	20	0	7	7	18	18
Aqua/Agriculture	905	0	2,523	2,523	6,308	6,308
Forestry	2,395	0	9,964	9,964	24,910	24,910
Mineral Extraction	8	0	3	3	8	8
Transportation	391	0	460	460	1,151	1,151
Utilities	219	0	358	358	895	895
Totals	42,035	18,797	35,128	53,925	87,823	134,815
Totals w/Clustering*			37,176	55,973	92,943	139,935

Note: Table values are based on Table IV.3-7A in the 2005 Mason County Comprehensive Plan.

¹Calculated based on zoning district density or lot size allowance.

*Clustering allows certain land uses to increase the number of potential residences located on one parcel provided the development meets specific criteria in the County Code.

According to the County's analysis in 2005, rural lands had the capacity to potentially absorb an additional 37,176 dwelling units, or approximately 92,943 people. This would be in addition to the estimated population existing at the time of the analysis (2005) of 53,884 (U.S. Census Bureau, 2011b). In other words, county rural lands had the capacity to absorb about 1.7 times the current population. However, this estimate does not take into account lands that are not suitable for residential development, such as those with wetlands or other critical areas, or area needed for supporting infrastructure, such as roadway networks and stormwater facilities.

Existing land uses were categorized as part of this Inventory and Characterization Report using 2010 Mason County Assessor's data. The land use categories developed for this report are not identical to the ones that Mason County developed for the land capacity analysis. For example, Mason County differentiated between Long Term Commercial Forest and Forestry land uses but for the purposes of this Inventory, the two categories have been collapsed as one. The difference between the two land use categories is that Long Term Commercial Forest lands have a 100-year commitment to forestry while Forestry land uses can be converted to non-

forestry land uses at any time. Also, Parks, Recreation and Open Space is a single land use category for this Inventory but not in the land capacity analysis. Examining existing land uses in the shoreline areas in light of the land capacity analysis is useful at a qualitative level to view trends in development anticipated for the shoreline.

Figure 10-3 below illustrates the existing major land uses within Mason County's freshwater shoreline areas (excluding Allyn, Belfair and Shelton UGAs and U.S. Forest Service lands) based on the Inventory and Characterization Report analysis:

Figure 10-3. Major Land Uses in Freshwater Shoreline Areas (Rural Lands)

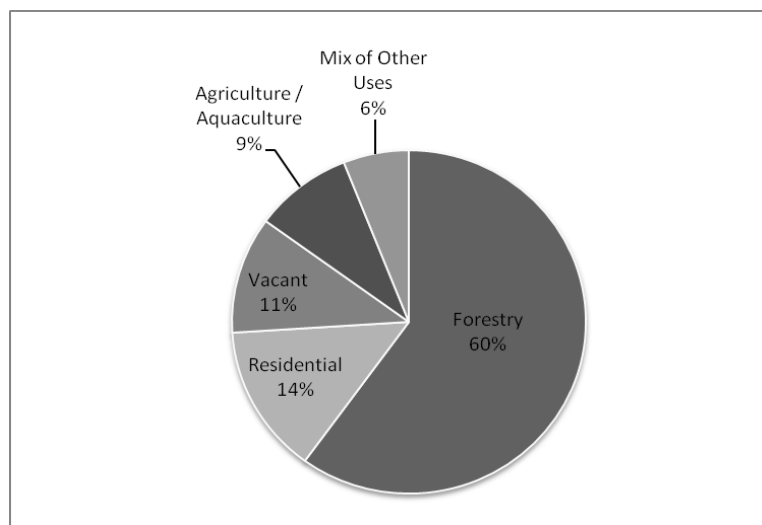
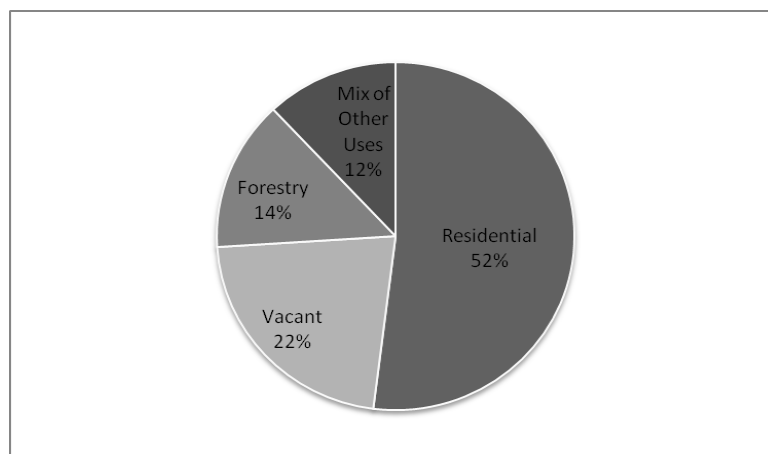


Figure 10-4 below illustrates existing major land uses within Mason County's marine shoreline areas (excluding Allyn, Belfair and Shelton UGAs and U.S. Forest Service lands) based on the Inventory and Characterization Report analysis:

Figure 10-4. Major Land Uses in Marine Shoreline Areas (Rural Lands)



According to the land capacity analysis, the vast majority of additional dwelling units would occur on lands classified as vacant. It can therefore be deduced that residential land capacity is generally higher in the marine shorelines than in the freshwater shorelines in Mason County, especially since many of the freshwater shorelines are designated forest resource lands (and therefore unavailable for residential development) or already developed and not vacant. Development that does occur in freshwater shorelines would more likely take place around lakes than along rivers, based on the historical residential development pattern and the prevalence of floodplain areas along rivers. Lakes also provide private recreational opportunities that would serve to attract additional single-family residential development. Currently, 26 percent of lake shorelines are in residential use and 11 percent of river shorelines are in residential use.

Mason County also conducted a land capacity analysis for Belfair, Allyn and Shelton UGAs. Table 10-3 shows the distribution of existing land uses within the urban growth areas according to the Mason County Assessor's data (December 2004). Land uses within Shelton's city limits are not included in the table below.

Table 10-3. Belfair, Allyn and Shelton UGA Land Use

Land Use	Belfair UGA	Allyn UGA	Shelton UGA
Residential	19%	34%	22%
Vacant	22%	26%	16%
Commercial	8%	12%	5%
Industrial	0%	0%	8%
Agriculture/Aquaculture	1%	11%	1%
Forestry	41%	10%	27%
Mineral Extraction	0%	0%	0%
Transportation	2%	5%	13%
Utilities	3%	2%	1%
Tax Exempt	3%	1%	7%
Total	100%	100%	100%

Note: Percentages in table have been derived based on acreage values shown in Tables IV.3-4, IV.3-5, and IV.3-6 of the 2005 Mason County Comprehensive Plan.

The land capacity analysis for the UGAs in Mason County was conducted in a similar manner as that for the rural lands, except that the acres shown to be available for development were reduced to accommodate an assumed percentage of roadway, market demand and, in the case of Shelton's UGA, critical areas. The assumed percentages varied by UGA.

Table 10-4. Belfair, Allyn and Shelton UGAs Land Capacity Summary

UGAs	Developable Area	Number of DU	Estimated Additional Population
Belfair	510	2,250	5,620
Allyn	270	1,060	2,240
Shelton	1,050	2,380	5,950
Total	1,830	5,690	13,810

Note: Table values are derived from Tables IV.3-4A, IV.3-5A, and IV.3-6A of the 2005 Mason County Comprehensive Plan.

According to the County's 2005 analysis, the UGAs have the capacity to absorb 5,690 additional dwelling units, or approximately 13,810 people. This is in addition to the rural land's capacity to absorb 37,176 dwelling units, or approximately 92,943 people bringing the total amount of land capacity to 42,863 dwelling units, or 106,751 people (Mason County, 2005).

The Mason County Comprehensive Plan relied upon the Medium Series (or mid-range) projection provided at the time by the Office of Financial Management to plan for projected population estimates. OFM estimated that the total population for Mason County would be 64,007 by the year 2015 and 75,088 by 2025. The 2010 population according to the U.S. Census Bureau in Mason County is 60,699 (U.S. Census, 2011a).

Based on the land uses analysis prepared for the Inventory and Characterization Report (2010 Mason County Assessor's data), Figure 10-5 illustrates the majority of existing land uses in the freshwater shoreline areas of Belfair, Allyn and Shelton UGAs. Freshwater shoreline in Belfair, Allyn and Shelton UGAs is equal to about 8 linear miles, most of which is located in Shelton.

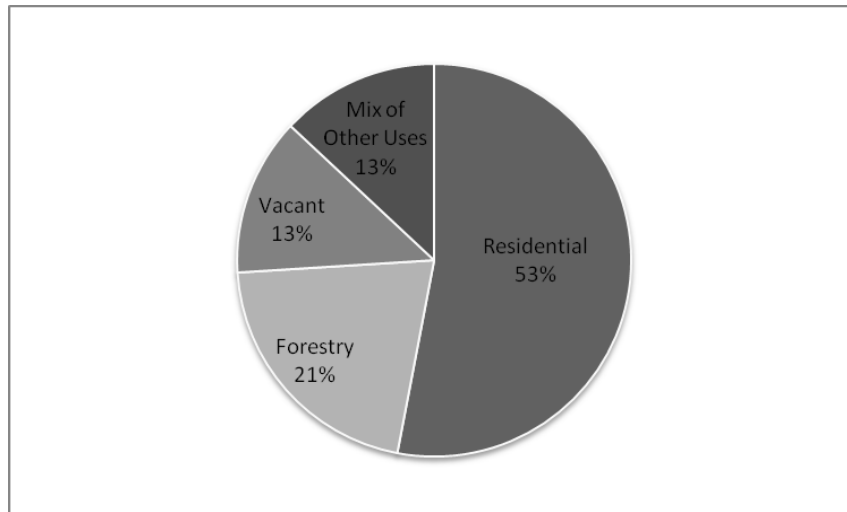
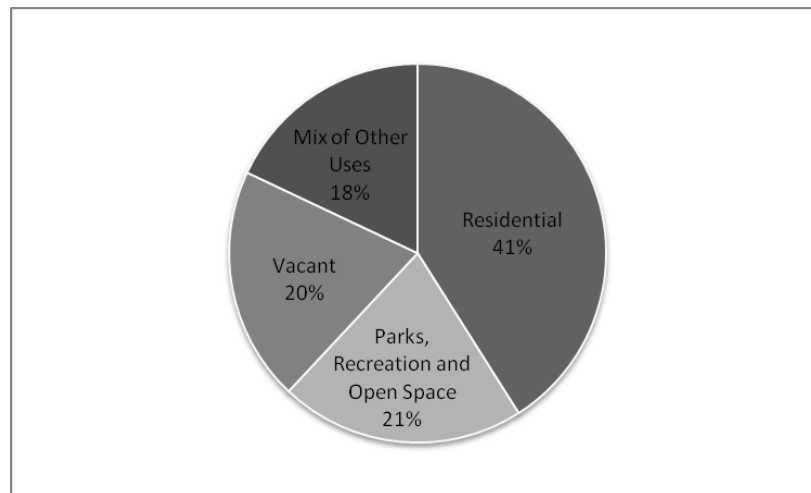
Figure 10-5. Major Land Uses in Freshwater Shoreline Areas (UGAs)

Figure 10-6 illustrates the majority of existing land uses in the marine shoreline areas of Allyn and Shelton UGAs (Belfair UGA limits are not adjacent to the marine shoreline) based on the Inventory and Characterization Report analysis. Marine shoreline in Allyn and Shelton UGAs is equal to about 2 linear miles, most of which is located along Allyn.

Figure 10-6. Major Land Uses in Marine Shoreline Areas (UGAs)

It is not clear from the land capacity analysis documented in the Mason County Comprehensive Plan which land use category in the UGAs would have the largest capacity to absorb additional dwelling units since the analysis was organized by zoning district. However, it is likely that the vacant lands would have the most potential to absorb new development.

Population Growth and Wastewater Treatment Facilities

Existing wastewater treatment facilities in Mason County are predominately comprised of individual treatment systems such as septic tanks and drainfields.

The County owns and operates small sewer systems for the Rustlewood and Beard's Cove communities. There is no planned expansion beyond the existing platted lots. These systems currently provide services to approximately 1,200 customers, with the potential to serve an additional 100. The County also operates a medium-sized wastewater collection system and treatment plant for the North Bay Case Inlet area. This area was defined based on studies that revealed the areas contributing human sewage contamination to Case Inlet. The North Bay Case Inlet system provides service to approximately 950 customers, with additional capacity to serve an estimated 850 additional equivalent residential units within the existing service area (Mason County, 2005).

A Membrane BioReactor plant completed in July, 2012 will treat sewage from more developed areas of the Belfair UGA to Class A reclaimed status (water that meets State Class A Reclaimed Water criteria per state standards, as established under the Reclaimed Water Act). Future sewer extensions and plant upgrades are expected to provide service to the entire Belfair UGA by 2025 (Mason County Wastewater, 2011).

Centralized sewer systems are defined as an urban service under the Growth Management Act, and are not allowed outside urban growth areas unless they are necessary to protect public health and the environment. To address water quality problems, Mason County, along with partners including the Skokomish Tribe and Washington State Parks, are in various stages of planning and building wastewater treatment plants for Hoodspout, Potlatch, and the densest part of the Skokomish Indian Reservation. Finding economically viable solutions for wastewater treatment in these and other unincorporated but relatively densely populated rural communities has been an ongoing challenge in Mason County (Mason County, 2005).

Since 2007, the Squaxin Island Tribe has used a biomembrane bioreactor to place the entire Squaxin Island Indian Reservation at Kamilche on 100% water reclamation. The region's first small membrane bioreactor wastewater reclamation plant treats 150,000 gallons of water per day. The plant receives wastewater from the Squaxin Island Tribe's government campus, the Little Creek Casino and Resort, and a residential area on a nearby hillside. The wastewater plant treats the effluent and transports it as Class A reuse water into an irrigation reservoir with a capacity of 23 million gallons. Water from the reservoir is available for several uses including

irrigation for the resort's Salish Cliffs Golf Course, regional fire suppression, and as reuse water on the resort property (Green Media, 2008).

Impervious Surface Buildout in Hood Canal

In 2008, the Hood Canal Coordinating Council (HCCC) conducted an impervious buildout analysis that quantified the amount of additional impervious surface that could potentially be built as allowed by the applicable zoning district. The study area for the analysis is equivalent to the summer chum evolutionarily significant unit (ESU), outlined in bold black in the figure below (Figure 10-7). The study area was split into smaller basin-sized polygons so that information could be grouped into hydrographically relevant zones (PetersonGIS, 2009). The southern portion of the study area is located in Mason County.

Figure 10-7. HCCC Study Area



The HCCC conducted this analysis at a parcel level. Current land use, housing density (if any), future land use (based on existing land use, parcel size, and zone) and zoning allowances and restrictions were considered when assigning each parcel an appropriate buildout impervious surface amount. The approximate amount of impervious surface associated with a land use group (both current and future) comes from an average of impervious surfaces within all parcels of that land use group. Residential, commercial and industrial land uses were all quantified using this approach (PetersonGIS, 2006; Hood Canal Coordinating Council, 2011). The intent of the data is to be used at the basin or riparian scale and compared across a broad region (Hood Canal Coordinating Council, 2011).

In order to evaluate the findings of the impervious surface buildout study relative to the Mason County shoreline planning areas, Tables 10-5 through 10-8 below were developed to show buildout impervious values within the shoreline planning areas of freshwater and marine shorelines. The tables are organized by WRIA and marine waterbodies. Shorelines planning areas that were included in the buildout study are listed in alphabetical order under each corresponding WRIA. The impervious surface categories (0-5%, 5-10%, 10-25%, and 25%-52%) refer to the potential amount a property would be developed with impervious surfaces. The percentages listed for each shoreline area are based on the amount of properties that would potentially develop according to each category.

Table 10-5. WRIA 14b Impervious Surface Buildout Potential by Shoreline Area

WRIA 14 - Kennedy-Goldsborough Shoreline Areas	Impervious Surface Categories			
	0 to 5%	5 to 10%	10 to 25%	25 to 52%
Coon Lake	40%	60%	0%	0%
Devereaux Lake	4%	32%	1%	62%
Trails End Lake	41%	1%	45%	14%

Under a full buildout scenario, Devereaux Lake would have the highest percentage of impervious surface coverage. Sixty-two (62) percent of the properties in the lake's shoreline planning area would be developed with 25 to 52 percent impervious material. About 40 percent of Coon Lake and Trails End Lake would be developed with minimal amounts of impervious surface coverage (0-5 percent).

Table 10-6. WRIA 15 Impervious Surface Buildout Potential by Shoreline Area

WRIA 15 - Tahuya Peninsula	Impervious Surface Categories			
	0 to 5%	5 to 10%	10 to 25%	25 to 52%
Blacksmith Lake	74%	4%	22%	0%
Dewatto River	95%	3%	0%	2%
Erdman Lake	54%	23%	23%	0%
Goat Ranch Lake	100%	0%	0%	0%
Haven Lake	62%	1%	21%	17%
Lake Bennettsen	68%	0%	0%	32%
Lake Wooten	67%	2%	27%	4%
Maggie Lake	43%	6%	30%	22%
Mission Creek	47%	22%	24%	7%

WRIA 15 - Tahuya Peninsula	Impervious Surface Categories			
	0 to 5%	5 to 10%	10 to 25%	25 to 52%
Panther Lake	83%	0%	17%	0%
Rendsland Creek	63%	36%	1%	0%
Section One Pond	100%	0%	0%	0%
Tahuya River	58%	34%	7%	1%
Tee Lake	48%	10%	39%	3%
Tiger Lake	71%	2%	25%	3%
Twin Lakes	100%	0%	0%	0%
Union River	31%	43%	23%	3%
Unnamed Lake - Elfendahl Pass	92%	0%	0%	8%

The majority of shoreline planning areas located in WRIA 15 is likely to have minimal impervious surface development, under the full buildout scenario. All of Goat Ranch Lake, Section One Pond, and Twin Lakes would be developed with 0 to 5 percent of impervious surfaces. Most of the remaining shoreline planning areas would be similarly developed for more than half of the shoreline properties. More intensely developed properties are likely to occur along Haven Lake, Lake Bennettsen, and Maggie Lake.

Table 10-7. WRIA 16 Impervious Surface Buildout Potential by Shoreline Area

WRIA 16 - Skokomish-Dosewallips Shoreline Areas	Impervious Surface Categories			
	0 to 5%	5 to 10%	10 to 25%	25 to 52%
Aristine Creek	100%	0%	0%	0%
Big Creek	89%	11%	0%	0%
Frigid Creek	100%	0%	0%	0%
Hamma Hamma River	95%	5%	0%	0%
Jefferson Creek	100%	0%	0%	0%
Lake Cushman	89%	5%	4%	1%
Lake Kokanee	77%	2%	9%	11%
Lilliwaup Creek	97%	0%	2%	1%
Lilliwaup Swamp	100%	0%	0%	0%
McTaggart Creek	100%	0%	0%	0%
Melbourne Lake	96%	4%	0%	0%
N. F. Skokomish River	99%	0%	0%	1%
Price Lake	100%	0%	0%	0%
Price Lake Outlet	100%	0%	0%	0%
S.F. Skokomish River	53%	39%	6%	1%
Skokomish River	70%	22%	4%	3%
Vance Creek	52%	45%	2%	1%
Waketick Creek	98%	1%	0%	1%

Shoreline properties along the majority of waterbodies in WRIA 16 are likely to be developed with 0 to 5 percent impervious surface, under the full buildout scenario. South Fork Skokomish River, Skokomish River and Vance Creek would have some properties developed with 5 to 10 percent impervious surfaces. Of all the shoreline planning areas studied in WRIA 16, Lake Kokanee has the highest amount of properties that would develop with 25 to 52 percent impervious materials.

Table 10-8. Impervious Surface Buildout Potential in Hood Canal Shoreline Areas

Hood Canal Marine Reach	Impervious Surface Categories			
	0 to 5%	5 to 10%	10 to 25%	25 to 52%
Marine Reach 01	44.5%	23.6%	20.8%	11.2%
Marine Reach 02	55.7%	24.7%	14.3%	5.3%
Marine Reach 03	46.2%	12.4%	12.0%	29.4%
Marine Reach 04	34.0%	22.5%	17.3%	26.3%
Marine Reach 05	42.1%	11.1%	16.1%	30.8%
Marine Reach 06	99.6%	0.4%	0.0%	0.0%
Marine Reach 07	28.6%	19.0%	33.3%	19.1%
Marine Reach 08	27.5%	13.6%	43.7%	15.2%
Marine Reach 09	51.0%	28.1%	12.7%	8.2%
Marine Reach 10	24.1%	23.7%	38.6%	13.6%
Marine Reach 11	51.3%	18.8%	19.9%	10.0%
Marine Reach 12	56.1%	22.5%	14.4%	7.0%
Marine Reach 13	63.3%	31.2%	5.5%	0.1%

Under a full buildout scenario, Marine Reaches 3, 4 and 5 (generally between Hamma Hamma River stream mouth and Hoodspout) would have the highest percentage of impervious surface coverage. The remaining marine reaches would have a variety of developed properties, ranging between 0 and 52 percent impervious. Marine Reach 6 (near Skokomish Tribe Reservation) would have the least amount of impervious surface.

Water-use Demand at Buildout and Stream Flow Impacts

In 2009, Aspect Consulting prepared a report titled *River and Stream Impairment Analysis, WRIA 16 and 14b, Skokomish-Dosewallips Planning Area* that estimates the potential consumptive water use in WRIA 16 and 14b under a full buildout scenario. Similar to the HCCC analysis, the buildout analysis documented in this report is based on the assumption that properties would fully develop as allowed under the existing zoning districts. Full buildout water use for WRIA 16 and 14b is estimated at approximately 12,500 acres-feet/year (afy). Total current (2008) water withdrawals in the WRIA 16/14b study area is estimated to be at 2,300 afy. Irrigation withdrawals is estimated at about 280 afy or 12 percent of the total.

The report also evaluated stream impairment as a result of increased water use under the full buildout scenario. Six subbasins in WRIA 16 and 14b were examined

to determine the potential impact of full buildout on streams and stream habitat. The following are the findings for subbasins within Mason County:

1. **Hamma Hamma Subbasin:** Total withdrawals in the Hamma Hamma subbasin are estimated to increase from 184 afy for 2008 to 1,400 afy at full buildout. At greater than a seven fold increase, this is the largest increase in water use from 2008 to full buildout on a percentage basis for the study area subbasins. Shoreline waterbodies that are ranked with a high potential for overall stream impairment are Waketickeh Creek, the lower Hamma Hamma River, and Johns Creek.
2. **Finch/Lilliwaup Subbasin:** Total groundwater withdrawals for 2008 in Finch/Lilliwaup subbasin are estimated to increase from 334 afy to 1,465 afy at full buildout. Lower Lilliwaup is the only shoreline waterbody in the subbasin that is ranked with a high potential for overall stream impairment.
3. **Skokomish Subbasin:** Total withdrawals in the Skokomish subbasin for 2008 are estimated at 835 afy with an increase to 5,400 afy at full buildout. The increase is the greatest projected water use increase for any of the subbasins and is a result of the large amounts of agriculturally zoned land. Shoreline waterbodies that are ranked with a high potential for overall stream impairment are Vance Creek and the lower Skokomish River.
4. **South Shore:** Total 2008 withdrawals for the South Shore subbasin are estimated at 574 afy and will likely increase to 2,673 afy at full buildout. This is the second greatest projected water use increase of the study area subbasins. All streams in the subbasin were ranked with a high potential for stream impairment. None of the streams within the South Shore area are shorelines of the state, although several shoreline lakes (i.e., Devereaux, Coon and Trails End) serve as the headwaters for a few of the streams.

The following figure (Figure 10-8) shows the subbasin and county boundaries.

Figure 10-8. Study Area Map



Source: Aspect Consulting, 2009

10.2.2 Demand for Water-dependent Uses

The demand for water-dependent uses in Mason County includes recreation and public access, marina developments, ferries and ferry landings, port facilities and other industrial water-dependent uses, and aquaculture, primarily commercial shellfish.

There are many water-dependent or water-oriented recreation sites in Mason County that currently provide use and public access to the shoreline. Mason County, Mason County ports, Washington State Parks, and Washington State Department of Natural Resources manage parks, campsites, boat launches, and trails that provide public access to shorelines. Public boat launch facilities managed by the Washington Department of Fish and Wildlife provide access to numerous lakes. The Squaxin Island Tribe provides a public boat launch site in the marine environment. Further, the US Forest Service provides campgrounds and public access to rivers in the Olympic National Forest. In addition to public recreation sites, there are many private docks and piers associated with residential development on lakes and portions of the marine shoreline. Private marinas are generally limited in number but can be found in the marine environment.

Many of the small inlets and bays within the marine waters of Mason County are likely too shallow to support development as new public or private marinas. The inlets and bays in Mason County do not appear to provide water depths necessary to accommodate larger boats and be considered viable for marina development. Shallow bays are found in Hood Canal, Case Inlet, Harstine Island, Oakland Bay, Totten Inlet and areas in South Puget Sound. Therefore, the bathymetry (water depth) of Mason County marine shorelines plays a role in limiting the potential location of new marinas or ferry facilities. Water-dependent transportation facilities are limited to bridges that connect islands to the mainland. There are no ferry terminal facilities in Mason County.

There are very few water-dependent industrial and commercial uses in the county (see aquaculture discussion below). John's Prairie Industrial Park is a major industrial center located on Port of Shelton property near John's Creek in Shelton's UGA. The industrial park hosts a variety of tenants, none of which are water-dependent or water-related. Mason County has 6 port districts (Port of Allyn, Port of Dewatto, Port of Grapeview, Port of Hoodspout, Port of Shelton, and Port of Tahuya). Other than Shelton, ports in the County are small and manage recreational facilities such as boat launches and docks.

Cargo activity is prevalent in Hammersley Inlet in association with Shelton's Harbor. Although the City of Shelton is not included as part of this report, cargo activity occurs in marine waters outside Shelton city limits. In 2009, 468,289 short tons

(2,000 pounds equal one short ton) of domestic shipments occurred along the Hammersley Inlet waterway. In addition, 7,742 short tons of domestic shipments were received. The shipments were composed of wood chips, rough wood, and sand and gravel. There were 470 total trips made, 231 upbound and 239 downbound. Most trips were made with self-propelled towboats and non-self propelled dry cargo vessels (U.S. Army Corps of Engineers, 2009).

The Port of Allyn has established primary goals for the Port that relates to increasing water-dependent recreational development and water-related commercial businesses (Port of Allyn, 2011):

1. **Goal 2: Saltwater Access & Harbor Improvements.** Objective: Acquisition of salt water access on Hood Canal and Case Inlet to improve recreational and tourist opportunities - Build kayak 'take outs' and other such structures to improve and increase non-motorized water craft activity.
2. **Goal 5: Tourism.** Objectives: Increase opportunities for public access to saltwater throughout the Port District; Seek opportunities for small and/or seasonal businesses that support waterfront activities to locate in Allyn.

Mason County also has numerous commercial aquaculture sites in the marine environment. Shellfish harvesting has been a significant resource in the County. Large cultivators include Taylor Shellfish, an international shellfish wholesaler that has been operating in South Puget Sound for over 100 years (Cascade Land Conservancy, 2010). Taylor Shellfish is ranked as the 3rd highest private employer in the County, employing approximately 400 people (Mason County Journal, 2008). Taylor Shellfish harvests a wide variety of shellfish, including oysters, clams and geoducks. There are a number of other smaller shellfish growers that also harvest a variety of shellfish. The Skokomish Tribe and Squaxin Island Tribe also have aquaculture facilities. See Map 27 for a generalized depiction of commercial and tribal shellfish locations. There are 14 shellfish growers that are leasing lands from the Department of Natural Resources. The shellfish being harvested by these growers include: mussels, oysters, and clams. Lands being leased are located in Totten Inlet, Pickering Passage, Oakland Bay, Case Inlet, near Dewatto stream mouth, Hammersley Inlet, Skookum Inlet, North Bay and near Hamma Hamma stream mouth (see Map 19).

According to the Washington State Shellfish Aquaculture Regulatory Committee's report on geoduck aquatic operations, there is an increasing demand for aquaculture, specifically geoduck farming, in the intertidal zones of Puget Sound. The report states:

In recent years domestic and international demand for geoducks has increased dramatically. Wild geoducks are commercially harvested by divers. Over the

last decade shellfish growers have developed aquaculture techniques to grow geoduck clams in the intertidal zone. The most common method involves inserting plastic tubes into the beach at low tide, planting cultured geoduck seed in the tubes, and covering the tubes with netting. The tubes and nets protect the baby clams from predators. After the geoducks grow for one to one and a half years, the tubes and nets are removed. When the geoduck clams reach market size, usually after four to six years, they are harvested by workers using water jets to loosen the sediment surrounding the clams so they can be removed. Planting, maintenance of the tubes and nets and harvest usually occur during low tides when the area where the clams are planted is exposed. In certain times of the year the low tides occur at night. (Ecology, 2009)

The demand for new commercial shellfish areas is anticipated to continue to increase. According to the Mason County Comprehensive Plan, the aquaculture industry has experienced sustained growth over the past 10-15 years with sales rising nearly tenfold since the late 1980s (Mason County, 2005). Another indicator of demand for new commercial shellfish areas is the number of commercial aquaculture permit applications submitted by commercial shellfish growers. Between 2007 and 2011, the US Army Corps of Engineers received 408 permit applications in Hood Canal and South Puget Sound (see Map 26).

10.2.3 Parks and Recreation

Public Park Opportunities

Mason County adopted an update to the Mason County Parks and Recreation Comprehensive Plan in November 2006 (Mason County Department of Parks and Trails, 2006). Development of the plan included an extensive public process, including the distribution of 15,000 copies of a park survey, visits to community groups by County staff, and public meetings. Chapter 6 of the adopted plan describes park needs by establishing level-of service standards based on:

- Comparisons with other county's Level of Service standards.
- Creation of a Parks Advisory Committee.
- Results of a countywide citizen survey.
- Park usage information.
- Public input and miscellaneous factors.

Results of the countywide survey indicate that respondents had a strong desire for water access activities, such as fishing, swimming, boating, and kayaking. Based on the survey results, the top priority for park funding should go into waterfront parks

to improve water access. The second rated priority was to develop walking/bicycle trails and bike routes. Chapter 7 describes strategies to meet recreational needs. Potential projects that would provide or improve water access at specific locations include (Mason County Department of Parks and Trails, 2006):

- Acquisition of Harvey Rendsland Park from Washington State Parks.
- Possible future park development near Star Lake, Lost Lake, Lake Nahwatzel, or Cloquallum Road. A park that provides swimming access is identified in the Plan as being the most beneficial.
- Acquire 2-acre parcel adjacent to Latimer's Landing to enhance and improve the existing boat launch.
- Development of Oakland Bay park to provide passive recreation.
- Purchase of Lake Isabella State Park from Washington State Parks.
- Sale or trade of Mason Lake Picnic Park (currently undeveloped) to develop another larger site that could provide fresh water access since it is too small (1 acre in size) to be developed into a park and does not have land sufficient for parking.
- Children's play area could be added to Jacoby Park, Latimer's Landing, and Mason Lake County Park.

Recent Mason County efforts to increase public access opportunities are listed below (Keates, personal communication, 2012):

- County acquired property for Sunset Bluff Park in Oakland Bay and North Bay in Case Inlet for the Coulter Creek Nature Preserves. Both sites involve establishing public access.
- Parking expansion at Latimer's Landing Boat Launch on Pickering Passage.

Based on the GIS dataset from Ecology's Shoreline Public Access Project (Appendix B: 2008), the potential for new park opportunities and public access appears to be most prevalent within the marine shoreline due to the existence of publicly-owned lands.

Increasing public access to existing parks through park expansion or added recreational facilities may cause strain on existing on-site wastewater treatment facilities. For example, the Belfair State Park experienced a sewer overflow in 2007; however, the problem has since been repaired. The capacity of existing wastewater treatment facilities will need to be taken into consideration when addressing the potential increase in recreational demand.

WRIA 16 Watershed Planning Unit in coordination with WDFW has identified a list of recreational sites in need of sanitary facilities. The recreational sites have been classified into four tiers, with Tier 1 having the highest priority. Highest priority sites that are located within Mason County include: Purdy Cut-Off Road/Highway 106/Skokomish River; Menard's Landing (Rendsland Creek) County Park; and West Dewatto (WRIA 16 Watershed Planning Unit, Undated).

Public Trail Opportunities

Mason County Department of Parks and Trails also developed a Mason County Regional Trails Plan (2008) that identified existing major trail systems and short-term and mid-term priority trails that could address deficiencies. Potential new trail corridors were identified based on the following criteria:

- Public ownership or access is currently available.
- Potential connectivity to communities, existing trails, parks, schools or other public facilities.
- Proximity to sites of natural, scenic or historic interest.
- Presence of transmission lines and railroad grades.
- Private forest lands where public access may already be accommodated.
- Areas that are not well served by trails currently.
- Areas having shoreline access potential.
- Corridors that provide opportunities for varied settings and experiences that can be enjoyed by a diversity of users.
- Road shoulders or right-of-way where parallel paths can enhance safety or connectivity for local or regional trail systems.
- Areas where the need for new trails has been identified through other planning efforts (e.g., Belfair UGA Plan).

Approximately 163 miles of regional and local trail corridors were identified. Nearly half of the regional trails are located on private forest lands (predominantly Green Diamond), while most local trail corridors are on Mason County and DNR lands. Potential trail corridors that are located along shorelines of the state and identified as short-term priority trails (1-5 year outlook) include (Mason County Department of Parks and Trails, 2008):

- Camp Govey Trails, trail proposed for several miles along Vance Creek. Potential to connect with Goldsborough Creek Trail.

- Goldsborough Creek Trail, upgrade and create viewing access to stream at the existing interpretive trail on the west side of Shelton near U.S. 101. Add signage, benches and trailhead amenities including a small parking area and information kiosk. Extend the trail east into downtown Shelton and west toward Matlock (eventually connecting to the Camp Govey Trail).
- Kennedy Creek Trail, improve the trail and interpretive opportunities with a possible upstream extension to a waterfall. Create a 2.2 mile loop trail system.
- Menards Landing and Menards Landing to Jiggs Lake, create short path leading to a viewpoint and potential kayak camp at Rendsland Creek stream mouth, create a ten mile multi-use loop trail, a portion of which would be along Rendsland Creek.
- North Bay Trail, create a one-mile long trail on the east side of North Bay in Case Inlet, generally waterward of SR302 and terminating near the fish hatchery at Coulter Creek.
- Oakland Bay View Trail, improve an existing short path at WDFW site on Oakland Bay to provide a short, scenic walk near tidelands. An access easement currently exists around a portion of the Bayshore Golf Course.
- South Fork Skokomish River, redevelop a short viewpoint trail near the High Steel Bridge (Reach 2), along with a suitable overlook of the river gorge; consider extending the trail east and west along the river, with a possible link to Brown Creek Campground (Reach 3) and the existing South Fork Trail located farther upstream.
- SR-3 Sidepath (Belfair), establish links between Belfair State Park and Thelar Wetlands located south of Union River.

General trail opportunities are also identified near or within the following shorelines:

- North Fork Skokomish and Skokomish River,
- Jarrell Cove on Harstine Island,
- Isabella Lake,
- Nahwatzel Lake,
- Price Lake,
- Case Inlet Trail, and
- Haven Lake.

The report recommends improving access and launch facilities for Mason County water trails. Three new campsites for water trail users are recommended at the

stream mouth of Dewatto River, Menards Landing County Park (near Rendsland Creek) and Oakland Bay County Park. In addition, 44 sites are identified for physical and visual access to marine and freshwater areas, including Hood Canal, South Puget Sound, Nahwatzel Lake, Lake Cushman, Mason Lake, Tahuya River, and Skokomish River.

Public Road End Opportunities

Mason County conducted a GIS analysis to identify potential public access opportunities from public road-ends that intersected shorelines of the state. While there road-ends are exclusively intended for public travel, the majority are encumbered due to the fee-simple ownership by the adjacent property owners. This ownership restricts the use, access and future development of the road-ends (Brush, personal communication, 2012). The County does not have appropriate GIS data to adequately assess which road-ends are unencumbered by easements. Until that data is made available, opportunities to establish formal public access at road-ends are limited to site-specific project proposals by adjacent private property owners or government agencies. For example, the County is currently working on a right-of-way agreement with property owners adjacent to East Evans Street road end in Allyn (Keates, personal communication, 2012).

10.3 Potential Use Conflicts

10.3.1 Agricultural Uses

Conflicts may exist in Mason County between agricultural uses, other adjacent uses and environmental protection. Conflicts typically associated with agricultural uses include water quality degradation due to nutrient loading to streams and lakes. Sources of nutrients are livestock waste and fertilizers. Conflicts also occur from livestock physically accessing stream channels, which leads to streambank erosion and increased turbidity. In addition to conflicts with environmental conservation, agricultural uses have the potential to conflict with residential and recreational uses because of noise, odors and the hour of operations. Another potential conflict is between county policies and land use designations adopted under the Growth Management Act to preserve agricultural land for productive use, and proposed conversion of agricultural lands for habitat restoration.

Because agricultural uses generally do not create impervious areas, agricultural lands can provide an overall benefit in watershed processes, such as water retention and detention. Greater concentrations of agriculture around SMA waterbodies are found in the Skokomish River, Gosnell Creek and Skookum Creek areas. Under SMP guidelines [WAC 173-26-241(3)(a)], this SMP will not address existing and ongoing agriculture activities.

10.3.2 Flood Management and Habitat Restoration

Conflicts may exist in Mason County along shorelines where structural flood control measures are utilized. While these measures protect structures and uses from flooding, they also result in a disconnection of the river from its floodplain, which can have adverse impacts on hydrology and fish habitat. Structural flood control measures have been used in several SMA waterbodies including the Skokomish River, Goldsborough Creek, and Tahuya River.

Conflicts also exist along shorelines which are regulated by various state and federal agencies with different mandates related to flood management and habitat restoration. For example, relocating flood control structures further upland from the edges of rivers can address multiple flood management and habitat goals, such as reestablishing floodplain wetlands and side channels. On the other hand maintaining existing flood control structures can conflict with ecological protection/restoration. An example of this conflict is the U.S. Army Corps of Engineers requirements and guidelines for levee maintenance, which discourage tree growth on levees so as not to compromise the structures for flood certification.

10.3.3 Forest Practices

Forest resource lands cover a majority of the county. Forestry activities in Washington are regulated by the Forest Practices Act (RCW 76.09) and implementing rules (WAC 222.08). Recently, mitigation measures have been incorporated to address forest practice impacts to watershed functions. The forest practices rules require a riparian management zone (RMZ) around all streams, where timber harvests are more closely regulated (WAC 222.30.020). The RMZ is composed of three concentric buffers, each with specific management rules. Timber harvest is only prohibited in the inner ring, which is generally 50 feet, even though the SMA jurisdiction is a minimum of 200 feet.

The long-term maintenance of timber harvest roads and culvert crossings has an effect on downstream waters and water quality in shorelines of the state. Timber harvest roads can contribute sediment to downstream waters and can be associated with landslides, erosion and slope failures. Decommissioning forest roads when under-utilized is one way to restore upper watershed processes and reduce sediment loading to improve water quality. For example, the US Forest Service is actively decommissioning out of service forest roads in WRIA 16. Decommissioning of timber roads can be in conflict with public access to forest lands.

Under SMP guidelines (WAC 173-26-241(3)(e)), local SMPs are to rely on the Forest Practices Act and its rules for the regulation of commercial forest uses within shoreline jurisdiction. However, within shorelines of statewide significance, the SMA allows only selective commercial timber cutting in which no more than 30 percent of the trees within shoreline jurisdiction are removed in any 10-year period (RCW 90.50.150).

Where land use is converted to non-forestry uses, the SMP would apply. Conversions of forest lands can create use conflicts with surrounding long-term commercial forestry operations.

10.3.4 Log Booming and Storage

The placement and removal of logs and log bundles in marine waters have the potential to affect juvenile salmonid migration, natural sediment movement, shading of the nearshore environment, and water quality and habitat impacts resulting from wood waste. However, log booming and storage is a water-dependent use, a preferred use under the SMA. Existing log booming activity is found in and around Shelton Harbor affiliated with the mills located there.

10.3.5 Outfalls

Installation of outfalls in riparian buffers may be a potential use conflict in Mason County. Although sanitary sewer utilities are not likely to be located in the shoreline since Mason County is pursuing land application of treated wastewater for new facilities, new stormwater outfalls may occur in the shoreline. Such utilities tend to locate within shoreline areas either as outfalls discharging stormwater or as utility crossings. Establishing utility facilities is often in conflict with protecting riparian vegetation. Stormwater may affect water quality and water quantity and could result in streambank erosion. Water quality monitoring of major outfalls and monitoring the effectiveness of annual maintenance, are recommended for consideration by the County, as funding allows, in the Mason County Countywide Stormwater Management Plan (Otak, Inc., 2009). Instituting such a program would help address these conflicts.

10.3.6 Overwater structures

Development of overwater structures such as piers, docks, covered moorage, floating homes, mooring buoys, marinas, shipyards and terminals, boat lifts, and boat ramps and rails has the potential for conflicts with other shoreline uses. Areas in which these conflicts may occur include freshwater lakes and saltwater shorelines in Mason County, particularly those in WRIA 14 and 16. Public piers and docks and boat ramps provide public access and recreation for shoreline users, a major policy objective of the SMA. Private docks and boat lifts associated with residential development are considered exempt from obtaining a shoreline permit under certain conditions (WAC 173-27-040(h)). Large concentrations of piers and docks can create conflicts with other uses by limiting potential for recreation and restoration and potentially interfering with navigation. Large concentrations of docks can also have cumulative impacts on the environment (for example, on eelgrass or migrating juvenile salmon) and create aesthetic conflicts. On Hood Canal, individual docks may conflict with traditional tribal harvest methods, such as beach seining. Marinas with covered moorage also may have impact on shoreline views of adjacent shoreline users.

10.3.7 Permit Exemptions and Cumulative Impacts

A number of uses and activities are designated by the SMA as being exempt from the requirement to obtain a Shoreline Substantial Development Permit (WAC 173-27-040), but nonetheless have direct or cumulative adverse impacts to shoreline ecological functions. These uses and activities are considered “exempt” from permitting, but are not exempt from meeting the goals and intent of the SMA.

For example, single-family residential use is treated as a priority use under the SMA. Homes and bulkheads built above the ordinary high water mark are exempt from permitting. Cumulatively, residential development in shorelines increases impervious surfaces and, if unmitigated, contributes to an overall decline in shoreline functions. The cumulative effects of bulkheads and other types of hard armoring are also known to impact shoreline habitat (WAC 173-26-231(3)(a)(ii)). Note that even activities exempt from substantial development permit requirement must still be reviewed for consistency with the SMP as part of other permit processes (e.g., county building permit; Hydraulic Project Approval, etc.), and in some cases may need a Conditional Use or Variance permit.

The Puget Sound Partnership Action Agenda (Puget Sound Partnership 2012) has a strategy for cleaning up, restoring, and protecting Puget Sound by 2020. The Action Agenda outlines the current health of Puget Sound, identifies threats to a healthy Sound, and identifies priorities and strategies for meeting the goal of restoring Puget Sound by 2020. The Action Agenda notes that alteration of nearshore habitat through the localized construction of single-family bulkheads and docks, in a cumulative fashion, can threaten broad components of the Puget Sound ecosystem. Therefore, exemptions for single-family residential development, bulkheads and docks should be examined to make certain that cumulative impacts do not occur.

Another exemption outlined in WAC (173-27-040) covers repair and maintenance of existing public utilities and facilities. Similar to other exemptions which are defined in state law, the repair and maintenance of utilities and facilities is to be “construed narrowly” meaning that the repair or maintenance must only replace the existing use or facility within the same location, size and configuration.

Many of the county’s shorelines, particularly marine areas, are served by existing roads and utilities. In order to promote efficient and timely repair of damage to these structures, the repairs and maintenance for transportation infrastructure and public utilities, when meeting the definition for repair in the WAC, should be maintained as exempt activities. The exemption would need to demonstrate that potential environmental damage has been minimized and sufficiently mitigated; thereby meeting the goals and intent of the updated shoreline master program.

10.3.8 Shellfish Aquaculture

Aquaculture, particularly shellfish growing and harvesting, is considered a preferred use under the SMA as a water-dependent use. In addition, Ecology’s SMP guidelines consider commercial and recreational shellfish beds “critical saltwater habitat” that should be afforded higher levels of protection from other uses that can impact water quality and substrate composition (WAC 173-26-221(2)(c)(iii)). Shellfish beds perform a number of important ecological functions including cycling nutrients,

stabilizing substrates, creating habitat structure (e.g., oyster reefs), enhancing water quality (filtering and retention), and providing food for a wide variety of marine invertebrates, birds, fish, and mammals. Many other shoreline uses have the potential to adversely affect shellfish aquaculture. Any use or activity that degrades water quality or alters substrates in the nearshore has potential to impact native shellfish stocks and commercial aquaculture. Examples include use of pesticides and fertilizer on upland areas; marinas with potential for fuel spills; and shoreline modifications (e.g., bulkheads, breakwaters, and over-water structures) that can alter substrate composition by cutting off sediment supply or altering natural erosion and accretion processes.

While many shoreline uses can adversely affect aquaculture, commercial shellfish harvesting itself can potentially impact adjacent shoreline uses. Intertidal aquaculture operations can potentially create use conflict between shellfish farming and public access in the shoreline. Unlike recreational harvest of native shellfish, aquaculture requires the use of small equipment within the intertidal zone, including plastic tubes, nets and other devices that may temporarily inhibit public access and recreational uses. Washington State Parks has identified a potential conflict with mooring buoys and shellfish growers. When Washington State Parks seeks to install mooring buoys, they only do so when it is found not to conflict with a shellfish grower's ability to harvest shellfish.

There is also growing public and scientific interest in the Puget Sound region in the possible ecological effects of expanding aquaculture operations, specifically geoduck aquaculture. A large-scale multi-disciplinary study is currently underway, with researchers addressing many of the most pressing issues related to the effects of geoduck aquaculture on the Puget Sound ecosystem. Participants in the research include local university marine scientists from the University of Washington, state agencies, and researchers from local shellfish growers. For example, Washington Sea Grant (WSG) operating out of the University of Washington College of Ocean and Fishery Sciences has embarked on a Geoduck Aquaculture Research Program. This program is supported by the Washington geoduck aquaculture research account and aims to address the specific research priorities stated in SSHB220 2007-08 (see web site at: <http://www.wsg.washington.edu/research/geoduck/index.html>). A comprehensive literature review, which summarized the data gaps and pinpointed areas of future research needed, was prepared for WSG by Straus and others (Straus et al., 2008).

Projects supported by WSG in the 2007-2009 bienniums were selected through a scientific peer-review process. Research is underway related to the effects of geoduck aquaculture on: eelgrass, sediment characteristics in the intertidal zone, native benthic species, and other ecological systems in the shoreline. The possible

effects, including cumulative effects, of current geoduck aquaculture practices on the Puget Sound ecosystem are currently being studied.

In 2007, the Washington State Legislature directed Ecology to adopt new guidelines to address potential use conflicts resulting from commercial geoduck aquaculture in shoreline areas. Ecology's final guidelines, adopted with advice from a Shellfish Aquaculture Regulatory Committee, include the following (Ecology, 2011b):

- Requirement for local governments to better review water quality, contaminated sediment and other shellfish-related data and information during the local shoreline master program update process.
- Underscore existing requirements for local governments to have shoreline master program policies, regulations, and standards that address aquaculture
- Requirement that all new commercial geoduck aquaculture project applications obtain a conditional use permit.
- Requirement for new commercial geoduck aquaculture project applications to meet the mitigation sequence of first avoiding and then mitigating for environmental impacts.
- Requirement to address the impacts from noise, lights, vehicles, gear and other aspects of commercial geoduck siting and operations.
- Requirement for local governments to notify the public and tribes regarding proposed commercial geoduck aquaculture projects.

10.3.9 Finfish Aquaculture

In addition to shellfish operations, aquaculture includes finfish farming. Finfish farming involves raising fish, such as salmon or trout, commercially in tanks or enclosures. The fish are artificially fed and then harvested when they reach market size. Fish can be raised in cages or net pens placed in rivers, lakes or marine waters. Net pens consist of two nets, an interior net to keep fish in and an exterior net to exclude predators. Fish can also be raised in tanks outside of waterbodies with the use of large amounts of water to maintain water quality.

According to the *Final Programmatic Environmental Impact Statement (FEIS), Fish Culture in Floating Net Pens* (Parametrix, Inc., 1990) there are several use conflicts associated with finfish aquaculture, including navigation, commercial fishing, recreation, and adjacent shoreline uses. Finfish aquaculture could pose conflicts with navigation if sited in established navigation lanes, narrow channels, or where boats would be unable to navigate safely around them. In addition, if net pens break loose from their anchors during severe weather conditions, they could become a hazard to vessel traffic. On the other hand, in remote areas, finfish farms can

provide a point of assistance for boaters since they usually have some form of sea-to-land communication. Finfish farming could also impact commercial fishing due to the potential for collision or entanglement of the fishing nets with the farms. This could result in displacement of fishers from a productive and accustomed fishing area and lost harvest potential. Conflicts with recreation could involve obstructing access to shore or water areas traditionally used for recreation, like boating and recreational fishing, and affecting the visual quality which may reduce the value of an area for recreational use. Similar to shellfish aquaculture, any use or activity that degrades water quality has potential to impact finfish farms.

The Final Report Recommended Interim Guidelines for the Management of Salmon Net-Pen Culture in Puget Sound (Science Applications International Corporation, 1986) establishes siting and operational criteria for salmon net pens in Puget Sound, the Strait of Juan de Fuca, and the Strait of Georgia. The guidelines were developed with the goal of environmental protection, and were not intended to address social, economic, aesthetic or water/land use conflicts. Hood Canal (south of Hazel Point in Jefferson County) is identified as an area of special concern because of chronic low dissolved oxygen at depth and persistent nitrogen depletion in surface waters. The report recommends that net pen culture occur in Hood Canal only if the applicant can demonstrate that: 1) respiration and biochemical oxygen demand will not significantly depress dissolved oxygen concentrations; and 2) nutrient input attributable to net-pen culture will not affect the frequency, extent, intensity or duration of phytoplankton blooms. Other guidelines address minimum depth for net pens, distance from certain habitats (e.g., eelgrass, kelp, clam populations, bird), type of feed, type of predator control, and use anti-fouling agents.

The FEIS on Fish Culture in Floating Net Pens (Parametrix, 1990) evaluated the environmental impacts of the commercial culture of fish in floating fish farms. The FEIS recommended the areas of special concern identified in the Interim Guidelines, including Hood Canal south of Hazel Point, have limited fish production to avoid adversely affecting existing biota. It recommended use of predictive models to estimate allowable production levels in such areas.

CHAPTER 11.

SHORELINE ANALYSIS SUMMARY

11.1 Shoreline Analysis

This inventory and analysis for Mason County, Washington covers 217 linear miles of marine shoreline, 343 miles of river and 149 miles of lake shore for a total of 709 miles considered “shorelines of the state.” Of this total, 36 percent is considered “shorelines of statewide significance.” Shorelines of statewide significance include all marine waters and shorelands of Hood Canal and marine waters of South Puget Sound seaward from extreme low tide. Lake Cushman and the main stem of the Skokomish River downstream from the confluence of the North and South Forks, as well as their shorelands, are also shorelines of statewide significance.

11.2 Key Impairments

The key impairments for shorelines in Mason County have been identified by others and have been noted through the development of the inventory and characterization report. Countywide, impairments to shorelines include degradation to water quality from non-point sources, urban runoff, and failing septic systems. Sedimentation, temperature exceedances, and other water quality problems have been caused by upstream timber harvest and culverts on forest roads, infrastructure such as highways and railroads crossing shorelines. Hydrologic functions have been affected, including limiting of tidal action in estuaries by the placement of structures in the water such as docks, bulkheads, and riprap.

The State of Our Watersheds identifies key impairments affecting habitat quality and quantity in 20 watersheds in western Washington (including watersheds within Mason County) (Northwest Indian Fisheries Commission, et al., 2012). Although the report looks well beyond Mason County shorelines, the following principle findings of the report indicate similarities between Mason County and the watersheds of Western Washington:

- Degradation outpaces estuary restoration
- Degraded nearshore habitat unable to support forage fish
- Freshwater shoreline armoring continues unabated
- Forest cover disappearing

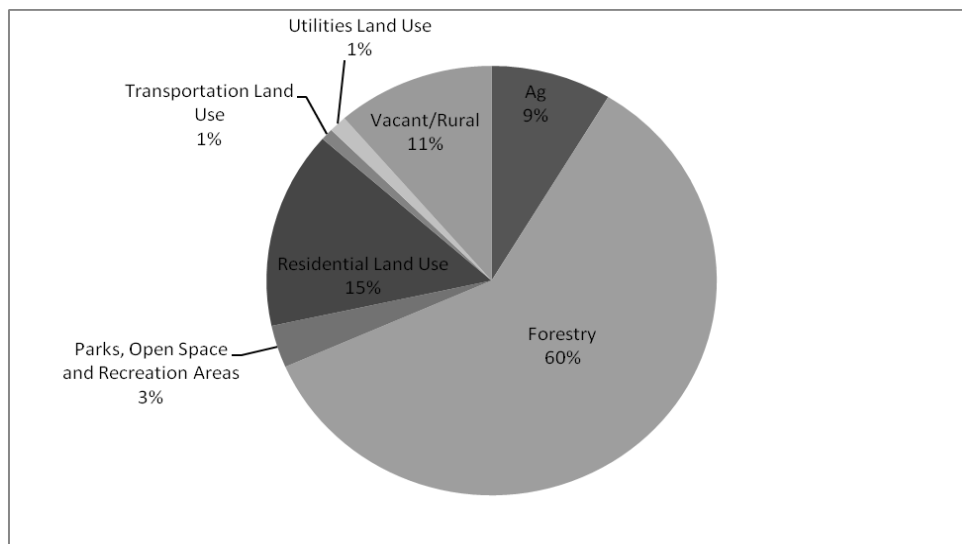
- Streams lack large woody debris
- Riparian forests not recovering
- Alarming number of stream crossings, high road densities
- Fish barriers cut off vast amounts of habitat
- Agricultural lands remain degraded
- Sensitive floodplains are being overdeveloped
- Rapidly increasing permit-exempt wells threaten water for fish

These impairments are applicable to the Mason County shorelines as documented within this Final Draft Shoreline Inventory and Characterization Report.

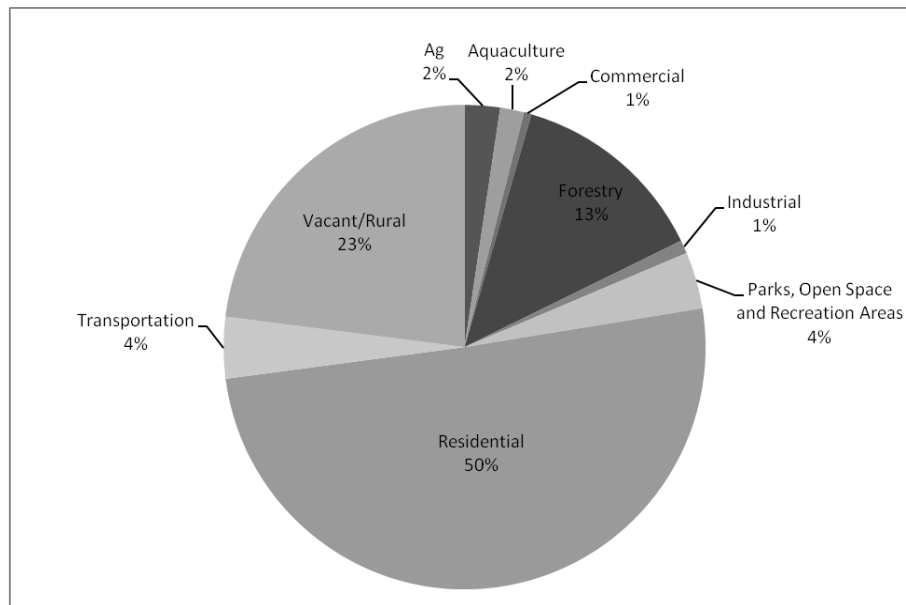
11.3 Key Shoreline Use Issues

Existing land uses in freshwater shoreline planning areas are predominantly in forestry. Residential, vacant, and agriculture land uses make up most of the remaining area. Residential land uses are concentrated around lakes and typically have individual docks/piers.

Figure 11-1. Freshwater Shoreline Land Uses



Existing land uses in the marine environment are predominantly residential. Vacant and forestry land uses are also common. Docks/piers are scattered throughout the marine environment with private marinas concentrated along Hood Canal.

Figure 11-2. Marine Shoreline Land Uses

11.3.1 Potential Use Conflicts

Conflicts exist in Mason County between agricultural uses, other adjacent uses and protection of shoreline ecological functions. Many of these can be addressed through improved management practices. Water quality degradation due to excess nutrients entering streams and rivers is one conflict typically associated with agricultural uses. Sources of nutrients are livestock waste and fertilizers. Other sources include failing or malfunctioning septic systems, stormwater runoff from roads, residential areas, and commercial areas.

The long-term maintenance of timber harvest roads and culvert crossings has an effect on downstream waters and water quality in shorelines of the state. Timber harvest roads can contribute sediment to downstream waters and can be associated with landslides, erosion and slope failures. Decommissioning forest roads when under-utilized is one way to restore upper watershed processes and reduce sediment loading to improve water quality.

Aquaculture, particularly shellfish growing and harvesting, is considered a preferred use under the SMA as a water-dependent use. Any use or activity that degrades water quality or alters substrates in the nearshore has potential to impact native shellfish stocks and commercial aquaculture. In addition to shoreline uses potentially affecting aquaculture adversely, commercial shellfish harvesting itself can potentially impact adjacent shoreline uses. Intertidal aquaculture operations can potentially create use conflict between shellfish farming and public access in the

shoreline. There is also growing public and scientific interest in the Puget Sound region in the possible ecological effects of expanding aquaculture operations, specifically geoduck aquaculture.

Development of overwater structures such as piers, docks, covered moorage, floating homes, mooring buoys, marinas, shipyards and terminals, boat lifts, and boat ramps has the potential for conflicts with other shoreline uses. Large concentrations of piers and docks can create conflicts with other uses by limiting potential for recreation and restoration and potentially interfering with navigation. Marinas with covered moorage also may have impact on shoreline views of adjacent shoreline users.

Residential development near the shoreline is an example of another potential conflict. Residential development can result in nutrient- and bacteria-enriched runoff from yards and gardens, pet waste, and malfunctioning or poorly-maintained septic systems. Residential homeowners may remove shoreline vegetation to enhance views, build docks, piers, and other structures as described above, and use chemicals such as pesticides in the shoreline area. These uses can result in degraded water quality, increased concentrations of chemicals in sediments and fish, and can contribute to invasive levels of aquatic weeds.

11.4 Park and Public Access Opportunities

Many of the shorelines within Mason County have at least limited public access. Marine shorelines are generally accessible through the Washington State Parks or local parks and/or informal access to tidelands and beaches from public roads. Most shoreline lakes, although fully developed in private residential structures, are accessible through a WDFW boat launch.

11.5 Restoration Opportunities

Restoration is currently underway in Mason County through a variety of organizations including the Squaxin Island Tribe, Skokomish Tribe, Mason Conservation District, Hood Canal Coordinating Council, Hood Canal Salmon Enhancement Group, South Puget Sound Salmon Enhancement Group, PSNERP and others. Restoration opportunities within the County include those projects identified on the PSNERP Habitat Work Schedule 2011 and by other salmon recovery groups. Restoration opportunities summarized in this report also include restoration actions noted during development of this shoreline analysis. Preservation and protection measures are described along with restoring degraded shoreline functions where impacted. The prioritization of restoration opportunities

and more detailed analysis of these will be accomplished in the Mason County Shoreline Restoration Plan, a component of the SMP update to be developed in 2012.

Restoration in the County's shorelines includes programmatic and specific actions such as:

Restore forested riparian areas and native vegetation in shoreline.

Native trees, shrubs and groundcover within the shoreline jurisdiction provide shade, organic nutrients, habitat structure, and improve water quality for stormwater runoff by capturing pollutants. Maintaining and conserving vegetation in the shoreline is a specific requirement of the 2003 Shoreline Guidelines. Restoring forested riparian areas adds trees and native shrubs to areas that are currently maintained as lawn, are developed in impervious surfaces, or are un-vegetated.

Remove invasive plants from riparian areas to restore ecological functions.

Removal of non-native invasive plants (which replace native species over time) is another habitat restoration opportunity. Countywide, there are problems with scots broom, knotweed, blackberry and noxious weeds within the riparian areas. This is an issue more within freshwater shore lands versus along the marine shores. Mason Conservation District has an existing program dedicated to the removal of invasive and noxious weeds which supports this goal.

Conserve existing forested riparian areas and native vegetation in shoreline.

According to data provided by PNPTC, over 45 percent of the County's freshwater shorelines are currently forested. Conserving vegetation, particularly trees and forest cover, during future development of the shorelines is a key element of the protection of ecological functions.

Remove hardened armoring and replace with soft-shore stabilization.

One of the requirements of the shoreline guidelines is to demonstrate a preference for soft-shore stabilization over hard armoring of the shoreline. Mason County has 63 linear miles of existing hard armoring on its marine shorelines, which could be replaced over-time with softer stabilization measures.

11.6 Management Recommendations

Development within the shorelines of Mason County will continue and therefore impacts must be addressed as development occurs. The shorelines are highly valuable assets to the County both for resource industries, particularly shellfish harvest and aquaculture, as well as recreational and citizen enjoyment. Nearly half of the shoreline residents in Mason County are thought to be seasonal, residing only during the summer vacation months.

Several management recommendations have come to light as a result of this shoreline inventory and analysis. These recommendations are generally broad and programmatic:

- Address point sources and non-point sources of pollutant loading to freshwater and marine shorelines. Remove pollutant sources to improve water quality and protect shellfish growing, recreational uses, and other primary water uses within Mason County. This includes continuing and/or strengthened support of Mason County's On Site Sewage System Management Program, the Comprehensive Stormwater Management Plan and support for established Shellfish Protection Zones, among other programs to protect water quality and habitat.
- Continue to address water allocation and consumptive uses to improve in-stream flows and maintain salmonid habitat. This is an important issue specifically for Skookum Creek, John's Creek and Skokomish River and its tributaries.
- Upstream logging and timber harvest have caused downstream issues with temperature exceedances and sedimentation. Continue to work with US Forest Service, Simpson, Green Diamond and other timber companies to address culvert crossings on logging roads and restoration of harvested lands so that these impacts may be minimized over time.
- Strengthen implementation of Integrated Vegetation Management Programs in selected watersheds to improve lake water quality.

11.7 Use of the Shoreline Inventory and Analysis Report

The shoreline inventory and characterization report and map folio are the foundation for the update to Mason County's SMP. Based on the findings of this report, the relationships between ecological processes, shoreline functions, and the built environment can be better understood to assist in the development of goals

and policies for shoreline management measures to protect and restore shoreline functions, encourage public access and promote water dependent uses.

The data and information summarized within this report have been used to inform the development and assignment of appropriate shoreline environment designations. Mason County has used this analysis to determine proposed shoreline environment designations that are compatible with the existing condition, ecological function, character and vision for the shoreline reaches. The shoreline environment designations serve as the framework for development of the implementing regulations for the SMP.

Additionally, the report establishes a general baseline of existing conditions for shorelines in the county and identifies restoration and public access opportunities. The restoration opportunities identified in this report will also assist in the preparation of a county-wide restoration plan, a separate document to be prepared in subsequent phases of the SMP update process.

CHAPTER 12.

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