Final Draft

THURSTON COUNTY
SHORELINE MASTER PROGRAM UPDATE

Inventory and Characterization Report

SMA Grant Agreements: G0800104 and G1300026

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1 INTRODUCTION

REPORT PURPOSE

The purpose of this report is to support Thurston County's Shoreline Master Program (SMP) update. Thurston County is updating its existing SMP to comply with the Washington State Shoreline Management Act (SMA or the Act) requirements (Revised Code of Washington [RCW] 90.58) and the state implementing guidelines (Washington Administrative Code [WAC] 173-26, Part III – "Guidelines") which were updated and adopted in 2003.

The County is conducting a multi-phased update of its SMP. The Inventory and Characterization process (the focus of this document) occurs in the second phase of the overall Thurston County SMP update process. The phases are as follows:

- Phase 1 – Preliminary Shoreline Jurisdiction and Public Participation Plan
- Phase 2 – Shoreline Inventory and Characterization
- Phase 3 – Shoreline Environment Designations (SEDs) Policy and Regulation Development, and Cumulative Impacts Analysis
- Phase 4 – Restoration Plan; Revisit Phase 3 Products as Necessary
- Phase 5 – Local Approval
- Phase 6 – State Approval

Thurston County is in the process of completing all of the required steps in accordance with the terms and conditions of two grant agreements (Grant Agreement Number G0800104, and G1300026) with the Washington State Department of Ecology (Ecology). State funds for grants to update local SMPs are provided by Budget Bill ESSB 6090.

For the inventory and characterization, all pertinent and available existing data, information, and descriptions of watershed and shoreline attributes that pertain to existing and emerging problems and issues in Thurston County were gathered and incorporated into this report (Appendix B). The information and data were used in this report to describe existing shoreline conditions, and characterize the ecosystem-wide processes and shoreline ecological functions that shape and influence the shoreline jurisdiction within Thurston County in accordance with the Guidelines in WAC 173-26-201(3)(c) and 173-26-201(3)(d).

Thurston County's SMP includes policies and regulations for managing all fresh and saltwater shorelines of the state. The Inventory and Characterization Report provides background and baseline information to be used in updating the existing shoreline environment designations (SEDs) goals, policies, and regulations for shoreline management to ensure no net loss of shoreline ecological functions. In addition, the Inventory and Characterization Report allows the County to identify gaps in shoreline related data, potential shoreline use issues, and opportunities for public access, protection, and restoration.

The Scientific and Technical Advisory Group (STAG) composed of experts from state and local agencies, and tribes, reviewed and commented on the June, 2009 draft of this report.

Shoreline Master Program Updates for Cities within Thurston County

Under a separate grant agreement with Ecology, Thurston Regional Planning Council (TRPC) worked with the local City jurisdictions within Thurston County to assist with the development of their SMP updates. SMP updates for the cities of Lacey, Tenino, and Bucoda have been state approved. The city of Olympia is in the process of obtaining local SMP approval, and the city of Tumwater locally adopted in the summer of 2012.

Although the County and cities are working separately on the SMP update tasks, lead regulators within each jurisdiction periodically coordinate for the purpose of exchanging information throughout the development process. Coordination among neighboring jurisdictions is strongly recommended by Ecology for all SMP updates.

Regulatory overview

The Shoreline Master Program requirement, including subsequent amendments, is a result of the Shoreline Management Act (SMA). The Shoreline Management Act of 1971, Chapter 90.58 Revised Code of Washington (RCW) was adopted by the citizens of Washington in 1972. The overall goal of the SMA is to "prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." This act is designed to provide for three broad polices: (1) protect shoreline natural resources and ecological functions, (2) reserve shorelines for water dependent and associated water-related uses, and (3) promote public access.

Local SMPs are adopted under guidelines established by Ecology, as defined in WAC 173-26. These guidelines allow local planners to tailor SMP goals, policies, standards and regulations to the specific needs of individual communities. In addition, the SMP is also meant to be used to provide comprehensive planning for the County's shoreline area (RCW 90.58.030(3)(b)).

The Washington State Department of Ecology administers the Act, but gives primary permitting authority for shoreline development to local governments. Local jurisdictions and Ecology work together to ensure that the policies of the SMA are applied to activities occurring in the vicinity of regulated shorelines. Local jurisdictions act as the primary regulators and utilize SMPs, a planning and regulatory document, to establish policies, goals and land use regulations for the shoreline. Ecology serves in a support and review capacity to the local jurisdictions, but is also required to review and approve certain shoreline permits and must approve new or amended SMPs.

The "Shoreline Master Program for the Thurston Region" was first adopted in 1976. Major revisions to this document were conducted in 1983 and 1990. The Thurston Regional Planning Council prepared the original SMP document and its two major revisions, as well as the original inventory of all marine, lake, and river shorelines.

Thurston County utilizes a variety of other regulations, policies, plans, and programs to supplement the goals and regulations contained within the SMP, and to manage shoreline resources and regulate development near the shoreline. All development projects are reviewed for compliance with the Thurston County Code (TCC) including but not limited to: Thurston

County Comprehensive Plan, Zoning Ordinance (TCC 20, 21, 22, and 23); Critical Areas Ordinance (TCC 24); Shoreline Master Program for the Thurston Region, Storm Water Drainage Design and Erosion Control Manual (TCC 15.05); and the State Environmental Policy Act (SEPA) Ordinance (TCC 17.09.). The County works with other entities such as the Thurston Conservation District, Stream Team, South Sound Salmon Recovery Group and watershed lead entities to promote awareness of shoreline issues. In addition, the County has developed Shellfish Protection Districts, Basin Plans, and Capital Facilities Plans to further the goals and the policies of the SMP and promote wise shoreline usage.

Although critical areas in shoreline jurisdiction are identified and designated under the GMA, they must also be protected under the SMA. The Washington State Legislature has determined that local governments must adopt programs that protect critical areas within shorelines at a level assures no net loss of shoreline ecological functions (ESHB 1653 Sec. 2(4)). Although Washington's shorelines may contain critical areas, the shorelines themselves are not critical areas by default as defined by GMA.

SHORELINE JURISDICTION AND DEFINITIONS

The Shoreline Master Program (SMP) update process begins with identification of "shorelines of the state" and their associated "shorelands," which comprise the geographic area where the Shoreline Management Act (SMA) applies (hereafter referred to as shoreline jurisdiction). Through the SMA, Thurston county regulates "Shorelines of the State" including all "shorelines" and "shorelines of statewide significance" as defined in RCW 90.58.030.

"Shorelines" means all of the water areas of the state, including reservoirs, and their associated "shorelands", together with the lands underlying them; except:

1. shorelines of statewide significance; and
2. shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second or less (cfsmaf) and the wetlands associated with such upstream segments; and
3. shorelines on lakes less than twenty acres in size and wetlands associated with such small lakes.

Specific larger water bodies are classified as "shorelines of statewide significance" (RCW 90.58.030(2)(e). Freshwater "shorelines of statewide significance" include rivers with mean annual flow of 1,000 cfs or greater (for rivers west of the Cascade Range crest) and freshwater lakes 1,000 acres or larger. In Thurston County, this includes the Nisqually and Chehalis Rivers for their entirety within Thurston County. Alder Lake is the only lake in Thurston County designated a shoreline of statewide significance. Marine shorelines of statewide significance in Thurston County include: Nisqually Delta -- from DeWolf Bight to Tatsolo Point between the ordinary high water mark (OHWM) (as defined in RCW 90.58.030(2)(b)) and the line of extreme low tide, areas of Puget Sound lying seaward from the line of extreme low tide; and the shorelands associated with the Nisqually Delta (Map 1).

"Shorelands" or "shoreland areas" means those lands extending landward for two hundred feet in all directions as measured on a horizontal plane from the OHWM; floodways and contiguous floodplain areas landward two hundred feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters. Shoreland areas for marine waters and lakes are set by statute; local governments have some discretion regarding shoreland extent along rivers. Local governments have the authority to define SMA jurisdiction along river corridors, within minimum and maximum areas defined in statute. The maximum SMA jurisdiction along rivers is the 100-year floodplain. The County is using the maximum SMA jurisdiction along rivers.

"Associated wetlands" are wetlands that are in proximity to shorelines and either influence or are influenced by tidal waters or a lake or stream subject to the Shoreline Management Act (WAC 173-22-030(1). These typically include wetlands that physically extend into the shoreline jurisdiction, and wetlands that are functionally related to the shoreline of the state through a hydrologic connection or other factors.

"Associated river deltas" are those lands formed as an aggradational feature by stratified clay, silt, sand and gravel deposited at the mouths of streams where they enter a quieter body of water. The upstream extent of a river delta is that limit where it no longer forms distributary channels.

Ecology advises counties updating their SMP to include shorelines of the state within tribal and federal lands on SMP maps to indicate shoreline jurisdiction under the SMA if a situation in which non-federal/non-tribal actions were to take place.

Ecology advises that an SMP should include federal lands within shoreline jurisdiction. Non-federal activities that take place on federal land are usually subject to the SMA. In some cases, federal and state statutes establish exclusive federal jurisdiction. Areas under exclusive federal jurisdiction may be excluded from the SMP. Ecology will assume the SMA applies on federal land unless documentation is provided of exclusive federal jurisdiction.

The SMA does not include any reference to tribal lands or Indian reservations. RCW 37.12.060 addresses regulation of the use of property belonging to any Indian or Indian tribe. *"**Nothing in this chapter** shall authorize the alienation, encumbrance, or taxation of any real or personal property, including water rights and tidelands, belonging to any Indian or any Indian tribe, band, or community that is held in trust by the United States or is subject to a restriction against alienation imposed by the United States; or **shall authorize regulation of the use of such property in a manner inconsistent with any federal treaty, agreement, or statute** or with any regulation made pursuant thereto…"* The courts have generally held that the tribes do not have jurisdiction over non-tribal members holding land in fee regarding land use regulation. There may be some instances where the tribe would have jurisdiction in these situations, however, and these are decided individually. Therefore, the SMP generally applies to any land within reservation boundaries owned in fee by a non-tribal member. The County should work with tribal governments to define the extent of shoreline jurisdiction and resolve the application of shoreline regulations.

Proposed shoreline jurisdiction within Thurston County is shown on Maps 3-7.

The Ordinary High Water Mark (OHWM) is used to determine shoreline jurisdiction. The OHWM is not a fixed elevation; the OHWM and shoreline jurisdiction can move as the shoreline changes over time. The OHWM is determined by visual inspection of the river, lake, wetland, or marine bank. It is difficult to precisely map the location of the OHWM during the SMP update process, so the SMP jurisdiction maps should not be assumed to show a precise location. The OHWM is determined on a project by project basis at the time of application.

When a comprehensive SMP update is approved by Ecology, it becomes the official delineation of SMA water bodies and shorelands within that town, city or county. The maps and lists in the approved SMP will replace the lists of water bodies contained in WAC chapters 173-18 (rivers and streams) 173-20 (lakes) and 173-22 (shorelands and wetlands).

REPORT ORGANIZATION

This report presents an inventory and characterization of Thurston County's shorelines at distinct spatial scales: the ecosystem-wide scale (presented within water resource inventory areas) and the shoreline reach-scale by basin and waterbody.

The information in this report is organized into eleven chapters and eight appendices as follows:

Chapter 1: **Introduction**
Discusses the purpose of this report, provides background on the regulatory context for shoreline planning, and outlines the overall organization of the report.

Chapter 2: **Methodology**
Describes the methods used to inventory and characterize ecosystem-wide processes and shoreline functions and conditions.

Chapter 3: **Ecosystem Profile**
Provides a county-scale regional context, an overview of ecosystem-wide processes and alterations, and a profile of the ecosystems and priority habitats and species within Thurston County.

Chapter 4: **Archaeological and Historic Resources**

Chapters 5 -8: **WRIAs 11, 13, 14, and 23**
Each chapter in this section provides a general overview of the WRIA characteristics, a characterization of ecosystem-wide processes by WRIA, and a shoreline reach-scale inventory organized by basin and waterbody.

The County includes jurisdictional shorelines in four WRIAs:

- WRIA 11 – the Nisqually River watershed,
- WRIA 13 – the Deschutes River watershed,
- WRIA 14 – the Kennedy/Goldsborough,
- WRIA 23 – the Upper Chehalis Watershed.

*Note: A small portion of WRIA 22 – the Lower Chehalis Watershed, is also located within the County but does not contain any shoreline jurisdiction.

Chapter 9: **Management Options**

Chapter 10: **Potential Use Conflicts**

Chapter 11: **Data Gaps**

<u>Appendices:</u>

Appendix A: **Shoreline Reach-scale Inventory Matrix**
Provides a review of the shoreline reaches within Thurston County in tabular format. The reach matrices are organized first by water body type (e.g, lakes, streams, and marine) second by WRIA, third by waterbody, and finally by reach.

Appendix B: **Shoreline Inventory Literature and Data Review**

Appendix C: **GIS data sources used in development of the map folio**

Appendix D: **Abbreviations used in the document**

Appendix E: **Chapter 3 and Appendix F Literature Cited**

Appendix F: **Ecosystem-wide Processes Characterization Methods**

Appendix G: **Streams not meeting 20 cfsmaf**

Appendix H: **Map Folio**
The map folio contains the maps that are referenced throughout this report.

2 METHODS

This chapter describes the methods used to determine shoreline jurisdictional limits, characterize ecosystem processes, and inventory shoreline conditions and functions. Slightly different processes are used for the marine (nearshore) and freshwater shoreline analyses. The results of this inventory and characterization methodology are presented in Chapters 5 though 8. It is important to note that information on Tribal reservation lands and Federal lands was included in the inventory and characterization area only for non-tribal or non-federal uses on these lands.

DETERMINING SHORELINE JURISDICTION LIMITS

Prior to conducting a detailed inventory and characterization of ecosystem processes and shoreline conditions, County staff identified and mapped areas subject to, or potentially subject to shoreline jurisdiction (per the criteria described in Chapter 1).

Shoreline jurisdiction and planning area boundaries were determined by overlaying the following:

1. a 200 foot buffer to all shorelines of the state;
2. the 100-year floodplain for streams; and
3. the associated wetlands that overlapped the 200 foot shoreline buffer (for all waterbody types) and/or the 100-year floodplain (for streams only). Wetland buffers were not included.

Some water bodies and shoreline areas that meet the thresholds for inclusion under the SMA may not be in older local SMP maps and legal descriptions. Changes in the shoreline jurisdiction may have resulted from new information on water-body size and human-made alterations of the shoreline (Map 2).

Determining the extent of stream shorelines of the state in Thurston County was conducted primarily using Ecology's "Suggested Shoreline Points". Following the passage of the Shoreline Management Act 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, had not been updated since their initial development. Ecology revised the list of shoreline streams and the 20 cfs points using data from several regional flow studies conducted by the U.S. Geological Survey and called this list "Suggested Shoreline Points". The results of the USGS studies showed that numerous streams that are not currently designated as shorelines of the state may actually meet the 20 cubic feet per second (cfs) mean annual flow criterion and should be regulated as state shorelines. The USGS studies also resulted in some of the 20-cfs points being relocated further upstream or downstream from their original WAC-designated locations. The "Suggested Shoreline Points" include points on streams that are likely to qualify as "shorelines" and "shorelines of statewide significance" as defined in the SMA. The "Suggested Shoreline Points" are specifically intended for local governments that are comprehensively updating their Shoreline Master Programs.

The streams and rivers addressed in this inventory and characterization include all those identified by the USGS studies. In addition, Thurston County used several points from the "Shoreline Management Act – Streams and Rivers – points" because they were not included on the "Suggested Points" list. The "Shoreline Management Act – Streams and Rivers – points" includes points where shoreline jurisdiction begins on streams and rivers, where "shorelines of statewide significance" begin, and where streams and rivers cross state and county boundaries, as published in WAC 173-18. Two other 20 cfs points were moved slightly to the equivalent point on the stream since Ecology uses a different stream layer than Thurston County and the location of the streams does not always line up exactly. Table 2.1 lists each stream shoreline and describes which points were used and any adjustments made. The Centralia Power Canal was determined by Ecology to not be a shoreline of the state because it is not a "naturally occurring" stream and the water is discontinuous from the Nisqually River.

Table 2.1. Points used to determine upstream extent of stream shoreline jurisdiction.

Stream Name	Point Used	Notes
Porter Creek	Suggested	
Kennedy Creek	Suggested	
Waddell Creek	Suggested	
Sherman Creek	Suggested	
Mima Creek	Suggested	
Black River (west border)	Suggested	
Chehalis River (west border)	Suggested	
Chehalis River (south border)	Suggested	
Dempsey Creek	Suggested	
McLane Creek	SMA points	Adopted point is further upstream than Suggested point
Black River (mid)	Suggested - Adjusted	Point moved to intersection with Dempsey Creek as mapped by GeoData
Black Lake Ditch	SMA points	Black Lake Ditch is not included in Suggested streams
Percival Creek	Suggested	
Hopkins Ditch	Suggested	
Beaver Creek	Suggested	
Scatter Creek	Suggested	
Chambers Creek	None	Chambers Creek does not meet the 20 cfs criteria at the suggested point, or at the most downstream stream gage located at Rich Road (Appendix G).
Woodland Creek	Suggested	
Spurgeon Creek	Suggested	
Johnson Creek	Suggested	
Thompson Creek (Skookumchuck)	Suggested	
Skookumchuck River	Suggested	
Unnamed Trib to Deschutes	Suggested	
Mitchell Creek	Suggested	
Little Deschutes River	Suggested	
Deschutes River	Suggested	

Nisqually River	Suggested	
Yelm Creek	None	Ecology determined that Yelm Creek does not meet the 20 cfs criteria (Appendix G)
Thompson Creek (Nisqually)	None	Ecology determined that Thompson Creek does not meet the 20 cfs criteria (Appendix G)
McAllister Creek	SMA points	McAllister is not included in the Suggested stream point list

For lake shorelines, Thurston County used ArcGIS and the Thurston County waterbody layer to identify all waterbodies greater than 20 acres. The analysis included lakes formed by gravel mine, rock, coal mine and other mining activities that are 20 acres or larger. There are three such lakes in southern Thurston County, located south of the Skookumchuck River. Mines are regulated by the Washington Department of Natural Resources (DNR). DNR requirements include specific reclamation plans and design standards for the approved use after the mining operation ends. If these standards are followed, and an ecologically functional lake results, it will need the protection provided by the SMA when reclamation is complete.

Two lakes (Shinke Lake and Bigelow Lake) were added to the proposed shoreline jurisdiction. These two lakes were not part of the shoreline jurisdiction in the existing Shoreline Master Program for the Thurston Region. The addition of these waterbodies as lakes was based on review of the OHWM of the associated wetlands.

1. Shinke Lake is not mapped as a waterbody and therefore was not picked up in the ArcGIS analysis of waterbodies greater than twenty acres. However, it is mapped in the Thurston County wetland GIS layer as a Palustrine Open Water and Aquatic Bed wetland of larger than 20 acres, and therefore met the criteria to be considered a shoreline of the state.
2. The shoreline jurisdiction of Bigelow Lake is in the jurisdiction of Thurston County in some areas, and may be in the jurisdiction of the City of Olympia in other areas. In 2008, Thurston Regional Planning Council (TRPC) hired The Coot Company to perform field work to determine the OHWM and associated wetlands for Bigelow Lake to determine shoreline jurisdiction for the SMP update for the Cities of Olympia, Lacey, and Tumwater and their urban growth areas. The field work for Bigelow Lake revealed a significant expansion of the mapped OHWM and associated wetlands. Based on this field work, Bigelow Lake changed from being below the 20-acre minimum threshold for shoreline jurisdiction, to exceeding 78 acres of OHWM area. The Coot Company wetland report can be found in the Draft Shoreline Inventory and Analysis for the Cities of Lacey, Olympia, and Tumwater and their Urban Growth Areas Appendix.

The field work conducted by The Coot Company for TRPC in 2008 on several other lakes also resulted in changes to the proposed shoreline jurisdiction for two other lakes in Thurston County jurisdiction from the existing shoreline jurisdiction.

1. Trail’s End Lake was previously considered shoreline jurisdiction in the existing Shoreline Master Program for the Thurston Region. Based on the field work conducted by the Coot Company for TRPC, it was determined to not be associated with the

Susan/Munn Lake system, and therefore falls below the 20 acres shoreline jurisdiction minimum.

2. The Coot Company mapping of OHWM for the north end of Long Lake at the outfall channel resulted in minor increases to the mapped OHWM, resulting in slight extensions of shoreline jurisdiction. The mapped OHWM for the north end of Long Lake stops at a vegetation break between emergent and shrub habitat conditions. Field review confirmed that the OHWM actually extends throughout the shrub as well as emergent areas. Thurston County remapped the location of the OHWM based upon the new delineation.

Review of the north end of Long Lake by the Coot Company and Ecology also focused on whether the Long Lake North SMA jurisdiction should extend north to include Long's Pond and its associated wetlands. Ecology aided in the field delineation at this site, and concluded that the culvert under the railroad embankment provided enough flow that the wetlands north of the railroad and Long's Pond should be considered associated wetlands.

DATA AND INFORMATION SOURCES

Ecology guidelines to support SMP amendments require both the Inventory and Characterization to be based on scientific and technical information. Pursuant to WAC 173-26-201(3)(c) these efforts should use existing sources of information that are both relevant and reasonably available. However, no new data collection or research is required.

For the Inventory, Thurston County staff collected all readily available published and unpublished studies and literature as well as GIS maps and data relevant to Thurston County shorelines in its records. In addition, internet (typical governmental, resource agencies, non-profit restoration and/or enhancement groups) and library information sources were reviewed. Each document or resource was reviewed for relevancy, whether it addressed Ecology requirements, and the scale (County, WRIA, or Basin) to which the information applied. All relevant data sources were incorporated into an Inventory Matrix (Appendix B); sources reviewed but dismissed from further use were noted as such in the Inventory matrix for documentation purposes. The documents and resources obtained during the Inventory process were used for the creation of this Inventory and Characterization report. Additionally, reach specific information derived from the inventory process is shown in a tabular matrix format in Appendix A of this document. Much of the key inventory GIS data (Appendix C) was used to develop the map folio (Appendix H).

ANALYSIS OF ECOSYSTEM-WIDE PROCESSES

In the SMP update process, local jurisdictions are required by SMA guidelines to identify and assess key ecosystem-wide processes that create, maintain, or affect, the ecological functions of local shorelines. For the purposes of this report, ecosystem-wide processes were assessed at the watershed scale according to Water Resource Inventory Areas (WRIAs) boundaries (ecosystem-wide processes and watershed processes mean the same thing in this report and will be used interchangeably). The assessment approach for nearshore and freshwater processes varies slightly as outlined below.

Freshwater

Thurston County's method to describe ecosystem-wide processes for freshwater was based on an adaptation of the Protecting Aquatic Ecosystems by Understanding Watershed Processes: A Guide for Planners, by Stephen Stanley, Jenny Brown, Susan Grigsby, and Tom Hruby (2008) (Ecology Publication #05-06-027). Thurston County used this methodology to map and describe process "important areas" and "areas of alteration" for water, sediment, water quality, and wood movement (See Appendix F for methodology details, and Maps 16-23).

To identify management recommendations for freshwater ecosystem-wide processes, Thurston County used Puget Sound Characterization Volume 1: The Water Resource Assessments (Water Flow and Water Quality) (Stanley, et al. 2012. Ecology Publication #11-06-016) which is described in more detail in the Management Issues and Opportunities methods section at the end of this chapter.

Marine (Nearshore)

While the methodology in the Stanley et al., 2008 document focused on freshwater ecosystems, this characterization report also applied the concepts and approach to mapping the marine nearshore environment, in order to qualitatively describe and assess nearshore coastal processes such as littoral drift; sediment supply, transport, and deposition; coastal erosion; water quality; and functions provided by nearshore marine riparian vegetation (Maps 14, 15, 21, 22, and 23). (See Appendix F).

In addition, relative shoreline process degradation was assessed and mapped by the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) Strategic Needs Assessment (2011) (Schlenger et al., 2011) and is shown on Map 15a, and described in each WRIA chapter.

The PSNERP Strategic Needs Assessment (2011) evaluated the implications of extensive anthropogenic alterations (caused or produced by humans) on the nearshore ecosystem processes that create and sustain the nearshore ecosystems of Puget Sound. The assessment identified how the changes to the Puget Sound nearshore have impacted nearshore processes and the main problems caused by the changes.

The evaluation resulted in numeric outputs for each nearshore process in each process unit. These outputs were combined to estimate the degradation of the individual nearshore processes separately. Overall degradation categories were then assigned to process units to reflect geographic differences in terms of where higher degradation occurs compared to lesser degradation. The degradation categories are relative to degradation conditions in other process units, rather than absolute based on impact thresholds. Overall degradation categories include Most Degraded, More Degraded, Moderately Degraded, Less Degraded, Least Degraded, and Not Degraded. The process degradation categories for marine waterbodies were reported for each waterbody within the WRIA chapters of this report (Map 15a).

Assessing landscape degradation helps identify locations where future restoration and protection efforts will be most successful. When a restoration site is located within a degraded environment, the function and resilience of the restoration project is reduced. Protection efforts should be targeted in large patches of shoreline with the least process degradation. A natural starting point for protection strategies is to conserve those processes and shoreforms identified that are relatively intact (i.e., conserve healthy deltas, shorelines with intact sediment movement processes, and embayments).

To identify management recommendations for the nearshore, Thurston County used Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino, et al. 2012. Technical Report No. 2012-01. Prepared in support of the Puget Sound Nearshore Ecosystem Restoration Project) which is described in more detail in the Management Issues and Opportunities methods section at the end of this chapter.

Terrestrial Wildlife Habitat Assessment

To identity local habitat condition over the landscape-scale, Thurston County used the Thurston County Local Habitat Assessment (WDFW, Habitat Program, 2008, Draft) data layer (Map 23b). The local habitat assessment (LHA) is a geographic information systems (GIS) model that identifies the condition of wildlife habitat across a broad-scale landscape such as Thurston County. This data layer shows broad-scale wildlife habitat characteristics, such as possible wildlife movement corridors.

The Washington Department of Fish and Wildlife developed the Local Habitat Assessment Model to identify areas of overall best habitat condition. The Local Habitat Assessment combined results from three analyses: Ecoregional Assessment, Road Density Analysis, and Land Conversion Analysis (Map 23b - Thurston County Local Habitat Assessment). Priority Habitat and Species (PHS) locations (mapped separately by the Washington Department of Fish and Wildlife) are also considered high wildlife value. The locations of PHS habitats and species are not shown on Map 23b, but will be generally discussed in the individual WRIA chapters. The locations of PHS habitats (though not the individual habitat types) are shown on maps 29 and 34.

SHORELINE REACH-SCALE INVENTORY

The shoreline reach-scale inventory presents a summary of existing and planned/potential land use and describes the physical, social, and ecological conditions within and adjacent to shorelines of the state.

The shoreline reach-scale inventory results are described by WRIA, basin, and SMA jurisdictional waterbodies in Chapters 5-8, and in a matrix format in Appendix A. Each chapter includes an initial introduction to the WRIA, and subsequent subsections by basins and SMA jurisdictional waterbodies. Each subsection includes information regarding water bodies, physical and biological characterization, shoreline land use, and management options. In addition to specific sources cited within this chapter, the content of the reach-scale analysis by basin portion of these chapters are generally based on documents, mapping information, and other resources described in Appendix B: Shoreline Inventory, and Appendix C: GIS data resources.

Reach Break Determination

Reach analysis began with the determination of reach breaks. A reach break is the point at which one shoreline reach ends and another begins. Existing GIS information was used to initially determine shoreline type based on inherent physical characteristics. River shoreline types were generally classified as low or moderate gradient and low, moderately, or highly confined. Determination of lake type was not necessary for reach break determinations. For marine and riverine shorelines, additional information regarding shore forms (e.g., stream mouths, eroding bluffs, or floodplain characteristics) was considered to differentiate among shoreline types along a continuous shoreline area.

Additionally, in-depth consideration of physical features was necessary to further divide or combine areas into cohesive reaches for analysis. The features that were considered include:

- Marine Shorelines
    - Drift cells
    - Sediment and freshwater inputs
- River Shorelines
    - Confluence of streams
    - Tributary inputs
    - Gradient/confinement changes
- Lake Shorelines
    - Slope and surficial geology
    - Soils and nearshore substrate

For all shorelines, following review of physical features, riparian vegetation width and fragmentation, land use, zoning and ownership classes, park boundaries, and City or Urban Growth Boundaries were all considered to refine potential reach break locations.

Proposed reach breaks were reviewed by multiple parties for accurate assessment of physical, biological, and land use features as well as for ultimate use as a management tool. The resulting final reach breaks represent the product of a detailed assessment process. During the creation of final reach breaks, an effort was made to place reach break points on parcel lines. This was done to avoid the potential for a parcel to contain more than one environmental designation. Due to the emphasis of placing reach break points on parcel lines, these locations do not always exactly line up with the locations of key environmental changes (e.g., topography might begin to change shortly before or after a reach break point). Breaks were located closest to the environmental change that was also on a parcel line. Despite this focus on parcel line reach break placement, there were some instances when a reach break was located mid-parcel because that was where the geographic change occurred (e.g., basin lines). This was particularly true when an environmental change occurred within a large parcel.

Reach ID

Each reach was named with a unique identifier that combines the names of the reach break points bounding the reach.

Each reach break point was coded according to the name of the primary water body (e.g., Skookumchuck River = SK) with which the reach/point was associated. Lake and marine points were additionally distinguished by preceding the water body with an L or an M (e.g., Lake Skookumchuck = LSK). Reach break points were then numbered sequentially (e.g., SK-11, SK-12). Reaches were then named accordingly, i.e. the name of the reach bounded by SK-11 and SK-12 is SK-11-SK-12.

For jurisdictional tributary reaches, naming according to the primary reach was maintained, but a secondary numerical identifier was added to capture the tributary. For instance, Johnson Creek is a jurisdictional tributary to the Skookumchuck River (primary water body). Its confluence with the river is located at a reach break identified as SK-11. Therefore, all reach break points on Johnson Creek begin SK-11 and are numbered sequentially from there (e.g., points SK-11-1, SK-11-2, individual reach named SK-11-1-SK-11-2). This naming convention maintains easy reference for tributaries to the primary jurisdictional water body and to the location of their confluences.

Reach Length

Information regarding the length of shoreline within each basin was calculated using GIS spatial analysis tools to determine the sum of designated shoreline length within each basin for lakes, streams, and marine shorelines. Digitized lines representing designated shorelines were split at points proximal to each reach break point. The resulting cut lengths of shoreline were then associated with the appropriate reach. Finally, the length of designated shoreline for each reach was calculated. The length of designated shoreline for rivers is the average of both sides of a reach. The length of designated shoreline for lakes includes the length of shoreline for any islands within the lake. Some reaches only encompass jurisdictional area and not any designated shoreline; therefore those reaches were not given an associated shoreline length value.

Inventory Elements

Inventory elements include, but are not necessarily limited to, the attributes required by the shoreline guidelines in WAC 173-26-201(3)(c) which state:

"Local government shall, at a minimum, and to the extent such information is relevant and reasonably available, collect the following information:

(i) Shoreline and adjacent land use patterns and transportation and utility facilities, including the extent of existing structures, impervious surfaces, vegetation and shoreline modifications in shoreline jurisdiction. Special attention should be paid to identification of water-oriented uses and related navigation, transportation and utility facilities.

(ii) Critical areas, including wetlands, aquifer recharge areas, fish and wildlife conservation areas, geologically hazardous areas, and frequently flooded areas. See also WAC 173-26-221.

(iii) Degraded areas and sites with potential for ecological restoration.

(iv) Areas of special interest, such as priority habitats, developing or redeveloping harbors and waterfronts, previously identified toxic or hazardous material clean-up sites, dredged material disposal sites, or eroding shorelines, to be addressed through new master program provisions.

(v) Conditions and regulations in shoreland and adjacent areas that affect shorelines, such as surface water management and land use regulations. This information may be useful in achieving mutual consistency between the master program and other development regulations.

(vi) Existing and potential shoreline public access sites, including public rights of way and utility corridors.

(vii) General location of channel migration zones, and flood plains.

(viii) Gaps in existing information. During the initial inventory, local governments should identify what additional information may be necessary for more effective shoreline management.

(ix) If the shoreline is rapidly developing or subject to substantial human changes such as clearing and grading, past and current records or historical aerial photographs may be necessary to identify cumulative impacts, such as bulkhead construction, intrusive development on priority habitats, and conversion of harbor areas to nonwater-oriented uses.

(x) If archaeological or historic resources have been identified in shoreline jurisdiction, consult with the state historic preservation office and local affected Indian tribes regarding existing archaeological and historical information."

The shoreline reach-scale inventory presented as a narrative in this report groups attributes in three categories: physical and biological characterization; shoreline use patterns; and management issues and opportunities. The goal of the reach-scale analysis was to provide a high-resolution description of the existing condition of the shoreline, and to use that information to assess the condition of shoreline functions. Reach conditions are described by waterbody within chapters 4-7 as well as by reach in a tabular-format matrix (Appendix A). Methods for developing the reach-scale narrative and populating Appendix A's reach-scale inventory matrix are described below. For GIS data sources used, please see Appendix C.

Physical and Biological Characterization

This section includes descriptions of physical features, priority species and habitats (including shoreline vegetation), and water quality. The information below describes the data that was consulted to develop the description of each element.

Physical Features

The following physical features information was gathered and compiled in both the reach-scale narrative, and the reach matrix (see Table 2-2). This data includes critical areas (areas subject to regulation under the County's CAO). Due to the data available, data collected was slightly different for marine, river, and lake shorelines. For steep slopes and landslide hazard areas, two different data sources were used. The Thurston Geodata existing critical area ordinance layers for steep slopes (hazslope) and landslide hazards (hazslide) were used within the document narrative to identify and describe physical features and regulated critical areas. However, due to perceived mapping inaccuracies of those layers, the Slope_DEM_25ft data was used within the shoreline reach matrix to further identify reaches containing steep slopes and potential landslide areas.

Along rivers, potential channel migration zones are present in all locations of the 100-year floodplain. Areas where the potential channel migration zone may exceed the 100-year floodplain boundary are noted within the narrative and within the reach matrix.

Table 2.2. Physical Feature Data Collected for Marine, River and Lake Shorelines

Shoreline	Category	Response	Additional Information
MARINE			
	Shoreline type	List of shoreline types present	
	Slope stability	List of slope stability classes present along OHWM.	
	Steep slopes (>=40% slopes) *Noted only in the reach matrix	yes/no, anywhere in jurisdiction	qualitative descriptions of amount and/or location
	Potential landslide area (>=15% slopes) *Noted only in the reach matrix	yes/no, anywhere in jurisdiction	qualitative descriptions of amount and/or location
	Hazslide *Noted only in the document narrative	yes/no, anywhere in jurisdiction	
	Hazslope *Noted only in the document narrative	yes/no, anywhere in jurisdiction	
	Past landslides	yes/no, anywhere in jurisdiction	
	Drift cell changes	List of drift cell directions.	
	Surface hydrology	Streams with stream mouths, associated wetlands, 100-year floodplain, inlets, pocket estuaries, potential CMZs	qualitative descriptions of amount and/or location
	High groundwater hazard	yes/no, anywhere in jurisdiction. Only listed as "yes" if mapped within the jurisdiction but outside of mapped wetlands and water bodies.	
	Limited groundwater concern	yes/no, anywhere in jurisdiction	
	Hydric soils	yes/no, anywhere in jurisdiction	
	Soil names	List of soil names and MRCS soil identification number present anywhere in jurisdiction.	

Shoreline	Category	Response	Additional Information
	Bedrock age	List of bedrock names and ages present anywhere in jurisdiction	
	Lithology	List of lithology names present anywhere in jurisdiction	
RIVER			
	Gradient	List of gradients present, broken into classes. <2% = Low gradient, <8% = Moderate gradient, <20% = Steep, >20% = Very steep	
	Confinement	List of confinement classes present	
	Habitat	List of habitats present	
	Steep slopes (>=40% slopes) *Noted only in the reach matrix	yes/no, anywhere in jurisdiction	qualitative descriptions of amount and/or location
	Potential landslide area (>=15% slopes) *Noted only in the reach matrix	yes/no, anywhere in jurisdiction	qualitative descriptions of amount and/or location
	Hazslide *Noted only in the document narrative	yes/no, anywhere in jurisdiction	
	Hazslope *Noted only in the document narrative	yes/no, anywhere in jurisdiction	
	Surface hydrology	Tributaries and confluences, associated wetlands, 100-year floodplain, potential CMZs	qualitative descriptions of amount and/or location
	High groundwater hazard	yes/no, anywhere in jurisdiction. Only listed as "yes" if mapped within the jurisdiction but outside of mapped wetlands and water bodies.	
	Limited groundwater concern	yes/no, anywhere in jurisdiction	
	Geologically sensitive area	yes/no, anywhere in jurisdiction	
	Hydric soils	yes/no, anywhere in jurisdiction	
	Soil names	List of soil names and MRCS soil identification number present anywhere in jurisdiction.	
	Bedrock age	List of bedrock names and ages present anywhere in jurisdiction	
	Lithology	List of lithology names present anywhere in jurisdiction	

Shoreline	Category	Response	Additional Information
LAKE			
	Steep slopes (>=40% slopes) *Noted only in the reach matrix	yes/no, anywhere in jurisdiction	qualitative descriptions of amount and/or location
	Potential landslide area (>=15% slopes) *Noted only in the reach matrix	yes/no, anywhere in jurisdiction	qualitative descriptions of amount and/or location
	Hazslide *Noted only in the document narrative	yes/no, anywhere in jurisdiction	
	Hazslope *Noted only in the document narrative	yes/no, anywhere in jurisdiction	
	Surface hydrology	Tributaries and confluences, associated wetlands, 100-year floodplain.	qualitative descriptions of amount and/or location
	High groundwater hazard	yes/no, anywhere in jurisdiction. Only listed as "yes" if mapped within the jurisdiction but outside of mapped wetlands and water bodies.	
	Limited groundwater concern	yes/no, anywhere in jurisdiction	
	Geologically sensitive area	yes/no, anywhere in jurisdiction	
	Hydric soils	yes/no, anywhere in jurisdiction	
	Soil names	List of soil names and MRCS soil identification number present anywhere in jurisdiction.	
	Bedrock age	List of bedrock names and ages present anywhere in jurisdiction	
	Lithology	List of lithology names present anywhere in jurisdiction	

Priority Species and Habitats

Due to the sensitive nature of WDFW Priority Habitats and Species information, specific locations of species and habitats within the reaches were not included, although there are general descriptions for the locations of some habitat types. The locations of specific habitat features, such as raptor nests, are not identified. Further, if a reach was less than ¼ mile in length, species point locations were duplicated in neighboring reaches to prevent inadvertent dissemination of sensitive species information. Fish and wildlife habitat conservation areas protected under the Critical Areas Ordinance are included in this section.

Species information is primarily from the WDFW Priority Habitats and Species GIS layer. This data included, but was not limited to: salmonids and other priority fish species, priority animal species, and priority habitat information. Habitat data was applied to species information in cases where habitats were applied to individual species. For instance, where a reach included habitat for Roosevelt/Rocky Mountain elk, elk would be included in the species information. The habitat sub-column of Appendix A: Reach Matrix provides a narrative description assessing the following attributes, if present, within the reach:

- Anadromous Fish spawning or rearing;
- WDFW Priority Habitats and Species (for marine reaches this also includes herring, rock sole, sand lance, seabirds, shellfish, clams, and eelgrass based on DNR Shorezone data);
- Qualitative assessment of vegetation within the shoreline jurisdiction based on the most recent aerial photographs available (2009). (For the reach-level narrative, 2012 aerial photographs were used).

For riverine reaches, the location of habitat features was identified generally, in order to maintain an appropriate resolution for sensitive data. The location of these features was identified utilizing the Left/Right bank naming convention (Figure 2.1). The naming convention is based on an observer's perspective facing downstream (direction of flow): the observer's right hand side is "right bank", left hand side is "left bank". This convention provides a consistent approach for bank naming that is not dependent on cardinal direction (north, east, south and west). Therefore the bank naming is continuous for the entire water course, regardless of the compass orientation of the stream. For those unfamiliar with this naming convention, cardinal directions follow the left bank right bank designation.

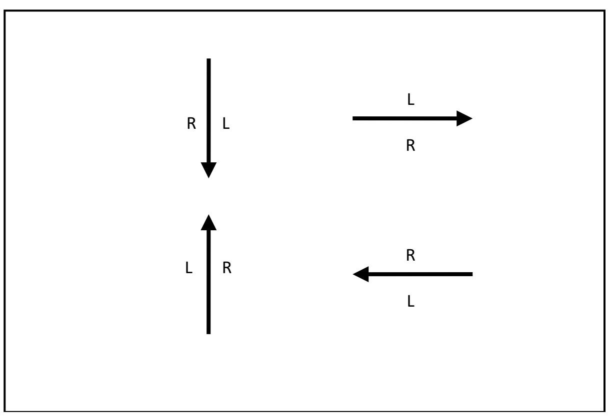

Figure 2-1. Left and Right bank designations for various flow scenarios.

Water Quality

Ecology's 2012Water Quality Assessment (also known as the 303(d) list) was reviewed at the reach scale. The assessment identifies and reports on tested water body segments (marine and freshwater) as they relate to State water quality standards for a variety of parameters, including temperature, pH, dissolved oxygen, metals, etc. Water body segments are classified as Category 1, 2, 4a, 4b, 4c, or 5. Category 5 waters are polluted waters that require a Total Maximum Daily

Load (TMDL) calculation to determine the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards. Category 4a waters are polluted but already have a TMDL, 4b have some other type of pollution control plan already in place, or 4c, the water body is impaired by a non-pollutant (e.g., low stream flow, dams, etc.).

The Washington Department of Health Shellfish Commercial Growing Area Classifications were noted for marine nearshore reaches.

Contaminated soil or groundwater sites were also noted in this section.

Shoreline Use Patterns

This section includes descriptions of existing land use patterns within shoreline jurisdiction, water-oriented uses, and shoreline modifications including levels of impervious surfaces (estimated to exceed 10% or 30%). In addition, existing zoning, existing shoreline environment designations (SEDs) and future development potential were described.

Land Use

The Land Use information in the narrative and in the reach matrix identifies land use within a reach based on the Thurston County Assessor's land use codes associated with the Geodata Parcel shapefile. All shapefiles utilized for this analysis process are identified in Appendix C. The Assessor's land use codes were simplified into the following major land uses: residential, commercial, transportation, utilities, other, recreation, parks, agriculture, mining, timber/forestland, undeveloped, open space, industrial, aquatic, and other. All land use types identified within a reach were included in this sub-column of the reach matrix; the order is not specific (Map 39).

Zoning

The zoning for a reach is provided from the Geodata Zoning shapefile. All zoning types identified within a reach are included; the order is not specific (Map 41b). Zoning abbreviations are included within Appendix E.

Current shoreline environment designation

The current shoreline environment designation is provided from the Thurston County Geodata GIS shapefile. Those areas that do not have a current designation are noted with the text "not designated". All current SMP designations identified within a reach were included; the order is not specific (Map 44).

Future Development Potential

Future development potential (Map 41c) is discussed in the waterbody level narrative, but not listed within the reach matrix in Appendix A. Future development potential is determined from an ArcGIS shapefile developed by Thurston Regional Planning Council (TRPC) (see Appendix C). This layer includes information on parcels with the potential for future development including vacant single lots, vacant subdividable lots, and partially-used subdivisions. Environmental constraints to development were incorporated into TRPC's analysis.

To determine the future development potential for each waterbody, parcels were intersected with the SMA jurisdiction of the water body. This analysis resulted in counts of developable parcels by type and the total number of parcels within the shoreline jurisdiction of each waterbody. If any portion of a parcel fell within the shoreline jurisdiction, it was counted. Parcels could be counted for more than one water body if the parcel fell within the jurisdictional area of multiple waterbodies.

Public Access

Existing and potential public access sites includes: public rights of way and utility corridors; designated parks, trails, and open space corridors; and water-oriented uses such as boat ramps, marinas, and fishing piers.

Two types of public access points were identified: defined and informal. Defined access points include mapped boat launches, parks with shoreline access, and government land such as parks, county trails and bikeways. In addition, areas of "semi-public access" were identified. "Semi-public access indicates areas that are open to all members of the community association. Defined access points were identified utilizing ArcGIS shapefiles, websites, and literature resources including:

- Washington Department of Ecology Shorelands and Environmental Assistance Program, "Reaching the Shore" Project. Public access information for marine shorelines. 2010.
- Trust for Public Land. Public Access Regional Maps. http://www.tpl.org/tier3_cd.cfm?content_item_id=19981&folder_id=262
- Washington Department of Ecology BEACH Program. Public Access Information. http://www.ecy.wa.gov/programs/eap/beach/
- Washington State Parks. 2006. Washington State Accessible Outdoor Recreation Guide - North Puget Sound Region. http://www.parks.wa.gov/adarec/detail.asp?region=NPS#12
- Washington State Department of Health. Swimming Beach Access. http://ww4.doh.wa.gov/scripts/esrimap.dll?name=BEACHMON&Left=985748&Bottom=562851&Right=1110251&Top=648147&Cmd=Zoom+Out&Co=Select+a+County
- Washington State Department of Fish and Wildlife. Water Access. http://wdfw.wa.gov/lands/reg6accs.htm
- Shoreline Public Access Planning Handbook. Thurston Regional Planning Council 1993.
- The Profile. Thurston Regional Planning Council. October 2006
- ArcGIS mapping layers (summarized in the table below).

Informal access to the shoreline was considered to be available in locations where public roads intersected any portion of shoreline jurisdiction, including, but not limited to, all crossings of jurisdictional water bodies. Intersections of public roads and shoreline jurisdiction were identified within the narrative and within the shoreline reach matrix (Appendix A).

Public access within a reach was assessed primarily using ArcGIS data layers, but was supplemented with information on additional known public access programs. Aerial photographs occasionally augmented mapped information, but typically were used to confirm presence or extent of mapped facilities.

Access was generally categorized under four types:

- Launches;
- Trails (mapped trails and bikeways)
- Roads (public roads intersecting any portion of associated shoreline jurisdiction); and
- Parks and Government Land

For the first three elements, all identified features are included in the analysis. Since mapped parks include public preserves or other facilities that do not necessarily provide shoreline access, access was confirmed either using the ArcGIS data layer attributes identifying shoreline facilities (e.g., swimming) park information available elsewhere (e.g., County or State websites) or aerial photograph review. Parks that do not provide shoreline access, or where access is limited to informal approach by boat from the water, were not considered to provide public access. When related to the review process, information regarding limited access or informal approach by water is included in the Notes column of the reach matrix.

Government Land is a feature mapped by Thurston County to include three primary land types: Capitol Forest, Native American tribe reservation lands, and Fort Lewis. Lands within Capitol Forest were considered to have public access and road access within those lands was additionally noted. Native American tribe reservation lands may contain areas of public access, but were not considered to provide access due to private ownership within those lands. Fort Lewis was not considered to provide public access.

Shoreline Modifications

Data relating to known contaminated sites, water quality, and shoreline modifications including: piers, docks, and boat ramps; groins/jetties; armored shorelines (dikes, bulkheads); and other over-water structures; transportation/utility facilities (roads, bridges, railroads, marinas, utilities, culverts and dams) and impervious surfaces (estimated to exceed 10% or 30%) were identified using ArcGIS mapping layers and aerial photograph review (Appendix C).

Shoreline structures, modifications, and water quality were assessed in the reach matrix. Categories were: modifications, facilities, adjacent land uses, and water quality (Table 7). In each response, all elements were included with a yes/no response based on data and aerial review, with additional information as described below. If a category is not applicable for a reach, such as the shellfish rating for a riverine environment, a response of N/A is provided.

Table 2.3. Shoreline structure and modification review

Category	Elements (yes/no response)	Additional Information*
Modifications	Piers/docks/boat ramps	Number and type
	Groins/jetties	
	Culverts	Number within associated jurisdiction, number blocked.
	Dams	
	Armoring	Brief description of location
Facilities	Roads	Number within associated jurisdiction.
	Bridges	Number within associated jurisdiction, bridge name or general location
	Railroads	Number within associated jurisdiction
	Marinas	
	Utilities	Type within associated jurisdiction, data also includes number of utilities if necessary
Adjacent Land Uses	Agriculture	Based on land use and aerial photographs
	Aquaculture	
	Impervious Surface	A response of Yes is provided if visual estimation of >10%, If visual estimation of >30% a note is also provided.
Water Quality	303 (d) list	Parameters listed
	Contaminated sediments	Parameters or additional information listed
	Shellfish harvest ratings (rating)	DOH shellfish harvest rating provided

*When necessary additional information on these categories is provided in the Notes column.

Notes

This column was used in Appendix A: Reach Matrix, to provide additional clarification for information addressed in the rest of the matrix. It is also used to capture items of interest and characteristics that did not fit into a specific column of the reach matrix, which include, but were not limited to:

- Water quality/quantity monitoring sites;
- Fish hatcheries;
- Fluctuations in jurisdiction between County and cities and/or UGAs;
- Non-culvert fish barriers;
- Any questionable fish barrier not confirmed by map elements or aerial photograph;
- Presence of public preserves or parks; and
- Parcel ownership complexity for marine tidelands.
- Thurston County Staff notes about specific areas.

Management Issues and Opportunities

The opportunities for protection and restoration column in Appendix A and narrative section in this report includes areas or projects which have been formally identified by prior studies, conservation organizations, or agencies as areas important for restoration and/or protection. These opportunities are described in general terms to lay the foundation for the SMP Restoration Plan.

Puget Sound Nearshore Ecosystem Restoration Project Strategies

The “Strategies for Nearshore Protection and Restoration in Puget Sound” report (Cereghino et al. 2012), has identified management strategies for all river deltas, barrier embayments, beaches, and coastal inlets in Puget Sound. Management measures are the types of actions that can protect and restore nearshore Puget Sound (Figure 2-2). The report organizes the landscape into four different kinds of places that describe four different ways that ecosystem processes structure the shoreline to sustain a unique set of ecosystem services. Each landform provides a discrete set of services, not replaceable by another landform. Therefore the strategies do not attempt to compare deltas to beaches or beaches to inlets. For all marine waterbodies, these management strategies were reported (Maps 45-48). Each nearshore management strategy has numerous potential management options listed under marine shorelines in Chapter 9.

PROTECT HIGH High potential sites that are minimally degraded and indicate substantial opportunities to protect large complex systems.	RESTORE HIGH High potential sites with moderate degradation, where there may be opportunity to substantially increase ecosystem services.	ENHANCE HIGH High potential sites that have been highly modified, and where strategic actions may enhance ecosystem services.	Increasing Potential
PROTECT Sites that are minimally degraded and indicate opportunities to protect systems.	RESTORE Sites with moderate degradation, where there may be an opportunity to increase ecosystem services.	ENHANCE Sites that have been highly modified and where strategic actions may enhance ecosystem services.	
	Increasing Degradation		

Figure 2-2. Management Strategies for Nearshore Protection and Restoration in Puget Sound. Figure adapted from Cereghino et al. (2012).

Puget Sound Water Flow Assessment

The Puget Sound Water Flow Assessment identified general management recommendations for shoreline restoration and/or protection of water flow processes (Maps 49-52). These GIS model results are for **water flow processes only** and are based on the final technical document Puget Sound Characterization Volume 1: The Water Resource Assessments (Water Flow and Water Quality) (Stanley, et al. 2012. Ecology Publication #11-06-016). WRIAs 11, 13, and 14 are the final results. WRIA 23 was assessed for Thurston County’s SMP update (because WRIA 23 was not included in the Puget Sound Assessment) by the Washington Department of Ecology in December, 2010 using the technical document Puget Sound Watershed Characterization Project: Description of Methods, Models and Analysis (Draft for Peer Review, March 2010, Version 2) (Stanley et al., 2010. Ecology Publication #10-06-05).

The management recommendations are based on a water flow management matrix (Figure 2-3). Areas that are important and relatively unimpaired become candidates for protection, while those that are important to the process but more impaired become candidates for restoration. Areas that are both relatively less important for a process and in which severe changes have already occurred will result in the least impact to watershed processes if further development occurs.

The water flow management recommendations are to be used in conjunction with the shoreline inventory to identify reach-scale opportunities for restoration/ protection. For each waterbody, readers should look at the general management recommendation outcome from the Puget Sound Water Flow Characterization (Stanley et al., 2010 and 2012) studies. Each general management recommendation has numerous potential management options listed in Chapter 9. If a general recommendation from these studies lists two categories of general recommendations (such as protection/restoration), users should consider the management options for both recommendation categories. The management options listed for each general recommendation may or may not apply, depending on the specifics of each waterbody.

IMPORTANCE			
	HIGH	Highest Protection	Highest Restoration
	MED-HIGH	Protection	Restoration
	MEDIUM	Protection/Restoration	Restoration/Development
	LOW	Conservation	Development/Restoration
	DEGRADATION	LOW / MEDIUM	MED-HIGH / HIGH

Figure 2-3. Watershed Management Matrix. The rating for importance is on the vertical axes, and rating for impairment is along the horizontal axes. The combination of these two indicates suitability of the sub-unit for protection, restoration, conservation, or development. Figure modified from Stanley et al. (2012).

3 ECOSYSTEM PROFILE

This chapter describes a broad overview of Thurston County's regional setting, ecosystems, critical areas, and priority species and habitats. The chapter discusses the process controls of precipitation, geology, topography, soils, and land cover that govern ecosystem-wide processes.

This chapter is intended to serve as an overview to provide context for the details on individual WRIAs and their shoreline reaches provided in Chapters 5-8 and the Reach Analysis Matrix located in Appendix A. Maps depicting key shoreline attributes described in this chapter are provided in the map folio in Appendix H and listed in Table 3.1.

Table 3.1. Appendix H Map Folio Names and Numbers

Map #	Map Title/Theme
1	Shorelines of the State and Shorelines of Statewide Significance
2	Shoreline Jurisdiction Changes
3	Proposed Shoreline Jurisdiction with Reach Breaks
4	Proposed Shoreline Jurisdiction with Reach Breaks NE
5	Proposed Shoreline Jurisdiction with Reach Breaks NW
6	Proposed Shoreline Jurisdiction with Reach Breaks SC
7	Proposed Shoreline Jurisdiction with Reach Breaks SW
7a	Proposed Shoreline Jurisdiction with Reach Breaks SE
8	Water Resource Inventory Areas (WRIAs)
9	Watershed Basins
10	Topography and Hydrology
10a	Shoreline Type
11	Geology – Bedrock
12	Geology – Lithology
13	Precipitation
14	Coastal Processes Important Areas
15	Coastal Processes Alterations
15a	PSNERP - Marine Shoreline Degradation
16	Hydrology Important Areas
17	Hydrologic Processes Alterations
18	Sediment Important Areas
19	Sediment Processes Alterations
20	Water Quality Important Areas
21	Water Quality Processes Alterations
22	Large Woody Debris Process Important Areas
23	Large Woody Debris Process Alterations
23b	Local Habitat Assessment - WDFW
24	Aerial Photos with Reaches

25	Land Cover
26	Impervious Surfaces
27	Built Environment by Basin
28	Forest Cover
29	Critical Areas – Biological
30	Critical Areas – Critical Aquifer Recharge Areas
31	Critical Areas – Hydrologic
32	Critical Areas – Geologic
33	Slope
34	Biological Features
34b	Kelp and Eelgrass
34c	Saltmarsh
35	Marine Fisheries
36	Shellfish Areas
37	Aquatic Land Ownership
38	Nationwide Permit 48
39	Current Land Use – Generalized from the Office of the Assessor
40	Current Land Use – Thurston Regional Planning Council - Buildable Lands 2007
41a	Future Land Use – Thurston Regional Planning Council - Buildable Lands 2007
41b	Zoning
41c	Future Development Potential
42	Registered Historic Districts and Properties
43	Public Access and Public Lands
44	Existing Shoreline Environment Designations
45	PSNERP - Beach Management Recommendations
46	PSNERP - Coastal Inlet Management Recommendations
47	PSNERP - Barrier Embayment Management Recommendations
48	PSNERP - River Delta Management Recommendations
49	WRIA 11 - Puget Sound Water Flow Management Recommendations
50	WRIA 13 - Puget Sound Water Flow Management Recommendations
51	WRIA 14 - Puget Sound Water Flow Management Recommendations
52	WRIA 23 - Puget Sound Water Flow Management Recommendations
53	Proposed Shoreline Environment Designations
54	Proposed Shoreline Environment Designations NE
55	Proposed Shoreline Environment Designations NW
56	Proposed Shoreline Environment Designations SC
57	Proposed Shoreline Environment Designations SE
58	Proposed Shoreline Environment Designations SW

REGIONAL OVERVIEW

Thurston County is located in western Washington at the southern point of Puget Sound. The total area of the county is approximately 717 square miles. The County is bordered by Pierce County and the Nisqually River to the northeast, Lewis County to the south, Grays Harbor County to the west, Mason County to the north/northwest, and Puget Sound to the north.

Thurston County is one of the most rapidly urbanizing regions of Puget Sound. Since the 1960's, Thurston County's population has generally exceeded the statewide growth rate. Thurston County's population grew by 14.8 percent, to roughly 238,000 residences, between 2000 and 2007. Thurston County's cities and UGA's contain approximately 67 percent of the residential population (TRPC, 2007). Thurston County's largest population centers are the cities of Olympia, Lacey, and Tumwater. Other population centers include the cities of Yelm, Bucoda, Rainier, and Tenino.

A "watershed" is an area that drains into a common river, lake, or other waterbody. Washington State has been divided into 62 watershed areas known as water resource inventory areas (WRIAs). The WRIAs were formalized under Washington Administrative Code (WAC) 173-500-040 and authorized under the Water Resources Act of 1971, Revised Code of Washington (RCW) 90.54. Thurston County contains portions of the following WRIAs: 11 - Nisqually, 13 - Deschutes, 14 – Kennedy-Goldsborough, and 23 - Upper Chehalis. A small portion of WRIA 22 - Lower Chehalis is located in the western-most portion of the county. However, WRIA 22 does not contain any SMA jurisdictional shorelines (Map 8).

Thurston County Shorelines

Within Thurston County there are approximately 468 linear miles of shoreline. There are approximately 116 linear miles of marine shoreline (including the inner shores of bays and marinas) and approximately 131 miles of lakeshore on 38 lakes that are designated as shorelines of the state in Thurston County. In addition, this report provides a general inventory of more than 221 miles of stream shoreline (per WAC 173-18, with revisions from 20 cubic feet per second [cfs] mapping from USGS, 1998). There are 137 marine reaches, 164 lake reaches, and 236 stream reaches (Maps 1-7).

Marine Shorelines

Thurston County is adjacent to several bodies of marine waters within the Puget Sound. The major marine waters are as follows and are provided in order from east to west and with the corresponding WRIA number in parentheses: Nisqually Reach (WRIA 11) Henderson Inlet (WRIA 13) Budd Inlet (WRIA 13) Eld Inlet (WRIAs 13 and 14) and Totten Inlet (WRIA 14).

Freshwater Shorelines

Rivers, Streams, and Associated Floodplains

Thurston County is drained by five major rivers, in addition to several small streams which flow directly in to Puget Sound. The five major rivers are described below in order from east to west with the corresponding WRIA number in parentheses (See Map 8).

The Nisqually River (WRIA 11) is the easternmost river in Thurston County, forming the east county border with Pierce County. The Nisqually River is fed by glaciers on the south flank of Mount Rainier. It flows from Mount Rainier in a northwesterly direction into Puget Sound at a point about ten miles northeast of Olympia. The vast majority of the River and its regulated tributaries include associated 100-year floodplain. The associated floodplain is relatively simple by comparison with other rivers in the County (e.g., Chehalis). It is typically tightly associated with the channel but widens in a number of areas, effectively expanding the area of regulated shoreline well beyond the 200-ft zone.

The Deschutes River (WRIA 13) begins in the Bald Hills of Lewis County and flows northwesterly. The Deschutes River is roughly parallel to the Nisqually River and is located five to ten miles to the west of the Nisqually. It flows into the Puget Sound at Budd Inlet in the City of Olympia. The vast majority of the River and its regulated tributaries include associated 100-year floodplain. The associated floodplain is somewhat more complex than that of the Nisqually River and includes a number of wide spots, lobes, and alternate channels based on the local topography. This contributes to a more complicated associated shoreline jurisdiction. The Deschutes River has four SMA regulated tributaries: Little Deschutes, Mitchell Creek, Reichel Creek, and Spurgeon Creek.

The Skookumchuck River (WRIA 23) also begins in the Bald Hills of Lewis County. It flows north into Thurston County where it drains the hills in the south central portion of the County. It winds towards the City of Bucoda and then turns in a southern direction to its confluence with the Chehalis River in Lewis County. Part of the upper Skookumchuck River has been impounded to form Lake Skookumchuck. Most of the River and its regulated tributaries include associated 100-year floodplain. Below Lake Skookumchuck, the floodplain is relatively wide and is complex in areas including lobes, alternate channels, and areas where the floodplain includes pockets of non-floodplain land. It also extends up at least one non-regulated tributary. All of these characteristics contribute to a more complicated associated shoreline jurisdiction. The Skookumchuck River has two SMA regulated tributaries: Thompson Creek (Skookumchuck) and Johnson Creek.

The Chehalis River (WRIA 23) flows into Thurston County in a northwesterly direction from Lewis County. It crosses from Lewis County into the southwestern corner of Thurston County where it drains the Michigan Hills area and receives water from both Prairie and Scatter Creeks. The Chehalis discharges into the Pacific Ocean at Grays Harbor. The entire Chehalis River and most of Scatter Creek, its single SMA regulated tributary within the County, include associated 100-year floodplain. The topography around the Chehalis River results in a very wide, very complex associated floodplain, particularly where the Black and Chehalis Rivers share 100-year floodplain areas. The most complicated floodplain areas are in the uppermost reaches within the County and the area immediately downstream of the Scatter Creek confluence. The Scatter Creek floodplain is relatively wide downstream of the City of Tenino and includes features such as lobes and alternate channels. The lower reaches of the Chehalis

River (within Thurston County) along with the lower reaches of the Black River (again within the County) have some of the most complicated associated jurisdiction in the County due to floodplains and the wetlands which are also typical of the area.

The Black River (WRIA 23 south of Black Lake, WRIA 13 north of Black Lake) like the Skookumchuck, is also a tributary to the Chehalis River. The Black River drains a large portion of the easternmost Black Hills and much of the prairie area east of the river. The gradient of the Black River is not great enough for effective drainage, and consequently, has a large number of adjacent wetlands throughout its course. Its confluence with the Chehalis is within Grays Harbor County. The Black River has five SMA regulated tributaries: Mima Creek, Beaver Creek, Waddell Creek, Salmon Creek, and Dempsey Creek.

In addition to the five large rivers, there are four SMA regulated streams draining to Puget Sound shorelines. Kennedy Creek (WRIA 14) originates in northwest Thurston County and flows to Totten Inlet by way of Mason County. Kennedy Creek does not have associated floodplain. McLane Creek (WRIA 13) drains the area immediately south of the head of Eld Inlet. Its associated floodplain is relatively simple but wide in places. Woodland Creek (WRIA 13) drains the area immediately south of the head of Henderson Inlet. It also has a relatively simple associated floodplain. McAllister Creek (WRIA 11) drains the area immediately west of the Nisqually River and empties into the Nisqually Delta area. South of 1-5, its associated floodplain is simple and relatively narrow. North of 1-5, its associated floodplain is extremely wide and complex where it merges with the floodplain of the Nisqually River in the Nisqually Delta area.

Two additional regulated streams, Sherman Creek and North Fork Porter Creek (both in WRIA 23) do not connect to the five larger rivers in Thurston County. Both streams originate in the southwest area of the County within Capitol Forest and eventually drain to the Chehalis River. Neither stream includes associated floodplain or substantial wetland areas; their jurisdiction is primarily defined by the 200-ft distance from OHWM. While the 20 cfs point for North Fork Porter Creek occurs approximately 200 ft within the boundary of Thurston County, the remainder of the area that falls within shoreline jurisdiction on North Fork Porter Creek is within Grays Harbor County.

Lakes

Lakes greater than 20 acres and therefore managed under the SMA within Thurston County include the following, arranged by WRIA:

WRIA 11: Lake Saint Claire, Clear Lake, Elbow Lake, Bald Hill Lake, Inman Lake, Alder Lake, and an unnamed lake.

WRIA 13: Bigelow Lake, Trosper Lake, Ward Lake, Hewitt Lake, Shinke pond, Long Lake, Munn Lake, Hicks Lake, Southwick Lake, Pattison Lake, Sunwood Lake, Tempo Lake, Offut Lake, McIntosh Lake, Lawrence Lake, Reichel Lake, Lawrence lake, unnamed lake.

WRIA 14: Summit Lake, two unnamed ponds.

WRIA 23: Deep Lake, Scott Lake, Pitman Lake, Black Lake, Skookumchuck Lake, several unnamed lakes, several unnamed ponds, and four unnamed lake shorelines created from mining activities.

Lakes that are located within the County but are wholly within a municipal jurisdiction are not included in this list. Additional information for the above listed lakes is provided within the individual WRIA chapters (Chapters 5-8). Information at an even more detailed scale can be found within Appendix A - the Reach Matrix.

Wetlands

Most regulated freshwater jurisdiction, with the exception of some of the higher gradient streams and rivers, are also mapped as wetland areas. Associated wetland areas, those areas outside of the actual waterbody, are less ubiquitous within County shorelines. In low gradient areas, including the main stems of the major rivers and many of the lakes, associated wetland and associated floodplain areas often co-occur. The Black River, which has a particularly low gradient and very slow flow, has large areas where a quite wide channel, essentially the entire floodplain, is almost entirely vegetated with complex wetland vegetation (much of this area has been identified by the USFWS as priority restoration/conservation area as part of the Black River Unit of the Nisqually Wildlife Refuge). The Deschutes River includes large reaches where associated wetlands extend beyond the floodplain; again, a function of a relatively low gradient reach.

Particularly in low-gradient areas, wetlands (like floodplains) are often not associated with a single regulated waterbody but rather form a complex between them. The complex of wetland and floodplain making up associated wetland jurisdiction between the Chehalis and Black Rivers an example of this, as is the much smaller complex located between Scott and Deep Lakes.

In higher gradient areas, including much of Capitol Forest and the upper reaches of the Nisqually and Skookumchuck Rivers, associated wetlands are much less prevalent.

Topography

Thurston County’s topography varies from coastal lowlands to Puget prairie flatlands to the foothills of the Cascades. The northwest and southeast corners of the County are marked by peaks ranging from 1,700 to 3,000 feet in elevation. However, the central region rarely exceeds 600 to 700 feet in altitude and most of the prairie areas range from 100 to 500 feet in altitude. Glacial activity in Thurston County’s geologic past left the land scattered with lakes and ponds. The northernmost boundary of the County is determined by the shoreline of Puget Sound. Inlets exclusive to the County are Budd, Henderson, and Eld Inlets. Budd and Henderson Inlets are separated by Dana Passage. Other inlets form the boundaries between Thurston and adjacent counties. Totten Inlet divides Thurston and Mason Counties, and the Nisqually River separates Thurston County from Pierce County (Map 10).

Geology

Thurston County lies within the Puget Trough. The Puget Trough is a long northward slanting lowland located between the Cascade Mountains on the east and the Olympic Mountains on the west, extending from central western Oregon into Canada. The County is heavily influenced by past glaciations and glacial erosional and depositional features dominate the landscape. These features influence the routing of water and sediment through the landscape. Glacially deposited sediment varies in composition depending on the depositional process and can influence infiltration and erosion potential.

The underlying geology of the region is the end product of over 40 million years of long-term tectonic, glacial, fluvial, and hillslope processes occurring at the western end of the North American plate. The geologic history can be condensed into three general time frames, ordered here from oldest to newest. Thurston County's bedrock was formed from 50 to 2 million years ago, by volcanism and marine deposition. The volcanism resulted from the North American plate moving over more dense oceanic rocks. Balsaltic and Andesitic volcanic flows are found in the higher elevation areas of Thurston County, including the Capitol Forest area and the hills in southern Thurston County around Skookumchuck Lake and north to the City of Tenino, the Deschutes River, and around Alder lake. Marine sedimentary rocks are found in the same locations as the volcanic flows. Additionally, there is a large patch of marine sedimentary rock south of the Chehalis River (Map 12).

The geology, soils and land forms of Thurston County are largely the result of glacial action during the ice age that lasted from 2,000,000 years ago to 10,000 years ago (the Pleistocene Epoch) (Map 11). Between 2 million to approximately 10,000 years ago, during the Pleistocene epoch, the landscape experienced multiple glacial and inter-glacial periods that provided the raw materials and shaped much of the modern landscape in the Puget Sound lowlands. During the Pleistocene ice age, valley glaciers joined into huge continental glaciers that were thousands of feet thick. At their maximum advance, the glaciers extended to Scatter Creek south of Olympia, and to the Deschutes River in eastern Thurston County. The glaciers advanced and retreated four times during the ice age, with the last advance (ending around 14,000 years ago) referred to as the Vashon glaciation. As the glaciers moved southward from British Columbia they gouged and scoured the land beneath them and picked up large amounts of sediment ranging from boulders to silt. The friction of movement caused melting of the ice at the glaciers' base, resulting in some of the sediment load being deposited as a compressed layer directly below the glacier. This formed the dense, generally impermeable material known as glacial till (also hardpan or boulder clay). Glacial till is found in patches throughout the lowland areas of all the Thurston County WRIAs. The largest areas include the peninsulas that jut into Puget Sound, the area south of Yelm between the Nisqually and Deschutes Rivers, and an area west of the Black River south of the Tumwater Urban Growth Area and north of the City of Tenino (Map 12).

Most recently, from 10,000 years ago to present, the large ice sheets receded and the post-glacial reorganization occurred. As the glaciers melted, the waters that flowed off it carried large amounts of silt, sand, and gravel. Coarser materials were deposited close to the glacier's edge, while sands were carried farther and deposited on the flood plains. Silt and clay were deposited mainly in lakes and marine waters. Except for numerous scattered "islands" of older consolidated rocks, the entire basin has been partly filled with unconsolidated fluvial and glacial materials of the Pleistocene age. Glacial “drift”, “moraines”, and “outwash” are found in the majority of the low elevation areas in Thurston County. The meltwater from the retreating glaciers carved complex drainages that likely created an outlet from the Puget Sound lowlands to what is now the Chehalis River and Grays Harbor. After the glacier melted, large remnant ice blocks were left on the outwash plains and covered by younger sediments. When the ice blocks melted, the surface collapsed into the holes left by the melted ice, thereby forming the numerous "kettle" lakes of the County (Map 12).

Currently, the dominant geologic factors driving landforms in Thurston County are hillslope and fluvial processes, which are superimposed on glacial, volcanic, and tectonic regimes. Hillslope and fluvial processes govern the movement of materials through the landscape, creating and maintaining aquatic habitat. The large rivers in Thurston County move materials to valley floors through hillslope processes and transport or temporarily store those materials via fluvial processes. Deposited alluvium is found throughout Thurston County in the floodplains of the large rivers and to a lesser extent in smaller systems (Map 12).

Climate

Thurston County has a marine type climate with mild temperatures year-round. In the warmest months, the average high temperature ranges between 75 and 80 degrees. In the winter months, high temperatures average 45 degrees. Like most of western Washington, Thurston County’s weather is characterized by cool, dry, sunny summers and mild, wet winters. Average yearly rainfall for Thurston County is 50 inches with the majority of precipitation occurring between October and May. Precipitation is highest in areas of higher elevation such as the headwaters of the Deschutes, and in the Black Hills. Precipitation typically occurs as low-intensity, long-duration storms. The county spans at least two of Washington’s climatic regions; the Puget Sound Lowlands, and the western Cascades.

Global Climate Change

Thurston County’s shorelines will undoubtedly be impacted by global climate change over time. Effects of global climate change will occur everywhere on the shorelines, but will probably be most pronounced on the low lying nearshore areas. The United Nations Intergovernmental Panel on Climate Change (IPCC, 2007) concluded that, “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level.”

University of Washington’s Climate Impacts Group researchers and others have dedicated substantial effort to modeling potential climate change effects on the Pacific Northwest. Despite these modeling efforts, uncertainty exists regarding the precise timing, magnitude, and extent of climate change impacts in the Puget Sound region. However, it is certain that global climate change impacts will occur. Being proactive by developing plans and taking action now will reduce harm to natural resources and human communities in the future.

The IPCC predicts that average global surface temperature could increase from 2.5 to 10.4˚F, and global sea level could rise between 4 and 35 inches between 1990 and 2100, depending on both the rate of natural changes and the response of the climate system to present and future greenhouse gas emissions (IPCC, 2007). Thurston County's shorelines are likely to be impacted in multiple ways from increasing temperatures and sea levels, as described below.

Temperature Effects on Habitat

Over the past century, Washington has already experienced climate change (Casola et al., 2005a). The surface air temperature has increased on average by approximately 1.5˚F. Over the past 80 years, snowpack has declined, particularly at lower elevations. The beginning of snowmelt and peak stream flows in snow-fed rivers has been occurring earlier in the year. Many plants are also blooming earlier (Casola et al., 2005a).

Washington is likely to face an increase in temperature across all seasons over time (Casola et al., 2005a). By the 2020s, average Pacific Northwest temperatures will likely rise between 2.5 and 3.7˚F, with additional increases in the 2040s of between 3.1 and 5.3˚F. As air temperatures rise, water temperatures are also predicted to increase. Increased air and water temperatures may create inhospitable conditions in lakes, rivers, and salt water, for coldwater fish species such as salmon and trout. The change in conditions may be beyond those species' ability to adapt. Along with temperatures, lake and ocean stratification may also increase which may reduce available nutrients and increase competition among fish species. Additionally, rising air and water temperatures may further impair areas of Puget Sound that are already suffering from low dissolved oxygen levels (e.g., Hood Canal) (Casola et al., 2005a).

Some marine plant species, such as eelgrass and bull kelp, appear to have a narrow range of tolerance for water temperature. As such, these species may suffer as a result of projected temperature increases (Snover et al. 2005). Changes in marine plant communities could alter habitat for marine species that are not substantially affected by moderate water temperature increases, but that depend on bull kelp and eelgrass habitat for shelter, food, or nesting sites.

Pacific salmon species have an unusual life cycle that might make them particularly sensitive to air and water temperature changes (Casola et al., 2005a). Increased summer stream temperatures could stress juvenile salmon rearing in those streams as well as create thermal barriers to adult salmon upstream migration. Lower winter snowpack and earlier spring runoff may increase the occurrence of redd-scouring events and prevent the flushing of juvenile salmon to salt water in runoff. In marine waters, higher water temperatures or altered currents may affect the food availability and change predator distribution, though the impacts of climate change on these factors are not well understood (Casola et al., 2005a).

As water temperatures increase, marine and freshwater planktonic communities may also change (King County, 2006). Warm temperatures in shallow water over prolonged periods favor several groups of organisms, including bluegreen cyanobacteria, (some species of which make toxic substances to people and animals); dinoflagellates, (which produce the toxins that cause red tides); and chlorophyte algae, (some species of which form sizable filamentous masses that cover rocks and structures) (King County, 2006).

Precipitation and Runoff

The modeling results of effects of global climate change on precipitation levels are somewhat uncertain, because many factors influence precipitation that are not well understood (Casola et al., 2005a). However, the majority of models predict that Washington will receive more precipitation with most increases occurring from October through March due to climate change during the 21st century. As winter temperatures increase, more of this precipitation is expected to fall as rain rather than snow, leading to reduced snowpack and earlier spring runoff (Casola et al., 2005a).

Air temperature and precipitation changes from global climate change will affect stream flow, stormwater runoff, and water temperature (Casola et al., 2005a). Stream flow is predicted to experience varying impacts depending on whether a stream is fed primarily by snowmelt or rainfall (Casola et al., 2005a). Low elevation coastal rivers have flow volumes closely connected to seasonal precipitation patterns; as winter precipitation increases, winter flows in these systems are thus also likely to increase. Rivers draining intermediate "transient snow zone" elevations have higher sensitivity to the proportion of winter precipitation falling as snow versus rain. These rivers typically have peak flows during November and December and again during spring runoff. Rivers draining "transient snow zone" elevations are likely to see an increase in "wet season" flows as rainfall increases, reduced spring and summer flows, and an earlier occurrence of runoff. Basins dominated by transient snow zones are also expected to experience an increase in moderate floods, though large floods are expected to occur at roughly the same frequency as present (Casola et al., 2005a).

As temperatures increase and snowpack declines toward mid-century, river systems that depend on snowmelt will likely have peak runoff occur earlier in the spring, as well as have lower summer base flows (King County, 2006). Both of these changes may greatly impact fish and other biota adapted to coldwater habitat during the warm, dry months of summer (King County, 2006).

Sea Level Rise

One of the anticipated effects of climate change in the Pacific Northwest is sea-level rise. In response to global climate change, sea levels are estimated to rise between 4 and 35 inches by 2100 (Intergovernmental Panel on Climate Change 2006). In Olympia, land subsidence alone is already responsible for a sea level rise of approximately 1 foot per century. Adding the impacts of climate change to subsidence on sea level rise may result in port district inundation and central business district flooding in Olympia in the future (Casola et al. 2005b).

Climate change might affect sea levels and coastlines of Washington State in a number of ways (Casola et al., 2005b). Coastal flooding and erosion could be increased by rising sea levels, particularly in areas of tectonic subsidence and on flat beaches. To protect infrastructure, shoreline armoring in many areas may have to be enhanced, while in other areas, development and housing may simply have to be abandoned or moved in response to flooding. Landslide and freshwater flooding occurrence may also increase with winter precipitation. In order to minimize additional risks to infrastructure in the future, further development in coastal hazard areas should be discouraged (Casola et al., 2005b).

Sea level rise may also considerably change the geographic locations of the shoreline jurisdiction over time. A sea level rise of up to 3 feet will cause a substantial movement of water inland and would be particularly pronounced in lower slope or flatter areas (King County, 2006). Water moving inland has the potential to flood beachfront homes and cause associated property damage, as well as significantly increasing erosion of feeder bluffs. Rising sea level is also likely to disrupt other coastline ecological processes. Predicted habitat changes in Thurston County are: increased shoreline erosion, loss of estuarine beach and tidal flat areas, saltwater intrusion into freshwater wetlands and brackish marshes, and reduction in tidal marshes (NWF, 2007).

Options to address the impacts of rising sea levels were presented by Casola et al. (2005b) including:

- Preserving ecological buffers to allow for beach migration inland;
- Restoring wetlands to control runoff and floods;
- Augmenting shoreline protection while understanding its negative consequences on shoreline habitat;
- Creating a disaster relief plan for erosion and flooding events.

Landcover

Land cover in Thurston County follows the patterns of geology and topography discussed above. Forest land dominates the higher elevation part of the county that lies within the foothills of the Black Hills and the hills along the County's southern border. Much of the forest land is in active harvest rotation, as evidenced by numerous patches of shrub and grassland in these areas.

The river valleys and adjacent lowland areas around the Black River, Chehalis River, Scatter Creek, Skookumchuck River, Deschutes River, and the Nisqually River are covered primarily in pasture/hay, cultivated land, grassland, and Palustrine emergent wetlands.

Developed land cover is most heavily concentrated within the cities and urban growth areas of Olympia, Lacey, and Tumwater in WRIA 13. Secondarily, developed land cover is most concentrated within the cities of Yelm, Tenino, Bucoda, and Rainier.

To provide an overall summary of land cover in Thurston County, data from the NOAA CCAP (2006) project are shown on Map 25 (Land Cover) and summarized in Table 3.2 below. The density of urban development generally decreases with distance away from Puget Sound.

Table 3.2. NOAA CCAP Landcover Category Percentages per WRIA

	WRIA Number			
2006 NOAA CCAP Landcover Category	**11**	**13**	**14**	**23**
2 - Developed, High Intensity	0.3%	1.7%	0.0%	0.2%
3 - Developed, Medium Intensity	1.5%	4.8%	0.6%	0.7%
4 - Developed, Low Intensity	4.8%	10.9%	3.7%	3.1%
5 - Developed, Open Space	3.2%	6.1%	1.7%	2.2%

6 - Cultivated Crops	0.6%	0.5%	0.0%	2.5%
7 - Pasture/Hay	12.0%	5.7%	1.1%	9.1%
8 - Grassland/Herbaceous	4.7%	6.0%	5.7%	5.2%
9 - Deciduous Forest	3.0%	6.4%	7.5%	6.3%
10 - Evergreen Forest	36.9%	28.9%	44.2%	33.4%
11 - Mixed Forest	11.1%	11.8%	15.5%	10.2%
12 - Scrub/Shrub	11.9%	10.3%	13.5%	17.3%
13 - Palustrine Forested Wetland	2.0%	1.7%	1.8%	2.3%
14 - Palustrine Scrub/Shrub Wetland	2.8%	1.9%	1.5%	3.5%
15 - Palustrine Emergent Wetland	3.4%	1.8%	1.0%	2.6%
18 - Estuarine Emergent Wetland	0.4%	0.1%	0.2%	0.0%
19 - Unconsolidated Shore	0.1%	0.2%	0.2%	0.1%
20 - Barren Land	0.5%	0.4%	0.2%	0.6%
21 - Open Water	0.6%	1.0%	1.6%	0.8%
22 - Palustrine Aquatic Bed	0.0%	0.0%	0.0%	0.0%
23 - Estuarine Aquatic Bed	0.0%	0.0%	0.0%	0.0%
25 - Perennial Ice/Snow	0.0%	0.0%	0.0%	0.0%

OVERVIEW OF KEY SPECIES AND HABITATS IN THURSTON COUNTY

Thurston County Critical Areas

The Thurston County Critical Areas Ordinance addresses the following types of critical areas, all of which occur within shorelines: critical aquifer recharge areas; geologic hazard areas; seismic hazard areas; volcanic hazard areas; mine hazard areas; frequently flooded areas (including channel migration zones); fish and wildlife habitat conservation areas; and wetlands. Regulations protecting Critical Areas are listed in Thurston County Code (TCC) Title 24, which was last updated in July, 2012. See Maps 29-32. Agricultural uses and lands critical areas are addressed in TCC 24. Pursuant to TCC 24, agricultural uses and lands critical areas applies to agricultural lands and uses as defined as "Agricultural Activities" in the Growth Management Act, as amended (RCW 36.70A.703). The Thurston County Critical Areas Ordinance (Title 24) applies to all other uses, structures, and lands.

Critical aquifer recharge areas

Pursuant to TCC 24.03, "Critical aquifer recharge areas" means an area with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge.

Geologic Hazard areas

Pursuant to TCC 24.03, "Geologic hazard areas" means those areas that because of their susceptibility to erosion, landsliding, earthquake, volcanic lahar, liquefaction or other geological events, are not suited to siting commercial, residential or industrial development consistent with public health or safety concerns.

Seismic hazard areas

Pursuant to TCC 24.03, "Seismic hazard areas" means the following:

A. Those areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, surface faulting, settlement or soil liquefaction, such as artificial fill areas, and areas underlain by glaciolacustrine deposits and/or glacial outwash; or
B. Those areas mapped as having a liquefaction susceptibility of high, moderate to high, or low to moderate on the Liquefaction Susceptibility Map of Thurston County, Washington, published by Washington Department of Natural Resource (September 2004).

Volcanic hazard areas

Pursuant to TCC 24.03, "Volcanic hazard areas" means those areas subject to pyroclastic flows, lava flows and inundation by debris flows, mud flows or related flooding resulting from geologic or volcanic events of Mount Rainier, as mapped by United States Geological Survey Open File Report 98-428. The boundaries on these maps are approximately located, and areas outside of the boundaries should not be regarded as hazard-free.

Mine hazard areas

Pursuant to TCC 24.03, "Mine hazard areas" means those areas directly underlain by, adjacent to, or directly affected by mine workings such as adits (mine entrances) gangways (tunnels) drafts or air shafts.

Frequently flooded areas

The frequently flooded areas chapter applies to frequently flooded areas and one-hundred-year channel migration hazard areas as defined in TCC 24.03. Pursuant to TCC 24.03, "Frequently flooded areas" means lands in the flood plain subject to at least a one percent or greater chance of flooding in any given year or areas within the highest known recorded flood elevation, or within areas subject to flooding due to high ground water. This includes all areas within unincorporated Thurston County identified on flood insurance rate maps prepared by the Federal Insurance Administration, as supplemented by "The Flood Insurance Study for Thurston County," dated November 17, 1980, as amended. (These maps and the referenced report shall be on file with the department at the Thurston County Permit Assistance Center). Frequently flooded areas may include special flood hazard areas as defined in Chapter 14.38 TCC or high ground water flood hazard areas, where high ground water forms ponds on the ground surface, or may overlap with other critical areas, such as streams, rivers, lakes, coastal areas, and wetlands. Frequently flooded areas include: channel migration areas; high groundwater flood hazard areas; and river, lake, marine, and coastal flood hazard areas.

Fish and wildlife habitat conservation areas

Pursuant to TCC 24.03, "Fish and wildlife habitat conservation areas" are areas that serve a critical role in sustaining needed habitats and species for the functional integrity of the ecosystem, and which, if altered, may reduce the likelihood that the species will persist over the long term. These areas may include, but are not limited to, rare or vulnerable ecological systems, communities, and habitat or habitat elements including seasonal ranges, breeding habitat, winter range, and movement corridors; and areas with high relative population density or species richness. These also include locally important habitats and species.

A. Fish and wildlife habitat conservation areas that must be considered for classification and designation include:
B. Areas where endangered, threatened, and sensitive species have a primary association;
C. Habitats and species of local importance, as determined locally;
D. Commercial and recreational shellfish areas;
E. Kelp and eelgrass beds; herring, smelt, and other forage fish spawning areas;
F. Naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat;
G. Waters of the state;
H. Lakes, ponds, streams, and rivers planted with game fish by a governmental or tribal entity;
I. State natural area preserves, natural resource conservation areas, and state wildlife areas; and
J. Any other habitat areas as defined by WAC 365-190-130, as amended.

<u>Wetlands</u>
Pursuant to TCC 24.03, “Wetlands” means areas that are inundated or saturated by surface water 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, and other areas meeting the definition of wetland under RCW 36.70A.030, as amended. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas in order to mitigate conversion of natural wetlands. Areas below the ordinary high water mark (OHWM) of a water body, including but not limited to marine waters, lakes, ponds, streams, and rivers, may also qualify as wetlands if they meet the criteria of the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual and the 2008 Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region.

Important Habitats and Species

This section describes some of the key shoreline-related species and habitat resources of Thurston County. Many of these species rely upon the shorelines (nearshore, freshwater, or shorelands) of the county for some portion of their life cycle.

This is not an exhaustive review of all habitats and species in the County, but a general overview of the resources that are most closely related to or affected by shoreline planning. Additional information on the locations of these specific resources in Thurston County is provided in the shoreline-reach scale analysis by basin and waterbody (Chapters 5-8) in the Shoreline Reach Matrix (Appendix A) and in the Map Folio (Appendix H).

Federal and State Species and Habitat Lists

Thurston County provides critical habitat resources for many federally and/or state listed threatened and endangered species. The federal Endangered Species Act (ESA) (64 FR 14307) lists species as threatened or endangered and their federally designated critical habitats.

The WDFW Priority Habitats and Species (PHS) Program manages information for habitats and species considered by the State to be priorities for conservation and management. Priority species require protective measures for their survival due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations (e.g., heron colonies, bat colonies) considered vulnerable; and species of recreational, commercial, or tribal importance that are vulnerable. Priority habitats are habitat types or elements with unique or significant value to a diverse assemblage of species. A priority habitat may consist of a unique vegetation type (e.g., West side prairie) or dominant plant species (e.g., Oregon white oak woodlands) a described successional stage (e.g., old-growth forest) or a specific habitat feature (e.g., cliffs). WDFW reports the PHS information listed in Table 3.3 for Thurston County, many of which may occur in regulated shorelines.

Table 3.3. Thurston County Priority Habitats and Species including Federal and State Status

	Species/ Habitats	State Status	Federal Status
Habitats	Aspen Stands		
	Biodiversity Areas & Corridors		
	Herbaceous Balds		
	Old-Growth/Mature Forest		
	Oregon White Oak Woodlands		
	West Side Prairie		
	Riparian		
	Freshwater Wetlands & Fresh Deepwater		
	Instream		
	Puget Sound Nearshore		
	Caves		
	Cliffs		
	Snags and Logs		
	Talus		
Fishes	Pacific Lamprey		Species of Concern
	River Lamprey	Candidate	Species of Concern
	White Sturgeon		
	Olympic Mudminnow	Sensitive	
	Pacific Herring	Candidate	Species of Concern
	Longfin Smelt		
	Surfsmelt		
	Bull Trout/ Dolly Varden	Candidate (Bull Trout only)	Threatened (Bull Trout only)
	Chinook Salmon	Candidate	Threatened (Puget Sound ESU) (Upper Columbia Spring run is Endangered)
	Chum Salmon	Candidate	Threatened
	Coastal Res./ Searun Cutthroat		Species of Concern
	Coho		Threatened – Lower Columbia Species of Concern – Puget Sound
	Pink Salmon		
	Rainbow Trout/ Steelhead/ Inland Redband Trout	Candidiate (Steelhead only)	Threatened (Steelhead only)

	Sockeye Salmon	Candidate	Threatened – Ozette Lake Endangered – Snake River
	Pacific Cod	Candidate	Species of Concern
	Pacific Hake	Candidate	Species of Concern
	Walleye Pollock	Candidate	Species of Concern
	Brown Rockfish	Candidate	Species of Concern
	Copper Rockfish	Candidate	
	Quillback Rockfish	Candidate	Species of Concern
	Lingcod		
	Pacific Sand Lance		
	English Sole		
	Rock Sole		
Amphibians	Cascade Torrent Salamander	Candidate	
	Van Dyke's Salamander	Candidate	Species of Concern
	Oregon Spotted Frog	Endangered	Candidate
	Western Toad	Candidate	Species of Concern
Reptiles	Pacific Pond Turtle (also known as Western Pond Turtle)	Endangered	Species of Concern
Birds	Common Loon	Sensitive	
	Common Murre	Candidate	
	Marbled Murrelet	Threatened	Threatened
	Western grebe	Candidate	
	W WA nonbreeding concentrations of: Loons, Grebes, Cormorants, Fulmar, Shearwaters, Storm-petrels, Alcids		
	W WA breeding concentrations of: Cormorants, Storm-petrels, Terns, Alcids		
	Great Blue Heron		
	Brant		
	Cavity-nesting ducks: Wood Duck, Barrow’s Goldeneye, Common Goldeneye, Bufflehead, Hooded Merganser		
	Western Washington nonbreeding concentrations of: Barrow's Goldeneye, Common Goldeneye, Bufflehead		
	Harlequin Duck		
	Waterfowl Concentrations		
	Bald Eagle		
	Golden Eagle	Sensitive	Species of Concern
	Peregrine Falcon	Candidate	
	Mountain Quail		
	Sooty Grouse		
	Wild Turkey		
	W WA nonbreeding concentrations of: Charadriidae, Scolopacidae, Phalaropodidae		
	Band-tailed Pigeon		
	Yellow-billed Cuckoo	Candidate	Candidate
	Spotted Owl	Endangered	Threatened
	Vaux’s Swift	Candidate	
	Pileated Woodpecker	Candidate	
	Oregon Vesper Sparrow	Candidate	Species of Concern
	Purple Martin	Candidate	
	Streaked Horned Lark	Endangered	Candidate
Mammals	Dall's Porpoise		
	Harbor Seal		
	Orca (Killer Whale)	Endangered	Endangered
	Pacific Harbor Porpoise	Candidate	
	California Sea Lion		
	Roosting Concentrations of: Big-brown Bat, Myotis bats, Pallid Bat		
	Townsend’s Big-eared Bat	Candidate	Species of Concern
	Western Gray Squirrel	Threatened	Species of Concern
	Western Pocket Gopher	Threatened	Candidate
	Fisher	Endangered	Candidate
	Marten		
	Columbian Black-tailed Deer		

	Elk		
Invertebrates	Geoduck		
	Butter Clam		
	Native Littleneck Clam		
	Manila Clam		
	Olympia Oyster	Candidate	
	Pacific Oyster		
	Dungeness Crab		
	Pandalid shrimp (Pandalidae)		
	Beller's Ground Beetle	Candidate	Species of Concern
	Pacific Clubtail	Candidate	
	Leschi's Millipede	Candidate	
	Mardon Skipper	Endangered	
	Puget Blue	Candidate	
	Valley Silverspot	Candidate	Species of Concern
	Taylor's Checkerspot	Endangered	Candidate

Thurston County Important Habitat and Species

This section includes important habitat and species defined by the Thurston County Critical Areas Ordinance (TCC 24.25.065) as the following:

A. Federally Listed Species and Associated Habitats. Animal and plant species listed under the federal Endangered Species Act (64 FR 14307) as endangered, threatened, or candidates for listing and their habitats of primary association. (Consult the U.S. Fish and Wildlife Service and National Marine Fisheries Service for current listings.)
B. State Listed Species and Associated Habitats.
    1. Priority species and their habitats of primary association. Priority species identified on the WDFW Priority Habitats and Species (PHS) List and their habitats of primary association. (Consult the state department of fish and wildlife for the current PHS list).
    2. Priority habitats. Priority habitats identified on the WDFW Priority Habitats and Species (PHS) List. (Consult the state department of fish and wildlife for the current PHS list).
    3. Prairies meeting the following criteria are priority habitats:
        a) Prairie habitat, as defined in Chapter 24.03 and Table 24.25-4 TCC;
        b) Areas less than one acre in size with characteristics meeting the definition of prairie habitat which are functionally connected to another prairie habitat located within one-half mile of the subject area.
    4. Oregon white oak (Quercus garryana) woodlands, stands, and individual trees meeting the following criteria are subject to this section:
        a) Oak woodlands, as defined in Chapter 24.03 TCC.
        b) Oak Savanna, as defined in Chapter 24.03 TCC.
        c) Individual oak trees and stands of oak or oak conifer associations less than one acre in size that are located within one-half mile of a stand meeting the criteria in this subparagraph.

5. State listed plant species, such as those occurring on the Department of Natural Resources' List of Known Occurrences of Rare Plants.

C. Habitats and Species of Local Importance

6. Habitats of Local Importance. Habitats of local importance in Thurston County are listed in TCC Table 24.25-4 in Appendix 24.25-1 (See Table 3.4 below).
7. Species of Local Importance. Wildlife species of local importance are listed in TCC Table 24.25-5 in Appendix 24.25-1 (See Table 3.5 below).

Table 3.4. Habitats of Local Importance (TCC 24.25-4).

Habitat	Purpose of Habitat/Basis for Listing	Related Species
Cottonwood floodplains	Current floodplain regulations do not protect this habitat from being cleared for converting to agricultural uses. This is a habitat found only along the Nisqually River in Thurston County. Cottonwoods are a keystone species in many riparian zones (Johnson et al 2001).	Red-eyed vireo
Balds (dry plant communities, grasslands)	Globally unique and rare plant community. Primarily located in SE corner of Thurston County, vicinity of Bald Hills. Similar to prairies, but smaller and shallower soils (associated with bedrock outcrops).	
Prairie or Westside Prairie	Important prairie or westside prairie habitat means herbaceous, non-forested (forested means greater than or equal to sixty percent forest canopy cover) plant communities that can either take the form of a dry prairie where soils are well-drained or a wet prairie. Priority dry prairie areas have a minimum size of one acre. In addition, some areas dominated by Scot's (Scotch) Broom (non-native shrub) or other invasive species to prairies shall be considered prairie if the area is restorable and when there are native prairie species in the understory below the shrubs. Such marginal and restorable areas can be less valuable, but may have significant value if they are large in area, or in a landscape that connects two or more prairies. Small areas less than one acre with characteristics meeting the definition of prairie habitat which are functionally connected to another larger prairie habitat within approximately one half mile are also important prairie habitat areas. Mima mounds shall be preserved to the greatest practicable extent as determined by the review authority. See the definitions for prairie habitat, dry prairie, and wet prairie.	Mazama pocket gopher, Taylor's checkerspot bufferfly, Mardon skipper, streaked horned lark
Oregon White Oak Habitat	Important Oak Habitat means stands of Oregon white oak (Quercus garryana) or oak/conifer associations	Western gray squirrel

	where canopy coverage of the oak component of the stand is twenty-five percent or more; or where total canopy coverage of the stand is less than twenty-five percent, but oak accounts for at least fifty percent of the canopy coverage. The latter is often referred to as oak savanna. Important oak habitat consists of stands greater than or equal to one acre (0.4 hectares) in size. Single oaks or stands less than one acre (0.4 hectares) shall also be considered an important habitat when found to be particularly valuable to fish and wildlife (i.e. they contain many cavities, have a large diameter at breast height, are used by priority species, or have a large canopy) or are located in degraded habitat areas. Individual oak trees and stands of pure oak or oak conifer associations less than one acre in size that are located in close proximity to an oak habitat larger than one acre may also be considered an important habitat.	
Springs and seeps (includes mineral springs)	Forested springs/seeps are protected in the Forests and Fish Report to protect stream associated amphibians (SAA) protect water quality, etc. fifty-foot no cut buffer required. Mineral springs are important to Band-tailed pigeons, especially during breeding season.	

Table 3.5. Wildlife Species of Local Importance (TCC 24.25-5)

Common Name	Scientific Name	Basis for Listing as Locally Important
Birds:		*The following bird species depend on prairie habitat and are declining in population due to loss of habitat. They serve as indicator species for relatively large and/or healthy prairie and may assist in protection of prairie habitat.*
Western Meadowlark	Sturnell neglecta	Prairie species. Needs large open areas. Found on Joint Base Lewis McChord (JBLM) Mima Mounds, and Olympia Airport year round.
Lazuli Bunting	Passerina amoena	Prairie species. Declining populations. Found near Scatter Creek and Joint Base Lewis McChord (JBLM).
Common nighthawk	Chordeiles minor	Prairie species. Population declining significantly.
American Kestrel	Falco sparverius	Prairie species. Population is declining. Nests in cavities. Can use nest boxes.
Northern Harrier	Circus cyaneus	Prairie and herbaceous wetlands. Ground nester. Uncommon breeding in Washington.
American Bittern	Botaurus lengitinosus	State of Washington Birds classifies A. Bittern as a Species of Immediate Concern for wetlands.
Olive-sided Flycatcher	Contopus cooperi	State of Washington Birds classifies Olive-sided Flycatcher as a Species of Immediate Concern for forests.
Short-eared owl	Asio flammeus	State of Washington classifies Short-eared owl as a Species of High Concern for grasslands.
Amphibians and Reptiles:		*The following amphibian species ranges have been significantly reduced due to habitat alteration and development. Sensitive to site and landscape alterations, specifically that limit breeding and foraging site connectivity, and dispersal/seasonal corridors.*
Olympic Torrent Salamander	Rhyacotriton olympicus	Three of the four species of Rhyacotritoninae occur in Thurston County - Olympic Torrent, Columbia Torrent, and Cascade Torrent. Cascade and Columbia Torrent salamanders are both listed as State Candidate Species by WDFW. Erik Neatherlin of WDFW and Bill Leonard, Biologist with WDOT, both recommend listing the Olympic Torrent Salamander as a Locally Important Species due to their association with old-growth forests and sensitivity to increased temperatures and sedimentation in streams and headwaters.
Tailed Frog	Ascaphus truie	Sensitive to timber harvest. Survival may depend on protection of cool flowing streams required for breeding and larval development. Likely to be affected by increased water

		temperatures occurring after timber harvest. Headwater stream protection through buffers is important mitigation measure.
Cope's Giant Salamander	Dicamptodon copei	Cope's giant salamander (Dicamptodon copei) are sensitive to habitat change and fragmentation from development. Both species would be expected to occur in the extreme SE portion of the county, similar to the two PHS species, Cascades torrent salamander and Van Dyke's salamander. The SE portion of the county in the headwaters of the Deschutes systems and the Nisqually system in the vicinity of Alder lake should be considered a "hot" region for all four (2 PHS, 2 local species mentioned) as this area is the only place they are likely to occur in the county. (Source: E. Neatherlin, WDFW)
Pacific Giant Salamander	Dicamptodon tenebrosus	May be associated with old-growth forests. Found in moist coniferous forests. During breeding season found in or near streams. Closely associated with high gradient streams with coarse substrate.

Salmonids

Both federally listed and non-listed species of salmonids use streams, rivers, and nearshore habitats throughout Thurston County. In Thurston County, Chinook, coho, pink, and summer and fall chum salmon, resident and searun cutthroat trout, as well as summer and winter steelhead are documented in the larger rivers and streams. Thurston County rivers and estuaries provide spawning and rearing habitat for summer and fall Chinook, coho, and chum salmon as well as for winter and summer steelhead trout.   Resident fish are also present in streams and lakes through Thurston County. All of Thurston County’s marine nearshore is designated as federal critical habitat for Puget Sound Chinook. The Nisqually Delta area is designated as federal critical habitat for Bull Trout. Much of the Nisqually River is designated federal critical habitat for both the Puget Sound Chinook and Bull Trout.

Nearshore Habitats and Species

Important nearshore marine habitats in Thurston County include shoreline types, forage fish spawning areas; shellfish beds; estuaries / pocket estuaries, salt marshes, eelgrass and kelp, and marine nearshore riparian areas. Many of these areas or habitats are included in the definition of critical saltwater habitats in the Guidelines (WAC 173-26-221 (2) (iii)).

Shoreline Type

The WDNR qualified and mapped information, including shoreline type, observed on the shorelines of Thurston County in the Washington ShoreZone Database. The Shoreline Type divides the shoreline into 15 shoreline types commonly used in British Columbia. The classification is a simplification of the BC shoreline classification.

Analyses of shoreline type data show that the most frequently occurring shoreline type in Thurston County is sand beach (39.5%) followed by mud flat (25.5%) (Table 3.6).

Table 3.6. Thurston County Shoreline Type (DNR Shorezone Inventory).

Shoreline Type	Miles	% of Thurston County Shoreline
Estuary wetland	13.5	11.6%
Man-made	3.2	2.7%
Mud flat	29.6	25.5%
Sand and gravel beach	6.2	5.4%
Sand and gravel flat	1.7	1.4%
Sand beach	45.8	39.5%
Sand flat	16.0	13.8%
	116.0	100.0%

Forage Fish

Forage fish such as Surf smelt, sand lance and herring are a critical prey base for salmonids. Forage fish use a variety of shallow nearshore and estuarine habitats for spawning, feeding, and rearing (Long et al., 2005). Surf smelt (*Hypomesus pretiosus*) and Pacific sand lance (*Ammodytes hexapterus*) have habitat requirements for spawning in the upper intertidal zones of beaches, within a limited tidal elevation range, and in substrate of specific size and type (Penttila, 1978; 1995). In contrast, Pacific herring (*Clupea harengus*) spawn in intertidal and shallow subtidal areas, where they deposit eggs on marine vegetation at elevations between 0 and -10 feet MLLW (WDFW, 2000a). Spawning habitat suitable for forage fish for these species is limited, and these species are especially vulnerable to changes in beach morphology, beach sediment characteristics (sources, transport or deposition) or nearshore riparian cover (WDFW, 2000a). Forage Fish spawning beaches have been mapped along much of the marine shoreline of Thurston County. Documented surf smelt spawning areas occur widely along Thurston County's shorelines. Sand Lance documented spawning areas include the upper Steamboat Island Peninsula, the upper Cooper Point peninsula, between Boston Harbor to Big Fishtrap, and along the Nisqually Reach. Herring have been documented spawning in Gallagher Cove, Dana Passage, and the Nisqually Reach (Map 35).

Shellfish Resources

Cobble to fine sand beaches and tidal sand and mudflats are important habitats for many shellfish species. Intertidal areas in Thurston County support hardshell clams including butter clams (*Saxidomus gigantea*) native littleneck (*Protothaca staminea*) manila clams (*Venerupis philippinarum*) cockles (*Clinocardium nuttalli*) and horse clams (*Tresus* spp.). Geoducks (*Panopea abrupta*) typically burrow offshore in subtidal areas up to 2 to 3 feet into the mud or soft sand. Shrimp, crab, Olympia oysters (*Ostreola conchaphila*) and non-native Pacific oysters (*Crassostrea gigas*) also inhabit the shoreline areas. Dungeness crab (*Cancer magister*) frequent eelgrass beds, and red rock crab (*Cancer productus*) inhabit rocky terrain with less silt content (Thurston County 2008, WDFW, DOE).

Shellfish beds perform a number of ecological functions including stabilizing substrates, cycling nutrients, enhancing water quality (filtering and retention) creating habitat structure (e.g., oyster reefs) and providing food for a wide variety of marine invertebrates, birds, fish, and mammals. Shellfish beds and commercial and recreational shellfish harvest beaches are found along the shorelines of Thurston County. For locations within Thurston County, please see Map 35 - Marine Fisheries, Map 36 - Shellfish Areas, and Map 38 - Nationwide Permit 48 (NWP 48) for Shellfish Aquaculture. The U.S. Corps of Engineers NWP 48 covers all existing shellfish aquaculture activities, including all culture methods currently used in oyster, mussel, scallop, clam (including geoduck) farming. Activities not covered under NWP 48 include: new operations; expansion of project area; stockpiles and staging areas. The Tribal shellfish beaches and growing areas are also distributed throughout the County.

Water quality issues and their effect on the harvest of commercial and recreational shellfish have resulted in the Henderson Inlet and Nisqually Reach Shellfish Protection Districts (Thurston County Public Health and Social Services 2013). Commercial harvest areas have been closed (classified prohibited) along Carlyon Beach, in Woodard Bay, lower Henderson Inlet, and along sections of the Nisqually Reach. Part of Henderson Inlet is open conditionally (DOH, 2013).

Estuaries/ Pocket Estuaries

Estuaries are semi-protected inland waters with freshwater inputs that act as transition zones between freshwater and marine environments. They make up the area at the mouth of a river or stream from the head of tidal influence seaward to the point where fluvial influences no longer dominate (Map 14). Historically, Thurston County estuaries were located at the mouths of the major river systems. Several of these, such as Budd Inlet at the mouth of the Deschutes River, have been highly modified and have impacted habitat. However, habitat remnants are present even in the most impacted areas. Nisqually Delta is the largest and most prominent of the Thurston County estuary systems.

As well as the major estuaries listed above, there are tidal marsh systems called “pocket estuaries” that are believed to support the early marine life histories of juvenile salmon species, though are not connected to the natal watersheds (Hood Canal Coordinating Council, 2005). ‘Pocket estuaries’ range from the mouths of small streams and creeks to nearly enclosed bays, and can be composed of habitats such as unvegetated flats, salt marsh, and tidal channels. Pocket estuaries occur irregularly along the protected and exposed shorelines that dominate most of Puget Sound. The amount of freshwater input into a pocket estuary ranges from year round to none. There may be hundreds of pocket estuaries scattered throughout Puget Sound, and cumulatively, these smaller estuaries can be very important to several life history stages of juvenile Chinook or juvenile chum salmon.

Pocket estuaries are mapped in Thurston County to occur in Totten Inlet in Burns Cove, north of Elizan Beach, and along Gallagher Cove. Pocket estuaries are mapped in Eld Inlet in Sanderson Harbor, Flapjack Point, Sunrise Beach, Mud Bay, and north of Countryside Beach. Budd Inlet contains mapped pocket estuaries in Silver Spit, Gull Harbor, and Little Fishtrap. Henderson Inlet contains two mapped pocket estuaries. Along the Nisqually Reach, pocket estuaries are mapped near Baird Cove, near Sandy Point and in several other small inlets (Washington Coastal Atlas and WDWF). Mapped estuarine wetlands are also located in the Oyster Bay and Gallagher

Cove areas of Totten Inlet, in Sanderson Harbor and the Mud Bay area of Eld Inlet, Henderson Inlet at the mouth of Woodland Creek, and in Baird Cove and several other places along Nisqually Reach (Map 14).

Estuaries supply critical ecological functions and biological resources including: water quality improvement such as nutrient retention and cycling; food web support; and habitat structure/connectivity; erosion/shoreline protection; flood attenuation; tidal exchange/organic matter exchange; and stream base-flow and groundwater support. Estuaries supply critical habitat for the fish migration as well as refugia for many marine and brackish species. They provide critical functions for salmon by providing salinity gradients that allow juveniles to gradually adjust to salt water as well as serving as nurseries for a multitude of aquatic species that are a forage base for salmon.

Many species, including juvenile salmonids, use estuaries and other shallow water habitats as a refuge from predation when migrating, particularly when complex habitat features such as woody debris or submerged vegetation are absent (Kahler et al., 2000). Juvenile Chinook salmon and summer chum both depend on estuarine environments (WDFW and PNPTC, 2000). For recovery of threatened salmon stocks in Puget Sound, preservation and/or restoration of estuaries is considered crucial (Brewer et al. 2005; Hood Canal Coordinating Council, 2005; Todd et al., 2006).

Salt Marshes

Salt marshes and brackish marshes are tidally inundated habitats. Salt marshes occur in areas at and above mean higher high water (MHHW) where sediment supply and accumulation are relatively high. Salt marshes can occur on river and stream deltas, such as the Nisqually River Delta, along sand spits sheltered from waves and currents, and in bays. Salt marsh root mats and areas of dense stems trap and stabilize sediments. The accumulation of sediment cause marshes to extend outward over time as the sediments entering the delta from rivers are captured and retained by salt marsh vegetation. Salt marshes provide complex, branching networks of tidal channels used by juvenile salmonids for feeding and refuge from predators. The tidal channel networks also form migratory linkages to riverine and marine environments (Brewer et al., 2005).

In Thurston County, mapped salt marsh is located in most of the inlets within Totten and Eld Inlets; in Butler Cove, Gull Harbor; and Little and Big Fishtraps in Budd Inlet; in Woodard Bay and throughout the southern half of Henderson Inlet; and in most of the inlets along Nisqually Reach (Washington Coastal Atlas) (Map 34c).

Eelgrass and Kelp

Eelgrass (*Zostera marina*) is a native marine seagrass that develops extensive meadows on fine sand, gravel, and mud substrates in the lower intertidal and shallow subtidal zones within semi-protected or protected shorelines (Bulthuis, 1994; Thom et al., 1998). Eelgrass typical substrate locations have fine to medium sands as well as containing comparatively high levels of organic matter and nutrients (Simenstad, 2000). Typically this includes shallow tideflats, lining channels in estuaries, and in the shallow fringe areas of the subtidal zone. Eelgrass primarily grows between tidal elevations of +1 meter to -2 meters relative to mean lower low water (MLLW) (Thom et al., 2001; Simenstad, 2000).

Eelgrass can reach 2 meters in height, forming a dense canopy. Where undisturbed, eelgrass can grow in nearly adjoining corridors within a drift cell, but also grows patchily within and between drift cells. In general, eelgrass corridors decrease in width as beach gradient steepens and waters increase in turbidity (Simenstad, 2000). Eelgrass beds supply an important source of organic matter to food webs in the intertidal/shallow subtidal zones. Eelgrass plants produce organic carbon which is delivered to the food web via microbial decomposition of eelgrass materials (Williams and Thom, 2001). Juvenile salmon, and numerous species of fish and other marine animals use the decomposed organic matter in their diets. Eelgrass provides habitat structure and refuge from predators, for salmon and other species. Whereas herring use eelgrass for spawning and rearing habitat, epiphytic algae and other organisms use eelgrass leaves as attachment sites to ameliorate wave and current energy (PSAT, 2001).

Although Thurston County has limited mapping of eelgrass, there are some known areas associated with the Nisqually Delta and at the southern end of Oyster Bay in Totten Inlet; as well as the potential for habitat recovery in other areas of the County (Washington Coastal Zone Atlas and the DNR Shorezone Inventory) (Map 34b).

Kelp, are large brown seaweeds, which attach to bedrock or cobbles in shallow waters, especially in areas with moderate to high waves or currents. Kelp includes both floating and non-floating species. Thurston County does not contain any areas of floating kelp species. The southernmost floating bull kelp forest (*Nereocystis luetkeana*) in Puget Sound is located outside of Thurston County, near Squaxin Island (Mumford, 2007). Kelp is found primarily in the shallow subtidal zone in areas where the water is shallow enough to allow light penetration, and there is hard substrate including pilings and other artificial surfaces. Kelp beds are a critical component of nearshore food webs, reduce wave energy, and provide sheltered habitat within the kelp bed for juvenile salmon, other fishes, crabs, and other animals. Kelp can also change its environment by affecting wave and current energy (Mumford, 2007).

Non-floating kelp is mapped in the DNR ShoreZone Inventory data as occurring in Totten Inlet around Gallagher Cove, off of Steamboat Island, from Carlyon Beach past Hunter Point to Edgewater Beach and Sanderson Inlet into Eld Inlet, along Cooper Point and at the north end of Budd Inlet, from Zangle Cove to Big Fishtrap and northeast into Henderson Inlet, off of Johnson Point both into Henderson Inlet and along Nisqually Reach. It is also mapped just outside of the Thurston County boarder around islands in the South Sound (Washington Coastal Zone Atlas and the DNR Shorezone Inventory) (Map 34b).

Marine Riparian

Marine riparian areas occur at the interface between upland and aquatic areas and provide unique protection of the aquatic nearshore by the preservation of vegetation and protection of hydrologic regimes. Intact riparian habitats provide many critical ecological functions including: delivery of organic matter to nearshore and marine habitats; insect food sources for juvenile fish; microclimate control to upper beach and intertidal areas; sediment control, shoreline stabilization, and erosion reduction; water quality protection, woody debris to help build complex habitat and stabilize beach substrate; wildlife habitat; buffer from wave energy; protection from wind exposure; reduce rate and effects of stormwater runoff; increase infiltration versus runoff along bluffs (Levings and Jamieson, 2001; Brennan and Culverwell, 2004). Slope stability is dependent on a healthy nearshore riparian vegetation zone to protect against landslides and other erosion hazards. Nearshore riparian vegetation can mitigate the effects of excessive soil moisture which can lead to erosion and/or mass instability by promoting evapotranspiration and providing root masses that support mechanical slope stability (Brennan and Culverwell, 2004).

The nearshore riparian habitat in Thurston County varies considerably in its condition. There are areas of intact native vegetation ranging to areas of dense residential development where there is very little remaining native vegetation (See Maps 24 and 25).

Freshwater Habitats

Freshwater Wetlands

Thurston County's Critical Areas Ordinance is consistent with the state and federal definition of wetland. 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 perform numerous functions including: flood attenuation; water quality protection and groundwater recharge; habitat provision for numerous species of fish and wildlife. Freshwater wetlands provide biogeochemical functions involving trapping and transforming chemicals and improving water quality in the watershed; hydrologic functions related to reducing flooding and maintaining water regimes; and food web and habitat functions (Granger et al., 2005).

Freshwater wetlands are present throughout the County and mapped on Thurston County's Geodata system. Wetlands are frequently indicated by areas dominated by "hydric" soil types (including organic soil deposits) areas of low slope, depressional areas, along streams, and on slopes/transitional areas where groundwater is expressed to the surface (Map 10).

Wetlands associated with shorelines of the state, or the shoreline jurisdiction, are managed under the SMA. In the context of the SMA, *associated wetlands* means wetlands that are in proximity to shorelines or that influence or are influenced by waters subject to the Act (WAC 173-22-030 (1)). These typically include wetlands that are functionally related to the shoreline through a hydrologic connection or other factors, and wetlands that physically extend into the shoreline jurisdiction (Map 1 and Maps 3-7).

Riparian Areas

Freshwater riparian areas function similarly to marine nearshore riparian areas. Riparian zones contribute to healthy streams by suppressing the erosional processes that move sediment, mechanically filtering and/or storing upland sediments before they can enter stream channels, and dissipating energy and inhibiting sediment input (Knutson and Naef, 1997). Riparian areas perform water quality functions related to pollutant removal. This occurs primarily through trapping/storing of nutrients and heavy metals in the vegetation root systems and fine sediment present in the riparian areas.

Riparian zones are the major source of large woody debris (LWD) input to streams. This large woody debris is crucial to creating habitat within the ecosystem. Structural complexity within streams is developed from trees, root wads, and limbs that fall into the stream resulting from normal tree mortality, mass slope movement, windthrow, or bank undercutting. LWD creates complex hydraulic patterns that form pools and side channels; waterfalls; enhanced channel sinuosity; and other physical and biochemical channel changes. Aquatic species depend on the in-channel structural diversity created by LWD for hiding, overwintering habitat, and juvenile rearing, in all sizes of streams and rivers (Knutson and Naef, 1997).

Forest practices, including clear cutting, can damage and degrade many of the riparian zones on state-owned and private forest lands in Thurston County. Forest and Fish rules have helped minimize the short and long term effects of forest cover loss. However, the recovery on a basin scale and overall ecological functions may take time to recreate functional habitats.

In Thurston County, the condition of riparian habitat ranges from areas where the riparian habitat is essentially untouched, to areas where the riparian habitat has been primarily removed and extremely fragmented (Maps 24 and 25).

Priority Terrestrial Wildlife Habitats and Core Areas

Other habitat resources within Thurston County freshwater shoreline jurisdiction include terrestrial forests (including old growth/mature forests) Oregon White Oak Woodlands, and west side prairies. Lowland forests are dominated by western hemlock (*Tsuga heterophylla*) Douglas-fir (*Pseudotsuga menziesii*) and western red cedar (*Thuja plicata*). Old Growth/Mature Forests are mapped along the upper Nisqually River.

Oregon White Oak Woodlands and west side prairies occur in Thurston County freshwater shoreline jurisdiction. Oregon White Oak habitats are mapped along the Black River, Scatter Creek, and the Deschutes River. They are mapped (WDNR) in many locations throughout WRIAs 23, 13, and 11, including around Offutt Lake, and Long Lake (Map 34). Many rare grassland species are declining with increased urbanization and the suppression of frequent fires that once sustained the grasslands, leading to more densely forested areas (WDNR, 2005). West side prairie habitat is mapped along the Black River and Scatter Creek in WRIA 23 (WDFW). Soils that may support west side prairies are mapped throughout Thurston County in the low-lying and low gradient areas (Map 34).

Soils that may support the Mazama (Western) Pocket Gopher (*Thomomys mazama*) have been mapped in all Thurston County WRIAs. The soils are most prevalent in the low gradient areas of WRIA 23 around Black River and Scatter Creek, around the Deschutes River, and the low gradient areas in the northern section of WRIA 11 (Map 34).

Thurston County Local Habitat Assessment

The Washington Department of Fish and Wildlife developed a Local Habitat Assessment Model to identify areas of overall best habitat condition (described in Chapter 2 methods). The Local

Habitat Assessment combined results from three analyses: Ecoregional Assessment, Road Density Analysis, and Land Conversion Analysis (Map 23b - Thurston County Local Habitat Assessment). Priority Habitat and Species (PHS) locations (mapped separately by the Washington Department of Fish and Wildlife) are also considered high wildlife value. The locations of PHS habitats and species are not shown on Map 23b, but will be generally discussed in the individual WRIA chapters. The locations of PHS habitats (though not the individual habitat types) are shown on maps 29 and 34.

In Thurston County overall, the areas of highest habitat condition are located in the Nisqually National Wildlife Refuge, in the southeast portion of the county near Alder Lake, in portions of Capitol Forest, the Scatter Creek Wildlife Area, several areas along the Black River, an area between the Deschutes River, Offut Lake and Millersylvania State Park, and along the upper Skookumchuck between the Skookumchuck Lake and the county border. These areas contain the highest biodiversity, have the fewest roads, and contain the least land conversion.

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4 ARCHAEOLOGICAL AND HISTORIC RESOURCES

This chapter describes how archaeological and historic resources are managed in shoreline jurisdiction, defines these resources, summarizes the general location of these resources by Water Resource Inventory Area (WRIA) and describes the archaeological and historic resources data used.

According to the State shoreline management guidelines, if archaeological or historic resources have been identified in shoreline jurisdiction, the local government is required to collect information about these resources and contact the state Department of Archaeology and Historic Preservation (DAHP) and affected Indian Tribes.

The record was reviewed for completeness by Gretchen Kaehler, Local Government Archaeologist, describing the purpose of the shoreline inventory or historic and cultural resources, and verifying sources of data. Potentially affected Indian Tribes were contacted and notified of this inventory, including the Squaxin Island Tribe, the Nisqually Tribe, and the Confederated Tribes of the Chehalis Reservation. The Tribes were invited to participate in the inventory process and were provided with an opportunity to review draft products. The Nisqually Tribe and Chehalis Tribe reviewed the draft archaeological and historic resources chapter and their comments were incorporated. The Squaxin Island Tribe did not comment on the draft.

REGULATORY OVERVIEW

In addition to the Shoreline Management Act, regulations relevant to the inventory and management of historic and cultural resources in Thurston County include:

- RCW 27.53 (Archaeological Sites and Resources) makes it illegal to knowingly disturb an archaeological site on public or private lands without a state-issued permit. Both known and unknown sites are protected.

- RCW 27.44 (Indian Graves and Records) makes it illegal to knowingly disturb Native American cairns, petroglyphs, pictographs, and graves on public or private lands without a state-issued permit. Selling any Native American Indian artifacts or remains removed from a cairn or grave is also illegal.

- WAC 25-48 (Archaeological Excavation and Removal Permit) establishes procedures for application for and issuance of state permits for excavation and/or removal of archaeological sites and resources.

- RCW 42.56.300 (Certain personal and other records exempt) makes archaeological site location information exempt from public release in order to diminish the risk that sites will be vandalized or looted.

- TCC 2.106.040. Criteria for Determining Designation to the Thurston County Historic Register and process for designating properties or district to or from the register.

- TCC 2.106.050. Review of changes to historic district properties in Thurston County.

DEFINING ARCHAEOLOGICAL AND HISTORIC RESOURCES

Cultural resources include prehistoric and historic archaeological sites, and above-ground historic buildings, structures, areas, and districts that have been formally registered as landmarks or otherwise identified as historically significant by the County, State, or Federal Government. DAHP maintains lists of cultural resources and historic sites. Both archaeological and above-ground historic sites are protected by County, State and federal regulations.

The Thurston County Historic Register is an official list of places (sites, buildings, and structures) important to the history of Thurston and worthy of recognition and preservation. The Register was established in 1984 by the Board of Thurston County Commissioners. Owner consent is required for registration. The Thurston County Historic Register recognizes properties that are at least 50 years old (or of lesser age if of exceptional importance) which have demonstrated architectural or historic importance related to the history of the Thurston County. Historic properties must also have integrity, that is, they have not undergone changes which substantially alter their historic appearance. The process for designation and removal of register properties is in TCC 2.106.040.

The Washington Heritage Register (WHR) recognizes historic and cultural properties that are significant to local communities and to the state. The program is administered by DAHP. Consideration must be given to the effects of land use actions on WHR properties under the Washington State Environmental Protection Act. Properties nominated to the National Register automatically receive listing in the Washington Heritage Register. Property owners may object to WHR placement.

The National Register (NR) a listing of the country's most significant historic properties, is administered by the Department of the Interior, National Park Service and locally by the Washington State DAHP. Consideration must also be given to the effects of land use actions on National Register properties under the Washington State Environmental Policy Act. Property owners may object to National Register placement.

SUMMARY OF SHORELINE CULTURAL AND HISTORIC RESOURCES WITHIN SHORELINE PLANNING AREA:

Shorelines have been focal points of human activity due to their ecological richness and other utilitarian advantages. In particular, low-bank saltwater shorelines, especially near freshwater stream confluences, lowland stream reaches with fish runs, and large lake shores, particularly at stream/lake confluences, have been areas of human use.

Thurston County's archaeological and historical cultural resources extend back thousands of years to the earliest habitation of the Coastal Salish people, ancestors of the members of the current Nisqually Tribe, Squaxin Island Tribe and Confederated Tribes of the Chehalis Reservation. Salish Indian groups used Thurston County beaches to gather shellfish, the rivers to fish for salmon, and the prairies for hunting and plant harvest centuries before Euro-American exploration and settlement.

The Nisqually are descendants of the Southern Coast Salish who lived in the Nisqually River Basin, on nearby prairies and along the beaches of Puget Sound for generations. The oldest known village is over 5,000 years old. During the spring and summer months they ranged widely for food gathering and processing. Following the Medicine Creek Treaty of 1854, the Nisqually Indian Tribe was re-established on reservation lands in the northeast part of Thurston County, along the Nisqually River. The Nisqually Indian Tribe is a salmon fishing culture and is the prime steward of the Nisqually River fishery resource.

"Chehalis" is a collective name for several Salishan tribes. Historically, the Chehalis Indian people occupied a large area within the Chehalis River watershed, stretching from the foothills of the Cascade Mountains to the Pacific Ocean in Southwest Washington. Within Thurston County, the Chehalis Indian people lived, fished for salmon, hunted, and gathered roots and berries along the Chehalis, Black, and Skookumchuck Rivers. Since the 1860s, the tribe has been located on a reservation within the lower Chehalis watershed though important historic and archaeological sites are scattered throughout the tribe's aboriginal area. The Chehalis did not sign a treaty but by executive order in 1864 land was set aside for a Chehalis Reservation.

The Squaxin people are a Southern Coast Salish people who traditionally lived in the forests and waters of southern Puget Sound and used the shorelines of Totten, Eld, Budd, and Henderson Inlets (among other areas) for fishing, hunting, shellfish gathering, camping, and residence. Following the Medicine Creek Treaty of 1854, a reservation was established on Squaxin Island. Today, the reservation on Squaxin Island remains but is uninhabited. Tribal headquarters and a thriving population are located in Kamilche, between Little Skookum and Totten Inlets, in Mason County.

Euro-American introduction to WRIA 11 occurred in 1833 when the Hudson Bay Company selected a site near the Nisqually Delta for a fort, resulting in initial European settlement of WRIA 11. Settlement and subsequent land clearing and farming of the area near McAllister Creek occurred in 1845. Increased European settlement of the County (as well as Washington and Oregon in general) occurred in 1850 as result of Donation Land Claim Law. The increase in settlement and resulting increased need for transportation resulted in the establishment of the first ferry across the Nisqually River in 1852. In 1880, railroad construction to the city of Yelm occurred. Between 1904 and 1920, settlers diked the Nisqually estuary. In 1912, settlers began the establishment of Yelm Ditch. Logging along Nisqually River began in the 1890's. Railroad transportation through central portion of WRIA 11 was established in 1907. Logging of the areas around the City of Yelm occurred from 1910 to the mid-1970's. The Yelm Hydroelectric project was completed in 1929.

In WRIA 13, Euro-American introduction to the region occurred in 1824, when a British exploration expedition traveled the areas in and around the Chehalis River and Black River to Eld Inlet. Approximately twenty years later, in 1841, an American expedition mapped and named Budd, Totten, Eld, and Henderson Inlets. Settlement near Deschutes Falls began in 1845. This settlement resulted in the creation of Tumwater. A gristmill was developed near the

Deschutes Falls in 1846-47. Increased European settlement of the County (as well as Washington and Oregon as a whole) occurred in the 1850s as a result of the Donation Land Claim Law. Lacey was established in 1848; Olympia was established in 1850; Rainier was established in 1890. Late 19th century shoreline and abutting uses included transportation, fishing, logging, mining, and recreation. Commercial oyster operations also began in this area in 1890. A rail line through Lacey was established in 1891. This line crosses through Lake Pattison. During the mid 1920s, resorts opened on Hicks, Long, Pattison, and Southwick Lakes.

In WRIA 14, the northern point of the Steamboat Island area was used as a fishing resort between the years of 1927-59. More intensive residential development resulting in the land use patterns currently reflected in this WRIA began primarily during the mid-1950s to 1960's.

In WRIA 23, the cities of Bucoda, Tenino, Rochester, and Grand Mound were established between the 1850s to the 1890s. In the 1880s, railroad construction connected Bucoda and Tenino. This rail line crosses multiple creeks and streams including the Skookumchuck River, Scatter Creek and Beaver Creek. The platting of Rochester and Grand Mound occurred in the 1890s. Construction of Interstate Highway 5 began in 1954 and would have had, at a minimum, a mild impact to both Scatter and Beaver Creek.

Below is an overview of cultural and historic resources in the unincorporated Thurston County shoreline planning area by Water Resource Inventory Area (WRIA).

WRIA 11 – Nisqually - Cultural and Historic Resources

Cultural resources within the WRIA 11 shoreline planning area include one cemetery site (located on the Nisqually Indian Tribe Reservation) a state registered archaeological site, as well as recorded pre-contact materials (DAHP, 2011). Recorded artifacts in the shoreline planning area include: fire cracked rock; charcoal; flakes; Medicine Creek Archaeological Site coiled basket; pre-contact shell midden; pre-contact lithic isolate; pre-contact camp, shell, bone fragment (DAHP, 2011).

Historic resources within the shoreline planning area include: homestead sites, barns, railroad materials, orchards, and a bridge (DAHP, 2011, and TRPC, 2008). Recorded historic artifacts in the shoreline planning area include: Charles Lutkens Homestead 1889-1914; glass, ceramics, and metal associated with a railroad; Brown Farm Dairy Barns; feeder barn 1918-1930; Brown Farmhouse foundations; collapsed wooden bridge and historic apple orchard; historic homestead; and the Shilter Farm site (DAHP, 2011). There are no registered historic structures, sites, or areas in the WRIA 11 shoreline planning area.

WRIA 13 – Deschutes - Cultural and Historic Resources

Cultural resources within the WRIA 13 shoreline planning area include: eight cemeteries, a state registered archeological site, recorded pre-contact materials, a pre-historic village; pre-historic shell middens, a portage site, and a burial site (DAHP, 2011). Recorded cultural artifacts in the shoreline planning area include: bone; charcoal; fire cracked rock; projectile points; hearths; animal bones, metal point; chopper; pestle; pre-contact shell middens; Black Lake Portage Site;

Christopher Archeological Site with copper bracelets and trade beads; pre-contact lithic material; and a pre-historic village (DAHP, 2011).

Historic resources include: a log dump, light house, water tower, houses, resorts, a pier and road (DAHP, 2011 and TRPC, 2008) Recorded historic artifacts in the shoreline planning area include: buttons; old nails; historic artifacts 1848-1890; and the Atlas Power Company historic pier and road (DAHP, 2011). Registered historic structures, sites, and areas in the WRIA 13 shoreline planning area are listed in Table 4.1.

Table 4.1. Registered historic structures, sites, and areas, in the WRIA 13 shoreline planning area.

Site Name	National Register	Washington Heritage Register	Washington Heritage Barn Register	County Historic Register
Weyerhauser South Bay Log Dump Rural Historic Landscape	**x**	**x**	n/a	n/a
Johnson House	**x**	**x**	n/a	n/a
Dofflemeyer Point Light	**x**	**x**	n/a	n/a
Olympia Country and Golf Club Clubhouse	n/a	n/a	n/a	**x**
Poncin Estate Brown House	n/a	n/a	n/a	**x**
Bronson Resort	n/a	n/a	n/a	**x**
Falkner/Kolze House	n/a	n/a	n/a	**x**
Holmes Island Water Tower	n/a	n/a	n/a	**x**

WRIA 14 – Kennedy/Goldsborough - Cultural and Historic Resources

Cultural resources within the WRIA 14 shoreline planning area include two cemetery sites (DAHP, 2011). Recorded cultural artifacts include: projectile points; ash and shell; bone; charcoal; fire cracked rock; and pestle (DAHP, 2011). There are no registered historic structures, sites, or areas in the WRIA 14 shoreline planning area.

WRIA 23 – Lower Chehalis - Cultural and Historic Resources

Cultural resources within the WRIA 23 shoreline planning area include two cemetery sites (one located on the Confederated Tribes of the Chehalis Reservation). Recorded cultural artifacts include: flakes; hammerstones; scrapers; projectile points; fire cracked rock; bone; trade bead; and lithic scatter (DAHP, 2011).

Historic resources include: a schoolhouse, a state park, farmsteads, homes, a granary, orchards, mines, a bridge, a logging camp, logging road, and railroads (DAHP, 2011 and TRPC, 2008). Recorded historic artifacts include: Starke Farmstead (late 1800's); fence; glass, ceramic, and metal railroad debris; Waddell Creek Gold Mine (1930's); Drury orchard; historic debris scatter; historic dump (early-mid-20th century); Sherman Creek Bridge (1890-1938); Mason County Logging grade and spur (pre 1938); Mason County Logging Company Camp (1930-1941); and the Waddell Creek Railroad Grade and Trestle (1920-1941) (DAHP, 2011). Registered historic structures, sites, and areas, in the WRIA 23 shoreline planning area are listed in Table 4.2.

Table 4.2. Registered historic structures, sites, and areas, in the WRIA 23 shoreline planning area.

Site Name	National Register	Washington Heritage Register	Washington Heritage Barn Register	County Historic Register
Jonas and Maria Lovisa Erickson Farmstead	**x**	**x**	**x**	n/a
Millersylvania State Park	**x**	**x**	n/a	n/a
Jaaska House and Warehouse	**x**	**x**	n/a	**x**
Gate School	**x**	**x**	n/a	n/a
Miller-Brewer House	**x**	**x**	n/a	n/a
Jamestown Granary	n/a	**x**	n/a	n/a

DATA SOURCES

Histtrpc.shp – Historic buildings, sites, natural features and objects. This data was last updated by the Thurston Regional Planning Council (TRPC) in 2008. This data includes federal, state and local historic registered sites. The complete historic database, including some site specific photographs is available through both the Thurston GeoData Center and the Thurston Regional Planning Council (TRPC). Since 2008, Thurston County has taken over responsibility for the data. No new updates have been completed since 2008.

DAHP shapefiles (2011) – Locational information about known archaeological resources is available from the Washington State DAHP on a confidential basis. This is regulated by RCW 42.17.310(1)(k). Memoranda of Agreement can be made between local governments and DAHP to provide restricted access to this information for bona fide uses. The DAHP also maintains a statewide predictive model for archaeological sites.

The Nisqually Tribe, Squaxin Island Tribe and Confederated Tribes of the Chehalis all have cultural resource staff. These tribes should be contacted to comment on proposed land use or other actions or projects which could involve traditional areas or archaeological resources, as they often have more or different information than is available at DAHP. Not all properties or sites are published, and knowledge about their location and significance is a tribal matter.

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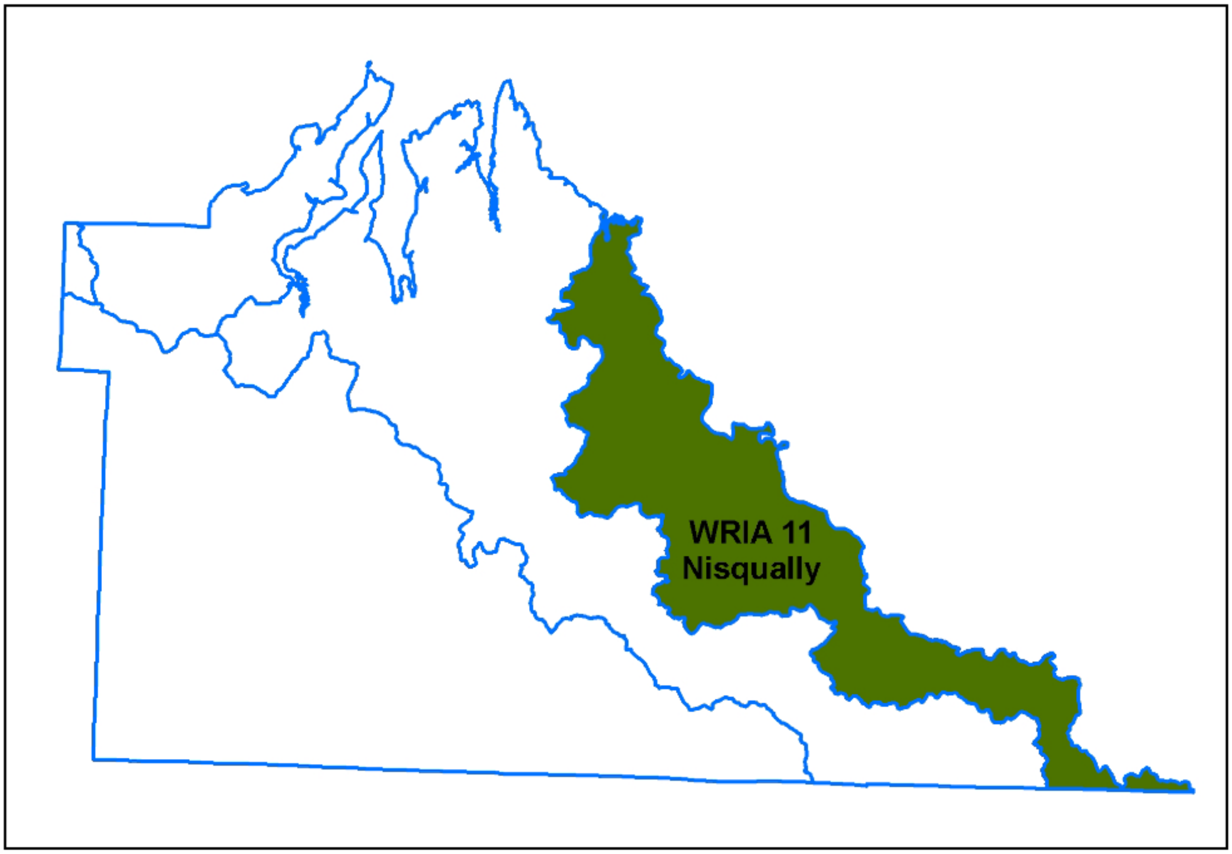
5 WRIA 11 (NISQUALLY)



Map 5.1. WRIA 11 (Nisqually)

After an initial introduction to the WRIA as a whole, the data provided in this chapter are divided into subsections by basins and SMA jurisdictional waterbodies located within the Nisqually Water Resource Inventory Area (WRIA 11). Each subsection includes information regarding water bodies, physical and biological characterization, shoreline land use, and management options.

WRIA 11 Characteristics

WRIA 11 (the Nisqually Watershed) is located within the eastern portion of Thurston County and is 760.9 square miles in size. Approximately 131 square miles of this WRIA is located within Thurston County. Twelve percent of the county is located within this WRIA.

The headwaters of WRIA 11 begin on the Nisqually Glacier located on Mount Rainier. From there, the Nisqually River flows in a northerly direction and provides the border between Thurston and Pierce Counties. The northern border of WRIA 11 and the Nisqually River occurs at the confluence of the river into Puget Sound. This area coincides with the Nisqually Wildlife Refuge.

The Nisqually National Wildlife Refuge is located at the confluence of the Nisqually River and the Nisqually Reach of Puget Sound, creating the Nisqually River Delta. The delta is a biologically-rich and diverse area that supports a variety of habitats including estuary, freshwater wetlands and riparian woodlands. It is considered the last ecologically intact major estuary in Puget Sound. The Nisqually Delta has been designated as a National Natural Landmark because of its national significance as one of the best examples of this kind of coastal salt marsh system remaining in the North Pacific. The Nisqually Refuge supports more than 275 migratory bird species that use the refuge for migration, wintering, or breeding. The refuge provides rearing and migratory habitat for steelhead trout and several salmon species, as well as habitat for a variety of threatened and endangered species. The Nisqually Delta is the largest tidal marsh restoration project in the Pacific Northwest. In fall 2009, the Brown Farm Dike was removed to allow tidal inundation of 762 acres of the Nisqually National Wildlife Refuge.

WRIA 11 also contains a series of springs associated with McAllister Creek. These springs, in addition to providing the headwaters for McAllister Creek also serve as a water supply for the City of Olympia.

The highest population density with the Thurston County portion of this WRIA is the City of Yelm. WRIA 11 also contains portions of the Lacey Urban Growth Area, the Nisqually Indian Reservation and Joint Base Lewis-McChord.

Joint Base Lewis-McChord (JBLM) named for the joining of Fort Lewis and McChord Airforce Base, is one of the largest military reservations in the United States. The JBLM base consists of a combined 90,000 acres of prairie land on the Nisqually Plain, stretched between Pierce and Thurston Counties. (http://www.lewis.army.mil/about-ft-lewis.asp).

LANDSCAPE ANALYSIS

Process Controls

Geology (Maps 11 and 12)

In the hills comprising the southern portion of WRIA 11, volcanic deposits, and alpine glacial drift make up the lithology. Moving north, in the mid-section of WRIA 11, the lithology is composed of glacial till, glacial moraines, and glacial outwash. The northern lowlands contain glacial drift and alluvium. Alluvium is also found along much of the Nisqually River, downstream of the more confined channels at the southern end.

Topography (Map 10)

The majority of WRIA 11 is lowland and has only moderate elevation changes. This is exemplified by the presence of wetlands throughout much of the watershed. The upper watershed is characterized by steep terrain. Elevations range from 1500 feet in the upper watershed near Alder Lake, to sea level at the Nisqually estuary.

Land Use/Land Cover

Current Land Use (Map 39 and 41b)

The predominant land uses for WRIA 11 are as follows: Single family residential 16.3 %, Agriculture 10%, Designated Forest Land 22%, and Undeveloped Land 33% (Map 39).

The predominant zoning designations for WRIA 11 are as follows: Long Term Forestry (15%) Military Reservation (15%) and Rural Residential - One Dwelling Unit per Five Acres (43%) (Map 41b).

Projected Future Use (Maps 41a and 41b)

TRPC's analysis of future basin use within this WRIA reflects that this area will experience increased residential development. Please refer to specific basins for additional data.

Land Cover (Map 25)

The predominant land covers in WRIA 11 are: evergreen forest (37%) scrub/shub (11%) and mixed forest (11%). High and medium intensity development is below 2% combined. Low intensity development is 5%. Agriculture is relatively high with Pasture/Hay (12%) and cultivated crops (0.6%) (Map 25).

Forest cover is extensive in the upper watershed and within Fort Lewis. The forest in the upper watershed shows signs of recent harvest by exhibiting a checkerboard effect of mixed forest with evergreen forest and areas of scrub shrub scattered throughout. The remainder of the WRIA contains large areas of pasture/hay landcover, as well as many areas of palustrine emergent wetlands and palustrine aquatic bed wetlands. The Nisqually delta area outside of the dike is estuarine emergent wetland land cover. Interspersed throughout the WRIA are small patches of evergreen, mixed, and deciduous forest cover as well as scrub/shrub. The area within the Lacey UGA is primarily low to medium intensity developed landcover. There is also a substantial area of low to medium intensity developed landcover along the Nisqually River just north of the north Yelm UGA boundary.

Landscape Process Important Areas and Alterations

Coastal

Important Areas (Map 14)

Drift cells are important areas for the movement of beach sediment. Drift at Nisqually Head is a divergence zone. There is a short stretch of right to left drift along Luhr Beach. The remainder of the Nisqually nearshore has no appreciable drift.

Coastal landslides are the primary contributor of sediment to beaches and net shore-drift systems. Coastal landslides occur on bluffs with unstable slopes and past landslides. The Nisqually Hillside area, located from Nisqually Head south to McAllister Creek on the west side of the inlet, is a continuous area of unstable slopes. This area also contains large mapped areas of past landslides.

Rivers and streams influence the nearshore in numerous ways, including salinity changes, sediment supply, altered littoral drift, and habitat formation. In WRIA 11, McAllister Creek and the Nisqually River drain to Puget Sound.

River deltas are process intensive areas for beach processes and fluvial processes. The Nisqually River Delta composes the majority of the nearshore in WRIA 11.

Estuaries, tidal inlets, tidal marshes, and lagoons are process intensive areas for circulation and beach processes. The Nisqually Delta is a large area of estuarine emergent wetland. There are no tidal inlets, tidal marshes, or lagoons in WRIA 11.

Riparian vegetation areas are process intensive areas for coastal erosion, water quality, and organic debris. Please see the Large Woody Debris Important Areas and Alterations section within this chapter for details.

Indicators of Alteration (Map 15)

Shoreline armoring reduces sediment supply to the beach. In 2009, the largest estuary restoration effort in Puget Sound was completed to remove miles of dike around the Nisqually Delta to restore tidal inundation to 762 acres. The dike removal created a more complete and functional estuarine system. A dike still remains around the Nisqually National Wildlife Refuge visitor center. An area near Luhr Beach is also armored.

Overwater structures such as docks and marinas, impact the nearshore through alteration of light, wave energy, sediment, and water conditions. A WDFW boat ramp and a dock/pier associated with the Nisqually Reach Nature Center are located at Luhr Beach. A public access boardwalk extends from the Nisqually Wildlife Refuge approximately one mile into the tidal area of the Nisqually Delta.

Loss of marine riparian habitat alters erosion rates, water quality, and abundance of woody debris. Around Nisqually Head and Luhr Beach, there are some small areas of built environment and non-forest vegetation within 100 feet of the shoreline. Please see the Large Woody Debris Alterations Map 23.

Shoreline Degradation (Map 15a)

The Strategic Needs Assessment: Analysis of Nearshore Process Degradation in Puget Sound (Schlenger et al., 2011) study identified the marine nearshore in WRIA 11 as ‘more degraded’.

Hydrology

Important Areas (Map 16)

Areas important for water delivery are areas with relatively higher precipitation, and rain-on-snow areas. WRIA 11 contains the lowest areas of mean annual precipitation in the County, roughly 38 inches, located around Clear Lake, Elbow Lake, and Bald Lake. The west side of

Alder Lake contains some areas mapped as “rain-on-snow zones”. Alder Lake north to Bald Lake is mapped as a “rain-dominated zone”.

Important areas for surface water storage are areas containing depressional wetlands, wetlands, lakes, 100-year floodplain, and unconfined river channels. Large areas of depressional wetlands are located along upper McAllister Creek, in the Nisqually Delta, south of Lake Saint Clairee at the headwaters of Eaton Creek, south of the City of Yelm and northwest of Clear Lake. There are numerous wetlands located in WRIA 11, with concentrations south of the City of Yelm, northwest of Clear Lake, and on Joint Base Lewis-McChord. Lakes within WRIA 11 include: Alder Lake, Elbow Lake, Bald Hill Lake, Clear Lake, Inman/Gehrke Lake, Lake Saint Claire, and Flanders Lake. The 100-year floodplain is mapped around Alder Lake, as well as the entire Nisqually River where the 100-year floodplain is extensive in numerous areas. The 100-year floodplain also covers the Nisqually Delta. Toboton Creek, Yelm Creek, Thompson Creek (Nisqually) McAllister Creek, as well as Inman/Gehrke Lake are mapped within the 100-year floodplain. All of WRIA 11’s marine shoreline is within the 100-year floodplain. Unconfined river channels are found along portions of the Nisqually River, Yelm Creek, Thompson Creek (Nisqually) McAllister Creek, Medicine Creek, Toboton Creek, and other unnamed tributaries. Unconfined river channels are found throughout the WRIA, typically in areas of high permeability soils.

Shallow subsurface flow important areas contain low permeability soils. The majority of WRIA 11 occurs on low permeability soils. Areas of low permeability soils also contain the majority of wetlands and depressional wetlands in WRIA 11.

Areas with high permeability soils are important for recharge. The majority of the Nisqually River valley, the Yelm area, the area between McAllister Creek and the Nisqually River, and the area south of Lake Saint Claire contain high permeability soils.

Indicators of Alteration (Map 17)

Water delivery timing is impaired when non-forested land cover occurs in rain-on snow zones, and in “rain-dominated” zones. There are some very small areas of non-forest landcover, due to timber harvest, in the rain-dominated zone in the southern portion of WRIA 11. These areas are infrequent and small, and likely do not significantly impair water delivery.

Water movement via overland flow may be impaired by the occurrence of impervious cover within a watershed (Map 26). WRIA 11 has several areas where impervious surfaces are concentrated: south of Interstate 5 and north of the railroad tracks, within and around the City of Yelm and its UGA, and around Lake Saint Claire northwest to the City of Lacey.

Surface storage may be impaired by the loss of depressional wetlands and the presence of the built environment adjacent to streams. The built environment is adjacent to the Nisqually River in several places near the City of Yelm. A few very small areas of depressional wetland have been lost south of the City of Yelm and to the east of McAllister Creek. The Interstate Highway 5 corridor, a rail line, and areas of fill and diking are located within the wetland and floodplain areas associated with the Nisqually River and Nisqually Delta. These features channelize the river and disconnect it from its floodplain which impacts surface storage. The I-5 bridge and placement of fill under portions of the Interstate highway along the lower Nisqually restrict natural channel migration and limit the upper extent of the estuary.

Shallow sub-surface flows may be impaired by the presence of land cover with impervious surfaces and non-forested vegetation on low permeability soils. There is a large area of built environment on low permeability soil west of McAllister Creek within the City of Lacey's UGA. Areas that are predominantly non-forested vegetation on low permeability soils are located: between McAllister Creek and the Nisqually River, in the vicinity of Lake Saint Claire, and south of the City of Yelm.

Recharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils. These areas are located between McAllister Creek and the Nisqually River adjacent to Interstate 5, along and south of State Route 510 on the east side of Joint Base Lewis-McChord, within and east of the City of Yelm, and in smaller areas in the forested hills in the southern third of the WRIA.

Vertical and lateral flows may be impaired by roads, ditches, and culverts. The major roads in WRIA 11 are Interstate 5 which crosses the northern section just south of the Nisqually Delta, and State Route 510 which is oriented diagonally between the City of Lacey and the City of Yelm. Several railroads cross WRIA 11: one crosses the Nisqually River and ends within the City of Yelm, one lies east/west through the city of Yelm, and the other lies diagonally northeast/southwest near McAllister Springs. Other roads are most concentrated within the City of Lacey's UGA, and within the City of Yelm. Numerous roads are also located around Lake Saint Claire, within Joint Base Lewis-McChord, and south of Yelm but north of Clear Lake. There are no public roads south of Elbow Lake. Culverts are most numerous in the area south of Yelm and north of Elbow Lake.

Stream flow in the Nisqually is altered by the Centralia Power Canal diversion which removes water from the Nisqually River and Nisqually River basin and sends it through a portion of the Yelm Creek basin before returning it to the Nisqually River and Nisqually River basin. The Centralia Power Canal diverts approximately 750 cfs (and has water rights to divert up to 800 cfs) from the Nisqually River, runs it through a human-dug canal for 9 miles, then through a hydroelectric powerhouse before putting the remaining water back into the river. The water diverted from the Nisqually River is approximately half of the river's mean annual flow.

Discharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils that intersect floodplains. Discharge may be impaired west of the Nisqually River just south of Interstate 5; as well as between the Nisqually River and Centralia Canal south of the Yelm UGA.

Sediment

Important Areas (Map 18)

Freshwater process intensive areas for sediment delivery are areas of surface erosion, mass wasting, and in-channel erosion. Sediment delivery via surface erosion occurs in areas with steep slopes and erodible soils. Areas with steep slopes and erodible soils are most common in the southern quarter of WRIA 11, south of Toboton Creek. The other concentrated area is the Nisqually Hillside, west of McAllister Creek.

Sediment delivery via mass wasting occurs in high mass wasting hazard areas and landslide areas. A few landslide areas are mapped in the southern quarter of WRIA 11, south of Elbow Lake. Mass wasting hazard areas are mapped in the hills around Alder Lake, east of Clear Lake, around Lake Saint Claire, and along the Nisqually Hillside.

Sediment delivery via in-channel erosion occurs in unconfined channels or those channels with gradients less than 4%. These channels are found along portions of the Nisqually River, Yelm Creek, Yelm Ditch, Powell Creek, Thompson Creek (Nisqually) McAllister Creek, Medicine Creek, Toboton Creek, and other unnamed tributaries.

Sediment storage occurs in depressional wetlands, floodplains, depositional stream channels, and lakes. Please see the surface water storage important areas section for locations of these features.

Indicators of Alteration (Map 19)

Sediment delivery via surface erosion may be impaired in areas of non-forested land cover on highly erodible slopes adjacent to streams, as well as locations with roads within 200' of aquatic ecosystems or road crossings. There are very few areas of non-forested landcover on highly erodible slopes adjacent to aquatic ecosystems in WRIA 11, with no significant concentrations. Small areas are located along Yelm Creek, Yelm Ditch, and McAllister Creek. Roads within 200 feet of aquatic ecosystems occur along Interstate 5 and the area between the Nisqually River and McAllister Creek, around Lake Saint Claire, east of the Yelm UGA, south of the Yelm UGA, around Clear Lake, and north of Bald Hill Lake.

Sediment delivery via mass wasting may be impaired when roads or non-forested vegetation occur in high mass wasting hazard areas. There are very few roads in high mass wasting hazard areas. Very small areas are located east of McAllister Creek, and in the southern portion of WRIA 11 near Clear Lake and Powell Creek. Non-forested vegetation in high mass wasting hazard areas is minimal in WRIA 11. These small areas are located along Yelm Creek, Yelm Ditch, and McAllister Creek.

Sediment delivery via in-channel erosion may be impaired when the built environment is adjacent to unconfined channels. The built environment is adjacent unconfined channels along: Powell Creek, the Nisqually River east of the Yelm UGA and between the river and Centralia Power Canal, the Nisqually River south of I-5 and north of the railroad, and lower McAllister Creek.

Sediment storage may be impaired when depressional wetlands are lost, or in the presence of dams. Small areas of depressional wetlands have been lost along the east side of McAllister Creek and in the rural area south of the City of Yelm. There are numerous dams in WRIA 11. Starting in the upper watershed and moving downstream along the Nisqually are: Alder dam; Le Grande Dam; and Centralia Dam. Outside of the Nisqually River, there are several other dams in WRIA 11: Beaver Dam on Clear Lake; Hooper Waste Pond No. 1 Dam and Windsor Waterski

Pond Dam near Yelm Creek; McAllister Springs Lake Dam; Medicine Creek Reservoir Dam; and Nisqually Trout Farm Dam.

Water Quality

Important Areas (Map 20)

Areas important for maintaining water quality are streams, wetlands (particularly depressional wetlands) floodplains, and areas of high and low permeability. Depressional wetlands adsorb pathogens, phosphorus, and toxins. Nitrification and pathogen sedimentation also occur in depressional wetlands. Floodplains are another important area for sedimentation of pathogens. Pathogens are moved along the surface via streams, rivers, and wetlands with a surface water connection. Pathogens move underground in areas with shallow subsurface flow and recharge areas. Please see the "Hydrology Important Areas" for locations.

Indicators of Alteration (Map 21)

Water quality alterations can occur from failing septic systems, agricultural operations, loss of depressional wetlands, and the clearing and impervious surface areas that occur from the built environment. The built environment is most concentrated in the City of Lacey's UGA, and east of the City of Yelm's UGA. Concentrations of the built environment are also located south of I-5 and north of the railroad, and around Lake Saint Claire. Increased inputs of nutrients and pathogens may occur on parcels with failing septic systems. Parcels with assumed on-site septic are most prevalent within and outside of the City of Yelm's UGA, as well as the area south of the Yelm UGA but north of Bald Hill Lake. Parcels with assumed on-site septic are also common surrounding Lake Saint Claire and west of the Nisqually River south of Interstate 5.

There are four contaminated terrestrial sites mapped within WRIA 11. These sites are located: within the City of Lacey's UGA, south of I-5 along the railroad track; south of Clear Lake, south of the City of Yelm near the WRIA 11 western border. The only waterbody on Ecology's 2012 303(d) polluted waters list in WRIA 11 is Clear Lake for Total Phosphorus. Shellfish harvest on the west side of Nisqually Head is 'Conditional'. From the east side of Nisqually Head and east across the Nisqually Delta, shellfish harvest is 'prohibited'. WRIA 11 contains ten areas designated as mineral lands. WRIA 11 contains large areas of agriculture. Areas zoned Long Term Agriculture are located around McAllister Creek, along the Nisqually River north of the Nisqually Indian Reservation, along the Nisqually River south of Yelm and east of the Centralia Power Canal, and south of Yelm west of Yelm Ditch. In addition, agriculture may also occur on parcels zoned Rural, which are very common in WRIA 11.

Large Woody Debris

Important Areas (Map 22)

Important areas for large woody debris delivery occur in areas of mass wasting, windthrow, and stream bank erosion. These areas are located in unconfined channels, mass wasting areas, and the area 100' from all water bodies and streams. Unconfined river channels are found along portions of the Nisqually River, Yelm Creek, Thompson Creek (Nisqually) McAllister Creek, Medicine

Creek, Toboton Creek, and other unnamed tributaries. Please see the sediment important areas section for mass wasting areas.

Important areas for large woody debris storage are channels with less than 4% slope or unconfined channels. In addition to the areas of unconfined channels described above, streams with less than 4% slope are found along Yelm Ditch.

Indicators of Alteration (Map 23)

There are few areas of non-forested land cover on high mass wasting hazard areas, indicating low impairment to LWD delivery to streams via mass wasting. These small areas are located along Mcallister Creek, Yelm Creek, and Yelm Ditch.

There is some impairment to large woody debris delivery via windthrow. The built environment is within 100 feet of streams along McAllister Creek, Medicine Creek, Eaton Creek, several places along the Nisqually River, Yelm Creek, Yelm Ditch, and the Centralia Power Canal. Areas of non-forest landcover within 100 feet of streams are located along the streams listed above, as well as Toboton Creek.

WDFW Local Habitat Assessment (Map 23b)

WRIA 11 contains some of the best condition habitat in Thurston County, located in the Nisqually National Wildlife Refuge. Other areas with large areas of good condition habitat include: the Nisqually Indian Reservation, Joint Base Lewis-McChord, the area east of Bald Hill Lake, and around Alder Lake. The areas in worst habitat condition are the City of Lacey's UGA, rural areas to the east of the Lacey UGA, the City of Yelm and its UGA, and some rural areas to the north and south of the City of Yelm (Map 23b). Please see the individual waterbody descriptions for more details on habitats and species.

Process-based Management Recommendations

Please see Chapter 9 for a discussion of programmatic management recommendations. These recommendations are discussed at the ecosystem scale and therefore apply throughout the County to areas where important ecological processes have been altered.

SHORELINE REACH-SCALE INVENTORY

The shoreline reach-scale inventory is organized by basin and waterbody. Applicable maps are listed in Table 5.1 and are located in Appendix H.

Table 5.1. Maps used for the shoreline reach-scale inventory (located in Appendix H).

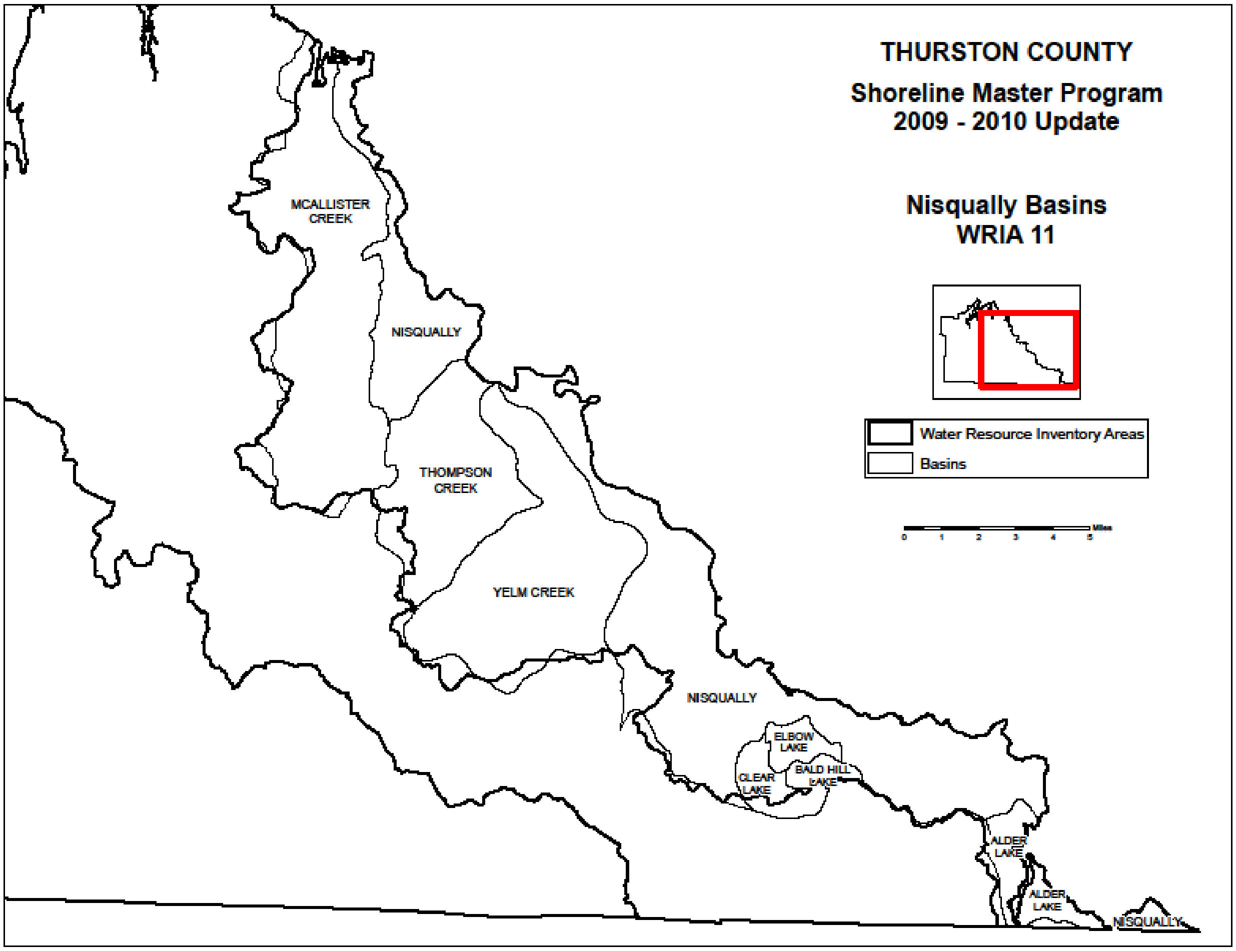
	Map Numbers and Titles	
Shoreline Type	**Physical and Biological Characterization**	**Shoreline Use Patterns**
Marine	10 – Topography and Hydrology 10a – Shoreline Type 14 – Coastal Process Important Areas 21– Water Quality Process Alterations 24 – Arial Photos 29 – Critical Areas - Biological 31– Critical Areas - Hydrologic 32 – Critical Areas - Geologic 34b – Kelp and Eelgrass 34c – Saltmarsh 35 – Marine Fisheries 36 – Shellfish Areas	15 – Coastal Process Alterations 17 – Hydrologic Process Alterations 26 – Impervious surfaces 24 – Arial Photos 37 – Aquatic Land Ownership 38 – Nationwide Permit 48 39 – Current Land Use – Generalized from the Office of the Assessor 41a – Future Land Use 41b – Current Zoning 41c – Future Development Potential 43 – Public Access and Public Lands 44 – Existing Shoreline Environment Designations
Freshwater	10 – Topography and Hydrology 21– Water Quality Process Alterations 24 – Arial Photos 29 – Critical Areas - Biological 31– Critical Areas - Hydrologic 32 – Critical Areas - Geologic	17 – Hydrologic Process Alterations 26 – Impervious surfaces 24 – Arial Photos 39 – Current Land Use – Generalized from the Office of the Assessor 41a – Future Land Use 41b – Current Zoning 41c – Future Development Potential 43 – Public Access and Public Lands 44 – Existing Shoreline Environment Designations

Basins

Table 5.2. Basins located within WRIA 11 (Nisqually).

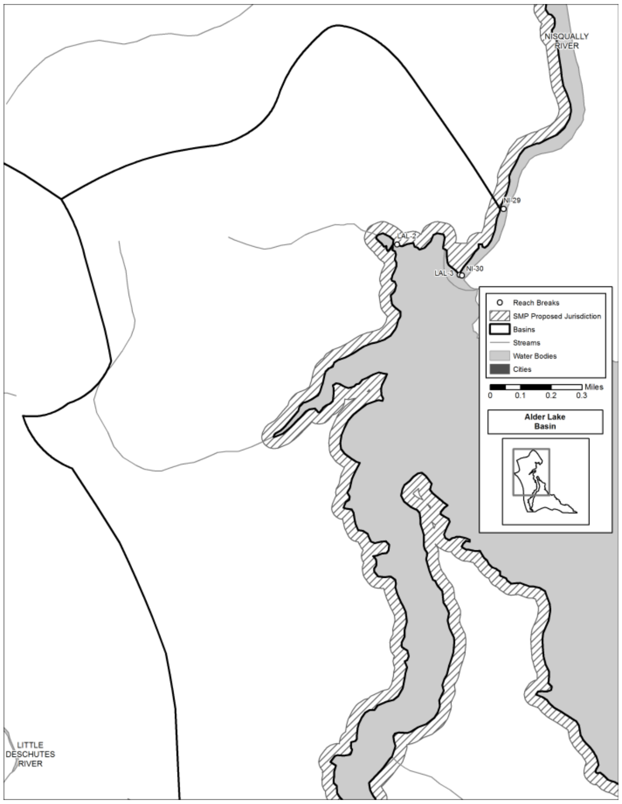
Basin	Area within WRIA (Acres)	Percent Area of WRIA
Alder Lake	2653.68	3.22
Bald Hill Lake	776.93	0.94
Clear Lake	1110.84	1.35
Deschutes River	1588.86	1.93
Elbow Lake	1162.50	1.41
Lake Lawrence	97.50	0.12

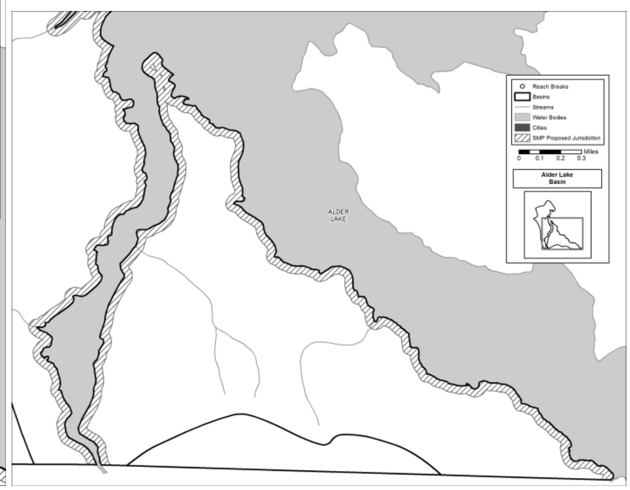
McAllister Creek	18681.10	22.65
Nisqually	30394.79	36.85
Spurgeon Creek	545.73	0.66
Thompson Creek (Nisqually)	9643.03	11.69
Woodland	556.37	0.67
Yelm Creek	15281.80	18.52



Map 5.2. Basins within WRIA 11 (Nisqually).

Alder Lake Basin





Basin Overview

Alder Lake basin is 2,657 acres in size and located in the southeastern corner of Thurston County. The majority of the basin, 2,652 acres, is located in WRIA 11. A small portion of this basin, 5 acres, is located in WRIA 13. Water in this basin generally flows towards Alder Lake and the Nisqually River and ultimately into south Puget Sound.

The land mass of the basin is split into two portions by Alder Lake. Alder Lake is the largest lake in Thurston County and is a man-made impoundment of the Nisqually River behind the Alder Dam. Alder Dam was created in 1945 and is a hydroelectric resource for Tacoma Power.

Alder Lake Basin contains 14.53 miles of Shorelines of Statewide Significance (SSS) jurisdictional shoreline around Alder Lake, broken into two reaches (Reach name series: LAL. See Appendix A) and 0.29 miles of SSS jurisdictional shoreline along the Nisqually River, contained in one reach (Reach name series: NI). The portion of the Nisqually River within this basin is described as part of the Nisqually River basin discussion.

Alder Lake

Physical and Biological Characterization

Alder Lake is a roughly 2930 acre reservoir formed by the Alder Dam impoundment of the Nisqually River. It is located at approximately 1200 feet elevation. Roughly 50% of Alder Lake's shoreline is mapped as steep slopes and landslide hazard areas. The entire lake is part of the 100-year floodplain and is a volcanic lahar hazard area.

Numerous un-named streams flow into Alder Lake. These streams are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Alder Lake itself is mapped as a wetland. Beyond the lake, there are no associated wetlands.

Alder Lake is mapped as containing resident cutthroat trout and kokanee. The kokanee population within Alder Lake is supplemented by WDFW stocking. The Alder Dam serves as a barrier to anadromous fish passage. Alder Lake may also provide habitat for bald eagle, osprey, common loon, wood duck, waterfowl concentrations, and the western toad. The riparian shoreline vegetation is undeveloped except for a small area near the north lake outlet where vegetation has been cleared to access Alder Dam and for utilities. No water quality issues have been noted.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is a mix of timber/forest land and undeveloped. Water oriented uses of Alder Lake are fishing, wildlife viewing, and hydroelectricity.

Alder Lake's existing shoreline environment designation is Conservancy. The shoreline jurisdiction around the lake is zoned Long Term Forestry which suggests that the shoreline will not have other land use besides forestry and use as a hydroelectric facility. Under current zoning regulations, there are approximately 37 lots within shoreline jurisdiction, none of which are developable.

The Alder Dam, which functions as a fish passage barrier, is located at the north end of the reservoir. A utility line owned by the City of Tacoma crosses shoreline jurisdiction near the dam. Impervious surface is associated with the dam structure at the north end of the reservoir and is nonexistent elsewhere.

Public access to Alder Lake may be obtained through a WDFW boat launch located in Pierce County.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)

Alder Lake is recommended for conservation along the northwestern portion of the lake, and highest restoration along the southeastern half of the lake.

Bald Hill Lake Basin

Basin Overview

Bald Hill Lake basin is 794 acres in size and is located in southeastern Thurston County. The majority of this basin, 784 acres, is located in WRIA 11; a small portion, 10 acres, of this basin is located in WRIA 13. As the majority of the Bald Hill Lake basin is located in WRIA 11, review of it is provided in this chapter. Water in Bald Hill lake basin generally flows towards Bald Hill Lake.

Bald Hill Lake basin contains 1.05 miles of SMA jurisdictional lake shoreline, in one reach (Reach name series: LBA, See Appendix A).

Bald Hill Lake

Physical and Biological Characterization

Bald Hill Lake has steep slopes located on its south and northeast shorelines. Landslide hazard areas are located on the south side of the lake. The lake is mapped within the 100-year floodplain and within a high groundwater hazard area.

One mapped un-named stream flows into Bald Hill Lake from the east. This stream is not mapped as meeting shoreline jurisdiction requirements. However, this stream is likely to qualify as critical areas pursuant to TCC 24. The lake itself is mapped as a wetland. In addition there is an area of associated wetlands on the northwest side of the lake.

The WDFW fishing guide states that Bald Hill Lake contains largemouth bass and perch. Shoreline jurisdiction contains habitat for wood duck, and Taylor's checkerspots butterfly, as well as mapped oak habitat and prairie soils. Bald Hill Lake is located within the "Bald Hill Natural Area Preserve", owned and managed by the Washington State Department of Natural Resources.

The entire Bald Hill Lake shoreline contains intact forest cover with no evidence of modification or development. No water quality issues have been noted for Bald Hill Lake.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is undeveloped and timber/forest land. The lake has no surrounding development.

Bald Hill Lake is not designated under the existing SMP. The lake is primarily zoned Public Parks Trails and Preserves. There are two very small portions of the outer shoreline jurisdiction that fall within an area zoned Long Term Forestry. The current zoning of Long Term Forestry and Public Preserve indicates that there will not be other future land uses within shoreline jurisdiction. Under current zoning regulations, there are approximately ten lots within shoreline jurisdiction, none of which are developable.

Bald Hill Lake does not have any shoreline modifications. The lake is in a natural setting with no impervious surfaces. Permission from the Department of Natural Resources is needed to access Bald Hill Natural Area Preserve due to the sensitivity of species and habitats located there.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Bald Hill Lake is recommended for protection.

Clear Lake Basin

Basin Overview

Clear Lake basin is 1,850 acres in size and is located in southeastern Thurston County. The majority of this basin, 1,111 acres, is located in WRIA 11; a smaller portion of this basin, 739 acres, is located in WRIA 13. As the majority of the Clear Lake basin is located in WRIA 11, review of it is provided in this chapter. Water in Clear Lake basin generally flows to Clear Lake. This basin contains a portion of Elbow Lake Park, which is primarily located in Elbow Lake basin.

Clear Lake basin contains 4.98 miles of SMA lake jurisdictional shoreline, broken into 16 reaches (Reach name series: LCL. See Appendix A).

Clear Lake

Physical and Biological Characterization

Clear Lake is roughly 184 acres, with a maximum depth of 25 feet, and a mean depth of 19 feet. It is located at approximately 518 feet in elevation. Clear Lake has two distinct sections: a main lake basin; and a sinuous lobe connected by a thin segment of open water at the southeast end of the main basin.

An area of steep slopes is mapped at the north end of the lake and around the associated pond (also known as Blue Water Lake) located off the northeast side of Clear Lake. All of Clear Lake is mapped within the 100-year floodplain.

One mapped un-named located at the northwest side of Clear Lake connects the lake to an un-named pond. This stream does not meet the shoreline jurisdiction requirements. However, this stream is likely to qualify as a critical area pursuant to TCC 24. The unnamed pond is not part of shoreline jurisdiction. Clear Lake has two large associated wetlands which are part of the shoreline jurisdiction. One of these wetlands is an open water wetland (also known as Blue Water Lake) located off the northeast corner of Clear Lake. The other is a scrub/shrub wetland connected to the northwest side of Clear Lake by the unnamed stream.

Fish priority habitat areas are not mapped within this basin. WDFW stocks Clear Lake with rainbow trout and triploid rainbow trout. No important species or habitats were noted for any of the reaches.

Shoreline vegetation is primarily intact forest adjacent to the lake, but exhibits fragmentation and clearing in the outer shoreline jurisdiction for residential development. Along the southern shoreline, vegetation has been cleared to the waterline in places. Within the associated wetlands located at the northwest side of Clear Lake, vegetation is intact scrub/shrub with the exception of a dry area with clearing for residential development.

Clear Lake is on the Ecology 2012 303(d) list for total phosphorous.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential, undeveloped, recreational, parks (semi-public) and other. Clear Lake is generally surrounded with low density residential development. Around the majority of the lake, parcel development does not begin until approximately 100 feet upslope from the shoreline because the area around the lake is owned by the Clearwood Community Association. Water oriented uses include swimming and boating.

Clear Lake is designated Rural under the existing SMP. All reaches around the lake are zoned Residential LAMIRD 2/1. The associated wetlands to the northwest of Clear Lake are zoned Residential LAMIRD 2/1 and Rural Residential Resource 1/5.Under current zoning regulations there are approximately 328 lots within shoreline jurisdiction, three of which are developable. One parcel is a vacant single lot, two parcels are subdividable vacant lots, and zero parcels have potential for additional infill.

Shoreline modifications include docks, boat ramps, armoring, a culvert, two dams, a foot bridge, and impervious surfaces. Docks are relatively infrequent and scattered around Clear Lake's main basin. There is a WDFW boat ramp located at the southern end of the main basin. Armoring occurs in some small areas around the lake. There is an unmapped culvert along the west side of the main basin. A foot bridge crosses a narrow channel in the southern basin. There are two dams, Muskrat Dam (also listed as Clearwood Dam 2) and Beaver Dam (also listed as Clearwood Dam 1) located on the thin passage of water connecting the southern lake basin with the main lake basin. All of the reaches around Clear Lake's main basin and southern basin contain impervious surfaces associated with residential development. Impervious surfaces are higher on the southwest side of the lake and may exceed 30% along the south shoreline of the main lake basin.

Public Access to Clear Lake is available via a WDFW boat launch located on the south lakeshore. The boat launch area contains public restroom facilities as well as a limited parking area. The subdivisions of Clearwood and Single Tree Estates also have boat launches and swimming access to Clear Lake for residents.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Clear Lake is recommended for highest protection.

Deschutes River

This basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information.

Elbow Lake Basin

Basin Overview

Elbow Lake basin is located in southwestern Thurston County. The basin is 1,163 acres in size and is located entirely within WRIA 11. Water from Elbow Lake basin generally flows towards Elbow Lake and Elbow Lake Creek. Elbow Lake Creek connects to Yelm Ditch and Powell Creek and ultimately the Nisqually River.

Elbow Lake basin contains 2.75 miles of SMA lake jurisdictional shoreline, broken into two reaches (Reach name series: LEL, See Appendix A).

Elbow Lake

Physical and Biological Characterization

Elbow Lake is surrounded by steep slopes on all sides, and landslide hazard areas along the west side. Elbow Lake is located within the 100-year floodplain.

Elbow Lake is drained by Elbow Lake Creek which drains to the Nisqually River via Yelm Ditch and Powell Creek. These streams are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Elbow Lake is mapped as a wetland, and has an associated wetland located at the eastern end of shoreline jurisdiction adjacent to Elbow Lake Creek.

Mapping resources do not indicate if, or what kinds of fish species are located in Elbow Lake. A review of fishing websites indicates that the lake contains resident cutthroat, largemouth bass and perch. Elbow Lake Creek is mapped as supporting cutthroat. Elbow Lake may provide habitat for the common loon, bald eagle, osprey, and wood duck. Prairie soils are mapped around the lake.

Shoreline vegetation is primarily intact forest cover. Exceptions are a few cleared areas on the north shoreline for buildings and grass, and one area cleared for timber on the east side of the lake adjacent to Elbow Lake Creek.

There is no data on Elbow Lake's water quality.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is undeveloped, timber/forest land and recreation. The majority of Elbow Lake (the southern half) falls within Elbow Lake State Park, an undeveloped park. The northwest corner of the lake has been cleared in two areas for a building, lawns, a driveway, and a swimming/boating area. Water oriented uses include swimming and boating.

Existing zoning is Rural Residential Resource (RRR 1/5) and Public Preserve (PP). The existing Shoreline Environment Designation for all of Elbow Lake is Conservancy. Under current zoning regulations, there are approximately five lots within shoreline jurisdiction, three of which are developable. Zero parcels are vacant single lots, three parcels are subdividable vacant lots, and zero parcels have potential for additional infill.

Shoreline modifications include pier/dock/boat ramps, shoreline armoring, and impervious surfaces. Elbow Lake has four docks and a bulkhead located in the northwest corner of the lake. This section of the lake is also the only area containing impervious surfaces.

Public access to Elbow Lake may be obtained in Elbow Lake Park from a trail located off Elbow Lake Road.

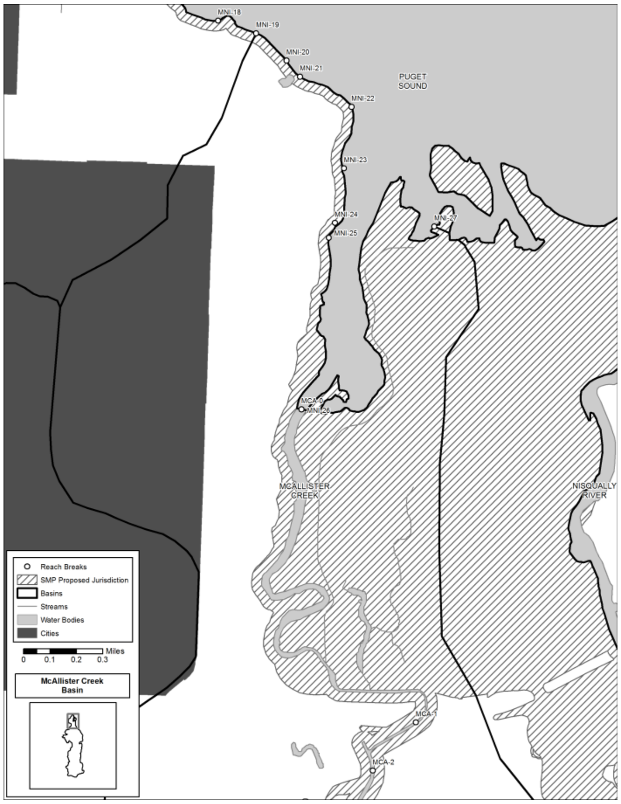
Management Issues and Opportunities

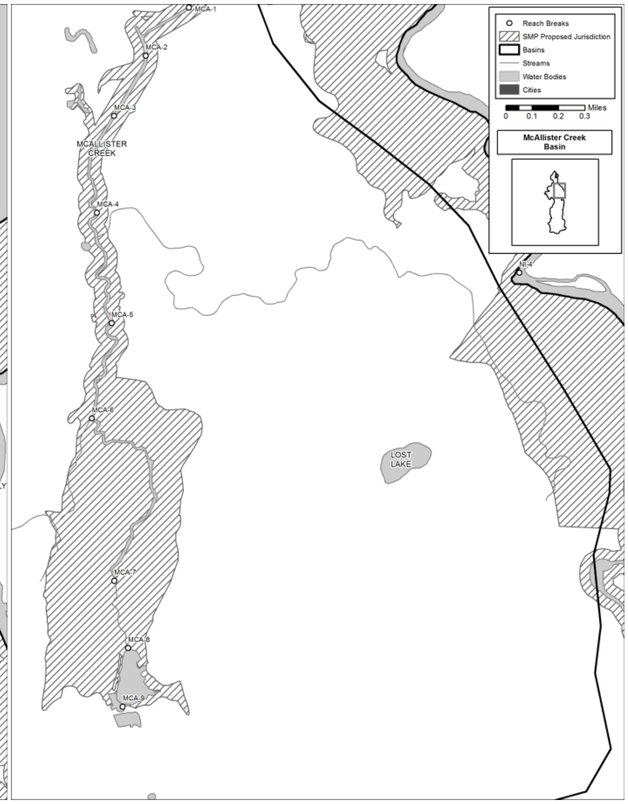
Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Elbow Lake is recommended for protection.

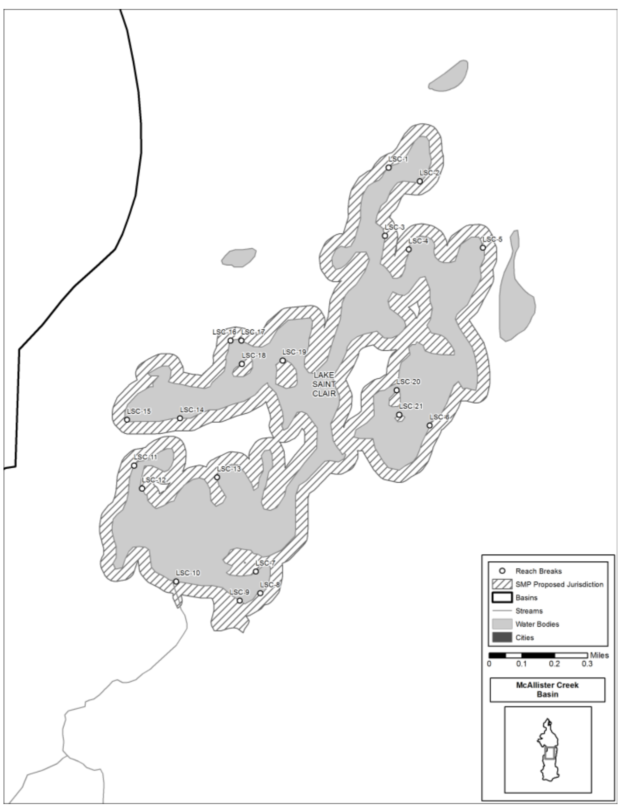
Lake Lawrence Basin

This basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information.

McAllister Creek Basin







Basin Overview

McAllister Creek basin is located in the northeastern portion of Thurston County. It is 19,765 acres in size. The majority of the basin, 18,615 acres, is located in WRIA 11; a small portion, 1,150 acres, is located in WRIA 13. As the majority of the McAllister Creek basin is located in WRIA 11, review of it is provided in this chapter.

Water within the McAllister Creek Basin generally flows towards McAllister Creek, the Nisqually River and ultimately south Puget Sound. The source for McAllister Creek is springs, which are used by the City of Olympia for their public water supply.

The western portion of McAllister Creek basin contains a portion of the City of Lacey as well as a portion of Lacey's Urban Growth Area. The southern portion of the basin contains portions of Fort Lewis. The eastern portion of the basin contains a part of the Nisqually Indian Reservation. The northern portion of the basin contains approximately half of the Nisqually Wildlife Refuge Federal Park. Lake Saint Claire lies within this basin.

McAllister Creek basin contains 5.44 miles of SSS marine shoreline along Nisqually Reach in five reaches (Reach name series: MNI); 11.86 miles of SMA lake jurisdictional shoreline around Lake Saint Claire in 21 reaches (Reach name series: LSC); and 5.52 miles of SMA stream jurisdictional shoreline along McAllister Creek in nine reaches (Reach series name: MCA). See Appendix A.

A portion of the marine nearshore reaches within this basin fall outside of WRIA 11 (MNI-19 to MNI-22). Since the majority of this basin falls within WRIA 11, these reaches are included in this narrative chapter as well as the WRIA 11 reach matrix.

Marine Shoreline

Physical and Biological Characterization

Reaches MNI-19 to MNI-25 along southern Nisqually Reach, around Nisqually Head and Luhr Beach are sand beach. The remainder of the shoreline around the mouth of McAllister Creek and the Nisqually Delta is estuary wetland.

Drift is Left to Right along southern Nisqually Reach. There is a divergence zone at Nisqually Head. Luhr Beach and south to MNI-25 is Right to Left. The remainder of the shoreline around the mouth of McAllister Creek and the Nisqually Delta has no appreciable drift.

Past landslides have occurred along the majority of the western edge of the McAllister Creek estuary. The entire bluff from Luhr Beach south along McAllister Creek is mapped as an unstable slope. Steep slopes and landslide hazard areas are mapped along the entire Nisqually Reach shoreline and south along the west bank of McAllister Creek. The Nisqually Hillside Area is located along the hill between Nisqually Head and south along the west side of McAllister Creek. The marine shoreline is mapped as 100-year floodplain.

Numerous small, unnamed streams drain to the nearshore in this basin. McAllister Creek is the only major tributary stream. McAllister Creek contains shoreline jurisdiction. The other tributaries are not mapped as shorelines of the state as they are not currently identified as exceeding a 20 cubic feet per second mean annual flow. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Associated estuarine wetlands are extensive near the mouth of McAllister Creek and along the east side of the McAllister estuary in the Nisqually Delta.

The marine nearshore shoreline is federal critical habitat for Puget Sound Chinook and Bull Trout. The shoreline may provide habitat for chum, coho, chinook, pink, sockeye, sea-run cutthroat, and winter steelhead. The shoreline may also provide habitat for great blue heron, bald eagle, purple martin, waterfowl concentrations, and wood duck. The following habitats may be present: wood duck brooding habitat, waterfowl nesting habitat, shellfish spawning, rearing, and harvesting areas, estuary marshlands, and eelgrass beds.

The shoreline vegetation along Nisqually Reach and through Luhr Beach is fragmented for residential development in the outer portion of shoreline jurisdiction. The forest cover adjacent to the water is mainly intact. South of MNI-23, the shoreline vegetation is heavily forested and completely undeveloped. On the east side of the McAllister Creek estuary, in the Nisqually Delta, intact coastal salt marsh, brackish marshland and salt meadows characterize the shoreline vegetation.

This area is part of the Henderson Inlet and Nisqually Reach Shellfish Protection Districts. The Washington Department of Health (2013) has classified the shellfish growing areas northwest of Nisqually Head as 'approved' and southeast of Nisqually Head as 'prohibited'. Nisqually Reach is included in a 2005 TMDL for fecal coliform bacteria and dissolved oxygen.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction along Nisqually Reach is residential, undeveloped, and aquatic. South of Nisqually Head and wrapping around the McAllister estuary, existing land use is undeveloped, residential, and open space. Nisqually Reach south to Nisqually Head contains low density residential development with associated impervious surfaces. MNI-21 to MNI-24 and MNI-25-MNI-26 contain the Nisqually Habitat Management Area owned by WDFW. South of MNI-23 and for the remainder of the McAllister Creek estuary, the shoreline jurisdiction has intact vegetation and no impervious surfaces. The east side of the McAllister estuary is the Nisqually National Wildlife Refuge. Geoduck aquaculture use is permitted (Nationwide 48 permits) in reaches MNI-19 to MNI-21. Water oriented uses are boating, fishing, and wildlife viewing.

The shoreline is currently designated Rural along Nisqually Reach to Luhr Beach. South of Luhr Beach, the shoreline is designated Natural on both sides of the McAllister estuary and on the west side of the Nisqually National Wildlife Refuge dike (removed in 2009). The east side of the old dike is designated Conservancy.

Zoning along Nisqually Reach to Luhr Beach is a mix of Rural Residential Resource 1/5 and Residential LAMIRD 1/2. South of Luhr Beach and around the perimeter of McAllister estuary and the Nisqually Delta, the zoning is all Public Parks Trails and Preserves with a very small section of Residential LAMIRD ½ on the Nisqually Bluff. Under current zoning regulations, there are approximately 42 lots within shoreline jurisdiction, 4 of which are developable, vacant single lots. There are no subdividable vacant lots or parcels with the potential for additional infill.

Shoreline modifications include piers/docks/boat ramps, armoring, a berm, and a boardwalk. A boat ramp and a pier are located at Nisqually Head. Armoring is present for greater than 50% of the shoreline along Nisqually Reach to Luhr Beach. A lagoon in reach MNI-20-MNI-21 is disconnected from Puget Sound by a berm. The shoreline on the east side of the McAllister estuarine in the Nisqually National Wildlife Refuge contains a miles long boardwalk.

Two public access points are available on the marine nearshore of McAllister basin. Near Nisqually Head, in the Nisqually Habitat Management Area, there is a WDFW boat launch (Nisqually Delta-Luhrs Landing) the Nisqually Reach Nature Center, and beach access at low tide. This area contains a boat launch and a fishing pier. The nature center serves as an education resource for school children. Shoreline public access is available along the east side of the McAllister estuary in the Nisqually National Wildlife Refuge on a public boardwalk.

Management Issues and Opportunities

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) prioritized the Nisqually Reach within McAllister basin (MNI-19 to MNI-23) as low for forage fish habitat preservation/ restoration due to the presence of pre-glacial sediments, few landslides, and moderate bluff height (Herrera and TRPC 2005). (See Appendix A).

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified the area between Nisqually Head and the Nisqually River (MNI-22 to MNI- 27) as beneficial to all juvenile salmon and appropriate for conservation. (See Appendix A).

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012).
PSNERP identified the Nisqually River Delta as important to restore. Within this basin, the Nisqually River Delta includes the marine nearshore reaches within McAllister Creek basin and McAllister Creek north of Interstate 5 (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	General Locations	Reaches
Highest Protection	None	None
Protection	None	None
Protection/restoration	None	None

Conservation	Southeast corner of Nisqually Reach	MNI-20 to MNI-27
Highest Restoration	West side of Nisqually Delta	MNI-26 to MNI-26
Restoration	None	None
Restoration/ Less impact to processes	None	None
Development/Restoration	West side of McAllister Creek estuary	MNI-22 to MNI-26

McAllister Creek

Physical and Biological Characterization

McAllister Creek is a low, unconfined, small tributary that originates in McAllister Springs and drains north to the Nisqually Delta and south Puget Sound. The creek is tidally influenced throughout its length. The left bank (west) shoreline jurisdiction contains steep slopes, landslide hazard areas, and the Nisqually Hillside Area in places along the entire creek. McAllister Creek flows closest to these areas along its middle reaches and most downstream reach. High groundwater hazard areas are located in several places along McAllister Creek south of Interstate 5. The 100-year floodplain is mapped along most of McAllister Creek, stopping just north of McAllister Springs. South of Interstate 5, the 100-year floodplain is confined and closely parallels the creek. North of Interstate 5, McAllister Creek drains to the Nisqually Delta. In this area, the Nisqually Hillside Area contains the floodplain on the left bank (west) whereas on the right bank (east) the 100-year floodplain expands over the entire Nisqually Delta area. The potential channel migration zone does not appear to go beyond the boundaries of the 100-year floodplain. McAllister Springs is within a wellhead protection area.

McAllister Creek is also fed by Little McAllister Creek and Hartman Creek. These streams do not meet the shoreline jurisdiction requirements; however, they are likely to qualify as critical areas pursuant to TCC 24. Associated wetlands are expansive in the upper reaches and lowest reach of McAllister Creek.

McAllister Creek is mapped as supporting the following fish species: fall chinook, chum salmon, summer steelhead, winter steelhead, sockeye, pink salmon, searun cutthroat, and coho salmon. McAllister Creek may provide habitat for bald eagle, wood duck, band-tailed pigeon, mink, waterfowl nesting and breeding habitat, salt marsh, estuarine zones, and marine sloughs.

Riparian vegetation condition is variable along McAllister Creek. In the uppermost reaches, both shorelines are heavily forested and appear unmodified. The creek then flows downstream through an area where the riparian vegetation has been cleared for agriculture to the creek edge on both banks. Moving downstream, the left bank (west) alternates between heavily forested and unmodified and fragmented for residential development. The right bank (east) is cleared to the creek for agriculture. Under Interstate 5 and just to the south, the riparian vegetation on both sides is cleared almost to the creek edge for agriculture, roads, and a commercial area. North of Interstate 5, the riparian vegetation is a combination of intact forest and intact estuarine emergent wetland vegetation on the left bank (west) and intact estuarine emergent wetland vegetation on the right bank (east).

Water quality in McAllister Creek is categorized as ‘fair’. The creek failed both parts of the fecal coliform standard for both water years (2010-2011). The dissolved oxygen and pH standard is also often violated. McAllister Springs, the source of McAllister Creek, is used by the City of Olympia for its public water supply. Non-point pollution problems from agriculture, on-site sewage systems, and stormwater runoff influence the water quality (Thurston County Water Quality Monitoring Report, 2012).

There are on-going efforts by local, state, and tribal agencies to protect and improve water quality. The McAllister Geologically Sensitive Area and City of Olympia wellhead protection program are in place to protect groundwater and McAllister Springs, which is the headwater of McAllister Creek. McAllister Creek is within the Henderson-Nisqually Shellfish Protection District, which was created in 2001 after a downgrade of commercial shellfish growing areas. The Shellfish Protection District created an implementation work plan in 2005. Most of the actions from this work plan have been completed and since 2012, the Shellfish Protection District stakeholder group has been working on an “adaptive management work plan”. The Washington Department of Ecology completed a Total Maximum Daily Load water quality implementation plan in 2007 for Fecal Coliform Bacteria and Dissolved Oxygen. The Washington Department of Health classified the commercial shellfish growing areas at the mouth of McAllister Creek as ‘prohibited’ (2013).

Shoreline Use Patterns

North of Interstate 5, land use within shoreline jurisdiction is primarily undeveloped and parks. This area of shoreline jurisdiction falls entirely within the Nisqually Wildlife Refuge. South of Interstate 5, existing land use within shoreline jurisdiction is agricultural, timber/forest land, residential, commercial, and undeveloped. McAllister Springs and the associated wetland area to its north, fall within McAllister Grove, an undeveloped park owned by the City of Lacey. The area on the right bank (east) of McAllister Creek, north of McAllister Park and south of Interstate 5 is the Nisqually Agriculture area. Portions of the shoreline jurisdiction on the left bank (west) fall within the Nisqually Hillside Area, which is a critical area with its own development regulations. A trout farm is located on the creek’s left bank (west) just south of Martin Way. Water oriented uses of McAllister Creek include wildlife viewing, municipal drinking water, and a fish hatchery.

Impervious surfaces along McAllister Creek shoreline jurisdiction range from very high to zero. Interstate 5 and the adjacent commercial area have very high levels of impervious surface, estimated to exceed 30%. In the middle reaches, there are low levels of impervious surface associated with residences and agricultural roads and buildings. In the lower and upper reaches, there is no impervious surface.

Under the current SMP, shoreline jurisdiction north of Interstate 5 is designated Natural. South of Interstate 5, shoreline environment designations are divided between Rural and Conservancy.

In general, the left bank (west) is designated Conservancy, and the right bank (east) is designated Rural. Exceptions to this pattern are the extensive wetland area at the headwaters which is designated Conservancy on both sides of the creek, and the area of Highway Commercial which is designated Rural on both sides of the creek.

Zoning south of Interstate 5 is Highway Commercial, Nisqually Agriculture, Rural 1/20, and Rural Residential 1/5. North of Interstate 5 is zoned Public Parks Trails and Preserves with a small section of Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 57 lots within shoreline jurisdiction, three of which are developable. There are two vacant single lots and one subdividable vacant lot. There are no parcels with the potential for additional infill.

Shoreline modifications along McAllister Creek include a culvert/fish barrier, a dam, three roads, three bridges, and stream channelization. There is one culvert that acts as a fish barrier near McAllister Springs. Nisqually Trout Farm Dam is located on a small tributary/associated wetland of McAllister Creek. Transportation/utility facilities along McAllister Creek include the following three roads with bridges: Interstate 5, Martin Way E, and Steilacoom Road SE. South of Interstate 5, McAllister Creek is channelized for two reaches.

Public access to lower McAllister Creek (north of I-5) is available via Interstate 5, and through the Nisqually Wildlife Refuge. Public access to McAllister Creek south of Interstate 5 is available via roads (Interstate 5 and Martine Way E, Steilacoom Road SE).

Management Issues and Opportunities

The dike removal that occurred as part of the large-scale restoration of the Nisqually River Delta has impacted the lowermost reach of McAllister Creek (see the Nisqually basin section for further discussion of the Nisqually Delta restoration project). Prior to the dike removal, the lowest reach of McAllister Creek was confined on its right bank (east) by the dike. Following dike removal, most of the lower reach of the creek is now free to migrate across the floodplain. McAllister Creek is still channelized just north of Interstate 5.
http://nisquallydeltarestoration.org/

McAllister Creek's most downstream reach was identified as beneficial to all juvenile salmon and appropriate for conservation throughout the reach (Squaxin Island Tribe, 2009). This reach is already entirely contained by the Nisqually National Wildlife Refuge.

<u>PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound</u> (Cereghino et al., 2012).
PSNERP identified the Nisqually River Delta as important to restore. The Nisqually River Delta includes McAllister Creek north of Interstate 5 and the marine nearshore reaches within McAllister Creek basin (See Appendix A)**.**

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	General Locations	Reaches
Highest Protection	None	None
Protection	None	None
Protection/ conservation	None	None
Conservation	None	None
Highest Restoration	McAllister Creek downstream of Interstate 5; South of Interstate 5	MCA-0 to MCA-1 (right bank); MCA-1 to MCA-4
Restoration	Mid McAllister Creek	MCA-4 to MCA-6
Restoration/ Development	Upper McAllister Creek and McAllister Springs	MCA-6 to MCA-9
Development/ Restoration	McAllister Creek downstream of Interstate 5	MCA-0 to MCA-1 (left bank)

Lake Saint Claire

Physical and Biological Characterization

Lake Saint Claire is an irregularly shaped lake formed by ice blocks left during the glacial age. It has steep sides, numerous narrow arms, and four islands. Lake Saint Claire is roughly 268 acres, with a mean depth of 34 feet, and a maximum depth of 110 feet. The lake is located at approximately 73 feet in elevation.

Lake Saint Claire is located entirely within the McAllister Geologically Sensitive Area. The lake is almost completely surrounded by steep slopes. Landslide hazard areas are limited to a small area along the east shoreline of the east basin. The entire lake is within the 100-year floodplain. Lake Saint Claire is located within a wellhead protection area.

Lake Saint Claire's only surface water input comes from Eaton Creek where it discharges into the southwest basin. The lake does not have a surface water outlet; instead, water seeps out via groundwater discharge to the north toward McAllister Springs. Eaton Creek does not meet the shoreline jurisdiction requirements; however, it is likely to qualify as a critical area pursuant to TCC 24. Small associated wetlands are mapped on the south side of the southwestern basin.

Lake Saint Claire may provide habitat for the western gray squirrel and wood duck. Prairie soils are mapped around the entire lake, and oak habitat is mapped along the western shoreline. Eaton Creek, which drains to Lake Saint Claire is mapped as supporting rainbow trout.

Riparian vegetation surrounding Lake Saint Claire is intact forest in some reaches, alternating with stretches of fragmented forest for relatively dense residential development.

Water quality in Lake Saint Claire is categorized as ‘Fair to Good’. The lake is mesotrophic to eutrophic, or moderately to highly productive; the phosphorus concentration sometimes violates the state water quality standard; and toxic algae blooms have occurred in recent years (2009 and 2011). Water quality conditions between basins vary due to the irregular shape of the lake with somewhat isolated basins, steep shorelines, and water depths of over 100 feet. Lake Saint Claire is naturally a dark brown “tea-color” which restricts light penetration, and limits aquatic plant and algae growth. In wet years, high water levels have caused concerns about shoreline erosion and property damage from boat and Jet Ski wakes in the big basin (Thurston County Water Quality Monitoring Report, 2012).

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential and undeveloped, with some smaller areas of aquatic, timber/forest land, and parks. Water oriented uses include fishing, boating, swimming, and domestic water supply.

The shoreline environment designations along Lake Saint Claire are primarily Rural, with some areas of Conservancy along the east side of the east basin, along the north side of the southwest basin, and along the south side of the western basin. Lake Saint Claire is zoned entirely McAllister Geologically Sensitive Area. Under current zoning regulations, there are approximately 476 lots within shoreline jurisdiction, 28 of which are developable. Eighteen parcels are vacant single lots, nine parcels are subdividable vacant lots, and one parcel has the potential for additional infill.

Shoreline modifications include piers/docks/boat ramps, armoring, roads, bridges, and impervious surfaces. Numerous docks are located around the majority of Lake Saint Claire. There are several undeveloped reaches that do not have any docks. Eight roads enter shoreline jurisdiction including: Peninsula Drive SE, Ad El Road SE, and Rehklau Road SE, Sitkum Drive SE, 62nd Avenue SE, Glory Drive SE and Raccoon Valley Road , Thompson Lane SE. Of those roads, only Peninsula Drive SE actually intersects with the water. A bridge associated with Peninsula Drive SE crosses the narrow, northern portion of the southwest basin. Impervious surfaces are variable, with the highest concentrations around the central portion of the lake. Numerous reaches are undeveloped and have no impervious surfaces; however, there are also several reaches where impervious surfaces may exceed 30%.

Public access is available via a WDFW motorboat launch located on the east shoreline of the southwestern basin. Informal public access is also available via the Peninsula Drive SE bridge.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
The eastern half of Lake Saint Claire (LSC-17 to LSC-7) is recommended for development/restoration. The western half of Lake Saint Claire (LSC-7 to LSC-17) is recommended for restoration/development.

Flanders Lake

Physical and Biological Characterization

Flanders Lake has areas of steep slopes on its east and west shorelines. The lake is located in a high groundwater hazard area. Flanders Lake does not have a surface inlet or outlet. The entire lake is mapped as a wetland. The southern shoreline contains two areas of larger associated emergent wetlands. Flanders Lake may support the following species: Western toad, Western bluebird, and wood duck. Riparian vegetation around the lake is entirely intact, with the exception of one area cleared for an unpaved water access road. Riparian vegetation is forested, with emergent vegetation in the associated wetlands. There is not data on water quality for Flanders Lake.

Shoreline Use Patterns

Flanders Lake is located within Joint Base Lewis McChord, a federal military reservation. Existing land use within shoreline jurisdiction is undeveloped. Water oriented use may include boating and swimming.

Flanders Lake is zoned Military Reservation and is not designated under the existing SMP. Flanders Lake contains one parcel which is not developable.

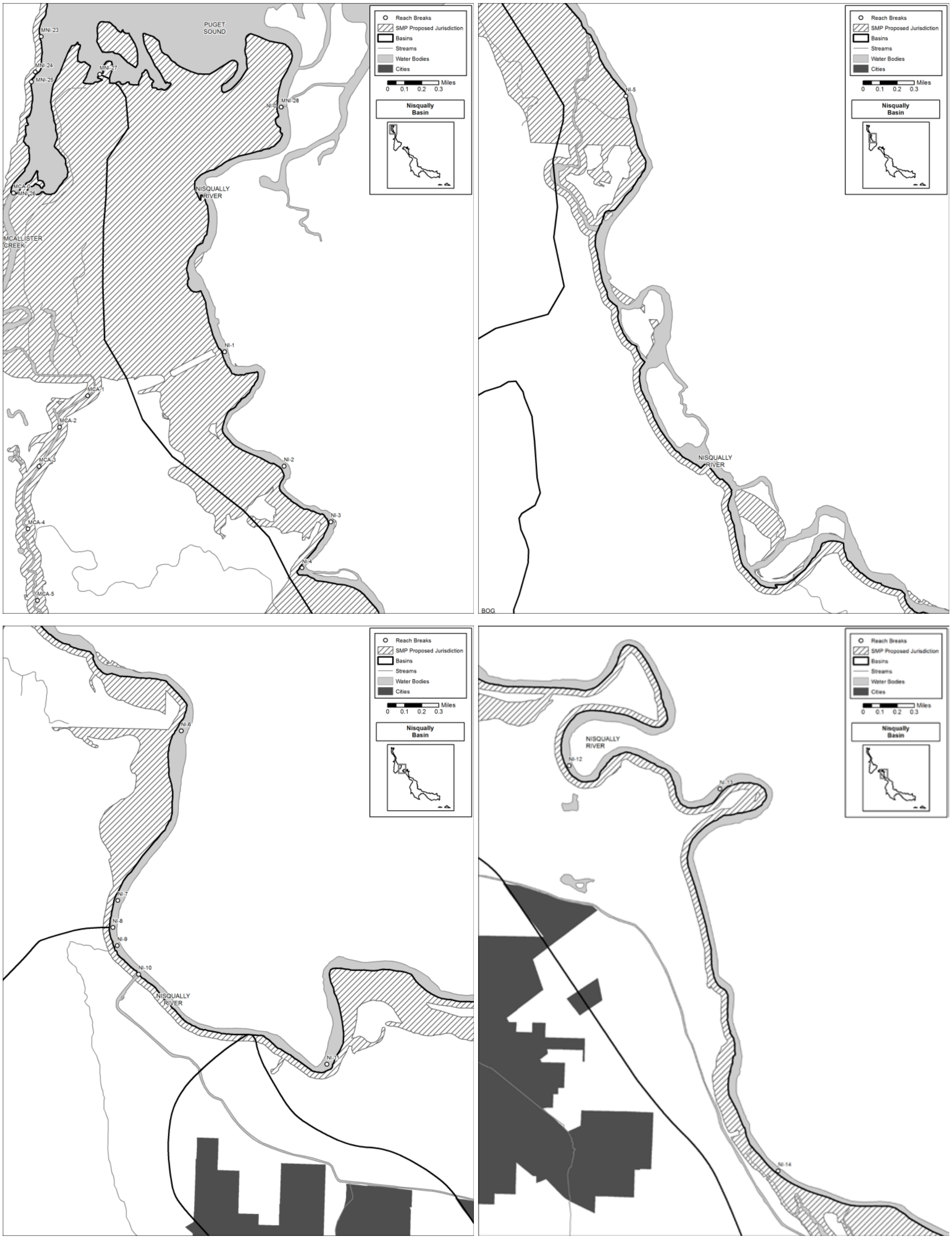
The shoreline is primarily unmodified with the exception of an unpaved water access road to the lake. There is no impervious surface around the lake.

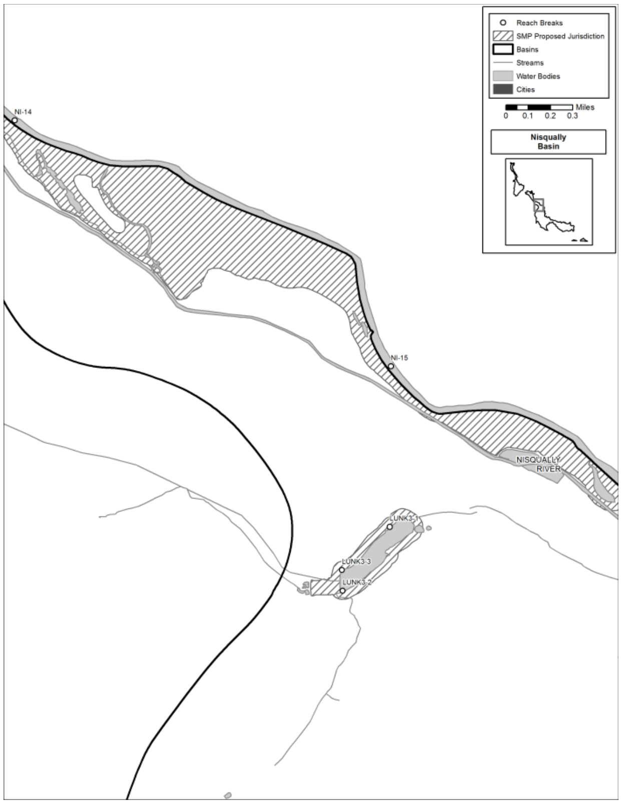
There is no public access to the lake.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Flanders Lake is recommended for protection/conservation.

Nisqually Basin




Reach Breaks
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Basins
Streams
Water Bodies
Cities
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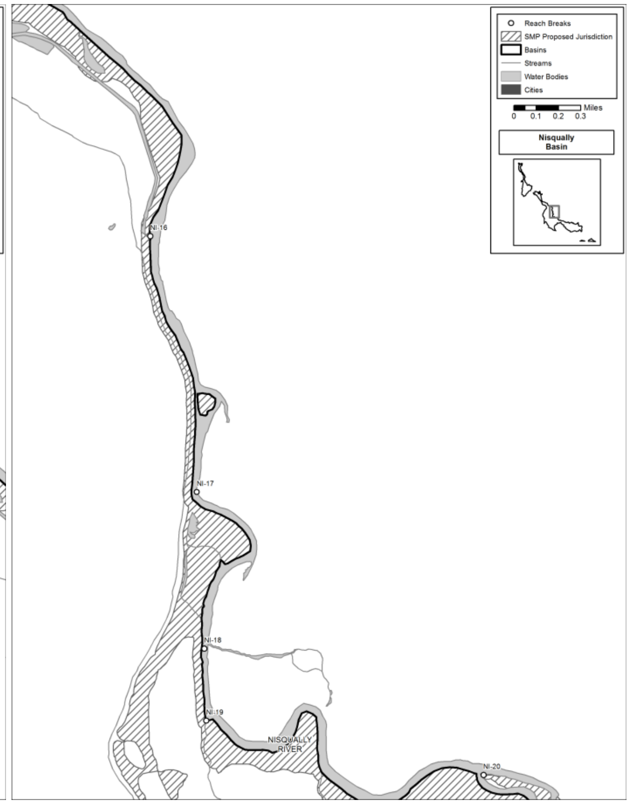
LUNK3-3
LUNK3-2


Reach Breaks
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Basins
Streams
Water Bodies
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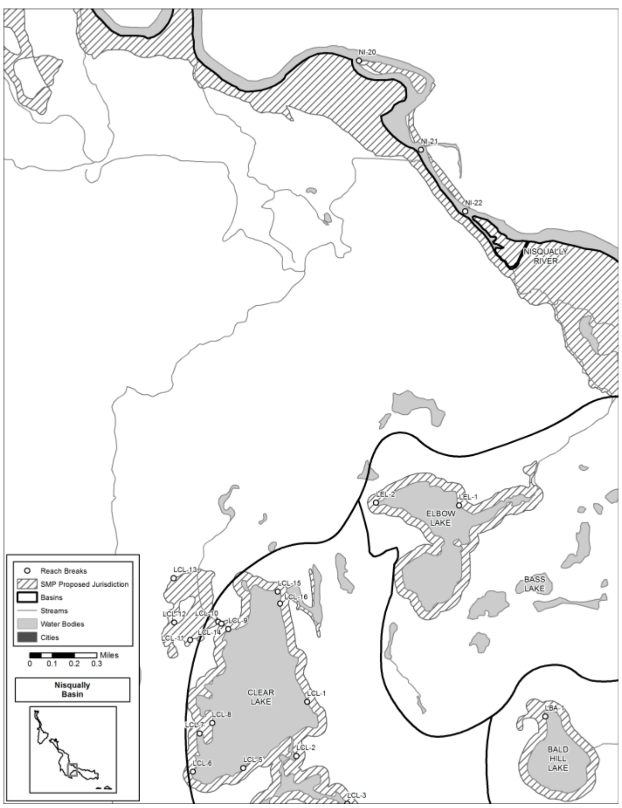
NISQUALLY RIVER
NI-20


NI-20
NI-21
NI-22
NISQUALLY RIVER
ELBOW LAKE
BASS LAKE
LCL-13
LCL-15
LCL-16
LCL-12
LCL-10
LCL-9
LCL-11
LCL-14
CLEAR LAKE
LCL-1
LCL-8
LCL-7
LCL-6
LCL-5
LCL-2
LCL-3
LBA-1
BALD HILL LAKE
Reach Breaks
SMP Proposed Jurisdiction
Basins
Streams
Water Bodies
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Nisqually Basin


Reach Breaks
SMP Proposed Jurisdiction
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Water Bodies
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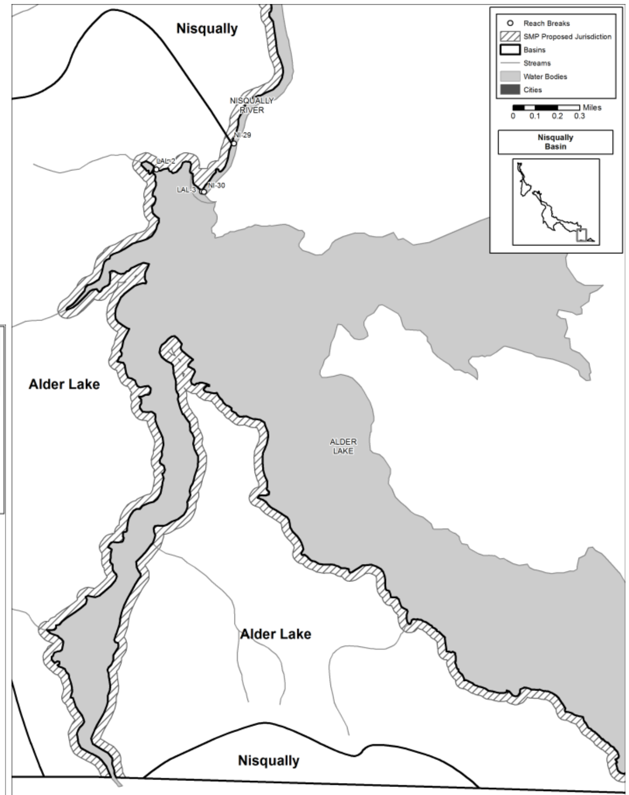
NI-23
NI-24
NISQUALLY RIVER
PARSNIP SWAMP
PARSNIP SWAMP



Basin Overview

Nisqually basin is located along the eastern border of the county. It is 31,555 acres in size. The majority of this basin, 30,367 acres, is located in WRIA 11; a small portion, 1,188 acres, is located in WRIA 13. As the majority of the Nisqually basin is located in WRIA 11, review of it is provided in this chapter. The Nisqually basin is flanked on its eastern side by the eastern boundary of the county. Water within the Nisqually River basin generally flows to the Nisqually River and south Puget Sound.

This basin contains a portion of the Nisqually Wildlife refuge. A small portion of the City of Yelm as well as a portion of the associated urban growth area is located within this basin. The basin also contains portions of the Nisqually Indian Reservation, Joint Base Lewis-McChord, and the Snoqualmie National Forest.

The Nisqually Basin contains 42.8 miles of SSS jurisdictional stream shoreline along the Nisqually River, broken into 28 reaches (Reach name series: NI) 1.03 miles of SMA jurisdictional lake shoreline around Unknown Lake 3, in three reaches (Reach name series: LUNK3) and 1.61 miles of SSS jurisdictional marine shoreline along the Nisqually Flats, in one reach (Reach series name: MNI). See Appendix A.

Marine Shoreline

Physical and Biological Characterization

The Nisqually River forms the eastern side of this reach (MNI-27-MNI-28) and the reach is part of the Nisqually River delta. The marine nearshore shoreline type is estuary wetland. There is no appreciable drift. The entire Nisqually Delta area is mapped as 100-year floodplain.

The Nisqually River is the only tributary to this portion of the Nisqually Delta. The entire Nisqually Delta is mapped as a wetland. The area within the dike is freshwater wetland. The areas outside of the dike are estuarine wetlands.

The marine nearshore in the Nisqually basin is critical habitat for Puget Sound Chinook and Bull Trout. This area may support the following species: chum, coho, chinook, pink, sockeye, sea-run cutthroat, winter steelhead, summer steelhead, harbor seal, wood duck, and Dungeness crab. The following habitats may be present: shellfish spawning, rearing and harvesting areas, waterfowl nesting habitat, harbor seal haulout/pupping area, wood duck brooding habitat, estuary marshlands and patchy eelgrass.

Coastal salt marsh, brackish marshland and salt meadows characterize this shoreline habitat. The reach is entirely undeveloped and contains intact riparian vegetation. No kelp is mapped in this area.

An area of the Nisqually Delta marine shoreline located in Pierce County just across the county line is listed on the Ecology 303(d) list of polluted waters for PCB’s in fish tissue. The Washington Department of Health has prohibited shellfish harvest along the Nisqually Delta marine shoreline.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is open space, undeveloped, and parks. The entire Nisqually Delta is part of the Nisqually Wildlife Refuge. Water oriented uses are wildlife viewing.

The existing shoreline environment designation is Natural on the north side of the old dike, and Conservancy on the south side of the old dike. The reach is zoned Public Parks Trails and Preserves. Under current zoning regulations, there are approximately four lots within shoreline jurisdiction, none of which are developable.

This reach recently had a continuous dike along its southern edge. In 2009, this dike was removed as part of the multi-year Nisqually National Wildlife Refuge Estuary Restoration Project. The dike removal allows reconnection of large tidal channels to historic sloughs. Gently sloped or level profiles have been constructed following dike removal to connect the elevations inside and outside of the dike and facilitate tidal flow and estuary restoration. A new, but shorter dike was built further south to maintain an area of freshwater for freshwater birds. This new dike makes up the southern boundary of this reach. There is no impervious surface within this reach.

Shoreline public access is available throughout this reach via the Nisqually National Wildlife Refuge.

Management Issues and Opportunities

This reach is part of the multi-year Nisqually National Wildlife Refuge Estuary Restoration Project, a large-scale restoration aimed at restoring estuarine habitat. Restoration opportunities within this reach are to continue implementing the Nisqually National Wildlife Refuge Estuary Restoration Project Plan, monitor results, and determine additional restoration steps based on monitoring results.

The Nisqually Watershed Salmon Recovery Three Year Work Plan (Nisqually Lead Entity, 2011) identified estuary protection and restoration as a “highest priority” action.

Nisqually Reach Aquatic Reserve (NRAR)
The Nisqually Reach Aquatic Reserve (NRAR) was established in 2011 as an environmental, scientific, and educational reserve with the goal to ensure protection of the unique species and habitats identified in the area and to promote sustainable public stewardship of the region. Within Thurston County, the NRAR extends from the northwestern boundary of Tolmie State Park south through the Nisqually River Delta, and includes all state-owned, DNR managed tidelands and bedlands. The tideland and bedland areas managed by the state are areas that would be considered aquatic in the shoreline master program.

Nisqually Reach Aquatic Reserve Management Goals:
1. Preserve, restore and enhance aquatic nearshore areas including intertidal and subtidal ecosystems with a special emphasis on native habitats for forage fish, salmonids, and marine birds.
2. Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.
3. Promote stewardship of riparian and aquatic habitats and species by supporting and providing opportunities for outdoor education, scientific research including citizen science and interpretive studies.
4. Promote sustainable management of traditional recreational (e.g., boating, water skiing, fishing) commercial (e.g., marinas) and cultural uses in the aquatic reserve in a manner consistent with the other goals and objectives for the reserve.

5. Support the recovery and protection efforts for federal and state threatened, endangered and sensitive species, species of special concern and their habitats.

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). PSNERP recommends restoration of the Nisqually River Delta (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
The marine nearshore in Nisqually basin is recommended for highest restoration.

Nisqually River

Physical and Biological Characterization

The upper reaches of the Nisqually River are surrounded by steep slopes and landslide hazard areas. Downstream, steep slopes and landslide hazard areas are present along stretches of the river. The majority of the Nisqually River is mapped as a volcanic lahar hazard area. Downstream of the Toboton Creek confluence and north to the Nisqually Delta, there are numerous scattered areas of high groundwater hazard within shoreline jurisdiction.

The 100-year floodplain alternates between confined and expansive areas. Areas of wide floodplain are located near Powell Creek and Yelm Ditch; north of the Centralia Power Canal; and north of Thompson Creek to Puget Sound. The Nisqually River has several areas where the potential channel migration zone appears to go beyond the mapped 100-year floodplain. These areas are generally as follows: the area of expansive wetland and floodplain near Powell and Toboton Creeks; near Yelm Ditch; north of the City of Yelm; and around the Nisqually Indian Reservation.

The Nisqually River has numerous tributaries within Thurston County including: Thompson Creek, Powell Creek, Yelm Ditch, Toboton Creek, Lackamas Creek, as well as several unnamed tributaries. The Centralia Power Canal diverts water out of and then back into the Nisqually River. The Nisqually River shoreline jurisdiction reaches are described in Appendix A. The remainder of creeks and ditches in the Nisqually basin, as well as the associated tributaries are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. There are many areas along the Nisqually River with associated wetlands, including: the area near the confluence of Powell Creek; Yelm Ditch area; within the Nisqually Indian Tribe Reservation; and north of I-5 within the Nisqually Delta.

The Nisqually River is mapped as supporting fall Chinook, chum, coho and pink salmon, summer and winter steelhead, sea-run cutthroat and resident cutthroat trout. Many portions of the Nisqually River are mapped as Puget Sound Chinook and Bull Trout federal critical habitat.

The Nisqually River shoreline jurisdiction may provide habitat for the following species: bald eagle, mountain quail, pileated woodpecker, western gray squirrel, egret, green heron, snowy owl, wood duck, waterfowl species, reticulate sculpin, prickly sculpin, torrent sculpin, riffle sculpin, large scale sucker, three spine stickleback, crayfish, lamprey, Taylor's (whulge) checkerspot, osprey, great blue heron, waterfowl concentrations, and turkey vulture.

The Nisqually River shoreline jurisdiction may include the following habitats: anadromous fish spawning and/or rearing, Nisqually Delta Waterfowl area, waterfowl nesting and breeding sites, waterfowl overwintering habitat, estuarine and riparian zones, riverine wetlands, coastal salt marsh, brackish marshlands, salt meadows, and the upper Nisqually bald eagle use area. The shorelines along the upper reaches are associated with old growth/mature forest and snag rich areas. Non-farmed wetlands and wet pasturelands adjacent to the Nisqually support large numbers of waterfowl nesting each season. Prairie soils are mapped along the entire river.

The most downstream reach of the Nisqually River falls within the Nisqually National Wildlife

Refuge and therefore, relatively low human disturbance of riparian habitat is evident. Vegetation on this reach's left bank (west shoreline) is mostly wetland emergent and shrub-scrub with some trees. Between I-5 and the north boundary of the Nisqually Indian Reservation, the shoreline jurisdiction is wide and riparian vegetation is generally fragmented for agriculture and residential development. Within the Nisqually Indian Reservation, riparian vegetation is intact forest cover. South of the Nisqually Indian Reservation, the riparian vegetation continues to be primarily intact except for some small areas of clearing for a road crossing, the Centralia Power Canal outflow, and an area cleared for agriculture. Upstream of Joint Base Lewis-McChord, in reach NI-12-NI-13, riparian vegetation is fragmented and cleared for residential development. In reach NI-13-NI-14, riparian vegetation is intact forest cover with two areas cleared for utilities, one area cleared for a railroad, and one area cleared for State Highway 507. Upstream of State Highway 507, the shoreline jurisdiction is very wide due to the 100-year floodplain. In this area, the riparian vegetation has been primarily cleared to very close to the water line for agriculture. Upstream of this reach, the riparian vegetation is primarily intact forest cover to the basin line. Exceptions are NI-20-NI-21 and NI-23-NI-24 where the shoreline jurisdiction is wide due to floodplains and much of the riparian vegetation has been cleared for agriculture.

No water quality issues are noted for the Nisqually River. In reach NI-24-NI-25, a tributary that joins the Nisqually River is listed as a 303d waterway for dissolved oxygen. However, as mapped, the 303d designation does not extend into the Nisqually. Additionally, in reach NI-26-NI-27, the Mashel River (located in Pierce County) flows into the Nisqually River. The Mashel River is listed as a 303d waterway for temperature. As mapped, the 303d designation does not extend into the Nisqually. The Washington Department of Ecology completed a Total Maximum Daily Load Water Quality Implementation Plan for Fecal Coliform Bacteria and Dissolved Oxygen for the Nisqually River Basin in 2007.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction on the uppermost reaches is a mix of timber/forest land, undeveloped, and residential. Between the Centralia Power Canal intake and outflow, land use is primarily a mix of commercial, agriculture, undeveloped, and transportation. Downstream of the Centralia Power Canal outflow, land use is primarily undeveloped, agriculture, open space, parks, and residential, with a small area of commercial. Water oriented uses include fishing, wildlife viewing, and hydroelectric power production.

Approximately seventy percent of the mainstem Nisqually River is in protected status under federal, state, local and private agreements. Large sections of land adjacent to the Nisqually River are protected because they are enclosed by Fort Lewis, the Nisqually Indian Reservation, and the USFWS Nisqually Wildlife Refuge. Other sections of land are safeguarded as major public landholdings such as the Nisqually-Mashel State Park, City of Centralia Hydroelectric Project (which includes the Centralia Power Canal), and the Tacoma Power Nisqually Hydroelectric Project. The non-profit land conservancy in the watershed, the Nisqually Land Trust, is the owner of a number of significant properties (Puget Sound Salmon Recovery Plan, 2007).

- Reach NI-0-NI-1 is entirely within the Nisqually Wildlife Refuge. The ownership of the park is a mix of federal and state.

- Reach NI-5-NI-6 is the Nisqually Indian Reservation.
- Reaches NI-6-NI-7 and NI-11-NI-12 are Federal Military Lands.
- Reaches NI-9 to NI-11 and NI-15 to NI-17 contain municipal open space for the City of Centralia Hydroelectric Project (Centralia Power Canal).
- NI-26-NI-27 is entirely contained within the Nisqually-Mashel State Park.
- Thurston County owns a small strip of shoreline in NI-27-NI-28 that is part of Pack Forest.
- Numerous reaches along the Nisqually River contain parcels owned by the Nisqually Land Trust (owns the majority of parcels) or the Tatrimina Land Trust for conservation.

Under the existing SMP, the Nisqually River is almost entirely designated Conservancy. An area just upstream of the Joint Base Lewis-McChord property which has relatively dense residential development within the shoreline jurisdiction is currently designated Rural. Areas of the shoreline jurisdiction surrounding I-5 and north of the Nisqually Indian Reservation are also currently designated Rural. The lowest reach (within the Nisqually National Wildlife Refuge) is designated Natural in the existing SMP.

The upstream reaches of the Nisqually River are zoned primarily Long Term Forestry, with a small area of Public Parks Trails and Preserves. Between NI-24 and NI-13, shoreline jurisdiction is zoned primarily Rural Residential Resource 1/5 with a small area of Rural 1/20, and an area of Long Term Agriculture. An area along the river north of the City of Yelm is zoned Residential LAMIRD 2/1. Downstream, the shoreline jurisdiction is zoned a mix of Military Reservation, Rural Residential Resource 1/5, Rural Resource 1/5, and Long Term Agriculture. The most downstream reach on the Nisqually Delta is zoned Public Parks Trails and Preserves. Under current zoning regulations, there are approximately 492 lots within shoreline jurisdiction, 39 of which are developable. There are 22 vacant single lots, 12 subdividable vacant lots, and five parcels with the potential for additional infill.

Shoreline modifications include dams, a power canal, roads, bridges, utilities, railroads, culverts, and impervious surfaces. The upstream reaches of the Nisqually River are modified by two dams which both function as fish passage barriers. The Alder Dam creates Alder Lake reservoir. The La Grande Dam is located just downstream from Alder Dam and does not have an associated reservoir. An area of wide shoreline jurisdiction near NI-22 contains three culverts that function as fish passage barriers. Two culverts are along Yelm Ditch, and one is on an unnamed creek. Impervious surfaces along the Nisqually River are generally very low. The areas of highest impervious surface concentration occur just north of the City of Yelm's Urban Growth Area and just north of the railroad but south of I-5.

South of the City of Yelm, the Centralia Dam diverts a portion of the water from the Nisqually River into the Centralia Power Canal. The Centralia Power Canal runs parallel to the Nisqually River through the City of Yelm, goes through a powerhouse and then empties back into the river. The Centralia Power Canal is regulated by and under the jurisdiction of the Federal Energy Regulatory Committee (FERC). Within the stretch of river between the intake and outtake of the Centralia Power Canal, six utilities cross the Nisqually. These include William's Fiber Optical, Olympic Pipeline, a gasline, and three different powerlines. This area also contains two railroad crossings and associated bridges: the Weyerhauser Railroad, and the Burlington Northern Railroad. State Highway 507 crosses the Nisqually over a bridge in this section. Briar Street SE enters shoreline jurisdiction in a residential area, but does not provide access to the water.

Downstream (north) of the Centralia Power Canal outflow, there is little shoreline modification until downstream (north) of the Nisqually Indian Reservation, with the exception of a road for tank crossing on Joint Base Lewis-McChord. Downstream (north) of the Nisqually Indian Reservation, the shoreline jurisdiction is wide due to the 100-year floodplain and numerous roads enter or cross shoreline jurisdiction. Major roads with associated bridges include the Old Pacific Highway SE, and Interstate 5. The I-5 Bridge and placement of fill restrict natural channel migration and limit the upper extent of the Nisqually estuary. Historically, the Nisqually estuary extended upstream of I-5. Other public roads that cross into shoreline jurisdiction but do not provide water access are: Nisqually Cut-off Road SE, Conine Avenue SE, Conine Street SE, 6th Avenue SE, and Riverside Drive SE. In addition, there are numerous private roads within shoreline jurisdiction in this area. The Burlington Northern Railroad crosses the river in this section. There is a culvert that functions as a fish passage barrier along Conine Avenue SE within shoreline jurisdiction but not along the Nisqually River.

North of Interstate 5, the Nisqually River historic delta has been modified by dikes on the Nisqually Wildlife Refuge. Although a large-scale restoration of the Nisqually River Delta within the Nisqually National Wildlife Refuge is underway (included removing miles of dikes) a portion of the delta on the left bank (west) of the river has been maintained as freshwater wetland by a new dike to support freshwater bird species. This area also contains a visitor/interpretive center, parking lots, and paved trails.

Defined public access occurs at the north end of Nisqually Basin in the Nisqually National Wildlife Refuge. There are trails and a visitor/interpretive center. Defined public access is also available via a WDFW boat launch onto the Nisqually River, located at the end of 6th Street.

Management Issues and Opportunities

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified reach NI-0-NI-1 as beneficial to all juvenile salmon and appropriate for conservation throughout the reach. The reach is currently used for conservation as it is located entirely within the Nisqually Wildlife Refuge.

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). PSNERP recommends restoration of the Nisqually River Delta (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	1. Nisqually Indian Reservation	1. NI-5-NI-6 (southern half of reach);

	2. Area of wide floodplain around the Toboton Creek confluece	2. NI-19-NI-21
Protection	This area of the Nisqually River passes through the Nisqually Indian Reservation	NI-3 to NI-6;
Protection/ Conservation	Joint Base Lewis-McChord	NI-6 to NI-8;
Conservation	River downstream of Alder Lake Dam	NI-26 to NI-30
Highest Restoration	1. Northernmost reaches 2. South of the railroad line to north of the Toboton Creek confluence 3. Area of wide floodplain near Powell Creek confluence	1. NI-0 to NI-3; 2. NI-13 to NI-19 3. NI-21 to NI-26
Restoration	1. Just north of Thompson Creek south to the railroad line 2. Wide floodplain and wetland area	1. NI-8 to NI-13; 2. NI-21 to NI-26
Restoration/ Development	None	None
Development/ Restoration	None	None

The Nisqually Watershed Salmon Recovery Three Year Work Plan (Nisqually Lead Entity, 2011) identified the following priority actions for the Nisqually River within Thurston County:

Tier 1 (Highest Priority)

- Protect functioning reaches of Mainstem Nisqually and the river mouth

Tier 2 (High Priority)

- Protect the rest of the Mainstem Nisqually reaches, except upper Nisqually
- Improve fish passage at Centralia Diversion Dam
- Restoration of the lowest reach of the Nisqually River
- Preservation of lower Yelm Creek

Tier 3 (Medium Priority)

- Protect upper Nisqually River from Alder/LaGrande Dams to mouth of Ohop Creek
- Protection of lower sections of Toboton and Powell Creek

Unknown Lake 3

Physical and Biological Characterization

Steep slopes lie along the north shoreline of Unknown Lake 3. High groundwater hazard areas surround the entire lake. An unnamed stream flows into Unknown Lake 3 from the south. Two streams drain from Unknown Lake 3. Yelm Ditch drains east from the lake. An unnamed stream drains northwest from the lake. Associated wetlands are mapped at the western and eastern ends of the lake.

Unknown Lake 3 is surrounded by prairie soils. No priority species or habitats are mapped within or near the shoreline jurisdiction of this lake. Riparian vegetation along the east and south sides of Unknown Lake 3 appears cleared to the shoreline for grazing. Riparian vegetation along the west and north lake shorelines is intact forest cover. There is no data on water quality for Unknown Lake 3.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is agriculture, residential, undeveloped, and aquatic.

Unknown Lake 3 is not designated under the current SMP. The entire lake is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately seven lots within shoreline jurisdiction, four of which are developable. One parcel is a vacant single lot, one parcel is a subdividable vacant lot, and two parcels have the potential for additional infill.

Shoreline modifications include one road and its associated impervious surface at the west end of shoreline jurisdiction.

No public access is noted for Unknown Lake 3.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Unknown Lake 3 is recommended for restoration/development.

Spurgeon Creek Basin

This basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information.

Thompson Creek (Nisqually) Basin

Basin Overview

Thompson Creek (Nisqually) basin is located in the central portion of the county along the eastern border. It is 10,294 acres in size. The majority of the basin, 9,643 acres, is located in WRIA 11. A small portion of the basin, 651 acres, is located in WRIA 13. As the majority of the Thompson Creek basin is located in WRIA 11, review of it is provided in this chapter.

Water within the Thompson Creek (Nisqually) basin generally flows towards the Nisqually River. This basin contains a portion of the City of Yelm as well as a portion of the associated urban growth area. The northwestern portion of basin contains portion of the Joint Base Lewis-McChord property. The basin also contains Cochrane Memorial Park.

Thompson Creek basin contains 1.11 miles of SMA jurisdictional lake shoreline along Inman Lake, broken into two reaches (Reach name series: LIN. See Appendix A). Thompson Creek basin also contains 1.09 miles of SSS jurisdictional stream shoreline along the Nisqually River in two reaches (Reach series name: NI). Those reaches are discussed as part of the Nisqually River in the Nisqually basin section.

Inman Lake

Physical and Biological Characterization

Inman Lake's southern shoreline is mapped with steep slopes. All of Inman Lake is within a high groundwater hazard area and the 100-year floodplain. The 100-year floodplain extends beyond the lake boundaries around most of the lake and its associated wetlands.

Inman Lake has numerous associated wetlands, including three large wetlands located at the west, north, and east ends of the lake. The associated wetland located at the east end of the lake is named Gehrke Lake. An unnamed stream is mapped off of the east end of Gehrke Lake, however, it is unclear whether the stream drains or feeds Gehrke Lake.

Inman Lake may provide habitat for waterfowl concentrations. The north half of the lake is mapped as containing prairie soils.

Riparian vegetation around the north half of the lake (including the associated wetland to the north) and around the southwest lake shoreline is primarily intact and forested. The associated wetlands to the west of Inman Lake and Gehrke Lake both exhibit clearing to the waterline for agriculture and residential purposes.

There is no water quality data for Inman Lake.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is residential, undeveloped, and timber/forest land. Agricultural land use is concentrated between Inman and Gehrke Lakes. Timber/forest land use is mapped within much of the shoreline jurisdiction.

Inman Lake was not designated in the existing Shoreline Master Program. Inman Lake and its shoreline jurisdiction is all zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately eleven lots within shoreline jurisdiction, seven of which are developable. Two parcels are vacant single lots, four parcels are subdividable vacant lots, and one parcel has the potential for additional infill.

Shoreline modifications include a dike, an unpaved driveway, and minimal impervious surfaces. A dike is located in the northeast corner of Inman Lake. An unpaved driveway cuts through the western shoreline jurisdiction. Impervious surfaces are limited to a few rooftops.

No public access is noted for Inman Lake.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
Inman Lake is recommended for restoration/development.

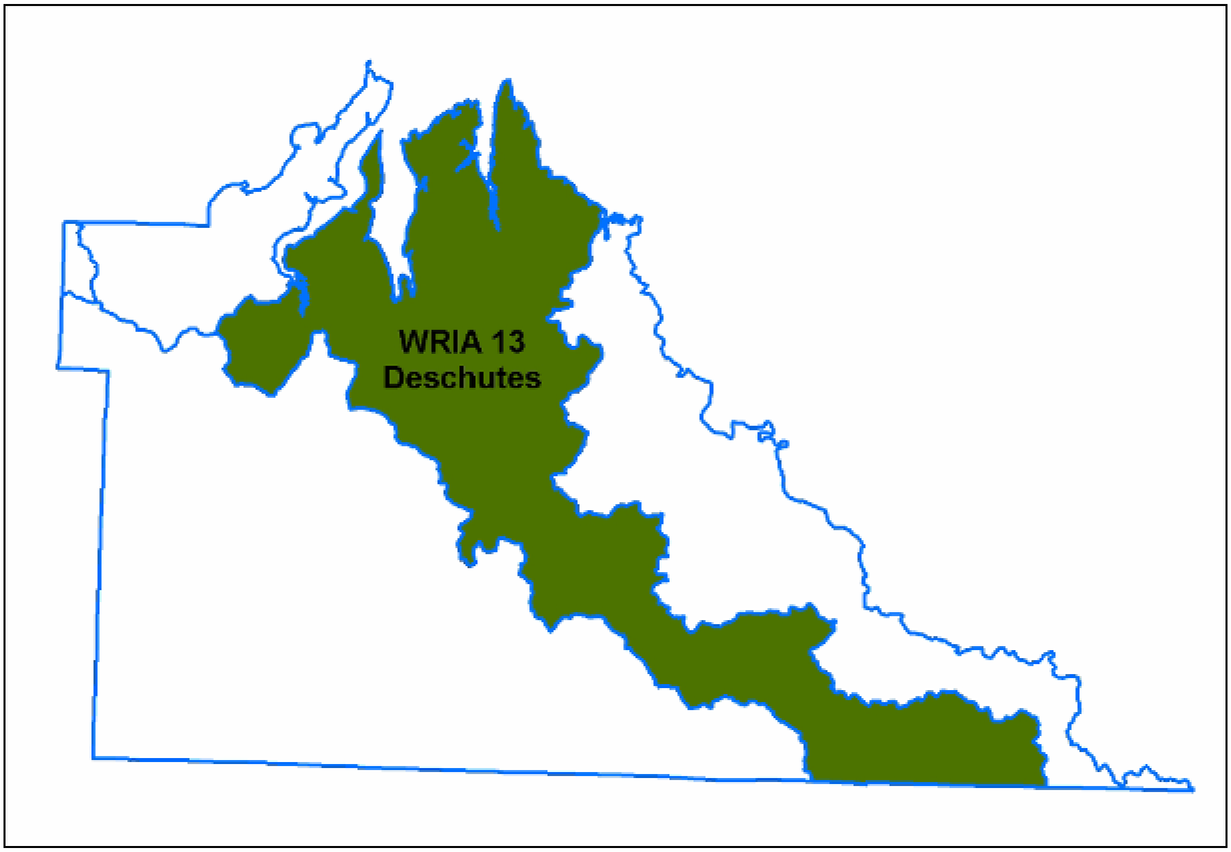
Woodland Basin

Woodland basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information.

Yelm Creek Basin

Yelm Creek basin does not contain any SMA shoreline jurisdiction.

6 WRIA 13 (DESCHUTES)



Map 6.1. WRIA 13 (Deschutes)

After an initial introduction to the WRIA as a whole, the data provided in this chapter are divided into subsections by basins and SMA jurisdictional waterbodies located within the Deschutes Water Resource Inventory Area (WRIA 13). Each subsection includes information regarding water bodies, physical and biological conditions, shoreline land use, and management options.

WRIA 13 Characteristics

WRIA 13 is located within the central portion of Thurston County in a northwest/southeast direction. WRIA 13 encompasses 270 square miles, with the majority of the WRIA falling within Thurston County (235 square miles) and a small portion in Lewis County. Thirty seven percent of the County is located within this WRIA.

WRIA 13 is composed of three primary inlets and their associated freshwater sub-basins: Henderson, Budd and Eld. It is dominated by three types of geographic features: intertidal shoreline, one major river (the Deschutes) and several small lowland streams discharging to the Puget Sound.

WRIA 13 encompasses the three major municipalities in Thurston County: the Cities of Lacey, Olympia and Tumwater, and their Urban Growth Areas (UGAs). The majority of the Thurston County population lives within the Deschutes WRIA. WRIA 13 is under tremendous growth pressure. This is particularly felt along the marine shorelines, and less developed basins such as Green Cove and McLane.

LANDSCAPE ANALYSIS

Process Controls

Geology (Maps 11 and 12)

The hills in the southern portion of WRIA 13 are composed primarily of erosion resistant andesite flows. The hills in the western portion of WRIA 13 around McLane Creek are composed of erosion resistant basalt flows and flow breccias. The remainder of WRIA 13 is covered with glacially derived deposits. Much of the Deschutes River Valley is composed of high permeability glacial outwash, with islands of low permeability glacial till and glacial drift. The majority of the three peninsulas between the primary inlets are covered with low permeability glacial till and glacial drift.

Topography (Map 10)

In WRIA 13, the Deschutes enters Thurston County from the south, surrounded by hills up to approximately 2200 feet in elevation. The river winds down from the hills in a northwest direction, to its drainage point in Budd Inlet. In the westernmost section of WRIA 13 surrounding McLane Creek, there are hills ranging between 500 to 1000 feet in elevation. The Cooper Point, Dana Passage, and Johnson Point peninsulas are all relatively flat with low elevations up to 200 feet.

Land Use/Land Cover

Current Land Use (Map 39 and 41b)

The predominant land uses within WRIA 13 (excluding the cities) are as follows: Single family residential (24%) Designated Forest Land (27%) and Undeveloped Land (18%). Timber/forest land is concentrated around the southern headwaters of the Deschutes, along the County border, and north along the southwest side of the river until just south of Offutt Lake. There is also a concentration of timber/forest land in the northwest corner of WRIA 13, west of McLane Creek, in Capitol State Forest. Undeveloped land is also most prevalent in the southern half of WRIA 13. Single family residential land use becomes increasingly dense moving northward, and is concentrated on the peninsulas. In central WRIA 13, east of Offutt Lake, and south of Spurgeon Creek, there is a large area of federally owned land which is part of Joint Base Lewis-McChord.

The predominant zoning designations within WRIA 13 are as follows: Long Term Forestry (38 %) and Rural Residential - One Dwelling Unit per Five Acres (63 %).

Much of both the marine and freshwater shorelines within WRIA 13 have experienced human alteration. The majority of the marine shoreline within this WRIA has been developed for residential use. Large portions of the marine shoreline have been armored and the adjacent vegetation altered. The flood plain and wetlands associated with the Deschutes River have been modified. Many of the areas adjacent to the rivers within WRIA 13 are utilized for agriculture. As a result of the agricultural practices within these areas, natural shoreline vegetation, associated habitat and occasionally water courses have been altered.

Projected Future Use (Maps 41a and 41c)

TRPC's analysis of future land use within this WRIA reflects that this area will experience increased residential development. Please refer to specific waterbodies for additional data.

Land Cover (Map 25)

The predominant land covers in WRIA 13 are evergreen forest (28.9%) mixed forest (11.8%) scrub/shrub (10.3%) and low intensity development (10.9%). Relative to the other WRIAs in Thurston County, WRIA 13 has the highest level of low density development, medium intensity development (4.8%) and developed open space (6.1%).

Landscape Process Important Areas and Alterations

Coastal

Important Areas (Map 14)

Drift cells are important areas for the movement of beach sediment. Drift along eastern Eld Inlet, East Bay, and the northern section of Henderson Inlet are primarily Right to Left. Drift along West Bay is primarily Left to Right. Dana Passage and Nisqually Reach have many coves, inlets, and points that create drift that frequently changes. Mud Bay, Budd Inlet (within the City of Olympia's jurisdiction) and western and southern Henderson Inlet are areas of no appreciable drift. Gull Harbor, Big Fishtrap, and Baird Cove are areas of undefined drift.

Coastal landslides are the primary contributor of sediment to beaches and net shore-drift systems. Coastal landslides occur on bluffs with unstable slopes and past landslides. Unstable slopes are widespread along WRIA 13's marine shoreline, covering approximately 75% of the shoreline. Eld Inlet (east) East Bay, Dana Passage, and Nisqually Reach have the majority of unstable slopes. Henderson Inlet has very few areas of unstable slopes. Past landslides are extensive and have been mapped along approximately 75% of WRIA 13's marine shoreline.

Rivers and streams influence the nearshore in numerous ways, including salinity changes, sediment supply, altered littoral drift, and habitat formation. In WRIA 13, there are numerous rivers and streams (both named and unnamed) that drain to the nearshore. The following is a list of the major inlets and the named creeks that drain to them:

- Eld Inlet (east) and Mud Bay: McClane Creek drains to Mud Bay; Green Cove Creek drains to Eld Inlet (east);
- Budd Inlet: the Deschutes River and Percival Creek drain to Budd Inlet via Capitol Lake; Butler Creek, Indian Creek, Ellis Creek, and Mission Creek;
- Henderson Inlet: Woodard and Woodland Creeks.

River deltas are process intensive areas for beach processes and fluvial processes. In WRIA 13, the Deschutes River historically had a river delta. The alterations to the Deschutes historic river delta have been so complete that now the shorelines are considered artificial shoreforms bearing no resemblance to their historic condition (PSNERP Strategic Needs Assessment, 2011).

Estuaries, tidal inlets, tidal marshes, and lagoons are process intensive areas for circulation and beach processes. The largest estuaries in WRIA 13 are Mud Bay/Eld Inlet, Budd Inlet, and Henderson Inlet. There are fourteen pocket estuaries mapped along the marine shoreline of WRIA 13. There are numerous tidal inlets in WRIA 13 including: Mud Bay, several unnamed inlets along Eld Inlet (east) Silver Spit, Butler Cove, West Bay, Budd Inlet, Ellis Cove, Gull Harbor, Boston Harbor, Zangle Cove, Little Fishtrap, Big Fishtrap, Chapman Bay, Woodard Bay, Henderson Inlet, Bard Cove, and many unnamed inlets along Nisqually Reach. Estuarine emergent wetlands are scattered along much of WRIA 13's marine shorelines.

Riparian vegetation areas are process intensive areas for coastal erosion, water quality, and organic debris. Please see the Large Woody Debris Important Areas and Alterations section within this chapter for details.

Indicators of Alteration (Map 15)

The historic Deschutes River delta has been altered by the creation of Capitol Lake. The Deschutes River was dammed at its outlet to Puget Sound in order to create the lake. As a result, beach and fluvial processes in Budd Inlet have been significantly altered due to the lack of sediment supply and circulation from the Deschutes River. The Deschutes Delta is recommended for enhancement, and identified as at high risk of further degradation from future nearshore development, future watershed development, and dam impoundment (PSNERP Strategies Report, 2012).

In addition to the creation of Capitol Lake, dense development of the City of Olympia has significantly altered the shorelines.

Shoreline armoring such as bulkheads and boat ramps reduces sediment supply to the beach. Shoreline armoring is extensive (approximately 40-50 percent) along Eld Inlet (east) West Bay, and Dana Passage. East Bay has areas of armoring, but to a lesser extent than West Bay. Henderson Inlet and Nisqually Reach have small areas of scattered armoring, covering approximately 10% of those shorelines. Much of the armoring coincides with areas of coastal fill. Three boat ramps are mapped along the County portion of WRIA 13's marine shoreline: at Boston Harbor, Baird Cove, and along Nisqually Reach.

Overwater structures such as docks and marinas impact the nearshore through alteration of light, wave energy, sediment, and water conditions. In WRIA 13, marinas are located in Boston Harbor, Baird Cove, and at Beachcrest (south of the City of Lacey along Nisqually Reach). The Beachcrest marina is partially located within the City of Lacey, and partially located within the City of Lacey's UGA (it is not included in the map layer of marinas). Docks are common along the majority of the County's WRIA 13 marine shoreline, particularly along Eld Inlet (east), West Bay, Dana Passage, Henderson Inlet, and northern Nisqually Reach. Areas where docks are infrequent are: Mud Bay, East Bay, Chapman and Woodard Bay area, and southern Nisqually Reach.

Loss of marine riparian habitat alters erosion rates, water quality, and abundance of woody debris. There are a few areas of the marine shoreline where the built environment is within 100 feet of the shoreline, primarily around Mud Bay, along West Bay near Silver Spit and Tykle Cove, Boston Harbor area, and Baird Cove. Areas of non-forested land cover on high mass wasting hazard areas are infrequent, with concentrations along West Bay and Nisqually Reach, indicating minimal impairment to LWD delivery to the marine shoreline via mass wasting. Please see the Large Woody Debris Alterations Map 23.

Marine waters on the 303(d) polluted waters list (from west to east) (Map 21):

- Cooper Point – Dissolved Oxygen
- Budd Inlet (Outer – TC jurisdiction) – Dissolved Oxygen (mid-inlet) and Fecal Coliform (at East Bay south of Gull Harbor)
- Henderson Inlet – Dissolved Oxygen
- Nisqually Reach/Drayton Passage (near Sandy Point and by the City of Lacey's UGA) – Fecal Coliform

Shellfish harvesting in Eld Inlet is approved for harvest. All shellfish harvesting in Budd Inlet is prohibited. Along Dana Passage, shellfish harvest in Boston Harbor is prohibited, but is approved between Zangle Cove and Little Fishtrap. The majority of Henderson Inlet is approved, with the exception of Chapman Bay, Woodard Bay, and the bottom of Henderson Inlet which are prohibited, and a small section just north of the bottom of Henderson Inlet which is conditional. All of Nisqually Reach is approved for shellfish harvest with three exceptions: Baird Cove (prohibited) a stretch between MNI-08 and MNI-09 (prohibited) and at MNI-15 within the City of Lacey (prohibited). (Map 36)

Shoreline Degradation (Map 15a)

Shoreline degradation as found by the Strategic Needs Assessment: Analysis of Nearshore Process Degradation in Puget Sound (Schlenger et al., 2011) study, is shown in tables below by basin (from west to east).

Table 6.1. Eld Inlet (east) Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011)).

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	None	None
Less Degraded	Small stretch at north entrance to Green cove	MEL-30-MEL-31
Moderately Degraded	Mud Bay north to Green Cove	MEL-19 to MEL-30
More Degraded	North of Green Cove to Cooper Point	MEL-30 to MEL-32

Most Degraded	None	None

Table 6.2. West Bay Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011))

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	None	None
Less Degraded	None	None
Moderately Degraded	None	None
More Degraded	All of West Bay with the exception of the southernmost section within the City of Olympia's UGA	MEL-32 to MBU-06
Most Degraded	Southernmost section within the City of Olympia's UGA	MBU-06-MBU-07

Table 6.3. East Bay Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011))

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	Shoreline just north of Gull Harbor	MBU-11 to MBU-12
Less Degraded	1. Southern East Bay from City of Olympia north through Gull Harbor 2. Northern East Bay from north of Gull Harbor through the west side of Boston Harbor	1. MBU-08 to MBU-11 2. MBU-12 to MBU-15
Moderately Degraded	None	None
More Degraded	East Boston Harbor	MBU-15 to MBU-16
Most Degraded	None	None

Table 6.4. Dana Passage Basin Shoreline Degradation (PSNERP Strategic Needs Assessment, 2011)

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	Just east of Big Fishtrap	MBU-20 – MBU-21 (western third of reach)
Less Degraded	Zangle Cove east through Big Fishtrap	MBU-17 to MBU-20
Moderately Degraded	1. Dover Point east through Zangle Cove 2. Eastern section of reach	1. MBU-16 to MBU-17

		2. MBU-20 – MBU-21
More Degraded	None	None
Most Degraded	None	None

Table 6.5. Henderson Inlet Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011))

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	Unnamed inlet on east side of Henderson Inlet	MHE-16 to MHE-17
Less Degraded	None	None
Moderately Degraded	Woodard Bay south to the bottom of Henderson Inlet and entire east side of Inlet with the exception of a small area between MHE-16 and MHE-17	MHE-08 to MHE-16 MHE-17 to MHE-22
More Degraded	Top west side of Henderson Inlet south through Chapman Bay	MBU-21 to MHE-08
Most Degraded	None	None

Table 6.6. Nisqually Reach Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011))

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	None	None
Less Degraded	1. Baird Cove south through unnamed inlet 2. Southern border of Tolmie State Park south to southern border of City of Lacey UGA	1. MNI-04 to MNI-08 2. MNI-13 to MNI-16
Moderately Degraded	1. Johnson Point south to west entrance to Baird Cove 2. Unnamed inlet south to southern border of Tolmie State Park	1. MHE-22 to MNI-04 2. MNI-08 to MNI-13
More Degraded	Southeast of the City of Lacey's UGA to the Nisqually Reach basin boundary	MNI-16 to MNI-20
Most Degraded	None	None

Hydrology

Important Areas (Map 16)

Areas important for water delivery are areas with relatively higher precipitation, and rain-on-snow areas. The southern portion of WRIA 13 that lies within the foothills contains large areas mapped as “rain-dominated zones” as well as areas of “rain-on-snow zones”. Much of the precipitation that falls in this area runs off because of the impermeable andesite flow that dominates the landform.

WRIA 13 contains many important areas for surface water storage such as depressional wetlands, wetlands, lakes, 100-year floodplain, and unconfined river channels. Lakes within WRIA 13 include: Capitol Lake, Trosper Lake, Ken Lake, Barnes Lake, Bigelow Lake, Hewitt Lake, Ward Lake, Munn Lake, Hicks Lake, Pattison Lake, Southwick Lake, Long Lake, Shinke Lake, Tempo Lake, Offutt Lake, McIntosh Lake, Reichel Lake, and Lawrence Lake. There are numerous small, Palustrine wetlands and depressional wetlands scattered throughout WRIA 13, with concentrations on the three peninsulas, within the cities, around Chambers and Spurgeon Creeks, and around Lawrence Lake. All of WRIA 13’s marine shoreline is within the 100-year floodplain. Most of the Deschutes River, McLane Creek, Woodard Creek, Woodland Creek, Chambers Creek, Spurgeon Creek, Silver Creek, Reichel Lake Creek, and the lakes are surrounded by 100-year floodplain. Unconfined stream channels are found along portions of McLane Creek, Percival Creek, Green Cove Creek, Woodard Creek, Woodland Creek, Chambers Creek, Spurgeon Creek, Silver Creek, the majority of the Deschutes River and numerous unnamed tributaries.

Shallow subsurface flow important areas contain low permeability soils. The hills in southern WRIA 13 occur on low permeability soils. There are islands of low permeability deposits through the middle third of the WRIA. The hills around McLane Creek, Cooper Point peninsula, Johnson Point peninsula, and the northern half of the Dana Passage peninsula all occur on low permeability deposits.

Areas with high permeability soils are important for recharge. In WRIA 13, high permeability deposits are found around the Deschutes River channel. The high permeability area is fairly narrow in the south, widening as the river moves north through the cities to be almost the entire width of the WRIA, and then going up in a wide swath around Woodard Creek and Woodland Creeks. The McLane Creek valley is also high permeability.

Indicators of Alteration (Map 17)

Water delivery timing is impaired when non-forested land cover occurs in rain-on snow zones, and in “rain-dominated” zones. There are areas of non-forest landcover, due to timber harvest, in the “rain-dominated” and “rain-on snow” zones in the south county hills.

Water movement via overland flow may be impaired by the occurrence of impervious cover within a watershed. In WRIA 13, the most concentrated areas of impervious surface are in the cities of Olympia, Lacey, and Tumwater. Following the cities, the most concentrated areas are on the Cooper Point Peninsula, the west side of the Dana Passage Peninsula towards Boston Harbor, and Nisqually Reach. There are also concentrations of impervious surface between Chambers and Spurgeon Creeks, in the town of Rainier, around Offutt Lake, and around Lawrence Lake.

Surface storage may be impaired by the loss of depressional wetlands and the presence of the built environment adjacent to streams. There are a few small areas within the cities and on the peninsulas where depressional wetlands have been lost. The built environment adjacent to streams occurs primarily in the northern, more developed portion of WRIA 13, along the Deschutes River, and Percival, Green Cove, Indian, Ellis, Woodard, and Woodland Creeks.

Shallow sub-surface flows may be impaired by the presence of land cover with impervious surfaces and non-forested vegetation on low permeability soils. WRIA 13 contains some extensive areas of impervious surfaces on low permeability soils concentrated within west Olympia, north Tumwater, and north and east Lacey and its urban growth area. To a lesser extent, there are numerous small, scattered areas of impervious surface on low permeability deposits north of the cities along the three peninsulas. There are very few such areas south of the cities. Areas with non-forested vegetation on low permeability soils are most prevalent in the hills in south Thurston County, and on the three peninsulas. In the southern hills, the non-forested vegetation on low permeability soils is associated primarily with timber harvest, whereas on the peninsulas, it is associated primarily with clearing for low density residential development and agriculture.

Recharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils. There are extensive areas of land cover with impervious surfaces on high permeability soils concentrated within the cities of Olympia, Tumwater, and Lacey, and their urban growth areas, between Trosper Lake on the west, and Pattison Lake on the east. There are smaller concentrations in the lower half of the Dana Passage peninsula, between Chambers and Spurgeon Creeks, within the City of Rainier, and around Lawrence Lake. Concentrations of non-forested vegetation on areas with high permeability soils are found in the central portion of WRIA 13, around the City of Rainier and south along the Deschutes to the Lake Lawrence area, as well as in the southern portion of the urban growth areas, between Chambers and Spurgeon Creeks, and the southern half of the Dana Passage peninsula. These areas are associated primarily with low density residential development and agriculture uses.

Vertical and lateral flows may be impaired by roads, railroads, ditches, and culverts. There are numerous ditches and culverts in WRIA 13 associated with the roads and railroads. There are three major highways in WRIA 13: Interstate 5, Highway 101, and Highway 507. Interstate 5 runs through the cities of Lacey, Olympia, and Tumwater and crosses the Deschutes River at Capitol Lake via a bridge. Highway 101 branches from I-5 just south of Capitol Lake, and runs west through the City of Olympia crossing Mud Bay via a bridge. Highway 507 crosses central WRIA 13 from east to west, running adjacent to McIntosh Lake, crossing the Deschutes River via a bridge, and going through the City of Rainier. County maintained roads are most concentrated within the cities and their urban growth areas. Within unincorporated Thurston County, roads are most dense along the three peninsulas, between Chambers and Spurgeon creeks, around the City of Rainier, and around Offutt, McIntosh, and Lawrence Lakes. Roads are least dense south of Lake Lawrence in the south county hills.

There are four railroad lines within WRIA 13, all north of the City of Rainier. One line runs east/west through the cities. Another runs north/south from the City of Olympia along the Deschutes River and western Chambers Creek. A rail line runs northeast/southwest through the

City of Lacey's urban growth area, across Pattison Lake, across Chambers Creek, and across the Deschutes River. The final line runs east/west across the Deschutes River and through the City of Rainier.

Discharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils that intersect floodplains. The Deschutes River appears to have many, large areas where discharge may be impaired. These areas are located between Capitol Lake and south to Offutt Lake, along the Silver Creek floodplain, along the unnamed creek draining Reichel Lake, and in the floodplain where the Lawrence Lake outlet joins the Deschutes. Upper Woodard Creek also has some areas of potentially impaired discharge.

Sediment

Important Areas (Map 18)

Process intensive areas for sediment delivery are areas of surface erosion, mass wasting, and in-channel erosion. Sediment delivery via surface erosion occurs in areas with steep slopes and erodible soils. Areas with potential for surface erosion are concentrated in the south county hills, particularly on the southwest side of the Deschutes River. There is also a concentration in the hills to the west of McLane Creek, in Capitol State Forest.

Sediment delivery via mass wasting occurs in high mass wasting hazard areas and landslide areas. There are substantial areas of potential mass wasting located in the forested hills south of the Deschutes River and McIntosh Lake in the southern section of WRIA 13.

Sediment delivery via in-channel erosion occurs in unconfined channels or those channels with gradients less than 4%. Almost all of the streams in WRIA 13, including the Deschutes River, have the potential for in-channel erosion.

Sediment storage occurs in depressional wetlands, floodplains, depositional stream channels, and lakes. These are the same locations where surface water storage occurs. Please see the "Hydrology Important Areas" surface water storage section for sediment storage locations.

Indicators of Alteration (Map 19)

Sediment delivery via surface erosion may be impaired in areas of non-forested land cover on highly erodible slopes adjacent to streams, as well as locations with roads within 200' of aquatic ecosystems or road crossings. Only a few small areas of non-forested landcover on highly erodible slopes adjacent to aquatic ecosystems exist in WRIA 13, with no significant concentrations. These are primarily due to active timber harvest and are located south of the Deschutes River, and east from Reichel Lake. Roads within 200 feet of aquatic ecosystems are most prevalent within the cities and their urban growth areas, and north along the three peninsulas. Further south in WRIA 13, there are fewer areas containing roads within 200 feet of aquatic ecosystems, located around Spurgeon Creek, Sunwood Lakes, McIntosh Lake, Reichel Lake, and near the Deschutes Mainstem.

Sediment delivery via mass wasting may be impaired when roads or non-forested vegetation occur in high mass wasting hazard areas. Only a few very small areas of non-forested landcover on high mass wasting hazard areas or roads in high mass wasting hazard areas exist in WRIA 13, primarily located in the south county hills, on the southwest side of the Deschutes River.

Sediment delivery via in-channel erosion may be impaired when the built environment is adjacent to unconfined channels. There is likely some impairment to sediment delivery from in-channel erosion along the Deschutes River, McClane Creek, Woodard Creek, and Woodland Creek, Chambers Creek, Percival Creek, and many of the unnamed creeks.

Sediment storage may be impaired when depressional wetlands are lost, or in the presence of dams. Depressional wetlands have primarily been lost within the three cities and scattered along the three peninsulas. There are fourteen dams mapped in WRIA 13, including dams located within the cities. Four are within the City of Tumwater, including the Tumwater Falls Dam on the Deschutes River. Two dams are mapped within the City of Olympia: the Deschutes Dam at the outlet of Capitol Lake; and Grass Lake Dam at Louise Lake, which drains to Green Cove Creek. Kaufman Dam is mapped at the unnamed lake that drains to Butler Cove within the City of Olympia's UGA. Taber and Adams Dams are mapped on either side of Woodland Creek, and Mackie Dam is located along Woodland Creek. Moving south, Sunwood Lakes Dam is at Sunwood Lakes, Tempo Lake Dam is located at the outlet of Tempo Lake, Schoenbacher Dam is mapped along Silver Creek, and Cougar Mountain Farm Dam is mapped near the Deschutes River south of Pipeline Creek. The Deschutes Dam at the outlet of Capitol Lake has significantly altered sediment storage and movement, by retaining sediment that would otherwise reach Budd inlet.

Water Quality

Important Areas (Map 20)

Areas important for maintaining water quality are streams, wetlands (particularly depressional wetlands) floodplains, and areas of high and low permeability. Depressional wetlands adsorb pathogens, phosphorus, and toxins. Nitrification and pathogen sedimentation also occur in depressional wetlands. Floodplains are another important area for sedimentation of pathogens. Pathogens are moved along the surface via streams, rivers, and wetlands with a surface water connection. Pathogens move underground in areas with shallow subsurface flow and recharge areas. Please see the "Hydrology Important Areas" for locations.

Indicators of Alteration (Map 21)

Water quality alterations can occur from failing septic systems, agricultural operations, loss of depressional wetlands, and the clearing and impervious surface areas that occur from the built environment.

The built environment is most dense within the cities of Olympia, Tumwater, and Lacey, and their urban growth areas. Following the cities, the built environment is most dense on the three peninsulas, between Chambers and Spurgeon Creeks, and within the City of Rainier. There are small concentrations of built environment around Offutt and Lawrence Lakes. There are numerous contaminated terrestrial sites mapped within WRIA 13. The majority of these sites are located within the three cities.

Clearing has occurred or is planned to occur through mining activity on areas designated as mineral lands. This clearing may result in increased runoff and sediment input to surface water. WRIA 13 contains 17 areas designated as mineral lands within unincorporated Thurston County, located from just south of Highway 507 and north.

Increased inputs of nutrients and pathogens may occur on parcels with failing septic systems or agricultural operations. Parcels containing assumed on-site septic are prevalent on the three peninsulas, around McClane Creek; between Chambers and Spurgeon Creeks, around the City of Rainier, and along much of the Deschutes River with concentrations near Offutt Lake, McIntosh Lake, and Lawrence Lake. In WRIA 13, most agriculture is located along the Deschutes River south of Chambers Creek, and north of Fall Creek.

There are numerous streams and lakes within WRIA 13 on the December 2012, 303(d) polluted waters list.

Streams on the 303(d) polluted waters list (alphabetical):

- Adams Creek – Bacteria
- Ayer (Elwanger) Creek – Bacteria, pH, dissolved oxygen
- Black Lake Ditch **-** Temperature, pH, dissolved oxygen
- Chambers Creek – Bacteria
- Deschutes River – Temperature, Fine Sediment, Dissolved Oxygen, Bacteria. Category 4C (impaired by a non-pollutant) **-** Large Woody Debris, Instream Flow
- Indian Creek – Bacteria
- Moxlie Creek – Bacteria Reichel Creek – Temperature, dissolved oxygen, and bacteria
- Percival Creek – Temperature, Dissolved Oxygen, Bacteria
- Sleepy Creek (drains to Chapman Bay in Henderson Inlet) – Dissolved Oxygen, pH
- Unnamed Creek (Tributary to Deschutes River) – Temperature
- Woodard Creek – Dissolved Oxygen.
- Woodland Creek – Temperature. Category 4C (impaired by non-pollutant) – Instream flow.

Lakes on the 303(d) polluted waters list (alphabetical):

- Capitol Lake – Total phosphorus, Bacteria. Category 4C (impaired by a non-pollutant) – Invasive Exotic Species
- Lawrence Lake – Total Phosphorus
- Long Lake – Total phosphorus, 2,3,7,8-TCDD in fish tissue, PCB in fish tissue. Category 4C (impaired by a non-pollutant) – Invasive Exotic Species
- McIntosh Lake – PCBs in fish tissue
- Offutt Lake – PCBs in fish tissue
- Ward Lake – PCBs in fish tissue

Large Woody Debris

Important Areas (Map 22)

Important areas for large woody debris delivery occur in areas of mass wasting, windthrow, and stream bank erosion. These areas are located in unconfined channels, mass wasting areas, and the area 100' from all water bodies and streams. Unconfined channels are located on the majority of the Deschutes River, Reichel Creek, Silver Creek, Spurgeon Creek, Chambers Creek, McLane Creek, Woodard Creek, and the upstream portions of Green Cove Creek and Percival Creek. Please see the sediment important areas section for mass wasting areas.

Important areas for large woody debris storage are channels with less than 4% slope or unconfined channels. In addition to the areas of unconfined channels described above, streams with less than 4% slope are found in the lower reaches of Woodland Creek, Woodard Creek, Green Cove Creek, Percival Creek, and in some of the unnamed streams draining to Eld, Budd, and Henderson Inlets.

Indicators of Alteration (Map 23)

Large woody debris delivery to streams via mass wasting is impaired in areas of non-forested land cover on high mass wasting hazard areas. There are no large concentrations of such areas in WRIA 13, however, there are small areas located in the hills surrounding the headwaters of the Deschutes River, near Mitchell Creek, Fall Creek, Pipeline Creek, and Reichel Creek. There are also some small areas located near McLane Creek, and scattered along the marine shoreline.

Large woody debris delivery via windthrow is impaired in areas of built environment within 100 feet of streams, and in areas of non-forest landcover within 100 feet of streams. In WRIA 13, large woody debris delivery via windthrow is impaired along the Deschutes River near Lake Lawrence and south to Fall Creek, along Reichel Creek, near Silver Creek, and increases as the Deschutes runs northward. Other streams have small areas of impairment, but no notable concentrations.

WDFW Local Habitat Assessment (Map 23b)

WRIA 13 is the most developed WRIA in Thurston County. The habitat within the cities of Olympia, Lacey, and Tumwater and their urban growth areas comprises the worst condition habitat in Thurston County. Other areas of poor habitat condition include the City of Rainier, around Lake Lawrence, between Chambers and Spurgeon Creeks, and along the peninsulas, particularly along West Bay and East Bay. Outside of the cities and the UGAs, the peninsulas are very fragmented and contain few large areas of good condition habitat. These are located around the Woodard Bay Natural Resource Area, around Woodland Creek in the stretch north of the City of Lacey, and along Shell Point. The habitat around McLane Creek is a large area of fairly good condition habitat.

There are only small areas of the best habitat condition, located in the southern half of WRIA 13 south of Spurgeon Creek through the foothills. The area south of Spurgeon Creek and north of Silver Creek, which includes Offutt Lake, Tempo Lake, and Joint Base Lewis-McChord, is in good habitat condition. South of the City of Rainier, on the south side of the Deschutes River are two areas of good habitat condition. Another areas is around the Deschutes River just west of where the Little Deschutes joins the Deschutes.

WRIA 13 Process-based Management Recommendations

Please see Chapter 9 for a discussion of programmatic management recommendations. These recommendations are discussed at the ecosystem scale and therefore apply throughout the County to areas where important ecological processes have been altered.

SHORELINE REACH-SCALE INVENTORY

The shoreline reach-scale inventory is organized by basin and waterbody. Applicable maps are listed in Table 6.1 and located in Appendix H.

Table 6.7. Maps used for the shoreline reach-scale inventory (located in Appendix H).

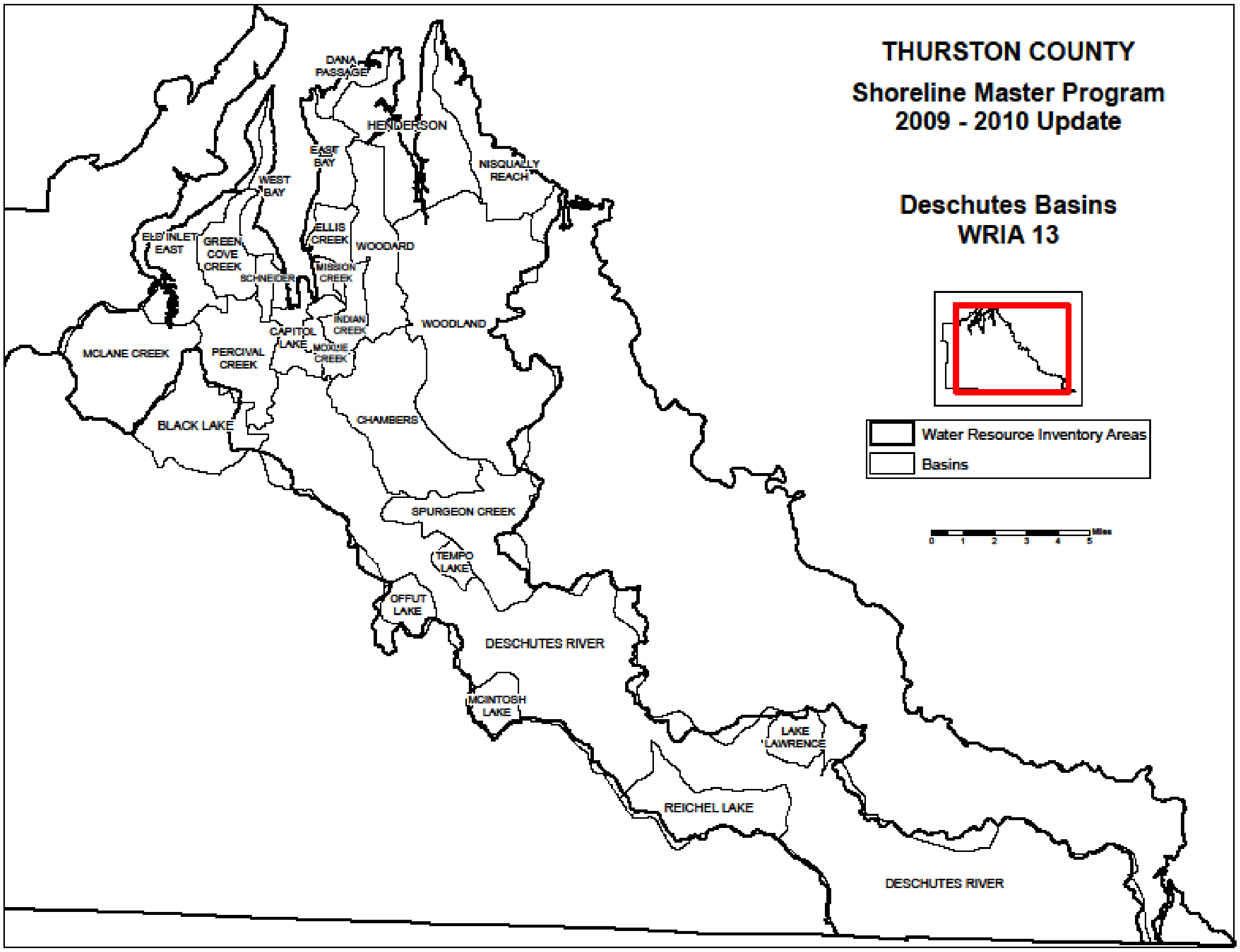
	Map Numbers and Titles	
Shoreline Type	**Physical and Biological Characterization**	**Shoreline Use Patterns**
Marine	10 – Topography and Hydrology 10a – Shoreline Type 14 – Coastal Process Important Areas 21– Water Quality Process Alterations 24 – Arial Photos 29 – Critical Areas - Biological 31– Critical Areas - Hydrologic 32 – Critical Areas - Geologic 34b – Kelp and Eelgrass 34c – Saltmarsh 35 – Marine Fisheries 36 – Shellfish Areas	15 – Coastal Process Alterations 17 – Hydrologic Process Alterations 26 – Impervious surfaces 24 – Arial Photos 37 – Aquatic Land Ownership 38 – Nationwide Permit 48 39 – Current Land Use – Generalized from the Office of the Assessor 41a – Future Land Use 41b – Current Zoning 41c – Future Development Potential 43 – Public Access and Public Lands 44 – Existing Shoreline Environment Designations
Freshwater	10 – Topography and Hydrology 21– Water Quality Process Alterations 24 – Arial Photos 29 – Critical Areas - Biological 31– Critical Areas - Hydrologic 32 – Critical Areas - Geologic	17 – Hydrologic Process Alterations 26 – Impervious surfaces 24 – Arial Photos 39 – Current Land Use – Generalized from the Office of the Assessor 41a – Future Land Use 41b – Current Zoning 41c – Future Development Potential 43 – Public Access and Public Lands 44 – Existing Shoreline Environment Designations

Basins

Table 6.8. The basins located within the Deschutes Watershed (WRIA 13).

Basin	Area within WRIA (Acres)	Percent Area of WRIA
Alder Lake	3.91	0.00
Bald Hill Lake	16.70	0.01
Beaver Creek	730.44	0.49
Black Lake	656.00	0.44
Bloom Ditch	4.69	0.00
Capitol Lake	1660.71	1.10
Chambers	8416.30	5.59

Basin	Area within WRIA (Acres)	Percent Area of WRIA
Clear Lake	739.19	0.49
Dana Passage	1126.75	0.75
Dempsey Creek	23.00	0.02
Deschutes River	53702.70	35.69
East Bay	2775.62	1.84
Eld Inlet (East)	4179.03	2.78
Ellis Creek	1469.88	0.98
Green Cove Creek	2635.54	1.75
Henderson	7305.08	4.85
Indian Creek	1499.73	1.00
Johnson Creek	14.45	0.01
Lake Lawrence	1589.48	1.06
McAllister Creek	1083.35	0.72
McIntosh Lake	1437.37	0.96
McLane Creek	7064.99	4.70
Mission Creek	357.86	0.24
Moxlie Creek	1463.18	0.97
Nisqually River	1160.06	0.77
Nisqually Reach	4644.64	3.09
Offutt Lake	1433.54	0.95
Percival Creek	4569.38	3.04
Perry Creek	165.46	0.11
Reichel Lake	4741.05	3.15
Salmon Creek (Black)	10.35	0.01
Scatter Creek	254.18	0.17
Schneider	680.54	0.45
Spurgeon Creek	6116.44	4.06
Tempo Lake	749.01	0.50
Thompson Creek (Nisqually)	651.16	0.43
Thompson Creek (Skookumchuck)	207.31	0.14
Waddell Creek	20.83	0.01
West Bay	1932.82	1.28
Woodard	4477.57	2.98
Woodland	18319.70	12.17
Yelm Creek	384.75	0.26



Map 6.2. Basins within WRIA 13 (Deschutes).

Alder Lake Basin

This basin is located primarily in WRIA 11. Please refer to the WRIA 11 chapter for further information.

Bald Hill Lake Basin

This basin is located primarily in WRIA 11. Please refer to the WRIA 11 chapter for further information.

Beaver Creek Basin

This basin is located primarily in WRIA 23. Please refer to the WRIA 11 chapter for further information.

Black Lake Basin

This basin is located primarily in WRIA 23. Please refer to the WRIA 11 chapter for further information.

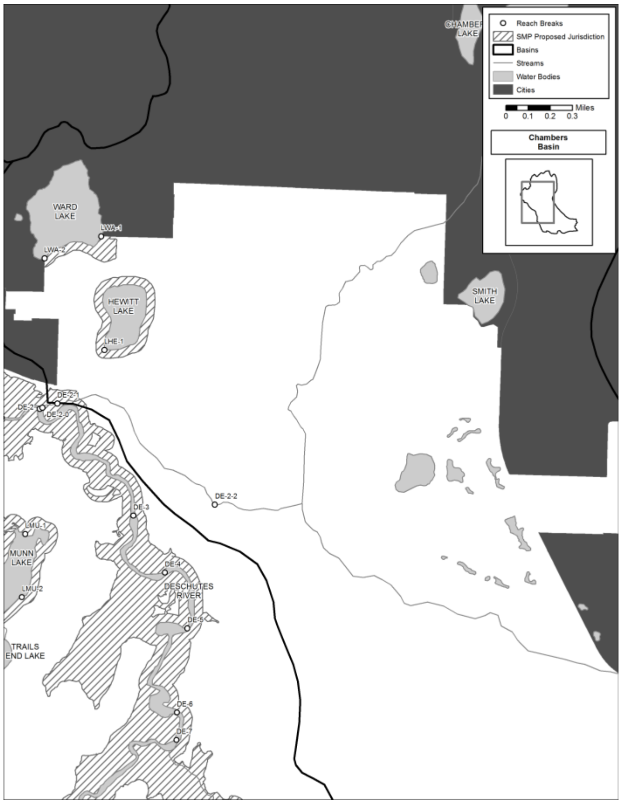
Bloom Ditch Basin

This basin is located primarily in WRIA 23. Please refer to the WRIA 11 chapter for further information.

Capitol Lake Basin

Capitol Lake basin is located primarily within the jurisdiction of the Cities of Tumwater and Olympia. The basin does contain two small islands of County jurisdiction. However neither island contains jurisdictional shorelines.

Chambers Basin



Basin Overview

Chambers basin is located in the central portion of the County. It is 8,416 acres in size and located entirely within WRIA 13. Water from this basin generally flows in a northwesterly direction toward the Deschutes River and ultimately into south Puget Sound. Portions of this basin are located within the City of Lacey, Lacey Urban Growth Area, City of Tumwater, City of Olympia, and the Olympia Urban Growth Area.

Chambers Basin contains 7.59 miles of SMA jurisdictional lake shoreline along three waterbodies: Hewitt Lake, Ward Lake, and Unknown Lake 1. Hewitt Lake has one reach (Reach series name: LHE), Ward Lake has one reach (Reach series name: LWA), and Unknown Lake 1 contains two reaches (Reach series name: LUNK1). See Appendix A.

Hewitt Lake

Physical and Biological Characterization

Hewitt Lake is surrounded by steep slopes. Hewitt Lake is mapped as a wetland, but there are no other wetlands associated with the lake. Hewitt Lake does not have an inlet or outlet. The southern portion of Hewitt Lake falls within a wellhead protection zone. Priority habitats and species are the same as those listed for the basin under Chambers Creek. There is no data on water quality within Hewitt Lake.

Vegetation is submersed and emergent within the lake. Terrestrial vegetation is fragmented shrub and forest cover including residential plantings. There has been significant clearing of the native forest cover for residential use.

Shoreline Use Patterns

Existing Land use within Hewitt Lake's shoreline jurisdiction is residential and undeveloped. There is extensive residential development around Hewitt Lake. Water oriented uses include swimming and boating.

The zoning is Residential 4/8 and its current SMP designation is Rural. Under current zoning regulations, there are approximately 54 lots within shoreline jurisdiction, three of which are developable. One parcel is a vacant single lot, one parcel is a subdividable vacant lot, and one parcel has the potential for additional infill.

Shoreline modifications include docks, roads, and impervious surfaces. Numerous docks are located around the lake. Laura Street SE and Yelm Highway pass within the outer shoreline jurisdiction but do not provide direct access to the lake. Moderate levels of impervious surfaces associated with residential development and roads are present around the lake but likely do not exceed thirty percent.

There is no public access to Hewitt Lake.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration sites.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Hewitt Lake is recommended for highest restoration.

Unknown Lake 1

Physical and Biological Characterization

Unknown Lake 1 is a large wetland complex with about 29 acres of open water. Chambers Creek flows through Unknown Lake 1. Its inlet is at the southern end of the wetland at Rainier Road SE (Rainier Road runs northwest to southeast in this area), and its outlet is at the north end of the wetland, forming Chambers Creek. The inlet brings water from a different large wetland complex that lies south of Rainier Road SE. The 100-year floodplain is mapped around the lake, as well as a high groundwater hazard area. Unknown Lake 1 falls within a wellhead protection area. The eastern half of the lake falls within the McAllister Springs Geologically Sensitive Area.

Priority habitats and species are the same as those listed for the basin under Chambers Creek. There is no data on water quality within Unknown Lake 1.

Vegetation is submersed and emergent within the lake. Terrestrial vegetation is undisturbed shrub and forest cover on the west, north, and east sides of the lake. The southern side of the lake contains some areas of clearing for low density residential development and agricultural use.

Shoreline Use Patterns

Existing shoreline land use patterns is undeveloped, residential, and agricultural.

Current zoning is Rural Residential Resource 1/5 and McAllister Geologically Sensitive Area. Unknown Lake 1 is not currently designated under the SMA. Under current zoning regulations, there are approximately nine lots within shoreline jurisdiction, two of which are developable. One parcel is a vacant single lot, one parcel is a subdividable vacant lot, and zero parcels have the potential for additional infill.

Shoreline modifications include limited residential development, Rainier Road SE, and associated low levels of impervious surfaces.

Rainier Road SE provides public access where it forms the southern boundary of Unknown Lake 1's shoreline jurisdiction. This is the only road within shoreline jurisdiction.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration sites.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Unknown Lake 1 is recommended for restoration/development.

Ward Lake

Physical and Biological Characterization

Ward Lake is located in a deep glacial depression, and does not have a surface water inlet or outlet. It is fed by groundwater springs. Ward Lake is approximately 65 acres with a mean depth of 33 feet and a maximum depth of 67 feet (Thurston County Water Resources Monitoring Report, 2012).

Ward Lake is surrounded by steep slopes. The 100-year floodplain is mapped within and around the entire lake. The lake itself is an open water wetland. There is also an associated Palustrine forested wetland at the southeast corner of the lake within Thurston County jurisdiction.

WDFW stocks Ward Lake with kokanee, rainbow trout and triploid rainbow trout.

Vegetation is submersed and emergent along the edges of the lake. Aquatic plants are limited primarily by the depth of the lake. Upland vegetation is fragmented forest and shrub cover, mixed with lawns and residential plantings. The eastern and southern shorelines of the lake have been cleared for residential development, in places down to the water's edge. The western shoreline remains primarily forested.

Ward Lake has 'good' water quality. The lake has low levels of nutrients, and its uses are not impeded by rooted aquatic plants, although spring algae blooms have been occurring in recent years. Late winter/early spring algae blooms and apparent increases in nutrients and chlorophyll *a* production have been increasing in occurrence and may be an indication of water quality degradation and possible impacts from development. Occasionally, accidental sewage spills and storm-related soil erosion incidents into Ward Lake have occurred (Thurston County Water Resources Monitoring Report, 2012). Ward Lake is on the Ecology 303(d) list of impaired water bodies for PCB contamination in fish.

Shoreline Use Patterns

Ward Lake is primarily located within the City of Olympia. A section at the southern end is within the City of Olympia urban growth area and is within Thurston County jurisdiction. Land use within Thurston County shoreline jurisdiction is residential, undeveloped, and other-cultural.

The area around Ward Lake is rapidly developing. The lake is surrounded by moderate to high density residential development. Ward Lake receives direct stormwater flows from high density residential areas in at least three locations. On the west side of the lake, a former plant nursery is in the process of conversion of to a planned urban village. The primary water oriented uses for the lake are fishing, boating, and swimming (Thurston County Water Resources Monitoring Report, 2012).

Within Thurston County shoreline jurisdiction, current zoning is Residential 4/8 and Residential 6/12. The existing shoreline environment designation is Rural. Under current zoning regulations, there are approximately 22 lots within shoreline jurisdiction, one of which is developable. There is one parcel with the potential for additional infill.

Impervious surfaces associated with residential development are concentrated on the east side of the lake where homes are most dense. There are numerous docks around the lake, with a concentration on the eastern side.

Public access to Ward Lake may be obtained by a paved WDFW boat launch, located on the east side of the lake within the City of Olympia. Conflict has occurred between lake users at the Washington Department of Fish and Wildlife public access. The public access is a boat launch, but is also the only public access to the lake for swimmers. The City of Olympia is developing a public park on the south east end of the lake, in unincorporated Thurston County.

A former toxic clean-up site is located adjacent to western Ward Lake at the former Briggs Nursery Site. The former nursery contained areas of undeveloped land, greenhouses, chemical storage and mixing areas, two fertilizer sheds, offices and laboratory space. All structures and hard surfaces have been demolished and septic tanks have been removed. The majority of the contamination areas at this site have already been cleaned. The former nursery site is being converted to a planned subdivision.

Management Issues and Opportunities

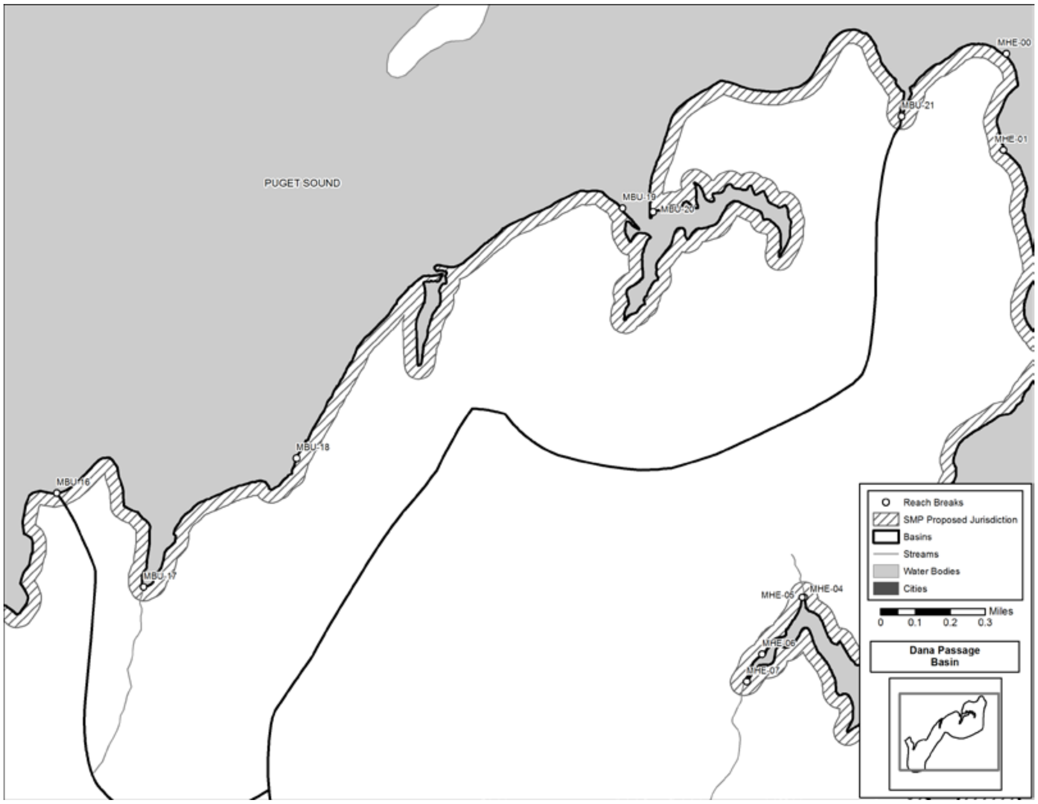
The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration sites.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Ward Lake is recommended for development/restoration.

Clear Lake Basin

This basin is located primarily in WRIA 11. Please refer the WRIA 11 chapter for further information.

Dana Passage Basin



Basin Overview

Dana Passage basin is located along the northern border of the County at the end of the Boston Harbor peninsula and is directly adjacent to Puget Sound. It is 1,127 acres in size and is located entirely within WRIA 13. Dana Passage contains 6.08 miles of SMA jurisdictional marine shoreline, broken into five reaches (Reach series name: MBU. See Appendix A).

Dana Passage basin is bordered by East Bay basin as well as Henderson basin to the south and South Puget Sound to the north. Water within this basin generally flows north into south Puget Sound.

Dana Passage

Physical and Biological Characterization

The non-inlet portions of Dana Passage shoreline are sand beach. The inlets are sand flats. Big Fishtrap is an estuary wetland. Net-shore Drift is primarily right to left. The east side of Zangle Cove contains an area of left to right and a divergence zone. Big Fishtrap has undefined drift.

The majority of the Dana Passage shoreline is mapped as containing steep slopes, areas of past landslides and as a landslide hazard area. Most of the shoreline, with the exception of Dover

Point and Little and Big Fishtraps, are mapped as unstable slopes. The entire marine shoreline is mapped as part of the 100-year floodplain.

An un-named stream drains to Zangle Cove. This stream is not mapped as meeting shoreline jurisdiction requirements. However, this stream is likely to qualify as critical areas pursuant to TCC 24. Small areas of estuarine emergent wetlands are scattered along the shoreline. Little Fishtrap and the unnamed inlet at the east basin boundary are mapped as pocket estuaries.

The majority of the Dana Passage shoreline is mapped as containing patchy, non-floating kelp. Dana Passage does not have areas of mapped eelgrass. Patchy salt marsh is mapped within Little and Big Fishtrap and the unnamed inlet at the east basin line. The marine shoreline provides habitat for forage fish species including rock sole, smelt and sand lance. In addition, the marine shoreline contains shellfish (geoduck) habitat. The shoreline may also provide habitat for purple martin, bald eagle, shellfish spawning, rearing, and harvesting areas, estuarine intertidal areas, forage fish spawning beaches, sloughs, and lagoons.

The majority of the marine riparian vegetation is fragmented for low density residential use. Along most of the shoreline, the forest is intact adjacent to the beach due to steep slopes and landslide hazards, and fragmented in the outer portion of the shoreline jurisdiction.

Water quality along Dana Passage appears to be in good condition. There are no areas on the Ecology 303(d) list of polluted waters. The commercial shellfish harvest and rearing areas have ‘approved’ status from the Department of Health.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is largely residential with some areas of undeveloped, timber/forest land, and aquatic use. Aquatic use includes shellfish aquaculture. Two parcels east of Zangle Cove have Nationwide 48 geoduck permits. Water oriented uses are fishing and shellfish rearing and harvest, as well as wildlife viewing from private properties.

Existing shoreline designations are a mix of Rural and Conservancy. The east side of Zangle Cove through Little Fishtrap and Big Fishtrap are Conservancy. The remainder of Dana Passage is designated Rural. The majority of Dana Passage is zoned Residential LAMIRD 1/1, although the east side of Zangle Cove and Little Fishtrap are zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 212 lots within shoreline jurisdiction, 26 of which are developable. Fifteen parcels are vacant single lots, seven parcels are subdividable vacant lots, and four parcels have the potential for additional infill.

Shoreline modifications along Dana Passage include docks, bulkhead armoring, roads, and impervious surfaces. Docks are concentrated on the west side of Zangle Cove, in Big Fishtrap and east of Big Fishtrap. Bulkheads are extensive and are located along the majority of the outer shoreline. Many of the bulkheads have associated coastal fill behind them. Several private roads narrowly cross into shoreline jurisdiction but do not provide water access. Fishtrap Loop NE (County owned) crosses shoreline jurisdiction near Big Fishtrap but does not provide water access. Impervious surfaces are associated with residential development and are spread across most of Dana Passage. Impervious surfaces are most concentrated at Dover Point and the west side of Zangle Cove.

Dana Passage does not contain any defined shoreline public access.

Management Issues and Opportunities

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified areas along Dana Passage as beneficial to all juvenile salmon and appropriate for conservation (See Appendix A).

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified many areas of marine shoreline along Dana Passage as containing high priority areas for forage fish habitat restoration/protection (See Appendix A). Localized restoration in pocket beaches and at estuaries could be effective, and measures to slow sediment transport could be tested. The high rate of littoral transport along Dana Passage would make sediment supply improvements difficult unless restoration measures to retain sediment were taken.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along Dana Passage.

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012).

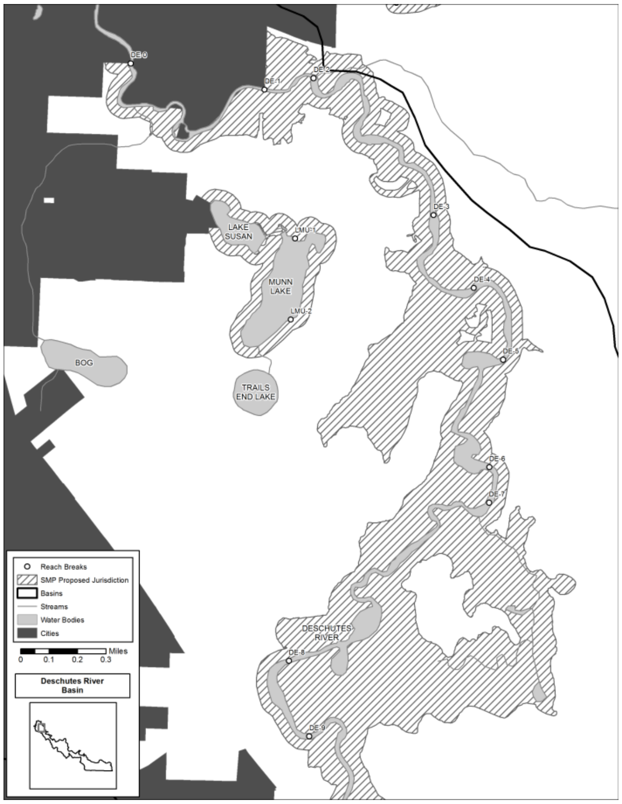
Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	None	Big Fishtrap	Big Fishtrap
Protect	None	None	Zangle Cove; Little Fishtrap; unnamed inlet at Dana Passage basin line
Restore High	None	North of Zangle Cove to south entrance of Big Fishtrap	None
Restore	Dover Point, Zangle Cove, north entrance to Big Fishtrap	Dover Point through Zangle Cove; north of Big Fishtrap to Dana Passage basin boundary	None
Enhance High	None	None	None
Enhance	North of Zangle Cove to Big Fishtrap; north of Big Fishtrap to Dana Passage basin line	None	None

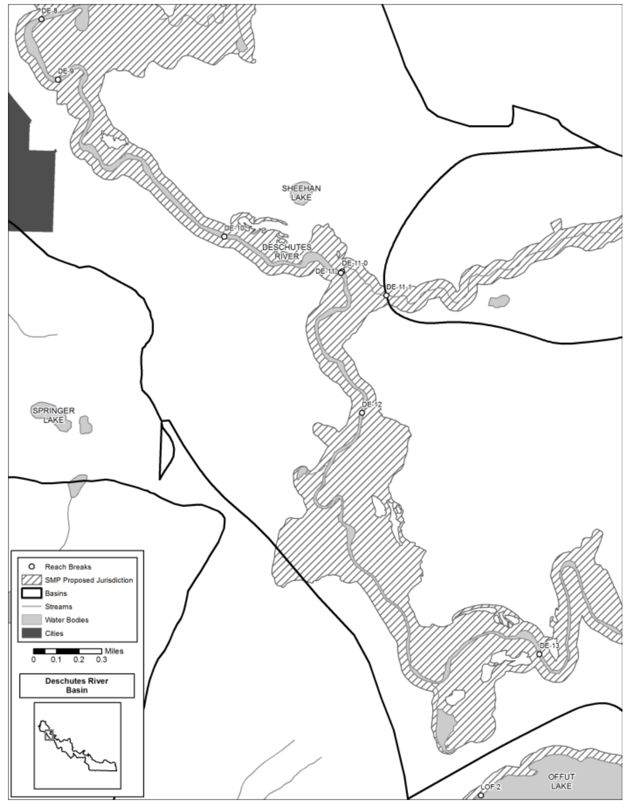
Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Dover Point through Zangle Cove and north to the western point at Little Fishtrap is recommended for protection. East Little Fishtrap and east through Big Fishtrap to the basin edge is recommended for highest protection.

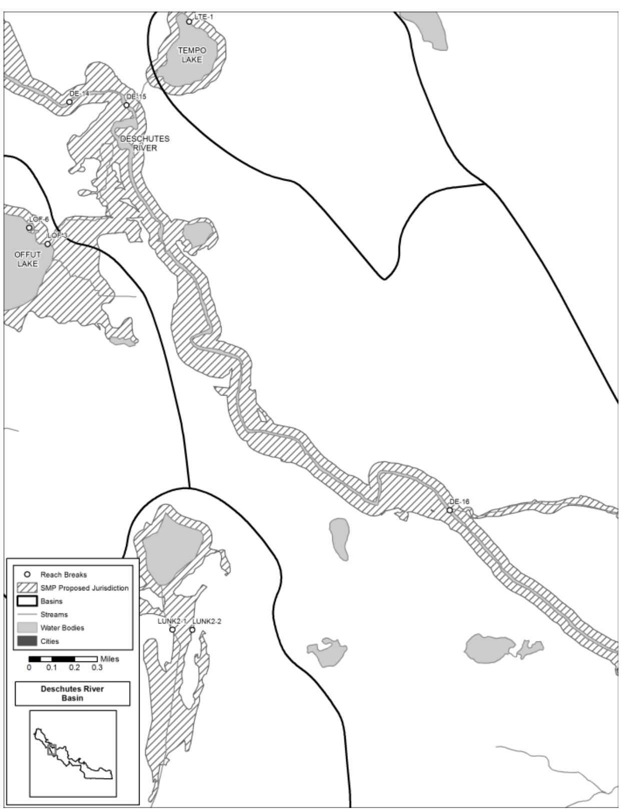
Dempsey Creek Basin

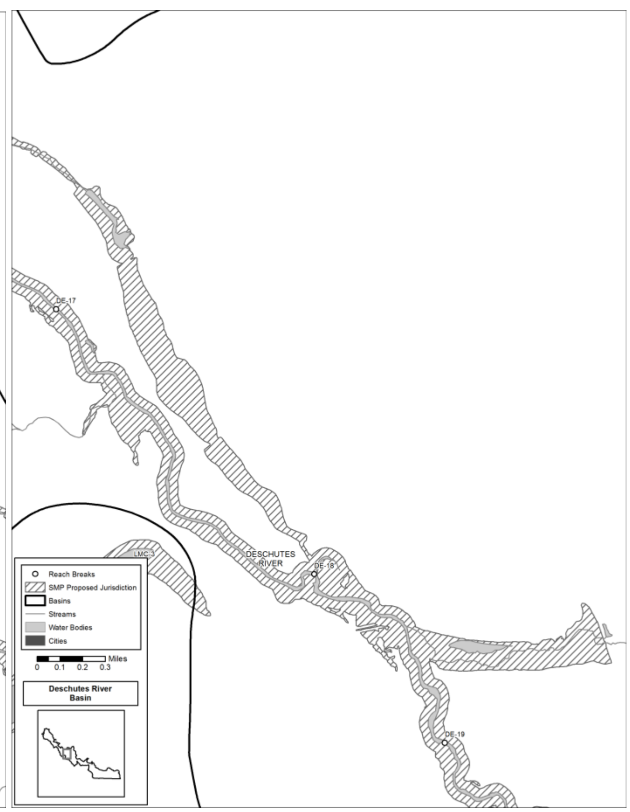
This basin is located primarily in WRIA 23. Please refer to that chapter for further information.

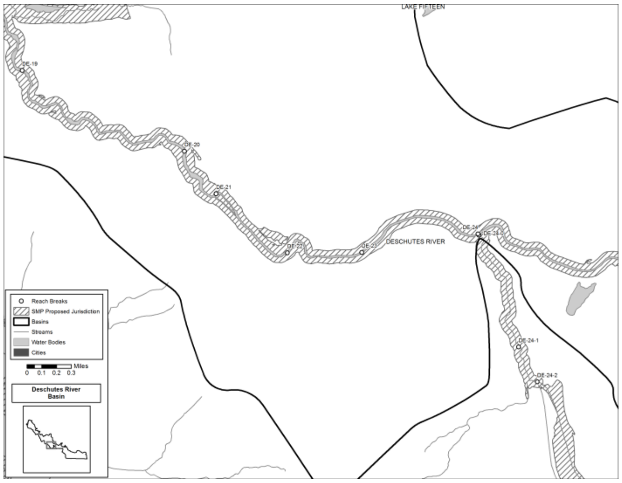
Deschutes River Basin

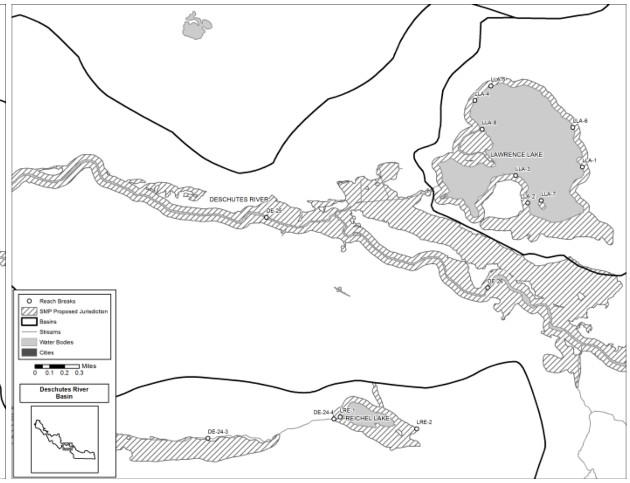


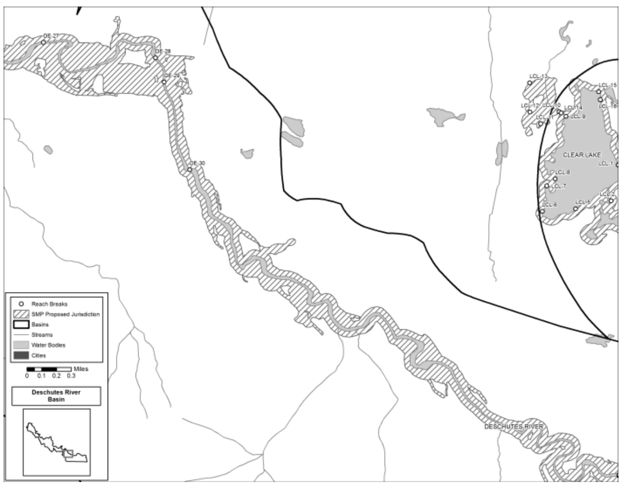


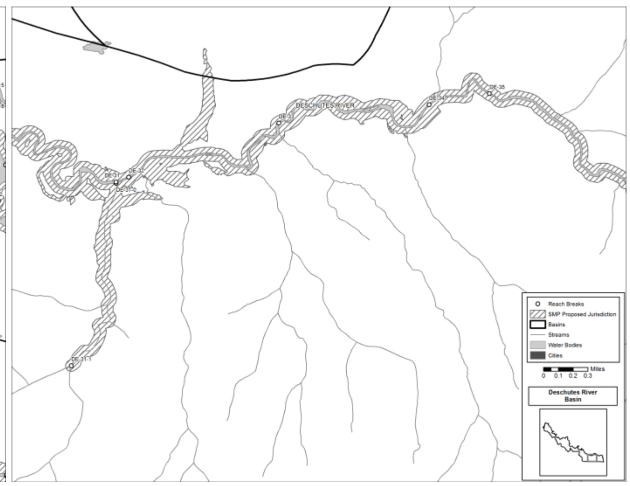


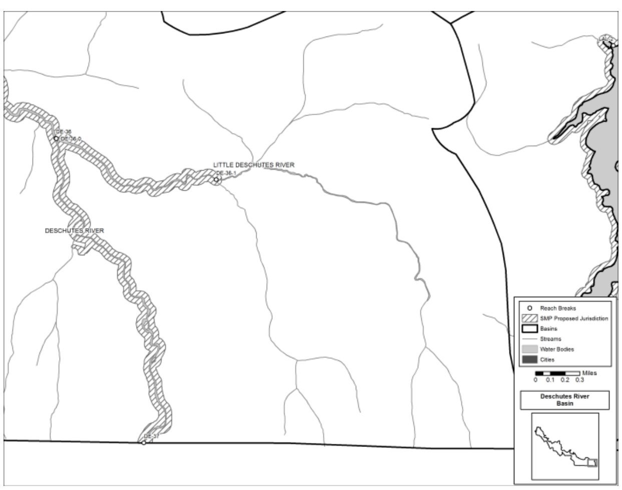












Basin Overview

The Deschutes River basin is located in the central portion of the County and extends from the rural southeastern portion of the County to the urban central portion of the County. It is 56,286 acres in size. The majority of the basin, 53,741 acres, is located in WRIA 13; smaller portions of this basin are located in WRIA 11 (1,463 acres) and WRIA 23 (1,082 acres). As the majority of the Deschutes River basin is located in WRIA 13, review of it is provided in this chapter. Water in this basin generally flows towards the Deschutes River, which lies in the center of the basin. The Deschutes River flows into north into the Puget Sound via Capitol Lake, a man-made impoundment of the river mouth.

Portions of the Cities of Olympia and Tumwater as well as portions of the associated urban growth areas are located with the northern portion of the basin. The central eastern portion contains the City of Rainier as well as the associated urban growth area. Additionally, the basin contains the Tumwater Falls hatchery and portions of Fort Lewis.

Deschutes basin contains 49.72 miles of SMA jurisdictional stream shoreline, along the Deschutes River (36 reaches, Reach series name: DE), Spurgeon Creek (1 reach, Reach series name: DE-11), Mitchell Creek (1 reach, Reach series name: DE-31), and the Little Deschutes River (1 reach, Reach series name: DE-36). The Deschutes River basin also contains 3.25 miles of SMA jurisdictional lake shoreline along Munn Lake, broken into two reaches (Reach series name: LMU). See Appendix A.

Deschutes River

Physical and Biological Characterization

The Deschutes River has areas of steep slopes and slide hazard areas within shoreline jurisdiction, concentrated in the southern Thurston County hills. The Deschutes River has a history of frequent flooding. The entire river is mapped within the 100-year floodplain, with the floodplain areas expanding in the downstream reaches. Notable areas of wide 100-year floodplain exist (from upstream to downstream) near Lake Lawrence, Silver Creek, Offutt Lake, and between Offutt Lake and the City of Tumwater. Areas of potential channel migration zones exist along the length of the Deschutes River. General areas where the potential channel migration may go beyond the 100-year floodplain are located (from south to north): along the upper reaches of the Deschutes in the south county hills, between Mitchell Creek and Hull Creek, near the Silver Creek/Deschutes River confluence, around Offutt and Tempo Lakes, and along the Tumwater UGA boundary.

The Deschutes River has numerous named and unnamed tributaries. Some of its tributaries include other shorelines of the state including Spurgeon Creek, Mitchell Creek, and Little Deschutes River. Those tributaries are discussed in their own sections and have reaches described in Appendix A. The remainder of creeks and ditches as well as the associated tributaries are not mapped as a shorelines of the state as they are not currently identified as exceeding a 20 cubic feet per second mean annual flow. However, these streams are likely to qualify as critical areas pursuant to TCC 24. The Deschutes River has many areas of associated wetlands along its length.

The Deschutes River is mapped as supporting resident and sea-run cutthroat trout, coho, and fall Chinook salmon, sea-run and winter steelhead. The river is also mapped as supporting the spawning and rearing of fall Chinook, winter steelhead, and coho salmon. The Deschutes did not historically have native salmon runs because the falls in Tumwater acted as a natural barrier to upstream migration. However, a fish ladder was constructed in 1954. Artificial runs of coho and Chinook salmon have been established since the 1950's by the WDFW hatchery program.

The Deschutes basin contains the following priority habitats: Mazama pocket gopher, streaked horned lark, elk, Taylor's checkerspot, wood duck, osprey, wild turkey, and Oregon vesper sparrow. The following priority species are also mapped within this basin: waterfowl concentrations, western blackbirds, western bluebirds, and Oregon lamprey.

The upper reaches of the Deschutes River are primarily zoned Long Term Forestry. These areas are surrounded by intact forested buffers although in some areas timber harvest has encroached into the shoreline jurisdiction. The Deschutes River middle reaches are zoned a mix of Rural Residential Resource 1/5 and Long Term Agriculture. Riparian vegetation within shoreline jurisdiction changes notably with this change in zoning. The riparian vegetation along these reaches is a mix of land cleared for agricultural purposes, fragmented forest associated with low density residential development, and some remaining intact forested areas. Between Reichel Lake Creek and south of State Highway 507, the zoning returns to Long Term Forestry and the shoreline jurisdiction is primarily forested again. North of State Highway 507, the Silver Creek arm of shoreline jurisdiction and the right bank (east) of the Deschutes contain large areas cleared for agriculture. The left bank (west) of the Deschutes is primarily intact forest in this section. North of the Silver Creek confluence with the Deschutes River and south of the Tumwater UGA, the riparian vegetation returns a mix of land cleared for agricultural purposes, fragmented forest associated with low density residential development, and some remaining intact forested areas. Along the City of Tumwater's UGA boundary, the riparian vegetation is a mix of intact forested and wetland areas, mixed with areas of fragmented and cleared forest cover.

Water quality in the Deschutes River is categorized as 'Good' due to failing part 2 of fecal coliform standard for water year 2009/10 but meeting both parts in 2010/11. Turbidity is often high in winter and temperature violations occur in summer. Habitat deficiencies and low-instream flow are a cause of concern for fisheries resources (Thurston County Water Resources Monitoring Report, 2012)

The Deschutes River is on the 2012 303(d) polluted waters list for fine sediment, dissolved oxygen, temperature, pH, and bacteria. It is also listed as a Category 4C (impaired by a non-pollutant) for lack of large woody debris and instream flow.

The Washington State Department of Ecology is conducting a total maximum daily load study for temperature, fecal coliform bacteria, dissolved oxygen, pH, and fine sediment in the Deschutes River/Budd Inlet system. Discharge limits for pollution sources will be established to bring the streams, river, and Budd Inlet into compliance with the water quality standards. The water quality study report was released in June 2012. A stakeholder committee was convened in 2009 and has begun development of a water cleanup plan. A water quality improvement report and implementation strategy is expected in 2013 (Ecology, 2012; and Thurston County Water Resources Monitoring Report, 2012)

Shoreline Use Patterns

Existing land use within shoreline jurisdiction includes: forest/timber land in the upper reaches and in places along the middle reaches; the middle and lower reaches (outside of the cities) are primarily residential, agricultural, and undeveloped, with small areas of commercial, utilities, mining, recreational, and open space. Water oriented uses of the Deschutes include fishing, wildlife viewing, and swimming.

From upstream to downstream, the Deschutes River is zoned Long Term Forestry in the upper reaches and between Reichel Lake Creek and south of State Highway 507. The middle reaches are primarily a mix of Rural Residential Resource 1/5 and Long Term Agriculture, with small areas of Residential LAMIRD 1/1, Residential LAMIRD 1/2, Public Preserve, and Public Parks and Trails. The lower reaches are zoned a mixture of Open Space, Residential 4-8, Rural Residential Resource 1/5, Residential LAMIRD, Light Industrial, and Single Family Low Density Residential 4-7.

Within County jurisdiction, the Deschutes River is designated Conservancy under the existing SMP. Under current zoning regulations, there are approximately 1058 lots within shoreline jurisdiction, 183 of which are developable. There are 104 vacant single lots, 60 subdividable vacant lots, and 19 parcels with the potential for additional infill.

Upstream of Reach DE-33 (confluence with Johnson Creek), the Deschutes River has no shoreline modifications. Downstream of DE-33 and upstream of Reichel Lake Creek, shoreline modifications include six bridges, six roads, a culvert, and one dam. Two bridges are public roads: Vail Cut-Off Road SE, and Vail Road SE**.** Four bridges are private roads. One culvert (non-barrier) is located under Vail Loop Road on the left bank (S). Cougar Mountain Farm Dam is located within shoreline jurisdiction in reach DE-27-DE-28.

Downstream of Reichel Lake Creek and upstream of the confluence of Spurgeon Creek with the Deschutes River, shoreline modifications include roads, bridges, trails, culverts, a dam, a railroad crossing, and vegetation clearing and structures for six utility lines. Roads with associated bridges include: Rich Rd SE, Waldrick Rd SE, Silver Creek Drive over Silver Creek, Military Rd SE, Hwy 507, and Vail Loop Rd SE. In addition to the roads that cross the Deschutes and Silver Creek, there are numerous roads that enter shoreline jurisdiction but do not provide access to the water. Public trails modify shoreline jurisdiction in two places through clearing and impervious surface. The Chehalis Western Trail is within shoreline jurisdiction near Tempo Lake and the Yelm to Tenino County Trail is adjacent to State Highway 507. Culverts are located in two places: the crossing of Silver Creek Drive over Silver Creek (3 non-barrier culverts) and the crossing of Military Road SE over both Silver Creek and the Deschutes River (3 non-barrier culverts). Schoenbacher Dam is located on Silver Creek. Within this section of the Deschutes, there is one railroad river crossing with an associated bridge, north of Silver Creek Confluence and south of Waldrick Road SE. Vegetation clearing for utilities, as well as associated structures are found in the following reaches: DE-11-DE-12 contains Williams pipeline. DE-19-DE-20 contains the Olympic pipeline and a power line, and DE-22-DE-23 contains a power line, gas line, and William’s fiber optic line.

Downstream of the Spurgeon Creek confluence to the City of Tumwater, shoreline modifications include: roads, bridges, culverts, and vegetation clearing and structures for utilities. Bridges are located at Henderson Boulevard SE and at the railroad crossing just downstream of the Spurgeon Creek confluence. Henderson Boulevard SE and 58th Ave SE both have non-barrier culverts within shoreline jurisdiction. Two utilities cross this section of the Deschutes and have structures and associated vegetation clearing. DE-2-DE-3 contains a power line and DE-9-DE-10 contains the Olympia pipeline.

Within shoreline jurisdiction, impervious surfaces are fairly minimal, limited to scattered areas where low density residential development and roads exist.

Public access to the shoreline jurisdiction may be obtained through multiple county and/or city parks including the following: Deschutes Falls Park (undeveloped and currently closed to public use), Deschutes River Park, Pioneer Park, Ruth Prairie Park, Rainier View Park, as well as the Chehalis Western Trail/Vail loop trail. Public access to shoreline jurisdiction may also be obtained from the following roads: Henderson Boulevard SE, Rich Road SE, Waldrick Road SE, Silver Creek Drive, Military Road SE, State Highway 507, Vail Loop Road SE, and Vail Cut-Off Road SE.

An area of special interest along the Deschutes River is the area around the Lake Lawrence outlet channel and the Deschutes River Mainstem that falls on the Ron Smith farm. The 197-acre Ron Smith farm and its water rights were just purchased by Olympia, Yelm and Lacey for providing mitigation on the Deschutes River. The farm's irrigation water rights will be retired to help offset the effects new city wells will have on Deschutes River stream flows. Riparian improvements along the farm's Deschutes River shoreline will provide additional "out-of-kind" mitigation. Additional irrigation rights are also being purchased.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommends the following overall management activities:

- Preserve existing riparian vegetation, and restore areas with young or no vegetation along the Deschutes mainstem and tributaries. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Enhance channel complexity by including LWD within the active river bed and riparian zones. Key locations are located around Henderson Blvd, Waldrick Road, State Route 507, and Old Camp Lane.
- Investigate and encourage opportunities to enhance groundwater recharge or surface water inflows through low impact development (LID) practices for new development and redevelopment. This should include infiltration of existing stormwater in all possible locations, and possibly include reclaimed water. This would potentially decrease peak water temperatures.

- Restore and protect natural wetlands in areas such as Ayer/Elwanger, Reichel, and Spurgeon Creeks. These tributaries have elevated temperatures, and restoration of riparian zones with appropriate plantings would reduce solar heating of these systems.
- The hottest tributary stream conditions are in the Tempo Lake and Lake Lawrence outflows, partially due to solar heating of the lake surfaces. Evaluate the lake outlets for existing hydraulic modifications that could be altered to decrease downstream temperatures.
- Management should be focused on the warmest, and therefore most sensitive, river section of the Deschutes mainstem, between 1000 Road and Vail Cutoff Road SE. Management of future development should (1) prevent further degradation of those areas already below standards (prevent riparian vegetation removal, reduce groundwater withdrawal, or enhance groundwater recharge) and (2) protect those areas currently meeting standards, as required by the antidegradation portions of the water quality standards.
- Avoid fine sediment input by controlling and reducing upland and channel erosion
- Develop voluntary programs to increase riparian vegetation for areas that are not managed in accordance with the Forests and Fish Agreement, such as private non-forest lands.
- Evaluate tributaries with high nutrient concentrations such as Ayer (Elwanger) Creek and Reichel Creek for nutrient reduction opportunities. Consider activities that reduce nutrient loads to natural levels.
- Institute low impact development (LID) for future development in appropriate areas in the watershed, with a focus on decreasing nutrient contributions below current levels and not worsening DO or pH.
- Maintain septic systems. Implement options to reduce nutrient loading and bacterial contamination from onsite sewage systems such as state-of-the-art onsite sewage systems. These systems particularly be considered in sensitive areas such as upstream of Offutt Lake, Chambers Lake and its outlet creek, Tempo Lake and its outlet creek, and the Ayer Creek watershed.
- Future groundwater infiltration facilities should ensure that any inputs are offset by reducing other local sources such that DO and pH do not worsen.
- Eliminate offsite transport of sediments and nutrients from agricultural operations, including dairies.
- Manage nutrients along the Deschutes between Old Camp Lane and the Lake Lawrence Tributary (RK 18 - 20) where ecology staff noted cows on the banks and fecal material in the river and on gravel bars. Management could include fencing and waste management.
- Continue adaptive management of anthropogenic sources of fine sediment including: unpaved roads and landslides associated with roads. In addition, other anthropogenic sources, such as off-road vehicle use, domestic animals, and facilities covered under

general permits, should be identified and reduced to the maximum extent. Fencing to remove access should be considered.

- Evaluate river restoration strategies that include control of instream fine sediment. Riparian and channel restoration, particularly between RK 12 and RK 20, will have multiple benefits including mitigating fine sediment levels and temperature improvements from increased channel complexity. Channel restoration should include large woody debris (LWD) to enhance pool formation and decrease the transport of fines in the system. River restoration will benefit coho and other fisheries resources (Anchor Environmental, 2008).
- Control anthropogenic sources of fine sediment so that sediment inputs do not exceed natural conditions. Projects should be designed so that they do not produce any offsite transport of fine sediment or any visible accumulation of fine sediment downstream of the sites.

<u>The Deschutes Watershed Characterization Report</u> (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along the Deschutes River.

<u>Salmon Habitat Protection and Restoration Plan for the Water Resource Inventory Area 13, Deschutes</u> (Thurston County Conservation District Lead Entity, 2005):

- Open up blocked intact habitat for Coho usage
- Create large woody debris jams
- Plant riparian corridors
- Protect existing habitat

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	1. Spurgeon Creek confluence to Tempo Lake outlet 2. Silver Creek confluence to near McIntosh Lake 3. Where zoning changes to Long Term Forestry on both sides of the river and the river changes to moderate gradient upstream to Mitchell Creek confluence	1. DE-11 to DE-15 2. DE-16 to DE-18 (along Mainstem Deschutes. See Silver Creek branch in restoration/development) 3. DE-30 to DE-31
Protection	1. Tempo Lake outlet south upstream to Silver Creek confluence	1. DE-15 to DE-16 2. DE-24 to DE-25 3. DE-36 to DE-37

	2. Confluence of Reichel Lake Creek with the Deschutes upstream to where zoning changes to Long Term Agriculture and river gradient changes to low 3. Little Deschutes confluence to southern boundary of Thurston County	
Protection/ Conservation	1. Edge of Long Term Agriculture area upstream to beginning of Long Term Forestry Zoning and where river changes to moderate gradient, highly confined 2. Mitchell Creek confluence to Little Deschutes confluence	1. DE-18 to DE-19 2. DE-31 to DE-36
Conservation	Beginning of Long Term Forestry Zoning upstream to the confluence of Reichel Lake Creek with the Deschutes	DE-19 to DE-24
Highest Restoration	1. Edge of City of Tumwater upstream to the Elwanger Creek confluence 2. From where zoning changes to Long Term Agriculture and river changes to low gradient upstream to where zoning changes to Long Term Forestry on both sides of the river and the river changes to moderate gradient	1. DE-0 to DE-07 2. DE-25 to DE-30
Restoration	1. Elwanger Creek confluence to the Spurgeon Creek confluence	1. DE-7 to DE-11
Restoration/ Development	Silver Creek	DE-16 to DE-18 (Silver Creek branch)
Development/ Restoration	None	None

<u>PSNERP Strategic Needs Assessment, 2011:</u>
Although Capitol Lake / the Deschutes River historic river delta are not within Thurston County shoreline jurisdiction, this area merits mention in the management issues and opportunities

section because of its notable opportunity for large-scale restoration. The Deschutes historic river delta is among the most degraded in Puget Sound. Full restoration may be infeasible due to existing development and land uses, therefore, opportunities for partial or incremental process restoration should be generated. Recommended general restoration actions include:

- Remove tidal barriers and other stressors that function like tidal barriers by constraining the river and reducing the river's access to its floodplain, thereby reconnecting the historic delta extent and re-establishing tidal wetlands
- Address stressors such as roads and railroads that bisect the river delta and limit tidal flow and other associated nearshore processes

Spurgeon Creek

Please see the Spurgeon Creek basin section for discussion of Spurgeon Creek.

Mitchell Creek

Physical and Biological Characterization

Mitchell Creek is a small tributary to the Deschutes River, located in the hills of southern Thurston County. Mitchell Creek is a primarily confined stream, surrounded by steep slopes and slide hazard areas on both sides. The creek becomes unconfined where it joins the Deschutes River.

Mitchell Creek has three unnamed tributaries. The associated tributaries are not mapped as shorelines of the state as they are not currently identified as exceeding a 20 cubic feet per second mean annual flow. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Forested wetlands are associated with the lower third of Mitchell Creek.

Mitchell Creek is mapped as supporting resident and sea-run cutthroat, coho salmon, and winter steelhead.

The riparian vegetation surrounding Mitchell Creek is intact for the majority of shoreline jurisdiction. Two areas, mid-reach, and lower reach, are forested adjacent to Mitchell Creek, but the outer shoreline jurisdiction has been cleared for timber harvest.

There is no data on water quality for Mitchell Creek.

Shoreline Use Patterns

Existing land use within Mitchell Creek's shoreline jurisdiction is timber/forest land. There is no impervious surface within shoreline jurisdiction. Mitchell Creek is zoned Long Term Forestry and the current SMP designation is Conservancy. Under current zoning regulations, there are approximately four lots within shoreline jurisdiction, none of which are developable.

Shoreline modifications include an unpaved logging road crossing the lower reach, and loss of forest cover due to timber harvest.

A study of fish barriers conducted during the years of 1996 to 2000 identified three barriers due to insufficient flow on Mitchell Creek.

There is no public access to Mitchell Creek.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommends the following overall management activities for tributaries to the Deschutes River:

- Tributaries should achieve full mature riparian vegetation. Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Reduce upland and channel erosion, and avoid fine sediment input to the Deschutes River and its tributaries.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Maintain septic systems.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along Mitchell Creek.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Mitchell Creek is recommended for protection/conservation.

Little Deschutes River

Physical and Biological Characterization

The Little Deschutes River is a low gradient, confined, small tributary to the Deschutes River. Areas of steep slopes and slide hazards are adjacent to the Little Deschutes River. A small area of 100-year floodplain intersects the shoreline jurisdiction in the lower reach.

The Little Deschutes River has one unnamed tributary. This associated tributary is not mapped as a shoreline of the state as it is not currently identified as exceeding a 20 cubic feet per second mean annual flow. However, this stream likely to qualifies as a critical area pursuant to TCC 24. There are no associated wetlands along the Little Deschutes River.

Little Deschutes River is mapped as supporting resident cutthroat trout.

Riparian vegetation is forested for the majority of the shoreline jurisdiction, however, the upper and lower left bank (south) include areas entirely cleared of vegetation for timber harvest.

There is no water quality data for the Little Deschutes River.

Shoreline Use Patterns

Existing land use within the Little Deschutes River shoreline jurisdiction is timber/forest land. There is no impervious surface within shoreline jurisdiction.

Little Deschutes River is zoned Long Term Forestry and the current SMP designation is Conservancy. Under current zoning regulations, there are approximately three lots within shoreline jurisdiction, none of which are developable.

Shoreline modifications include two unpaved logging roads within shoreline jurisdiction, one of which crosses the river in the lower reach.

There is no public access to the Little Deschutes River.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommends the following overall management activities for tributaries to the Deschutes River:

- Tributaries should achieve full mature riparian vegetation. Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Reduce upland and channel erosion, and avoid fine sediment input to the Deschutes River and its tributaries.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Maintain septic systems.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along the Little Deschutes River.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
The Little Deschutes River is recommended for conservation.

Munn Lake

Physical and Biological Characterization

Munn Lake is surrounded by steep slopes. The 100-year floodplain is mapped within and surrounding all of Munn Lake and its associated wetlands. Munn Lake and Susan Lake are connected open water wetlands via an unnamed stream and associated wetlands. Trails End Lake is connected to Munn Lake via an unnamed stream, however, this stream flows through a culvert under 73rd Ave SE. Trails End Lake is not part of the shoreline jurisdiction.

Munn Lake may provide wood duck brooding habitat. The WDFW stocks Munn Lake with rainbow and triploid rainbow trout. There is no water quality data for Munn Lake.

Vegetation is submersed and emergent within Munn and Susan Lakes. Upland vegetation is a mix of shrub and forest. The eastern side of Munn Lake's shoreline jurisdiction has unmodified forest cover. Elsewhere around Munn and Susan Lakes, the forest cover has been fragmented and cleared in areas for residential development.

Shoreline Use Patterns

The northern tip of this basin contains portions of the City of Tumwater and the Tumwater Urban Growth Area. The primary land use within Munn and Susan Lake's shoreline jurisdiction is residential and undeveloped. There is a small area on the northwest side of Susan Lake that is within the City of Tumwater. Residential development, impervious surfaces, and boat docks are concentrated around Susan Lake and the west side of Munn Lake. Water oriented uses are swimming, fishing, and boating.

Current zoning is Single Family Low Density Residential 4-7 and 6-9, Open Space, and Green Belt. The open water portion of the lake is zoned Green Belt. Munn Lake's current shoreline environment designation is Conservancy. Under current zoning regulations, there are approximately 92 lots within shoreline jurisdiction, three of which are developable. One parcel is a vacant single lot, two parcels are subdividable vacant lots, and zero parcels have the potential for additional infill.

Several roads are within shoreline jurisdiction, but do not reach the water and do not provide public access. Munn Lake has public access via a WDFW boat launch off of 65 Avenue NE on the north side of the lake.

Management Issues and Opportunities

<u>The Deschutes Watershed Characterization Report</u> (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Munn Lake.

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
Munn Lake is recommended for highest restoration.

East Bay Basin

Basin Overview

East Bay basin is located on the eastern side of Budd Inlet. It is 2,777 acres in size and is entirely within WRIA 13. The basin is divided into two sub-basins. The southern sub-basin is located within the City of Olympia and is therefore not covered within this report. The northern sub-basin is located within the County and is 2,408 acres in size. Water in this basin generally flows west towards south Puget Sound.

East Bay basin contains 9.69 miles of SMA jurisdictional marine shoreline, broken into 16 reaches (Reach series name: MBU, Appendix A).

East Bay

Physical and Biological Characterization

The East Bay shoreline is primarily sand beach with areas of sand flats in Boston Harbor and several small, unnamed inlets. Gull Harbor's shoreline type is estuary wetland. Net-shore Drift is primarily right to left. Gull Harbor and a portion of Boston Harbor have undefined drift.

The majority of the East Bay shoreline is mapped as containing steep slopes, areas of past landslides and as a landslide hazard area. Most of the shoreline, with the exception of Gull Harbor and Boston Harbor, are mapped as unstable slopes. The entire marine shoreline is mapped as part of the 100-year floodplain.

East Bay contains a small number of un-named streams that flow into Budd Inlet. These streams are not mapped as meeting shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Small patches of estuarine emergent wetland are mapped along the East Bay shoreline. Although East Bay basin contains a number of large wetlands, only a few small wetland areas are associated with shoreline jurisdiction.

Patchy, non-floating kelp is mapped at the north end of East Bay, south of Dofflemeyer Point. No eelgrass is mapped along East Bay. Saltmarsh is mapped in Gull Harbor and a small, unnamed inlet north of Gull Harbor. Gull Harbor is one of southern Puget Sound's most intact estuarine environments, providing high quality habitat for coho, steelhead, chum, sea-run cutthroat and Chinook salmon. The marine shoreline is mapped as supporting smelt, sand lance, rock sole, and purple martin. Geoduck habitat is mapped near Dofflemeyer Point. Gull Harbor contains an open lagoon and biodiversity area/corridor. There is one small area of prairie soils mapped within shoreline jurisdiction.

East Bay's marine riparian habitats are a mix of intact forested areas and portions of shoreline fragmented for low density residential development. As steep slopes and landslide hazard areas dominate the shoreline in this basin, most of the homes are set back from the shoreline. This results in many areas with intact forest adjacent to the water, with fragmentation occurring on the outer portions of the shoreline jurisdiction.

South of Gull Harbor, East Bay is on the Ecology 2012 303(d) list of polluted waters for Fecal Coliform and Dissolved Oxygen. East Bay basin is on the east side of Budd Inlet. The Washington Department of Ecology is working on reducing the level of contamination within the entire Budd Inlet area. The Washington Department of Health has classified the shellfish growing areas along East Bay and in Boston Harbor as prohibited (DOH, 2013).

Shoreline Use Patterns

Existing shoreline land use is primarily residential and secondarily undeveloped. The Gull Harbor area is surrounded by agricultural and timber/forest land use. There is park land use at Burfoot County Park south of Boston Harbor. There are two small parcels in commercial use, and one in transportation (in Boston Harbor). Impervious surfaces are associated with low density residential development. Impervious surfaces are most concentrated at the Dofflemeyer Point/Boston Harbor area where they may exceed 30% and south of Gull Harbor. Water oriented uses include public parks for swimming and water access, and a public boat launch at Boston Harbor.

The majority of East Bay is designated Rural. Gull Harbor and a small segment of shoreline just north of Priest Point Park are currently designated Conservancy. East Bay is primarily zoned Rural Residential Resource 1/5. There several places zoned Residential LAMIRD 1/1 or Residential LAMIRD 1/2, including Boston Harbor. Burfoot County Park is zoned Public Preserve. Under current zoning regulations, there are approximately 263 lots within shoreline jurisdiction, 20 of which are developable. There are 19 vacant single lots and one subdividable vacant lot. There are no parcels with the potential for additional infill.

Shoreline modifications include docks, bulkhead armoring, roads, and overwater structures associated with the Boston Harbor Marina. Docks are relatively infrequent along the East Bay shoreline, and are located in Gull Harbor and south, and at Boston Harbor. Bulkhead armoring appears to cover roughly 20% of the East Bay shoreline. Bulkheads are continuous around Dofflemyer Point and Boston Harbor, and are more numerous south of Gull Harbor than north. Many of the bulkheads have associated coastal fill behind them. Agricultural land use is concentrated around Gull Harbor. Roads within shoreline jurisdiction are limited to the Boston Harbor area where Commercial Street SE, Boston Harbor Road NE, and 73rd, 74th, 75th, 76th, and 77th Avenues NE cross into shoreline jurisdiction but do not provide access to the water.

A public boat launch is available at the Boston Harbor Marina. The marina is privately owned but accessible to the public and provides a variety of amenities including: marine views, picnic areas, a retail establishment, boat and kayak rentals, overnight moorage, as well as a fuel dock. Additionally, Burfoot Park provides 1,100 feet of shoreline access to the public as well as views of the state capitol building and Olympic Mountains. Public access is also available through a Department of Natural Resources Marine Research Center with a dock, and through a Thurston County Park with known public access (Indian Road undeveloped natural area).

Management Issues and Opportunities

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified two areas of marine shoreline as containing areas with high restoration potential for forage fish habitat (See Appendix A). East Bay is less heavily armored than the western side of Budd Inlet. Along East Bay, it is critical to preserve the connection between erosive bluffs and the littoral zone. It would also be extremely valuable in this area to remove bulkheads to reconnect the bluffs to the shoreline. The northern portion of East Bay is characterized by tall bluffs subject to toe erosion. Any shore protection that is successful at reducing toe erosion is likely to reduce the sediment supply to this inlet. Conservation easements may be a particularly valuable tool to preserve the sediment supply in this area.

Squaxin Island Tribe Budd Inlet Restoration and Conservation Planning, 2010:
East Bay is relatively intact with extensive opportunities for preservation and some opportunities for targeted restoration.

- Protect last remaining parcels in Gull Harbor;
- Demonstration bulkhead removal and wood placement at public sites- Burfoot Park, and WDNR marine facility;
- Create a Gull Harbor watershed district to improve water quality in Gull Harbor including culvert replacement and re-forestation of the uplands;
- Target the few bulkheads that do exist for removal or softening using parcel size as a screen;
- Assist efforts to create Gull Harbor to Woodard Bay corridor.

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified areas of East Bay as beneficial to all juvenile salmon and appropriate for conservation. The Juvenile Salmonid Approach to Prioritization for Restoration and Conservation of Budd Inlet (Squaxin Island Tribe, 2010) identified specific management suggestions for these sites (See Table 6.3 below and Appendix A).

Table 6.9. Recommended Restoration and Conservation Projects in East Bay (Squaxin Island Tribe, 2010)

Site Name	Reach	Recommended Management Strategy	Specific Projects and Project Numbers
WDNR Marine Lab (south)	MBU-08-MBU-09	conserve/ enhance/ restore/ preserve	• Bulkhead removal (43) • Creating riparian habitat (44)
WDNR Marine Lab (north)	MBU-08-MBU-09	enhance/ restore/ conserve	• Create a restoration plan (32) • Bulkhead removal (25)
Gull Harbor	MBU-11-MBU-12	conserve/ preserve	• Create a restoration plan for Gull Harbor (27) • Create a stewardship district for Gull Harbor watershed (28) • Create a connecting corridor (30) • Work to reforest the watershed (31) • Replace the culvert (77) • Remove overwater structures (78)

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommended:

- Identify and mitigate fecal coliform sources to Budd Inlet.
- Stormwater controls should be evaluated for tributaries to Budd Inlet.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along East Bay.

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012)(See Appendix A)

Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	None	From north boundary of City of Olympia north through Gull Harbor	Gull Harbor

Protect	North entrance to Gull Harbor	North of Gull Harbor through Boston Harbor	Unnamed inlet south of Dofflemyer Point
Restore High	None	None	None
Restore	Entirety of East Bay except mouth of Gull Harbor and east side of Boston Harbor	Dover Point	Boston Harbor
Enhance High	None	None	None
Enhance	East side of Boston Harbor	None	None

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	None	None
Protection	Gull Harbor	MBU-10-MBU-11
Protection/ Conservation	None	None
Conservation	East Bay north of Gull Harbor through Boston Harbor to Dover Point	MBU-11 to MBU-16
Highest Restoration	None	None
Restoration	East Bay south of Gull Harbor	MBU-08 to MBU-10
Restoration/ Development	None	None
Development/ Restoration	None	None

Eld Inlet (East) Basin

Basin Overview

The Eld Inlet (East) basin is located in the northern portion of the County. It is 4,247 acres in size and is entirely within WRIA 13. Water within this basin generally flows towards the west into Eld Inlet. This basin is located primarily within the County, but it also contains some portions of the City of Olympia and the Olympia UGA.

Eld Inlet (East) contains 16.97 miles of SMA jurisdictional marine shoreline, broken into 11 reaches (Reach series name: MEL, Appendix A).

Eld Inlet (East)

Physical and Biological Characterization

Eld Inlet (east) is primarily sand beach, with sand flats located within small inlets. The bottom of Eld Inlet and Mud Bay is composed of mud flat. Net-shore drift is primarily right to left north of Shell Point. Within Mud Bay, there is no appreciable drift. Green Cove has undefined drift.

The majority of the Eld Inlet (east) shoreline, with the exception of lower Mud Bay, is mapped as containing steep slopes and unstable slopes. Areas mapped as slide hazard areas and past landslide areas are common north of Mud Bay. The entire marine shoreline is mapped as part of the 100-year floodplain and as a geologically sensitive area. The 100-year floodplain extends further inland at the base of Mud Bay where elevations are low. South of Highway 101, the potential channel migration zone extends beyond the 100-year floodplain in places. There are several high groundwater hazard areas associated with the shoreline jurisdiction adjacent to Mud Bay and surrounding an unnamed inlet along Countryside Beach.

McLane Creek flows into Eld Inlet (east) at its southern terminus in Mud Bay. McLane Creek is a shoreline of the state and is discussed in the McLane Creek basin section. Eld Inlet (east) is also fed by Green Cove Creek and a small number of un-named streams. These streams are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24.

South of Highway 101, associated wetlands are extensive on both sides of the base of Mud Bay. Also in Mud Bay, north of Highway 101, associated wetlands are common along the east side of the bay. North of Mud Bay, associated wetlands are limited to one located between Shell and Squaw Points. Estuarine emergent wetlands are scattered along the length of the shoreline.

Eld Inlet (east) provides habitat for a number of priority habitats and species including: rock sole, smelt, sandlance, chum and coho salmon, steelhead, resident cutthroat, searun cutthroat, great blue heron, osprey, purple martin, harbor seal, and bald eagle. Hardshell clam habitat is mapped near the base of Eld Inlet (east) in upper Mud Bay. Geoduck areas are mapped along the north end of Eld Inlet (east). Shorebird concentrations, estuarine zones, lagoons, and slough areas are mapped within the southern portion of this basin in association with Mud Bay. Green Cove is mapped as an estuarine zone. A lagoon area is also present near the north end of Eld Inlet (east). A pocket estuary is mapped at the north end of Countryside Beach and on the east shoreline of Mud Bay.

Patchy, non-floating kelp is mapped along the northern tip of Eld Inlet (east). Eelgrass is not mapped within Eld Inlet (east). Patchy salt marsh is mapped within all of Mud Bay until close to Shell Point. North of Shell Point, patchy salt marsh is mapped within several small, unnamed inlets, as well as within Green Cove.

Marine riparian vegetation at the south end of Eld Inlet (east) around Mud Bay is a mix of intact forest areas, wetland areas cleared for agriculture, and areas cleared for roads and commercial buildings. The west side of Mud Bay is almost completely cleared for agriculture, roads, and commercial buildings. The east side of Mud Bay retains primarily intact forested vegetation, with a few areas cleared for roads and agriculture. North of Mud Bay, the marine riparian vegetation is mainly fragmented for low density residential development that extends to the shoreline in places. There are a few remaining areas of intact forested marine riparian vegetation, including the Evergreen State College waterfront.

Cooper Point, at the northern tip of Eld Inlet (east) is on the Ecology 2012 303(d) list of polluted waters for Dissolved Oxygen. The Washington Department of Health has classified the shellfish growing areas in Mud Bay as ‘unclassified’ and along Eld Inlet (east) as ‘approved’ (DOH, 2013).

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is mainly residential and undeveloped. Commercial land use exists along the southwest side of Mud Bay, north of Highway 101, and along the Evergreen State College's waterfront (although this area is undeveloped). Agricultural and timber/forest land use is present in places around Mud Bay. There are also some small areas of open space, utility and other-cultural land use. Aquatic land use occurs in Eld Inlet (east) for shellfish growing, including geoduck aquaculture. North of Shell Point, there are nine parcels with Nationwide 48 shellfish aquaculture permits. Water oriented uses in Eld Inlet (east) are shellfish growing and harvest, boating, fishing, and wildlife viewing.

Impervious surfaces are generally low and associated with residential development. Impervious surfaces may exceed 30% along the west side of Mud Bay north where there is commercial development and Highway 101 along the shoreline. The northern tip of Eld Inlet (east) at Cooper Point also has a high concentration of impervious surface due to relatively dense residential development.

Existing shoreline designations for Eld Inlet (east) are a mix of Rural and Conservancy. The majority of Mud Bay is designated Conservancy, with the exception of the commercial area on the west bank north of Highway 101. Green Cove, Squaw Point, and Shell Point are designated Conservancy. Sunset Beach, Countryside Beach, and the Cooper Point area are designated Rural.

The majority of Eld Inlet (east) is zoned Rural Residential Resource 1/5, with several long stretches of Residential LAMIRD 1/1. There is a small area of Residential LAMIRD 1/2 located on the mid-basin shoreline. The west shore of Mud Bay north of Highway 101 is zoned Rural Commercial Center. On the opposite shore of Mud Bay, there is an area zoned Residential 1/10. Under current zoning regulations, there are approximately 467 lots within shoreline jurisdiction, 41 of which are developable. There are 38 vacant single lots, one subdividable vacant lot, and two parcels with the potential for additional infill.

Shoreline modifications include roads, bridges, culverts, docks, and armoring. Highway 101 and Mud Bay Road NW each have an associated bridge across Mud Bay. Brenner Rd NW, which parallels the shoreline, has several culverts associated with it that are within jurisdiction. Bulkheads are located along the majority of the Eld Inlet (east) shoreline. Many of the bulkheads have associated coastal fill behind them. Bulkheads and docks are uncommon within Mud Bay. North of Mud Bay, docks are numerous with concentrations located just south of Shell Point, along Sunset Beach, and along Countryside Beach.

The Evergreen State College campus provides public access to the shoreline. Public access is available surrounding the Highway 101 and Mud Bay Road NW bridge crossings. Heritage Trail located on the west side of Mud Bay north of Highway 101 is private land with Buzz's Tavern just north of Mud Bay Road NW providing public views from their parking lot. Capitol Land Trust owns South Eld Inlet Property which is private land with known public access with permission from Capitol Land Trust.

Management Issues and Opportunities

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified two areas of marine shoreline along Eld Inlet (East) as containing high priority areas for forage fish habitat restoration. Most other reaches were prioritized low for forage fish habitat restoration/preservation due to the presence of glacial till and low bluffs (Herrera and TRPC, 2005) (See Appendix A). Forage fish habitat restoration and preservation actions should consider a combination of beach nourishment and slowing sediment transport.

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified the bottom of Eld Inlet, Mud Bay, as beneficial to all juvenile salmon and appropriate for conservation. North of Mud Bay, much of the Eld Inlet (East) shoreline was identified as beneficial to all juvenile salmon. Some of these areas were further identified as appropriate for conservation or restoration (See Appendix A).

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified 34 sites (wetland and riparian) within Eld Inlet (East) as potential restoration or protection locations (See Appendix A).

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012)(See Appendix A)

Management Strategy	**Beach**	**Barrier Embayment**	**Coastal Inlets**
Protect High	None	None	Mud Bay
Protect	None	None	Unnamed inlet south of Shell Point; Squaw Point north through Sunset Beach and Green Cove
Restore High	Around Shell Point and north through Green Cove	None	None
Restore	None	All of Eld Inlet East	Countryside Beach and north towards Cooper Point
Enhance High	North edge of Green Cove to Cooper Point	None	None
Enhance	None	None	None

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	None	None
Protection	None	None

Protection/ Conservation	Between top of Mud Bay and Green Cove	1.MEL-25 to MEL-30
Conservation	None	None
Highest Restoration	Mud Bay	MEL-19 to MEL-25
Restoration	Green Cove to Cooper Point	MEL-30 to MEL-32
Restoration/ Less impact	None	None
Less impact to processes	None	None

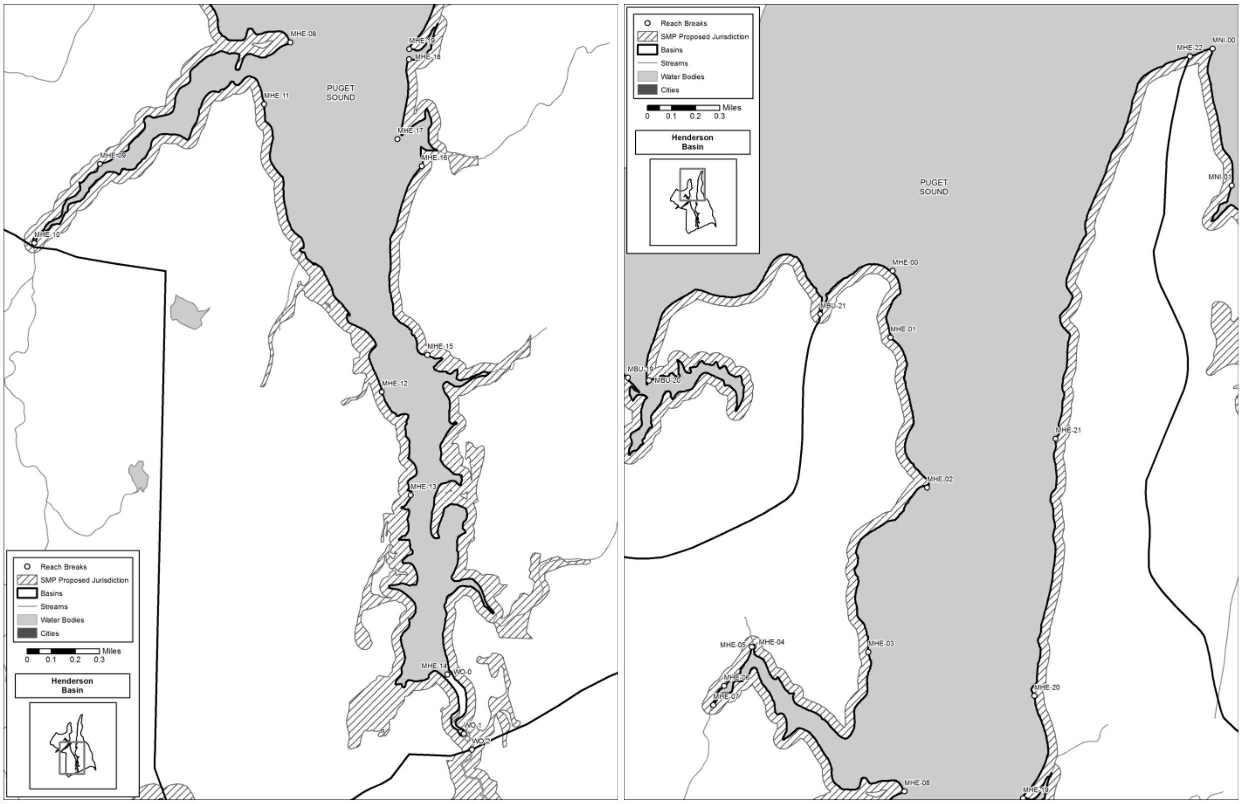
Ellis Creek Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

Green Cove Creek Basin

Green Cove Creek contains one short reach which is discussed as part of the Eld Inlet (east) basin.

Henderson Basin



Basin Overview

Henderson basin is located in the northern portion of the County. This basin is 7,306 acres in size and is entirely within WRIA 13. The land mass of this basin is split down the middle by Henderson Inlet. Water in this basin generally flows into Henderson Inlet. Henderson Inlet is approximately five miles long and ranges from one-fourth to three-fourths miles in width. A large portion of the lower inlet is exposed mudflats at low tide, and this inlet is home to large commercial shellfish operations. The inlet has an average depth of 25 feet, and reaches its maximum depth of 60 feet near the mouth. Woodard and Woodland Creeks are the largest tributaries to Henderson Inlet.

Henderson basin contains 20.44 miles of SMA jurisdictional marine shoreline, broken into 22 reaches (Reach series name: MHE) 0.21 miles of SMA stream shoreline along Woodland Creek, broken into two reaches (Reach series name: WO) and 0.18 miles of jurisdictional lake shoreline along Shinke Lake, broken into one reach (Reach series name: LSH). See Appendix A.

Henderson Inlet

Physical and Biological Characterization

Henderson Inlet is primarily sand beach with a few smaller areas of sand flat and one estuary wetland. Mud flats are located within Chapman and Woodard Bay and the base of Henderson

Inlet. Net-shore drift is primarily no appreciable drift. The upper shorelines have primarily right to left drift.

Most of Henderson Inlet's northern shoreline is mapped as containing steep slopes. Areas mapped as slide hazard areas, past landslide areas, and unstable slopes are common. The entire marine shoreline is mapped as part of the 100-year floodplain and as a geologically sensitive area. The 100-year floodplain is also mapped around Woodard and Woodland Creeks where they flow into Henderson Inlet.

Woodland Creek flows into Henderson Inlet at its southern terminus. Woodland Creek is a shoreline of the state and is discussed in the Woodland Creek basin section. Henderson Inlet is also fed by Woodard Creek, Meyer Creek, and a small number of un-named streams. These streams are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. South of Woodard Bay, there are numerous associated wetlands on both sides of southern Henderson Inlet. Estuarine emergent wetlands are scattered along both shorelines. A pocket estuary is mapped at the northwest basin line and on the east side of the inlet opposite from Woodard Bay.

Henderson Inlet contains a number of priority habitats and species including: rock sole, smelt, sandlance, chum, sea-run cutthroat, coho, winter steelhead, osprey, purple martin, bald eagle, great blue heron, great gray owl, harbor seal, hardshell clams, geoduck, forage fish spawning beaches, shellfish spawning, rearing, and harvesting beaches, estuaries, harbor seal haulouts, salt meadows, brackish marshes, and lagoons. The Woodard Bay Natural Resources Conservation Area (NRCA) includes habitat for bat species including Long legged myotis, Yuma myotis, and little brown myotis.

Patchy, non-floating kelp is mapped along the northern half of Henderson Inlet. There is a small area of continuous non-floating kelp mapped at the northwest inlet corner. Eelgrass is not mapped within Henderson Inlet. Patchy salt marsh is mapped throughout the lower half of Henderson Inlet as well as at the northwest basin line. Continuous salt marsh is mapped for a portion of the southwest side of the inlet.

The top of Henderson Inlet exhibits fragmented marine riparian habitats that have been cleared for residential development. Further south, vegetation alternates between areas fragmented for residential development or agriculture and areas of intact vegetation. The Woodard Bay Natural Resource Area has primarily intact marine riparian habitat.

Henderson Inlet is on the Ecology 2012 303(d) list of polluted waters for Dissolved Oxygen. The Washington Department of Health has classified the northern portion of Henderson Inlet as 'approved' for shellfish harvest. Chapman Bay, Woodard Bay, and the southern terminus of Henderson Inlet are classified as 'prohibited' for shellfish harvest. A section of southern Henderson Inlet just north of the prohibited area is classified as 'conditional' (DOH, 2013). The Henderson Inlet Watershed has a Total Maximum Daily Load Implementation Plan for Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature (2006).

Henderson Inlet is one of Puget Sound's most productive shellfish harvesting areas. Since the 1980's commercial shellfish harvesting in the lower third of Henderson Inlet has been prohibited or restricted due to high fecal coliform bacteria levels in the water. In 2000, bacterial pollution caused a shellfish harvesting area downgrade and triggered a legal requirement to form a shellfish protection district. In 2001, Thurston County created the Henderson Shellfish Protection District and a stakeholder committee was convened to consider the actions needed to improve water quality and reopen the shellfish beds. This report was completed in 2003 and can be found at: www.co.thurston.wa.us/shellfish. Some of the resulting pollution reduction activities included: construction of stormwater treatment facilities, farm planning and installation of agricultural best management practices, installation of pet waste collection stations, septic system inspections and repairs, and public education. In 2005 the Thurston County Board of Health created an "area of special concern" called the Henderson Watershed Protection Area, which established inspection requirements for all on-site sewage systems within the area. The requirements went into effect in this area in 2007. In 2010, improved marine water quality in Henderson Inlet resulted in a 240 acre commercial shellfish harvest area upgrade to approved status.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential and undeveloped. Woodard Bay NRCA is located along the shorelines of Chapman and Woodard Bays. Areas of agriculture are located at the bottom of the inlet. Some small areas of utilities and open space are located on the east side of the inlet. Aquatic use (aquaculture) is located within Henderson Inlet's marine waters. The northwest shoreline contains five parcels with Nationwide 48 permits for geoduck aquaculture. In addition, hardshell clam aquaculture is present in lower Henderson Inlet. Impervious surfaces are associated with residential development and are scattered along most of the shoreline. Water oriented uses include wildlife viewing and fishing.

Under the existing SMP, Henderson Inlet is designated Conservancy with two exceptions. The northwest corner is designated Rural and inner Woodard Bay is designated Natural. Henderson Inlet is zoned a mix of Rural Residential Resource 1/5, Residential LAMIRD 1/1, Residential LAMIRD 1/2, and Public Parks Trails and Preserves. Under current zoning regulations, there are approximately 477 lots within shoreline jurisdiction, 51 of which are developable. There are 43 vacant single lots, five subdividable vacant lots, and three parcels with the potential for additional infill.

Shoreline modifications include docks, armoring, coastal fill, bridges, roads, and culverts. Docks are located on both shorelines of Henderson Inlet. The Woodard Bay NRCA contains only two docks. Bulkheads are present along both shorelines of Henderson Inlet and are more common in the northern half of the inlet. Many of the bulkheads have associated coastal fill behind them. Coastal fill is also located within the mouths of both Chapman and Woodard Bays and is associated with an abandoned railroad across the bays. The abandoned railroad track still exists as a bridge. A bridge associated with Woodard Bay Road NE crosses Woodard Bay further inland. Culverts are located within shoreline jurisdiction under Woodard Bay Road NE, and Johnson Point Road NE.

Public Access is available via the Woodard Bay NRCA, a Washington Department of Natural Resources public preserve. Informal public access is available Woodard Bay Road NE.

The Woodard Bay NRCA is an 800 acre wildlife sanctuary including five miles of undeveloped marine shoreline, wetlands, and mature second growth forest. Woodard Bay NRCA has a human history that includes Native Americans, early settlers to southern Puget Sound and the logging and shellfish industries.

Woodard Bay NRCA is an active shoreline restoration site. Woodard Bay was operated by Weyerhaeuser Co. as a log transfer facility from the 1920s until the 1980s. The remnants of the log transfer railroad are creosote-laden pilings that obstruct important nearshore processes and contribute to the degradation of water quality. However, the pilings have also been providing habitat for important wildlife species like bats, seals, herons and cormorants. The Department of Natural Resources and its project partners are currently restoring the area. In 2010, the first phase of restoration was completed which included the removal of 1,450 tons of creosote-treated materials including the Woodard Bay Trestle, a portion of the Chapman Bay Pier, and hundreds of anchor pilings. Installation of nesting and roosting boxes for purple martins and bats was included in the project.

Future restoration may occur pending funding. Future restoration would include: relocating bat roost habitat upland, removal of the northern portion of the Chapman Bay Pier, removal of fill along the shorelines of Woodard and Chapman Bays, weed control and re-vegetation on twenty-acres of Weyer Point located between the two bays, as well as improvements to existing recreational and educational facilities.

Management Issues and Opportunities

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified many areas within Henderson Inlet as beneficial to all juvenile salmon. Some of these areas were further identified as appropriate for restoration or conservation (See Appendix A).

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified three areas of marine shoreline in Henderson basin as containing high priority areas for forage fish habitat restoration/protection (See Appendix A). Henderson Inlet is the most erosive of the Thurston County inlets which means that pressure for further armoring is likely to grow. Soft protection measures should be a management strategy for Henderson Inlet.

Henderson Inlet Watershed Characterization Report (Thurston County, 2007) identified 31 wetland, riparian, or floodplain sites as potential restoration or protection locations (See Appendix A).

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). (See Appendix A)

Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	None	None	Woodard Bay and south into Henderson Inlet

Protect	North side of point between Chapman Bay and Woodard Bay	Woodard Bay, unnamed inlet south of MHE-17 and all of Henderson Inlet south of these inlets.	Two unnamed inlets on east side of Henderson Inlet across from Woodard Bay
Restore High	None	None	Chapman Bay and north to MHE-02
Restore	South side of point between Chapman Bay and Woodard Bay; Unnamed inlet south of MHE-17 and just to south; North of MHE-19 to northeast tip of Henderson Inlet	South side of peninsula between Chapman and Woodard Bays; MHE-17 north to northeast tip of Henderson Inlet	None
Enhance High	None	None	None
Enhance	Inner beaches on peninsula between Chapman and Woodard Bays; area on east side of Henderson Inlet between MHE-17 and just north of MHE-19	None	None

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	1. West top of Henderson Inlet through Chapman Bay 2. Bottom of Henderson Inlet	1. MBU-21 to MHE-08; 2. MHE-13 to MHE-15
Protection	Area on east side of Henderson Inlet across from Woodard Bay	MHE-15 to MHE-18
Protection/ Conservation	Woodard Bay	MHE-08 to MHE-11
Conservation	Across Henderson Inlet from Woodard Bay north to Johnson Point	MHE-18 to MHE-22
Highest Restoration	None	None
Restoration	South of Woodard Bay to change in zoning to residential LAMIRD	MHE-11 to MHE-13
Restoration/ Development	None	None
Development/ Restoration	None	None

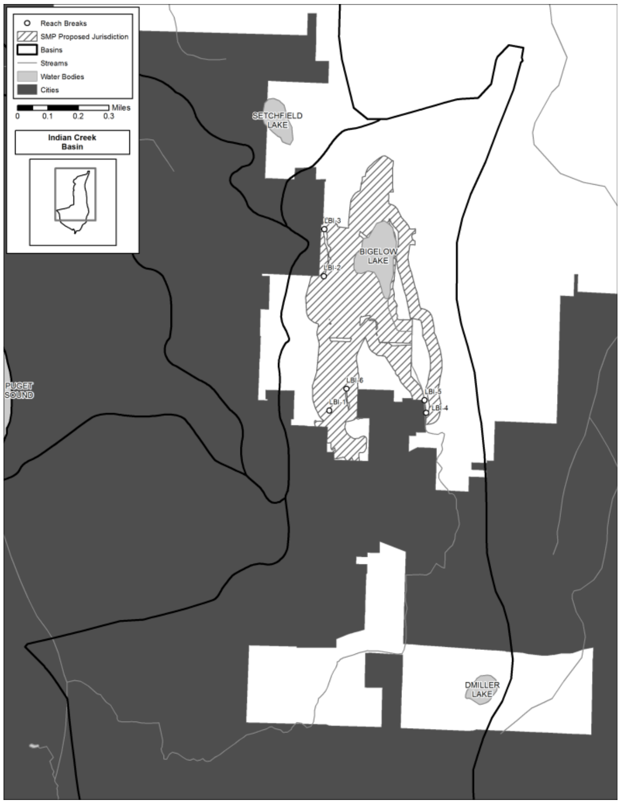
Woodland Creek

Please see the Woodland Creek basin section for a description of Woodland Creek.

Shinke Lake

Shinke Lake falls on the boundary between Woodland and Woodard basins. As the majority of the lake is within Woodard basin, it is described in that section.

Indian Creek Basin



Basin Overview

Indian Creek basin is located in the central portion of the county to the east of Budd Inlet. It is 1,500 acres in size and is entirely within WRIA 13. Indian Creek drains to Budd Inlet. The basin is located primarily within the City of Olympia; however, portions of it are located within the Olympia Urban Growth Area.

Indian Creek basin contains 2.52 miles of Thurston County SMA jurisdictional lake shoreline along Bigelow Lake, broken into two reaches (Reach series name: LBI. See Appendix A).

Bigelow Lake

Physical and Biological Characterization

Bigelow Lake is a large sphagnum bog lake. Its shoreline jurisdiction is composed of the lake and a large wetland complex. The Bigelow Lake shoreline jurisdiction contains 100-year floodplain and high groundwater areas.

Bigelow Lake forms the headwaters of Indian Creek. Indian Creek is not mapped as meeting the shoreline jurisdiction requirements. However, this stream is likely to qualify as critical area pursuant to TCC 24.

Bigelow Lake may provide habitat for wood duck and green heron. Indian creek is mapped as supporting resident cutthroat trout. Prairie soils are mapped in places around Bigelow Lake. Knotweed and tansy ragwort, non-native invasive species, have been mapped in Bigelow Lake.

Within the wetland, vegetation is submersed, emergent, and shrub. Along the wetland perimeter, vegetation is native shrub and forest cover which has been fragmented in areas for residential development. Areas cleared for residential development contain residential plantings.

There is no water quality data for Bigelow Lake, however, there is water quality data for Indian Creek which drains from Bigelow Lake. Indian Creek's water quality is rated as 'poor'. Indian Creek has consistently high levels of fecal coliform and nitrate concentrations. In addition, in past studies of Indian Creek, elevated levels of metals and organics have been detected in creek sediments. Major issues for Indian Creek water quality are fecal coliform bacteria contamination, and stormwater runoff from city streets and Interstate Highway 5 discharging into the creek (Thurston County Water Resources Monitoring Report, 2012). Indian Creek is on the 2012 303(d) polluted waters list for fecal coliform bacteria.

Shoreline Use Patterns

Land use within shoreline jurisdiction is residential and undeveloped. There are low levels of impervious surfaces associated with residential development around Bigelow Lake.

Current zoning is a mix of Residential-4, Residential 4-8, and Residential 6-12. Bigelow Lake is not currently designated under the SMP. Under current zoning regulations, there are approximately 89 lots within shoreline jurisdiction, thirteen of which are developable. Six parcels are vacant single lots, four parcels are subdividable vacant lots, and three parcels have the potential for additional infill.

Shoreline modifications around Bigelow Lake include roads, culverts, and docks. Three roads extend into shoreline jurisdiction: 12 Avenue NE, Southbay Road NE, and Chambers Street NE. Two culverts are located along 12 Avenue NE. Flood damage occurred at the intersection of Indian Creek and 12th Avenue NE during the 1996 flood event. Several private docks are located on the open water portion of Bigelow Lake.

Public access/viewing may be obtained through the following public roads: 12 Avenue NE, Southbay Road NE, and Chambers Street NE.

Management Issues and Opportunities

The Salmon Habitat Protection and Restoration Plan for the Water Resource Inventory Area 13, Deschutes (Thurston Conservation District, 2005) recommends the following for Indian Creek Basin:

- Educate landowners to increase voluntary implementation of best management practices and compliance with land use regulations (enforce existing setbacks along creek and wetlands).

- Manage stormwater runoff. Stormwater management is an important factor to improving water quality in Indian Creek. Continue to investigate and correct mistaken sanitary pipe hookups to stormwater pipes. Reduce pollution loading using street sweeping and other measures. The existing residential densities in most of the basin preclude retrofit to meet current stormwater standards to protect flow and water quality.

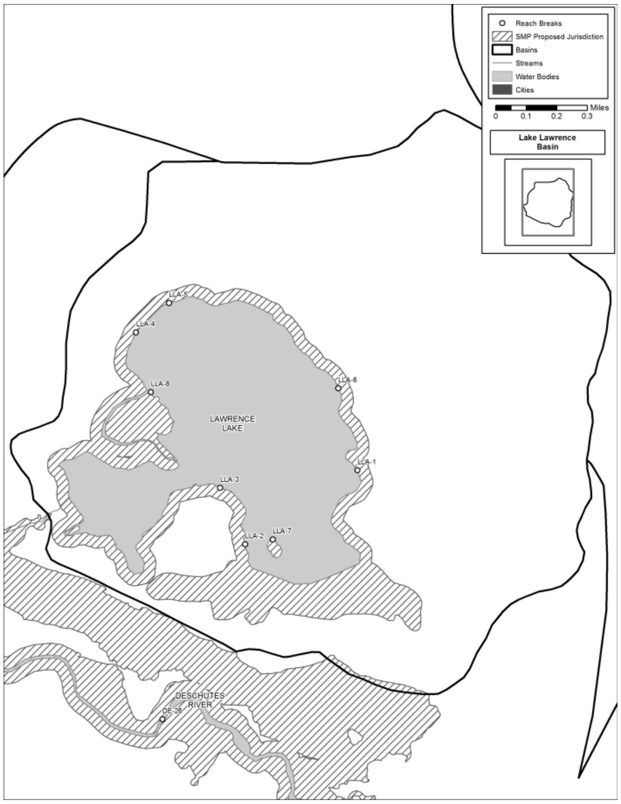
Henderson Inlet Watershed Characterization Report (Thurston County, 2007) identified six sites as potential restoration or protection locations (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Bigelow Lake is recommended for restoration/development.

Johnson Creek Basin

This basin is located primarily in WRIA 23. Please refer to the WRIA 23 chapter for further information.

Lawrence Lake Basin



Basin Overview

Lawrence Lake basin is located in the southeast portion of the county. The basin is approximately 1,688 acres in size. The majority of the basin, 1,594 acres, is located in WRIA 13; a small portion of the basin, 94 acres, is located in WRIA 11. As the majority of the basin is located in WRIA 13, review of it is provided in this chapter. Water within this basin generally flows to the south towards the Deschutes River.

Lake Lawrence basin contains 5.74 miles of SMA jurisdictional lake shoreline along Lake Lawrence, broken into eight reaches (Reach series name: LLA. See Appendix A).

Lawrence Lake

Physical and Biological Characterization

Lawrence Lake is located in close proximity to the Deschutes River at an approximate altitude of 421 feet. The lake has a large basin on the east side and a smaller basin on the west side. There is no surface water inlet. Water enters Lawrence Lake via direct precipitation, groundwater seeps, or stormwater runoff. Typically, Lawrence Lake discharges to the Deschutes River via an unnamed, seasonally or intermittently flowing stream (January to June) on the western shore of the west basin. This connection is also considered a shoreline of the state as part of the Deschutes River jurisdiction (via the 100-year floodplain and associated wetlands). It is discussed in the

Deschutes basin section of the report. The outlet channel goes through a control structure across the Deschutes River floodplain. However, in extreme flooding conditions, the river water backs up to the lake (Thurston County Water Resources Monitoring Report, 2012). Lawrence Lake is 330 acres, with a mean depth of 13 feet and maximum depth of 26 feet. The lake water is in continuity with the shallow groundwater. Reaches associated with Lawrence Lake are described in Appendix A.

The 100-year flood plain is mapped within and around the entire lake. Potential channel migration may occur around the outlet stream. High ground water flood hazard areas are associated with southern edge of the lake.

Lawrence Lake is considered an open water wetland. There is a large associated emergent and scrub/shrub wetland at the southern end of the eastern lake basin.

WDFW stocks Lawrence Lake with rainbow trout, triploid rainbow trout, and cutthroat trout. The stream that flows out of Lawrence Lake is mapped as supporting winter steelhead, coho salmon, sea-run cutthroat, and resident cutthroat trout. These fish are blocked from entering Lake Lawrence by the presence of the Lake Lawrence outflow structure and a fish screen. Waterfowl concentrations and prairie soils are associated with Lake Lawrence. Blue heron, bald eagle, and waterfowl overwintering habitat are located within this basin.

Roughly 40% of the total lake surface area is covered with submerged and floating aquatic plant growth (EnviroVision 2004). Shoreline vegetation has been extensively altered around portions of Lawrence Lake, particularly around the west basin and the northern half of the east basin. Much of the shoreline vegetation has been cleared and fragmented for residential development, in many places to the lake edge. However, there are several places along the shoreline with unmodified vegetation. Two state-listed noxious weeds, fragrant waterlily (*Nymphaea odorata*) and yellow flag iris (*Iris pseudacorus*) have been discovered in Lawrence Lake.

Lawrence Lake is rated ‘fair’ for water quality due to eutrophic conditions and occasional impaired uses from excessive algae and aquatic plants. Lake Lawrence is high in nutrients and contains extensive plant and algae growth. Toxic blu-green algae blooms occurred in 2004 and 2010/11. Lake Lawrence is on the 2012 303(d) polluted waters list for total phosphorus. The west basin appears to have slightly higher phosphorus levels than the east basin (Thurston County Water Resources Monitoring Report, 2012). The Deschutes River TMDL Water Quality Technical Report, 2012, found that the Lake Lawrence outlet has elevated phosphorus levels.

Since 1986, Lawrence Lake has had an active lake management district, which supports fisheries management and aquatic weed control activities. The Lake Management District is currently implementing the “Lake Lawrence Integrated Aquatic Vegetation Management Plan” (2004).

Shoreline Use Patterns

Land use within shoreline designation is agricultural, residential, undeveloped, recreational, parks, and other-cultural. Moderate density residential development and associated impervious surfaces and extensive docks are concentrated around the western lake basin and the northern half of the eastern lake basin. The south end of the east basin is undeveloped and is composed of a large associated wetland and a county park. The wetland is located within several large tracts of land that are zoned for agriculture. The Thurston County Park is managed as priority habitat for wildlife (EnviroVision, 2004). Primary lake uses are swimming, boating, and fishing.

Current zoning is Rural Residential Resource 1/5, Public Preserve, Residential LAMIRD 2/1, Residential LAMIRRD 1/2, and Long Term Agriculture. Current shoreline environment designations are primarily Rural, with some Conservancy, and some areas undesignated. Under current zoning regulations, there are approximately 198 lots within shoreline jurisdiction, six of which are developable. One parcel is a vacant single lot, five parcels are subdividable vacant lots, and zero parcels have the potential for additional infill.

Two roads cross shoreline jurisdiction around the west lake basin: Lake Point Drive DW and Pleasant Beach Drive SE. The Lake Lawrence outflow acts as a lake level control structure. It also blocks fish passage due to insufficient flow and screening. There is a culvert within Lake Lawrence shoreline jurisdiction just downstream from the Lake Lawrence outflow structure.

A WDFW public boat launch is located on the southwest side of the lake, adjacent to Lake Lawrence Park (an undeveloped County-owned property). Views or public access to shoreline jurisdiction may be obtained from Lake Point Drive DW and Pleasant Beach Drive SE.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology, 2012) recommends the following overall management activities for tributaries to the Deschutes River:

- Tributaries should achieve full mature riparian vegetation. Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Reduce upland and channel erosion, and avoid fine sediment input to the Deschutes River and its tributaries.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Maintain septic systems.
- The Lake Lawrence tributary has high water temperatures, partially due to the solar radiation received by the lake surface. Evaluate the lake outlet for existing hydraulic modifications that could be altered and result in decreased downstream temperatures.
- The Lake Lawrence outlet has elevated phosphorus and upstream nutrient sources should be quantified. Lake Lawrence is on the 303(d) list for total phosphorus. A TMDL should be conducted and implemented soon so that management activities may be coordinated.

Lake Lawrence Integrated Aquatic Vegetation Management Plan (2004)

The plans goals are to:

- Pursue a multi-faceted strategy to eradicate noxious aquatic plants, reduce native and non-native nuisance aquatic plants to improve recreational and aesthetic conditions, while maintaining fish and wildlife habitat
- Provide public education opportunities to the lake area residents, focusing on nutrient reduction, maintaining and improving the lake's water quality.

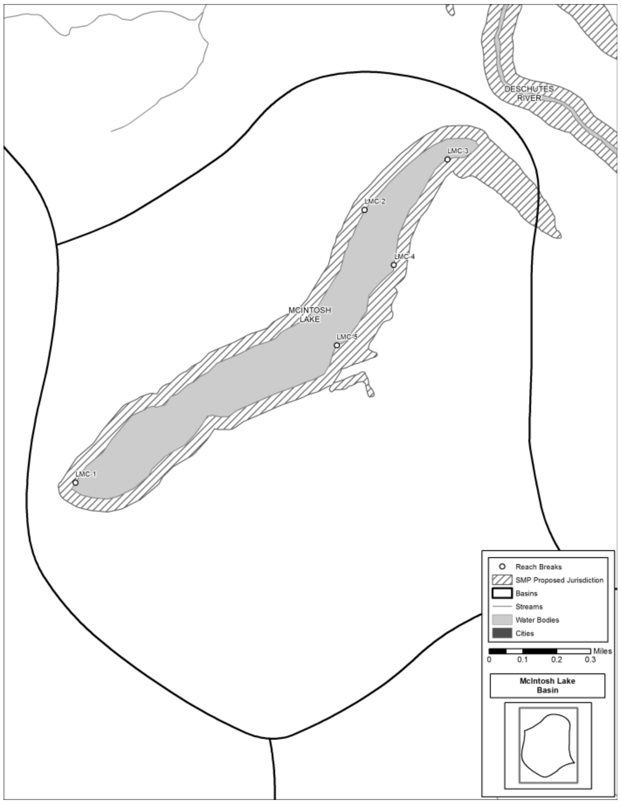
The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration sites.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Lake Lawrence and Lake Lawrence Creek are recommended for highest restoration.

McAllister Creek Basin

This basin is located primarily in WRIA 11. Please refer to the WRIA 11 chapter for further information.

McIntosh Lake Basin



Basin Overview

McIntosh Lake basin is located in the southern central portion of the county. This basin is 1,486 acres in size. The majority of the basin, 1,426 acres, is located in WRIA 13. A small portion of the basin, 60 acres, is located in WRIA 23. As the majority of McIntosh Lake basin is located in WRIA 13, review of it is provided in this chapter. Water in this basin generally flows to the north towards the Deschutes River.

McIntosh Lake basin contains 3.44 miles of SMA jurisdictional lake shoreline, broken into five reaches (Reach series name: LMC. See Appendix A).

McIntosh Lake

Physical and Biological Characterization

McIntosh Lake is located four miles east of Tenino. It is 93 acres, with a mean depth of 8 feet, and a maximum depth of 11 feet. It is located at approximately 336 feet elevation. McIntosh Lake has no surface inlets and drains via an unnamed outlet to the Deschutes River.

Steep slopes and landslide hazard areas are located along the southwest shore of McIntosh Lake.

High ground water flood hazard areas are located at the east end of the lake. The entire lake is identified a 100-year flood plain. The lake itself is mapped as a wetland. There are two larger associated wetlands located at the eastern end of the lake.

WDFW stocks McIntosh Lake with rainbow and triploid rainbow trout. Wood duck habitat is associated with the lake.

Shoreline Vegetation on the south and east sides of the lake is primarily unaltered. Along the north shore, shoreline vegetation has been cleared extensively for residential development, in places close to the waterline. Residential plantings exist in areas containing residential development.

McIntosh Lake is on the Ecology 2012 303(d) polluted waters list for PCBs in fish tissue.

Shoreline Use Patterns

Land use within shoreline jurisdiction is composed of residential, undeveloped, recreational, and timber/ forest land. The north shoreline is primarily moderate density residential and developed with small lot sizes. Impervious surfaces are concentrated in this area and are associated with residential development. The east side of the lake has larger parcel sizes and exhibits low density residential development. The southern shoreline is primarily undeveloped with the exception of State Highway 507 and a County trail. Primary lake uses are swimming, boating, and fishing.

Current zoning is Rural Residential Resource 1/5 along the eastern and southern shorelines, with a section of Residential LAMIRD 1/2 along the north shoreline. The existing shoreline designation is Conservancy along the east and south sides of the lake, and Rural along the north shoreline. Under current zoning regulations, there are approximately 83 lots within shoreline jurisdiction, seven of which are developable as vacant single lots.

State Highway 507 parallels the southwestern shoreline of McIntosh Lake. Military Road SE and Cedarwood Drive SE also cross through shoreline jurisdiction on the north side of the lake and may provide view opportunities. On the residentially developed north shore of the lake, numerous docks exist. There are also a few docks located at residential parcels on the southeast side of the lake.

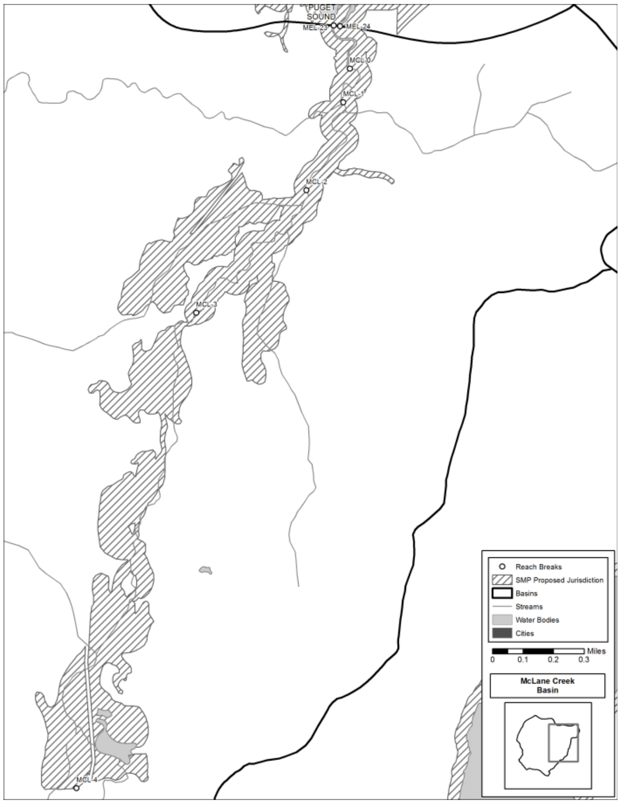
Public access to McIntosh Lake is available via a WDFW boat launch with public restrooms on the north shore of the lake. In addition there is a County trail adjacent to the south McIntosh Lake shoreline that may provide additional direct or view access to the shoreline.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around McIntosh Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) McIntosh Lake is recommended for protection/conservation.

McLane Creek Basin



Basin Overview

McLane Creek basin is located in the western portion of the County. It is 7,306 acres in size. The majority of the basin, 7,074 acres, is located in WRIA 13. Smaller portions of the basin are located in WRIA 14 (108 acres) and in WRIA 23 (124 acres). As the majority of McLane Creek basin is located in WRIA 13, review of it is provided in this chapter. Water in this basin generally flows to the north towards Eld Inlet. Capitol forest extends into the center of the basin from the east. The McLane nature trail, located off Delphi road, is also located in this basin.

McLane Creek basin contains 1.29 miles of SMA jurisdictional stream shoreline, broken into four reaches (Reach series name: MCL) and 0.13 miles of SMA jurisdictional marine shoreline, broken into one reach (Reach series name: MEL). See Appendix A. The single reach of marine shoreline in McLane Creek basin is discussed as part of the Eld Inlet (east) basin section.

McLane Creek

Physical and Biological Characterization

McLane Creek originates in the Alpine Hills area and flows through fairly level terrain, emptying into the Mud Bay estuary in Eld Inlet. The creek is a low gradient, unconfined and moderately confined small tributary.

McLane Creek is mapped as a geologically sensitive area. There are numerous areas of high groundwater hazard within shoreline jurisdiction. The 100-year floodplain is present along the entire creek within shoreline jurisdiction. The lower two reaches contain areas where the potential channel migration zone may extend beyond the mapped 100-year floodplain.

McLane Creek is fed by six tributaries including Swift Creek, Perkins Creek, Beatty Creek, and Cedar Flats Creek. The lower portion of McLane Creek is considered a shoreline of the state. Its reaches are described in Appendix A. The remainder of McLane Creek as well as its associated tributaries are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. The majority of shoreline jurisdiction contains extensive associated wetlands that extend beyond the 100-year floodplain in a large wetland complex. The lowest reach contains estuarine wetland and coastal salt marsh.

McLane Creek supports significant salmon runs, particularly chum. McLane Creek and its fish bearing tributaries are mapped as supporting chum salmon, sea-run and resident cutthroat trout, and coho salmon. McLane Creek may also provide wood duck habitat. Prairie soils are mapped within shoreline jurisdiction.

The riparian vegetation in the upper reach is primarily intact and forested with small cleared areas for low density residential development. The middle and lower reaches have areas of intact forest cover, but are a mosaic of areas cleared for agriculture, utilities, and low density residential development. A segment of McLane Creek in reach MCL-2-MCL-3 near Delphi Road, has very little riparian vegetation.

McLane Creek water quality is categorized as ‘fair’ because the creek usually meets Part 1 but fails Part 2 of the fecal coliform standard. McLane Creek also failed the turbidity standard in November 2009 and November, December 2010. The creek’s average phosphorus is above the reference condition. McLane Creek’s water quality is primarily impacted by forestry activities and agricultural sources of nonpoint pollution (Thurston County Water Resources Monitoring Report, 2012). McLane Creek is part of a TMDL for Fecal Coliform Bacteria and Temperature (Ecology, 2006).

Shoreline Use Patterns

Land use within shoreline jurisdiction is undeveloped, residential, and agricultural. Agriculture and associated vegetation clearing is present to some extent in all reaches. Impervious surfaces are limited within shoreline jurisdiction and are associated with low density residential development and Delphi Road SW. Water oriented uses of McLane Creek include fishing and wildlife observation.

McLane Creek is currently designated Conservancy in the three lower reaches. The upper reach is not currently designated. Zoning is primarily Rural Residential Resource 1/5 with some small areas of Long Term Forestry, and Residential LAMIRD 1/1 in the upper reach. Under current zoning regulations, there are approximately 55 lots within shoreline jurisdiction, 13 of which are developable. There are ten vacant single lots, three subdividable vacant lots, and one parcel with the potential for additional infill.

Shoreline modifications to McLane Creek include roads, bridges, utilities, and culverts. Delphi Road SW crosses shoreline jurisdiction in several places in the lower three reaches. A bridge is located in the lowest reach where Delphi Road SW crosses over McLane Creek and in the second lowest reach where Delphi Road SW crosses over Swift Creek. The middle reach (MCL-2-MCL-3) contains two bridges where Delphi Road SW crosses McLane Creek and an unnamed creek. Five culverts are associated with the crossing of Delphi Road SW and 32nd Court SW over McLane Creek and an unnamed tributary within this reach. This reach also contains a wide area of vegetation clearing for power lines. The upper reach contains two culverts associated with 40th Ave SW over an unnamed tributary within the shoreline jurisdiction.

Public access is available in the upper reach via Capitol State Forest and the McLane Nature Trail. In the lower reaches, public access is available via Delphi Road SW.

Management Issues and Opportunities

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified 38 sites as potential restoration or protection locations (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
The lowest reach of McClane Creek is recommended for protection/conservation. The middle two reaches are recommended for protection. The upper reach is recommended for highest protection.

Mission Creek Basin

This basin is located within the jurisdiction of the City of Olympia. The basin does contain a small portion of the Olympia Urban Growth area, within the county's jurisdiction. However, the area within the County's jurisdiction does not contain jurisdictional shorelines.

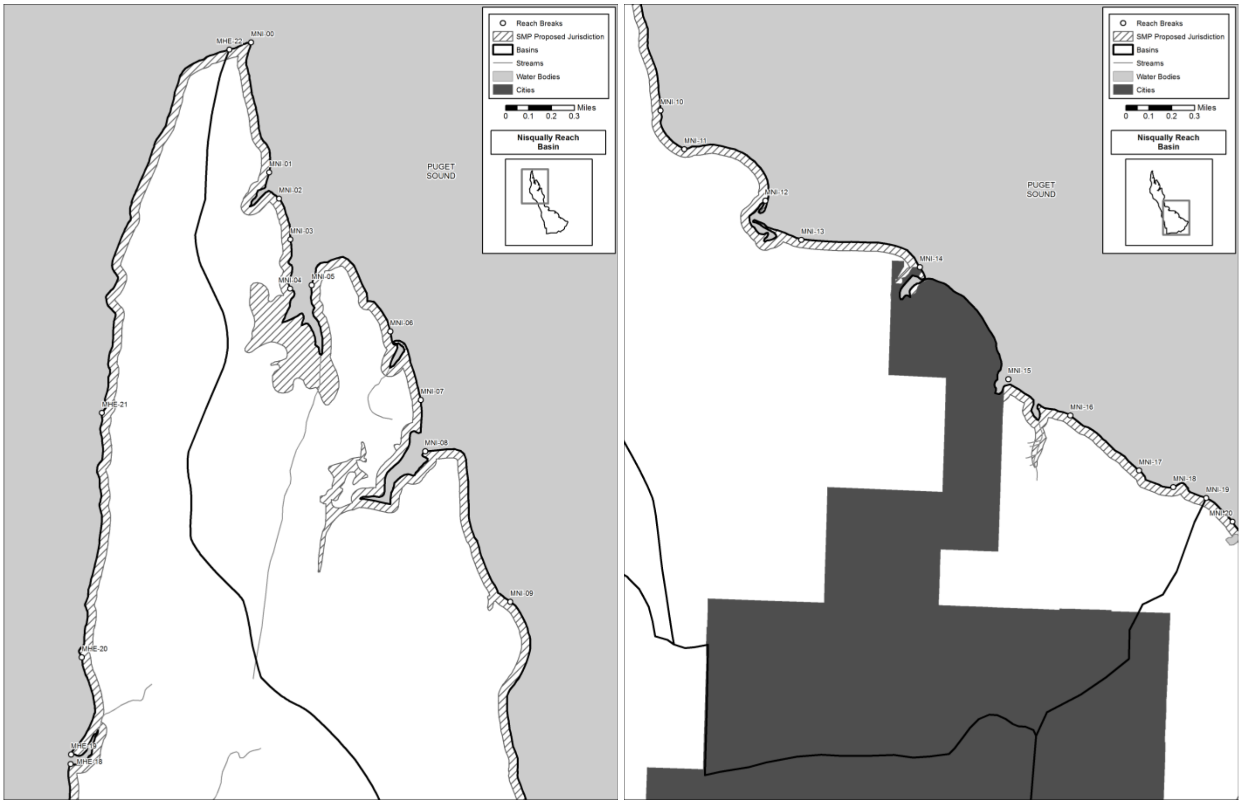
Moxlie Creek Basin

This basin is located within the City of Olympia Jurisdiction.

Nisqually Basin

This basin is located primarily in WRIA 11. Please refer to the WRIA 11 chapter for further information.

Nisqually Reach Basin



Basin Overview

Nisqually Reach basin is located in the northeast corner of the County. It is approximately 4,645 acres in size and is located entirely within WRIA 13. Water in this basin generally flows north towards Nisqually Reach. A portion of the City of Lacey is located in the southern section of the basin. In addition, this basin includes small portions of the Nisqually shellfish district.
Tolmie State Park is also located within this basin. Tolmie State Park is a 105-acre marine shoreline park. This park has 1,800 feet of saltwater shoreline on Puget Sound.

Nisqually Reach basin contains 10.72 miles of SMA jurisdictional marine shoreline, of which 2.11 miles are SSS jurisdictional marine shoreline, broken into 20 reaches (Reach series name: MNI. See Appendix A).

Nisqually Reach

Physical and Biological Characterization

Nisqually Reach is primarily sand beach with sand flats located within the inlets. There are two estuary wetlands, one in Baird Cove and the second in the unnamed inlet to the south. Net-shore drift is primarily left to right with areas of undefined drift within the inlets.

Most of Nisqually Reaches' shoreline is mapped as containing steep slopes and slide hazard areas. Areas mapped with unstable slopes and past landslide areas are common along the entire shoreline. The marine shoreline is mapped as part of the 100-year floodplain. An area of high groundwater hazard is mapped north of Sandy Point.

Nisqually Reach contains a small number of un-named streams that flow into the Puget Sound. These streams are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Baird Cove and two unnamed inlets have associated wetlands. Estuarine emergent wetlands are scattered along the shoreline. Seven pocket estuaries are mapped along the Nisqually Reach shoreline.

The Nisqually Reach marine shoreline provides habitat for geoduck, Dungeness crab, and forage fish including smelt, sand lance, rock sole, and herring. The marine shoreline also provides habitat for bald eagle, blue heron and waterfowl concentrations. Nisqually Reach is mapped as containing lagoons, estuarine wetlands, and sloughs. Continuous, non-floating kelp is mapped at the north end of Nisqually Reach, around Baird Cove. Patchy, non-floating kelp is mapped along the outer shorelines of central Nisqually Reach. Southern Nisqually Reach is mapped as containing patchy eelgrass. Patchy salt marsh is mapped within most of the inlets along Nisqually Reach.

Along Nisqually Reach, the marine riparian habitat is primarily fragmented for residential development, with some reaches retaining a forested foreshore, and some areas cleared to the shoreline. However, there are some unmodified, forested reaches.

Nisqually Reach/Drayton Passage (near Sandy Point and by the City of Lacey's UGA) is on Ecology's 2012 303(d) list of marine polluted waters for Fecal Coliform bacteria. The Washington Department of Health has classified the commercial shellfish growing areas along Nisqually Reach as a mix of 'approved' and 'prohibited' status (DOH, 2013). Baird Cove, an outer shoreline north of Sandy Point, and an unnamed inlet within the City of Lacey's jurisdiction are 'prohibited'.

The Nisqually Reach is part of the Henderson Inlet/Nisqually Reach Shellfish Protection District adopted by the Board of County Commissioners in December 2001. Washington State law required the board to form the district after the state Department of Health closed portions of the two watersheds to shellfish harvesting because of unacceptably high levels of fecal coliform bacteria. A shellfish protection implementation plan was created in 2005.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential and undeveloped with some small areas of transportation, recreation, agriculture, and parks. Impervious surfaces are mainly associated with residential development and are highest near Johnson Point, south of an unnamed inlet, and within the City of Lacey's Urban Growth Area. Impervious surfaces may exceed 30% in reach MNI-18-MNI-19. Water oriented uses include aquaculture, boating, and swimming. There are five parcels with Nationwide 48 permits for geoduck aquaculture.

Most of the Nisqually Reach shoreline is designated Rural under the existing SMP. Baird Cove and south through the unnamed inlet is zoned Conservancy. The area just south of the City of Lacey's Urban Growth Area is also designated Conservancy. Nisqually Reach's shoreline is mainly zoned Rural Residential Resource 1/5, Residential LAMIRD 1/1 or Residential LAMIRD ½. There is also a small area zoned Rural 1/20, and Tolmie State Park is zoned Public Parks Trails and Preserves. Under current zoning regulations, there are approximately 322 lots within shoreline jurisdiction, 32 of which are developable. There are 28 vacant single lots, two subdividable vacant lots, and two parcels with the potential for additional infill.

Shoreline modifications include roads, docks, armoring, piers/docks/boat ramps, groins/jetties, overwater structures associated with marinas, and coastal fill. Five roads extend into shoreline jurisdiction. Docks are relatively infrequent. Bulkheads are extensive along Nisqually Reach. Many of the bulkheads have associated coastal fill behind them. In addition, a small area of coastal fill is present in reach MNI-18-MNI-19. Three private marinas, Zittle's, Puget, and Beachcrest are located along Nisqually Reach. Zittle's Marina is located within Baird Cove and has associated groins/jetties and piers/docks/boat ramps. Puget Marina is located south of Zittle's, north of 78th Avenue NE, and has associated piers/docks/boat ramps. Beachcrest Marina is located partially within the City of Lacey, and partially within the City of Lacey's UGA. Beachcrest marina has associated piers/docks/boat ramps.

Public access to the shoreline may be obtained at Tolmie State Park, a 105-acre marine day-use park with 1,800 feet of saltwater shoreline. Public access is available through the motorboat launches at Puget Marina and Zittle's Marina. Informal public access is available via Sandy Point Beach Road.

Management Issues and Opportunities

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified a large area of marine shoreline from Baird Cove south through an unnamed cove at MNI-08 and the areas around Sandy Point south to Beachcrest as containing high priority areas for forage fish habitat restoration/protection. All other areas were prioritized low for forage fish habitat restoration/protection (See Appendix A). Along Nisqually Reach, much of the beach sediment is locally sourced, despite the presence of the Nisqually River to the east. The tall bluffs towards the north end of the Nisqually Reach provide a source of sediment through bluff toe erosion. Local restorations at pocket beaches and at estuaries could be effective. In addition, limitations and criteria for new bulkhead construction are recommended to help sustain current conditions.

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified much of Nisqually Reach as beneficial to all juvenile salmon and appropriate for restoration or conservation (See Appendix A).

Nisqually Reach Aquatic Reserve

The Nisqually Reach Aquatic Reserve (NRAR) was established in 2011 as an environmental, scientific, and educational reserve with the goal to ensure protection of the unique species and habitats identified in the area and to promote sustainable public stewardship of the region. Within Thurston County, the NRAR extends from the northwestern boundary of Tolmie State

Park south through the Nisqually River Delta, and includes all state-owned, DNR managed tidelands and bedlands. Along Nisqually Reach basin in Thurston County, the tidelands adjacent to the shoreline are privately owned. However, Washington State Parks manages the tidelands at Tolmie State Park and the state manages the exterior tidelands along the remainder of Nisqually Reach basin. The tideland and bedland areas managed by the state are areas that would be considered aquatic in the shoreline master program.

Nisqually Reach Aquatic Reserve Management Goals:

- Preserve, restore and enhance aquatic nearshore areas including intertidal and subtidal ecosystems with a special emphasis on native habitats for forage fish, salmonids, and marine birds.
- Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.
- Promote stewardship of riparian and aquatic habitats and species by supporting and providing opportunities for outdoor education, scientific research including citizen science and interpretive studies.
- Promote sustainable management of traditional recreational (e.g., boating, water skiing, fishing) commercial (e.g., marinas) and cultural uses in the aquatic reserve in a manner consistent with the other goals and objectives for the reserve.
- Support the recovery and protection efforts for federal and state threatened, endangered and sensitive species, species of special concern and their habitats.

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). (See Appendix A)

Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	None	North portion of unnamed inlet at MNI-08	None
Protect	None	Baird Cove south to top of unnamed inlet at MNI-08; City of Lacey south to north side of unnamed inlet at MNI-17	Baird Cove; unnamed inlet at MNI-08; inlet at Tolmie State Park; inlet within the City of Lacey; unnamed inlet south of the City of Lacey UGA at MNI-17
Restore High	None	None	None
Restore	Johnson Point south past Baird Cove to unnamed inlet at MNI-08; around the City of Lacey and its	Johnson Point south to mid- Baird Cove; unnamed inlet at MNI-08 south to City of Lacey; unnamed	Unnamed inlet at MNI-09; unnamed inlet at south end of City of Lacey at MNI-15

	UGA from MNI-14 to MNI-17	inlet at MNI-17 to basin line	
Enhance High	North of Sandy Point; south of unnamed inlet near MNI-18 to basin line	None	None
Enhance	Unnamed inlet at MNI-08 south to MNI-09; Sandy Point south through Tolmie State Park to the City of Lacey	None	None

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	None	None
Protection	1. Johnson Point south through Baird Cove 2. From north edge of area where zoning changes to residential LAMIRD south to the north edge of Tolmie State Park at Sandy Point	1. MNI-00 to MNI-05 2. MNI-09 to MNI-12
Protection/ Conservation	1. South outer edge of Baird Cove south through Sandy Point	1. MNI-05 to MNI-12
Conservation	1. Short reach on west side of Johnson Point 2. From southern edge of the City of Lacey's UGA to Nisqually Head	1. MHE-22 to MNI-00 2. MNI-16 to MNI-22
Highest Restoration	None	None
Restoration	North edge of Tolmie State Park south to north edge of the City of Lacey and its urban growth area	MNI-12 to MNI-14
Restoration/ Development	None	None

Development/ Restoration	Area within the City of Lacey's urban growth area	MNI-15 to MNI-16

Offutt Lake Basin

Basin Overview

Offutt Lake basin is located near the center of the County. It is approximately 1,532 acres in size. The majority of the basin, 1,430 acres, is located in WRIA 13. A small portion of the basin, 102 acres, is located in WRIA 23. As the majority of Offutt Lake basin is located in WRIA 13, review of it is provided in this chapter. Water in this basin generally flows to the east towards the Deschutes River.

Offutt Lake basin contains 3.03 miles of SMA jurisdictional lake shoreline, broken into six reaches (Reach series name: LOF. See Appendix A).

Offutt Lake

Physical and Biological Characterization

Offutt Lake is approximately 200 acres with a mean depth of 15 feet and a maximum depth of 25 feet. It is located at roughly 230 feet elevation.

Offutt Lake is fed by an unnamed tributary which flows into the southeast corner of the lake. An unnamed stream drains the northeast corner of Offutt Lake to the Deschutes River. These streams are not mapped as a shoreline of the state as they are not currently identified as exceeding 20 cubic feet per second mean annual flow. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Offutt Lake is mapped as an open water wetland. There is an associated Palustrine forested wetland on its southwest side, and an associated Palustrine emergent/Palustrine scrub/shrub wetland complex on its east side.

Steep slopes lie along the eastern edge of the Offutt Lake inlet stream. The entire lake and its associated wetland on the east side are located within the 100-year floodplain. Potential channel migration may occur at the east side of the lake along the outlet stream.

Offutt Lake is mapped as supporting resident cutthroat as well as rainbow trout, largemouth bass and perch. WDFW stocks Offutt Lake with cutthroat trout, rainbow trout and triploid rainbow trout. Offutt Lake's outflow acts as a fish barrier due to insufficient flow and a screen (WDFW). Downstream of the outflow barrier, the unnamed stream draining Offutt Lake to the Deschutes River is mapped as supporting winter steelhead, coho salmon, and resident cutthroat and sea-run cutthroat trout. Offutt Lake may also providing habitat for wood duck and bald eagle. Urban oak canopy and oak-conifer forest is associated with Offutt Lake along the north and southwest sides.

Riparian vegetation around Offutt Lake is primarily intact on the west and east sides of the lake, and fragmented for residential development on the north and south sides of the lake. The west side of Offutt Lake shoreline jurisdiction contains intact forest cover. The eastern side of the lake contains submerged and floating vegetation within the lake, and emergent and shrub vegetation upland. Portions of the associated wetland have been cleared and contain agricultural plantings. The residential areas on the north and south side of the lake contain fragmented native forest cover and residential plantings. Vegetation in these developed areas is cleared to the waterline in places.

Offutt Lake is on the Ecology 2012 303(d) polluted waters list for PCBs in fish tissue.

Shoreline Use Patterns

Within Offutt Lake's shoreline jurisdiction, current land use is primarily residential, undeveloped, and a small area of timber/forest land. Moderate residential development has occurred along the north and south shores of the lake. Impervious surfaces are limited to these areas. The east and west lake shores still retain primarily unmodified vegetation. Offutt Lake Resort is located on south side of the lake with a fishing dock, indicating that fishing is a water oriented use of the lake.

Under the existing SMP, Offutt Lake is designated Rural along the northern and southern shorelines, and Conservancy along the eastern and western shorelines. Approximately half of Offutt Lake is zoned Rural Residential Resource 1/5. These areas are located at the west and east ends of the lake and include the large areas of associated wetlands and the inlet and outlet streams. The mid-portion of the lake on the north and south sides is zoned a mix of Residential LAMIRD 2/1 and Residential LAMIRD 1/1. Under current zoning regulations, there are approximately 161 lots within shoreline jurisdiction, 24 of which are developable. Nineteen parcels are vacant single lots, three parcels are subdividable vacant lots, and one parcel has the potential for additional infill.

Shoreline modifications include roads, docks, armoring, culverts, and stream channel modification. Two roads enter shoreline jurisdiction: 116th Avenue SE (on the north shore) and 119th Avenue SE (on the south shore). Along the areas of residential development on the north and south shores, there are numerous private docks and shoreline armoring. Two fish barriers are mapped within shoreline jurisdiction. One is located on the south shore of the lake in a culvert along 119th Avenue SE. The other is located at the Offutt Lake outfall on the east side of the lake. Aerial photos indicate that the Offutt Lake outlet stream channel within the eastern portion of the basin has been modified to parallel a private driveway.

A WDFW boat launch provides public access to Offutt Lake via the north shore. The boat launch area contains a public restroom as well as limited parking facilities. Additional public access may be obtained from Offutt Lake Resort on the south lakeshore. Viewpoints may be obtained through the roads listed above.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Offutt Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Offutt Lake and Offutt Lake Creek is recommended for highest protection.

Percival Creek Basin

Basin Overview

Percival Creek basin is located in the central portion of the county. It is 4,712 acres in size. The majority of the basin, 4,548 acres, is located in WRIA 13. A small portion of the basin, 164 acres, is located in WRIA 23. As the majority of the Percival Creek basin is located in WRIA 13, review of it is provided in this chapter. Water within this basin flows east towards Capitol Lake and Budd Inlet. The majority of basin is located within Cities of Olympia, Tumwater or their associated Urban Growth Areas.

Percival Creek basin contains 4.42 miles of SMA jurisdictional stream shoreline in one reach (Reach series name: BL) along Black Lake Ditch, and 1.94 miles of SMA jurisdictional lake shoreline around Trosper Lake, broken into two reaches (Reach series name: LTR. See Appendix A).

Black Lake Ditch

Physical and Biological Characterization

Only the small segment of Black Lake Ditch located within Thurston County shoreline jurisdiction within the City of Tumwater UGA will be discussed in this section. Black Lake ditch is the outlet for Black Lake. Black Lake ditch drains from the north end of the lake and then flows to Percival Creek. The historic lake outlet was to the south via the Black River, which is now obstructed by many beaver dams and vegetation. Black Lake Ditch has steep slopes along its left bank (west). High groundwater hazard areas and 100-year floodplain are mapped along this reach.

Within Thurston County jurisdiction, it does not have any other tributaries. Extensive wetlands are associated with this reach.

Black Lake ditch is mapped as containing fall Chinook and coho salmon, sea-run and resident cutthroat trout. Percival Creek basin is mapped as providing habitat for mink, wood duck, and osprey.

The vegetation on both shorelines is primarily undeveloped (shrub-scrub dominated) but is partially cleared surrounding power lines mid-reach and along the left bank (west) for low density residential development.

Thurston County does not test water quality in Black Lake Ditch. Thurston County has identified some issues related to water quality for this basin. The majority of Percival Creek basin lies within the City of Tumwater and its UGA, and the City of Olympia and its UGA and is subject to rapid development. Increases in stormwater due to the development could result in impacts to water quality, stream bank erosion, hillslope failures, and channel scour. Reductions to Black Lake water quality could impact the water quality of Black Lake Ditch (Thurston County Water Resources Report, 2012). Black Lake Ditch is on the Ecology 2012 303(d) polluted waters list for temperature, pH, and dissolved oxygen.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is undeveloped and residential. Impervious surfaces are very minimal and limited to a several residences. The reach is currently designated Percival Shoreline Management Area and is zoned Green Belt and Single Family Low Density Residential 4-7/1. Under current zoning regulations, there are approximately 15 lots within shoreline jurisdiction, four of which are developable as partially-used subdividable lands. There are zero vacant single lots or subdividable vacant lots.

This reach of Black Lake Ditch is modified by a road, bridge, and vegetation clearing for powerlines. Black Lake -Belmore Road SW crosses Black Lake Ditch over a bridge at the outflow of Black Lake. There is a wide swath of vegetation that has been cleared for power lines mid-reach. Public access is available via Black Lake -Belmore Road SW.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommends the following for Black Lake Ditch:

- Establish full mature riparian vegetation, with heights governed by soil type, to increase effective shade from 47% to 84% on average in Black Lake Ditch which should significantly reduce stream temperature.

- Further evaluate the lake outlet to identify whether hydraulic modifications may be made at the outlet from Black Lake to enhance subsurface water connections and minimize the surface water connectivity.
- Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Reduce upland and channel erosion, and avoid fine sediment input.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Maintain septic systems.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along Black Lake Ditch.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
Black Lake Ditch is recommended for restoration.

Trosper Lake

Physical and Biological Characterization

Trosper Lake has high groundwater hazard areas at the north end. The lake itself and areas of shoreline jurisdiction are mapped within the 100-year floodplain.

Trosper Lake does not have a surface inlet. Percival Creek flows north out of Trosper Lake. Percival Creek is not a shoreline of the state until its confluence with the Black Lake Ditch. Trosper Lake is surrounded by associated wetlands and a wellhead protection area.

Trosper Lake may provide habitat for wood duck, harlequin duck, western pocket gopher, rocky mountain and roosevelt elk, waterfowl concentrations, summer and fall chinook; and coho. Prairie soils are mapped within shoreline jurisdiction.

Vegetation is submersed and emergent within the lake and associated wetland developing into shrub and forest upslope of the wetland. Outside of the wetland, a large swath of forest has been cleared for power line passage. Smaller areas of forest have been fragmented for lawns, and residential plantings.

There is no data on water quality for Trosper Lake.

Shoreline Use Patterns

Trosper Lake falls within an island of County jurisdiction within the City of Tumwater. Its shoreline jurisdiction is divided by the City of Tumwater on the eastern shoreline and a thin section on the southwest shoreline, and the County. Shoreline use patterns will only be discussed for the County's shoreline jurisdiction. Existing land use within the County's shoreline jurisdiction is residential, undeveloped, and recreation. Water oriented uses include swimming, boating, and fishing.

Shoreline modifications include docks (eleven), clearing of vegetation for power lines, and impervious surfaces associated with limited low density residential development.

Trosper Lake is currently designated Conservancy and is zoned Open Space and Single Family Low Density. Under current zoning regulations, there are approximately eighteen lots within shoreline jurisdiction, one of which is developable with the potential for additional infill.

Public access to Trosper Lake is available via the City of Tumwater's Trosper Lake Park. There is no public access within the County's jurisdiction.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Trosper Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Trosper Lake is recommended for restoration.

Perry Creek Basin

This basin is located primarily in WRIA 14. Please refer to the WRIA 14 chapter for further information.

Reichel Lake Basin

Basin Overview

Reichel Lake basin is located in the southeast portion of the County. It is approximately 5,147 acres in size. The majority of the basin, 4,713 acres, is located in WRIA 13. A small portion of the basin, 434 acres, is located in WRIA 23. As a majority of the Reichel Lake basin is located in WRIA 13, review of it is provided in this chapter. Water within this basin generally flows to the north to the Deschutes River.

Reichel Lake basin contains 1.19 miles of SMA jurisdictional stream shoreline, broken into four reaches (Reach series name: DE-24) and 0.96 miles of SMA jurisdictional lake shoreline, in two reaches (Reach series name: LRE. See Appendix A).

Reichel Creek

Physical and Biological Characterization

Reichel Creek is a low gradient, primarily unconfined small tributary. Steep slopes are mapped along the upper reaches of the right bank (N) and portions of the mid-reaches. The entire creek is mapped within the 100-year floodplain. There are high groundwater flood hazard areas in the middle reaches and associated with Reichel Lake.

There are several un-named streams which are mapped as tributaries to Reichel Creek. The main stem is mapped as a shoreline of the state and has reaches described in Appendix A. The associated tributaries are not mapped as shorelines of the state as they are not currently identified as exceeding a 20 cubic feet per second mean annual flow. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Associated wetlands are present along the entire creek but are widest along the upper two reaches.

Reichel Creek is mapped as supporting coho salmon, sea-run and resident cutthroat trout, winter steelhead, and waterfowl species. Prairie soils are mapped within shoreline jurisdiction. This basin is mapped as containing areas of conifer/deciduous oak habitat.

The most upstream reach is primarily forested but has the potential to be heavily forested or clear-cut, based on usage as Long Term Forestry zoning. The lower reaches are extensively cleared and modified for agricultural use. Very little riparian vegetation remains in these reaches. The left bank (west) of the lowest reach is a mix of intact forest cover and a large area cleared for commercial use.

Reichel Creek is on the Ecology 2012 303(d) polluted waters list Temperature, dissolved oxygen, and bacteria.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is undeveloped and timber/ forest land in the upper reach, agricultural for the lower three reaches, and small areas of timber/forest land, commercial and residential land use in the lower reach. Impervious surfaces are limited.

Reichel Creek is not currently designated under the SMP. It is zoned Rural Residential Resource 1/5 and Long Term Agriculture in the lowest reach, Long Term Agriculture in the middle reaches, and Long Term Forestry in the upper reach. Under current zoning regulations, there are approximately 29 lots within shoreline jurisdiction, five of which are developable. There is one vacant single lot, three subdividable vacant lots, and one parcel with the potential for additional infill.

Shoreline modifications include roads and culverts. Vail Loop SE crosses Reichel Creek and has an associated culvert. A culvert is also associated with the crossing of Gordon Road SE (private road) over Reichel Creek. Culverts are associated with Chatwood Road SE where it crosses the shoreline jurisdiction on the left bank (west) over an unnamed tributary to Reichel Creek.

Public Access is available via Vail Loop Road SE.

Management Issues and Opportunities

<u>The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings</u> (Ecology 2012) recommends the following overall management activities for tributaries to the Deschutes River:

- Tributaries should achieve full mature riparian vegetation. This includes restoring and protecting natural wetland vegetation. Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Reduce upland and channel erosion, and avoid fine sediment input to the Deschutes River and its tributaries.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Mitigate existing low DO and low pH
- Maintain septic systems.
- Reichel Creek has high nutrient concentrations. The creek should be evaluated for nutrient reduction opportunities that reduce nutrient loads to natural levels. Any future developments should evaluate management activities that reduce nutrient inputs from current conditions.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Reichel Creek.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Reichel Creek is recommended for highest restoration.

Reichel Lake

Physical and Biological Characterization

Reichel Lake has steep slopes and slide hazard areas mapped along its north shore. The entire lake is mapped as 100-year floodplain. High groundwater flood hazard areas are associated with Reichel Lake.

Reichel Lake has no surface water inlet. Its outlet is Reichel Lake Creek which drains the lake via a large wetland to the Deschutes River. Reichel Lake Creek is mapped as a shoreline of the state. Reichel Lake is an open water wetland with extensive associated wetlands to the south and southeast.

Reichel Lake shoreline jurisdiction may contain resident cutthroat trout, habitat for wood ducks, waterfowl concentrations, and prairie soils.

Within Reichel Lake and its associated wetlands, the vegetation is submersed and emergent. Upland, the riparian vegetation is forested, with large areas completely cleared for timber harvest. Native forested or shrub vegetation exists immediately around the lake, however, the vegetated buffer is very thin in areas. The lake's north shore has a wide area of intact forest cover. The east side of the lake is intact emergent wetland. The south and west sides of the lake exhibit extreme loss of forest cover, with minimal vegetated buffer left around the lake.

There is no data on water quality for Reichel Lake.

Shoreline Use Patterns

Land use within shoreline jurisdiction is primarily timber/ forest land and undeveloped. There is no impervious surface within shoreline jurisdiction. Current zoning is LTF. Reichel Lake is not designated under the existing SMP. Under current zoning regulations, there are approximately six lots within shoreline jurisdiction, none of which are developable.

There is one unpaved logging road within shoreline jurisdiction on the west side of the lake. Timber/forest harvest has occurred within shoreline jurisdiction. There is no defined shoreline access to Reichel Lake.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Reichel Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Reichel Lake is recommended for highest restoration.

Salmon Creek Basin

This basin is located primarily in WRIA 23. Please refer to the WRIA 23 chapter for further information.

Scatter Creek Basin

This basin is located primarily in WRIA 23. Please refer to the WRIA 23 chapter for further information.

Schneider Basin

This basin is located primarily in WRIA 14. Please refer to the WRIA 14 chapter for further information.

Spurgeon Creek Basin

Basin Overview

Spurgeon Creek basin is located in the eastern central portion of the County. It is approximately 6,662 acres in size. The majority of the basin, 6,134 acres, is located in WRIA 13. A small portion, 528 acres, is located in WRIA 11. As the majority of the Spurgeon Creek basin is located in WRIA 13, review of it is provided in this chapter. Water in this basin generally flows to the west towards the Deschutes River.

Spurgeon Creek basin contains 5.41 miles of SMA jurisdictional stream shoreline, broken into four reaches along Spurgeon Creek (Reach series name: DE-11) and 1.88 miles of SMA jurisdictional lake shoreline, broken into seven reaches along Sunwood Lakes (Reach series name: LSUN. See Appendix A).

Spurgeon Creek

Physical and Biological Characterization

Spurgeon Creek is a low gradient, unconfined, small tributary. Spurgeon Creek has a small area of steep slopes and slide hazard areas located on the left bank (south) of the lower stream. Spurgeon Creek has 100-year floodplain mapped for the length of shoreline jurisdiction. There are several areas of high groundwater hazard located along the creek.

Sunwood Lakes drains via an unnamed stream to Spurgeon Creek within its upper reaches. There are several unnamed tributaries which drain to Spurgeon Creek. These un-named streams are not mapped as meeting the shoreline jurisdiction requirements. However, the streams are likely to qualify as critical areas pursuant to TCC 24. There are wide associated wetlands for most of the creek, particularly in the upper reaches of shoreline jurisdiction.

Spurgeon Creek provides habitat for Chinook and coho salmon, reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

The riparian vegetation in the upper two reaches appears cleared for agriculture with little observable shoreline vegetation. The majority of the middle two reaches appear to have unmodified forested riparian vegetation. The right bank (N) has a few areas of wetland scrub-scrub brush fragmentation due to agricultural clearing and utilities. The lower portion of Spurgeon Creek is primarily fragmented vegetation with a narrow riparian buffer, due to agricultural clearing and residential land use.

Water quality in Spurgeon Creek is rated as 'good'. This rating is based on the creek meeting both parts of the fecal coliform standard in 2009/10 but faling part 2 in 2010/11. There was one turbidity violation in November 2009. Spurgeon Creek's nutrient levels are fairly low. Thurston County identifies non-point pollution from rural residential and agricultural activities, and encroachment on wetland and riparian areas for livestock grazing as potential threats to water quality. Spurgeon Creek is part of the total maximum daily load study of the Deschutes Watershed (TMDL) begun in 2003 by the Washington Department of Ecology to identify pollution sources and develop a plan to correct them (Thurston County Water Resources Monitoring Report, 2012). Spurgeon Creek is on the Ecology 2012 303(d) list of polluted waters for fecal coliform.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is undeveloped, residential, agricultural, commercial, and forest/ timber land. Impervious surfaces are limited to several road crossings and low density residential development.

Spurgeon Creek is not designated under the existing SMP. It is zoned Rural Residential Resource 1/5 in the lower three reaches, and McAllister Geologically Sensitive Area in the upper two reaches. Under current zoning regulations, there are approximately 160 lots within shoreline jurisdiction, 20 of which are developable. There are 15 vacant single lots, four subdividable vacant lots, and one parcel with the potential for additional infill.

Shoreline modifications include roads, culverts, and pipelines. Roads crossing shoreline jurisdiction with associated non-barrier culverts include Rich Road SE, Latigo Street, Rainier Road SE, and Spurgeon Creek Road SE. A non-barrier culvert is also located under the Chehalis Western Trail crossing. The Olympic pipeline crosses Spurgeon Creek just west of Rainier Road SE.

Public access is available via Rich Road SE, Latigo Street, Rainier Road SE, Spurgeon Creek Road SE, and the Chehalis Western Trail.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommends the following overall management activities for tributaries to the Deschutes River:

- Tributaries should achieve full mature riparian vegetation. This includes restoring and protecting natural wetland vegetation. Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.
- Reduce upland and channel erosion, and avoid fine sediment input to the Deschutes River and its tributaries.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Maintain septic systems.
- Reichel Creek has high nutrient concentrations. The creek should be evaluated for nutrient reduction opportunities that reduce nutrient loads to natural levels. Any future developments should evaluate management activities that reduce nutrient inputs from current conditions.

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Spurgeon Creek.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Spurgeon Creek is recommended for highest restoration.

Sunwood Lakes

Physical and Biological Characterization

Sunwood Lakes has two distinct basins, north and south, connected by a narrow stretch of water. Steep slopes lie along the southeast side of Sunwood Lakes. All of Sunwood Lakes lies within the McAllister Geologically Sensitive Area.

An unnamed stream drains Sunwood Lakes from the south basin to Spurgeon Creek. This unnamed stream is not mapped as meeting the shoreline jurisdiction requirements. However, the stream is likely to qualify as a critical area pursuant to TCC 24. The north basin has two large associated wetlands and the southern basin has a smaller associated wetland at the southern tip.

No critical or priority habitats or species are mapped within the Sunwood Lakes shoreline jurisdiction.

The riparian vegetation around Sunwood Lakes is primarily fragmented for residential use and is composed of a mix of forest cover and residential plantings. There are two reaches with intact forest cover belonging to the Sunwood Lakes Homeowners Association. The associated wetland at the north end of the north basin has been cleared in areas for a road and mining activity.

There is no water quality data for Sunwood Lakes. However, in response to an increase in aquatic weed growth, in 2011 the Homeowner's Association formed a Lake Committee committed to restoring the lake back to health. Chemical treatment of Sunwood Lakes for nuisance aquatic plants (pondweeds, lilypads, and any noxious species) began in spring 2012 and may continue for one to three years.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is residential and other-cultural (Homeowner's Association community space). The shoreline of Sunwood Lakes is a mix of residential areas and undeveloped areas managed by the Homeowner's Association. Impervious surfaces are associated with the low density residential development and a road. Primary water oriented uses are fishing, boating, and wildlife viewing.

Sunwood Lakes is currently designated Rural and zoned McAllister Geologically Sensitive Area. Under current zoning regulations, there are approximately 124 lots within shoreline jurisdiction, one of which is developable with the potential for additional infill.

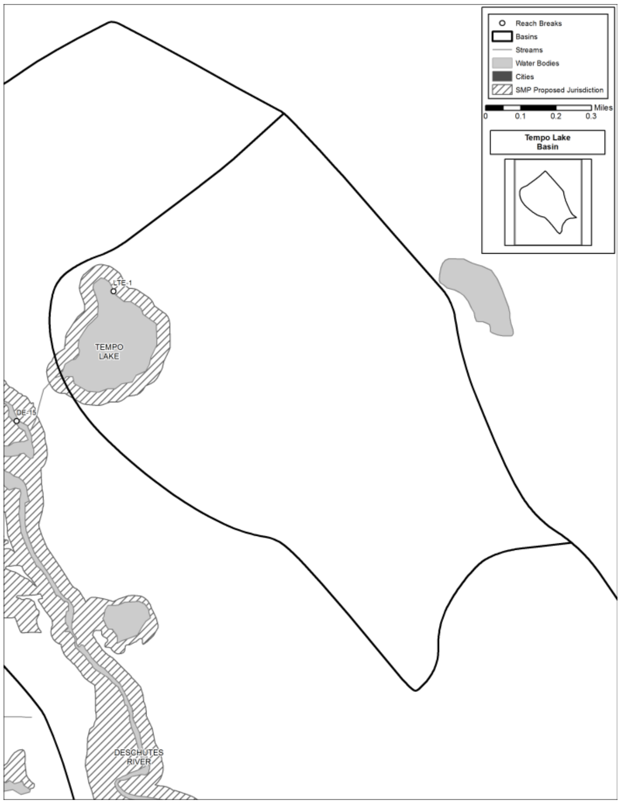
Shoreline modifications include a low number of docks and a footbridge to an island in the north basin. A dam is located at the north end of the north basin. There are two other culverts mapped within shoreline jurisdiction. The shoreline jurisdiction has also been modified by roads. Thrulake Circle SE bisects shoreline jurisdiction north of the north basin and south of the associated wetland. A mine is located in the associated wetland north of the dam. Several other roads enter shoreline jurisdiction but do not provide access to the water. Sunwood Lakes is surrounded by private property with no access points for the general public.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Sunwood Lakes.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Sunwood Lakes is recommended for restoration/development.

Tempo Lake Basin



Basin Overview

Tempo Lake basin is located in the center of the County. It is situated southeast of Lacey, Olympia, and Tumwater, north of Tenino, and northwest of Rainier. It is approximately 749 acres in size and is located entirely within WRIA 13. Water in this basin generally flows to the west towards the Deschutes River.

Tempo Lake basin contains 0.97 miles of SMA jurisdictional lake shoreline, in one reach (Reach series name: LTE. See Appendix A).

Tempo Lake

Physical and Biological Characterization

Tempo Lake is a human-made reservoir created in 1962 from an area that was originally an alder farm. The lake level is controlled by the residents of the Tempo Lake subdivision. The southeast side of Tempo Lake has steep slopes. All of Tempo Lake is mapped within the 100-year floodplain. Flood damage to Stedman Road occurred in 1996.

Tempo Lake does not have an inlet stream. It drains via an unnamed stream to the Deschutes River. A dam/control structure is located at the Tempo Lake outlet. The un-named stream is not mapped as meeting the shoreline jurisdiction requirements. However, this stream is likely to qualify as critical areas pursuant to TCC 24.

Prairie soils may exist on the southeast side of Tempo Lake.

Riparian vegetation has been cleared and fragmented for residential development around the lake. In places, the vegetation has been cleared to the waterline. There are submersed and emergent plants within the lake.

Tempo Lake Creek Outlet is on the Ecology 303d impaired waterbody list for temperature.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is residential, undeveloped, and other. Impervious surfaces are associated with residential development around the lake. Water oriented uses include fishing and wildlife viewing.

Current zoning is RL2/1. Tempo Lake is designated Rural under the existing SMP. Under current zoning regulations, there are approximately 60 lots within shoreline jurisdiction, four of which are developable as vacant single lots.

Shoreline modifications around Tempo Lake include roads, docks, culverts, and dams. Three roads cross into shoreline jurisdiction: Stedman Road SE (on the west side of the lake) Etude Loop SE (on the north side) and Tempo Lake Drive SE (on the south and east sides of the lake). Docks are present around the entire lake. Several culverts are mapped within shoreline jurisdiction along Tempo Lake Drive SE. The Tempo Lake outlet is a control structure/dam.

No public access sites are noted. Viewpoints may be obtained from the roads listed above. Tempo Lake is surrounded by private property with no access points for the general public. As noted, on the Tempo Lake Glade Association website, non-residents who wish to fish the lake must be accompanied by a resident.

Tempo Lake was established in 1961. The Tempo Lake Glade Association notes that the site was originally an alder farm. The reservoir and new name took place in 1962. The lake level is controlled by the residents of the Tempo Lake subdivision. Additional data on the Tempo Lake Community is available at the following website: http://tempolake.org/index.html.

Management Issues and Opportunities

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommends the following overall management activities for tributaries to the Deschutes River:

- Tributaries should achieve full mature riparian vegetation. Preserve existing riparian vegetation, and restore areas with young or no vegetation. Restoration plantings should include deciduous trees and shrubs, as well as conifer trees. Riparian vegetation will reduce stream temperature, DO, and pH.

- Reduce upland and channel erosion, and avoid fine sediment input to the Deschutes River and its tributaries.
- Emphasize stormwater infiltration on-site.
- Future developments should evaluate management activities that reduce nutrient inputs from current conditions.
- Maintain septic systems. Septic systems, particularly those near a water body, could be contributing excess nutrient loads. Continue and intensify existing management programs. Future efforts should examine and implement options to reduce nutrient loading from onsite sewage systems. These could include state-of-the-art onsite systems that should be considered in sensitive areas, such as Tempo Lake and its outlet creek.
- Current tributary nutrient loads contribute to violations of the DO and pH standards in the mainstem Deschutes River. Tempo Lake Creek has elevated nitrogen and should be evaluated for future nutrient reduction strategies.
- Full mature riparian vegetation should be established along tributaries to the Deschutes River. The Tempo Lake outflow contains the hottest tributary conditions due in part to solar heating of the lake surface.

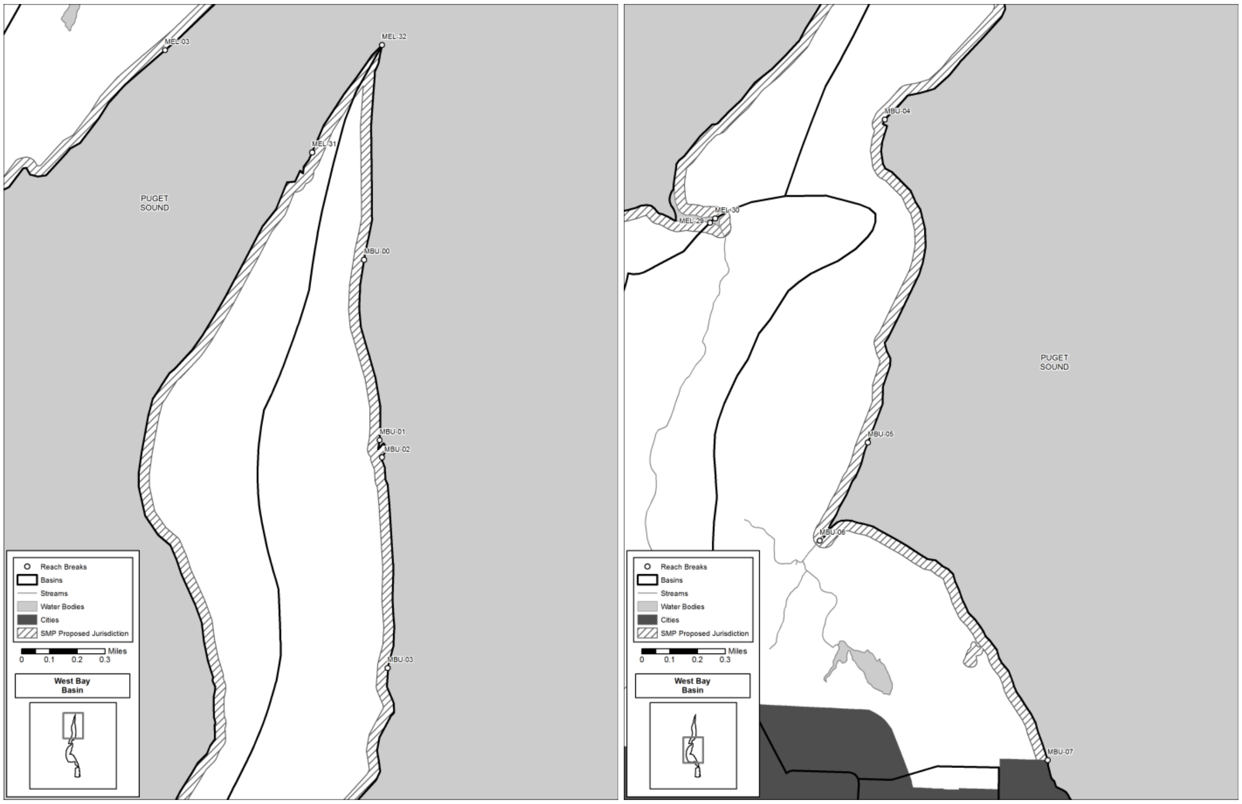
The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Tempo Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Tempo Lake is recommended for highest protection.

Waddell Creek Basin

This basin is primarily located in WRIA 23. Please refer to the WRIA 23 chapter for additional information.

West Bay Basin



Basin Overview

West Bay basin is located in the northern portion of the County on the Cooper Point Peninsula. It is approximately 1,933 acres in size and is located entirely within WRIA 13. West Bay basin contains 8.77 miles of SMA jurisdictional marine shoreline, broken into eight reaches (Reach series name: MBU. See Appendix A).

West Bay basin is bordered by Budd Inlet to the east, Schneider basin to the south, Green Cove Creek and Eld Inlet basins to the west. Water in this basin generally flows to the east towards Budd Inlet. The southern portion of this basin is located in the City of Olympia and urban growth area.

West Bay

Physical and Biological Characterization

West Bay is a mix of sand beach and sand and gravel beach. Sand flats are located within the inlets. A sand and gravel flat is located north of Tykle Cove. Net-shore drift is primarily left to right.

Most of West Bay's shoreline south of Silver Spit is mapped as containing steep slopes. Slide hazard areas are mapped from Tykle Cove south. Areas mapped with unstable slopes and past landslide areas occur over the length of West Bay's shoreline, but are larger and more common in the southern half. The marine shoreline is mapped as part of the 100-year floodplain.

West Bay basin contains Butler Creek that flows into the Puget Sound. Butler Creek is not mapped as meeting the shoreline jurisdiction requirements; however, it is likely to qualify as a critical area pursuant to TCC 24. The shoreline jurisdiction contains only one small associated wetland within the City of Olympia's Urban Growth Area. Estuarine emergent wetlands are scattered along the shoreline. Patchy salt marsh is mapped within Butler Cove. One pocket estuary is mapped south of Silver Spit.

West Bay's marine shoreline is mapped as supporting shellfish as well as smelt, rock sole, and sand lance. West Bay may provide habitat for purple martin, bald eagle, clams, and harbor seals. The following habitats are mapped along West Bay: open lagoon, delta, and estuarine intertidal habitat. Butler Cove is mapped as supporting sea-run and resident cutthroat trout. Patchy, non-floating kelp is mapped along the northern West Bay shoreline, north of Tykle Cove. No eelgrass is mapped within West Bay.

West Bay's marine riparian habitat has been extensively cleared and fragmented for residential development. In some areas the clearing extends to the shoreline. Few intact forested areas remain.

Outer Budd Inlet (within Thurston County jurisdiction) and Cooper Point are on Ecology's 2012 303(d) list of marine polluted waters for Dissolved Oxygen. Butler Creek, which drains to Butler Cove, is on Ecology's 2012 303(d) list of polluted waters for Fecal Coliform bacteria. The Washington Department of Health has classified the commercial shellfish growing areas within Budd Inlet as 'prohibited' (DOH, 2013). A contaminated site is located within shoreline jurisdiction just north of Butler Creek. This site is noted for contaminated soil, surface water, and ground water.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is residential and undeveloped with small areas of other-cultural, aquatic, and timber/forest land use. Impervious surfaces are associated with residential development and are highest at Cooper Point, south of Silver Spit, north of Butler Cove, and within the Olympia urban growth area. The area on the north side of Butler Cove may exceed 30% impervious surface. Water oriented use is primarily boating and recreation.

Under the existing SMP, West Bay is entirely designated Rural. West Bay is primarily zoned Residential LAMIRD 1/1 and Rural Residential Resource 1/5, with a small area of Residential LAMIRD 1/2. Within the City of Olympia's Urban Growth Area, zoning is Single Family Residential 4, Residential 1/5, and Residential 4-8. Under current zoning regulations, there are approximately 323 lots within shoreline jurisdiction, 31 of which are developable. Nineteen parcels are vacant single lots, seven parcels are subdividable vacant lots, and five parcels have the potential for additional infill.

Shoreline modifications along West Bay include docks, armoring, and roads. Docks are spread along much of West Bay, with concentrations at Silver Spit, Tykle Cove, and Butler Cove. The majority of the shoreline in West Bay is armored. Bulkheads cover roughly 75% of the marine shoreline. Many of the bulkheads have associated coastal fill behind them. Public roads include: Cooper Pt Rd NW, Athens Beach Dr NW, Country Club Dr NW, French Loop NW, 25th Avenue NW. Ten private roads enter shoreline jurisdiction along West Bay.

Informal public access to the shoreline jurisdiction is available via several public roads. These roads enter shoreline jurisdiction but do not provide access to the water (see shoreline modifications above and Appendix A).

West Bay is adjacent to Budd Inlet. Ecology is assessing Budd Inlet as a toxic clean-up site. Budd Inlet contains dioxin contamination, thought to have resulted from historical industrial use of shore areas or stormwater runoff. Budd Inlet is part of the Governor's Puget Sound Initiative and a high priority area for Ecology.

Management Issues and Opportunities

The <u>Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington</u> (Herrera Environmental and TRPC, 2005) identified Tykle Cove south through Butler Cove as containing high priority areas for forage fish habitat restoration/protection due to the presence of glacial outwash with many landslides (including deep seated) moderate bluff, and littoral connection (See Appendix A). West Bay is the most heavily developed and heavily armored shoreline within Thurston County, with the exception of Squaxin Passage. Restoration of forage fish habitat is limited along West Bay. Opening up Capitol Lake and making the sediment supply from the Deschutes River available to the littoral zone of Budd Inlet is a regional restoration project that would significantly improve the West Bay nearshore environment.

The <u>Juvenile Salmonid Nearshore Project Selection Tool</u> (Squaxin Island Tribe, 2009) identified the majority of the West Bay marine shoreline, from the Cooper point area, south past Tykle Cove, and through Butler Cove as beneficial to all juvenile salmon and appropriate for restoration (See Appendix A).

<u>Squaxin Island Tribe Budd Inlet Restoration and Conservation Planning document, 2010:</u>
Limited opportunities exist for restoration because this region is heavily modified by shoreline armoring.

- Target Butler Cove for protection and restoration
    - In Butler Cove, actively pursue restoration opportunities including planting riparian vegetation and removal or softening of armored shorelines
    - Target the Butler watershed for upstream restoration
- Target low energy areas for bulkhead removal at prioritized sediment sites
- Pursue restoration opportunities at creek mouths and pocket estuaries

<u>Juvenile Salmonid Approach to Prioritization for Restoration and Conservation of Budd Inlet</u> (Squaxin Island Tribe, 2010) identified specific management suggestions for these sites (See Table 6.4 below and Appendix A).

Table 6.10. Recommended Restoration and Conservation Projects in West Bay (Squaxin Island Tribe, 2010)

Location Name	Specific Projects
Cooper Point to north of Butler Cove	• Bulkhead removal • Riparian habitat creation • Overwater structure removal
Butler Cove	• Create a restoration plan • Create stewardship district • Create riparian habitat • Remove bulkheads • Remove fill • Replace culvert

The Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology 2012) recommended:

- Identify and mitigate fecal coliform sources to Budd Inlet.
- Stormwater controls should be evaluated for tributaries to Budd Inlet.

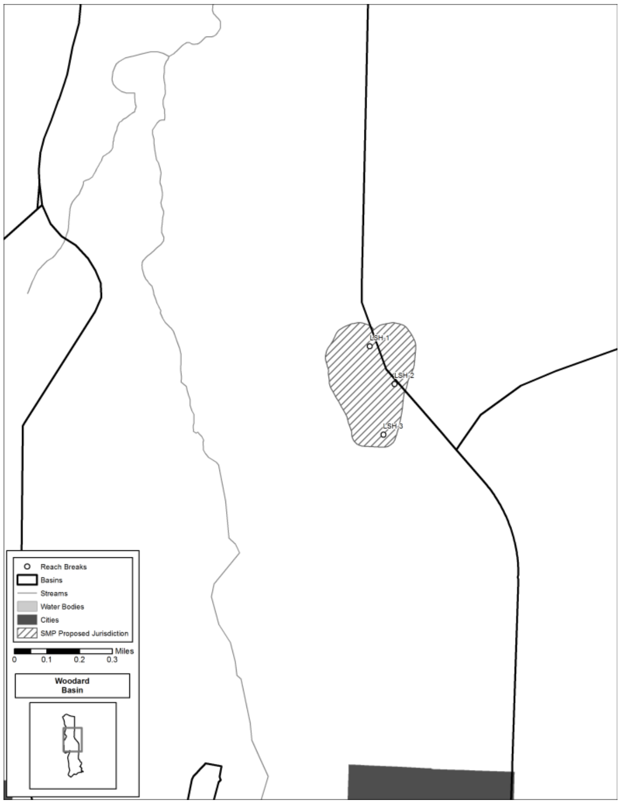
The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites along West Bay.

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). (See Appendix A).

Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	None	None	None
Protect	None	None	None
Restore High	None	None	None
Restore	North Butler Cove	None	Cooper Point south through Silver Spit to MBU-02; and Butler Cove
Enhance High	None	None	None
Enhance	Entirety of West Bay with the exception of north Butler Cove	Cooper Point south to Butler Cove	Just north of City of Olympia within the UGA

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
West Bay is recommended for restoration/development.

Woodard Basin



Basin Overview

The Woodard basin is located in the northeast corner of the county. It is 4,478 acres in size and is located entirely within WRIA 13. Woodard Creek flows north into Henderson Inlet.

Woodard basin contains 0.66 miles of SMA jurisdictional lake shoreline, in three reaches (Reach series name: LSH. See Appendix A).

Shincke Lake

Physical and Biological Characterization

Shincke Lake is an open water/aquatic bed wetland of approximately 25.9 acres with no surface water inlets or outlets. It may provide habitat for wood ducks. Vegetation within the lake is aquatic and emergent. On the northern side of the lake, upland vegetation is primarily untouched forest cover. On the southern half of the lake, forest cover has been fragmented and cleared for agriculture, residential development, residential plantings, and a road. Patches of forest cover remain. There is no water quality data for Shincke Lake.

Shoreline Use Patterns

Current land use within shoreline jurisdiction includes residential, undeveloped, and transportation. The Chehalis Western Trail goes across the northeast corner of the lake. Residential development is low density with extensive loss of forest cover around the southern half of the lake.

The current zoning is RRR 1/5, Rural Commercial, and LAMIRD 1/2. Shincke Lake is not designated under the current SMP. Under current zoning regulations, there are approximately 21 lots within shoreline jurisdiction, three of which are developable. Two parcels are vacant single lots, one parcel is a subdividable vacant lot, and zero parcels have the potential for additional infill.

Shoreline modifications include the Chehalis Western Trail (converted from a railroad), 36th Avenue NE, a culvert located at 36th Avenue NE, and impervious surfaces associated with residential development.

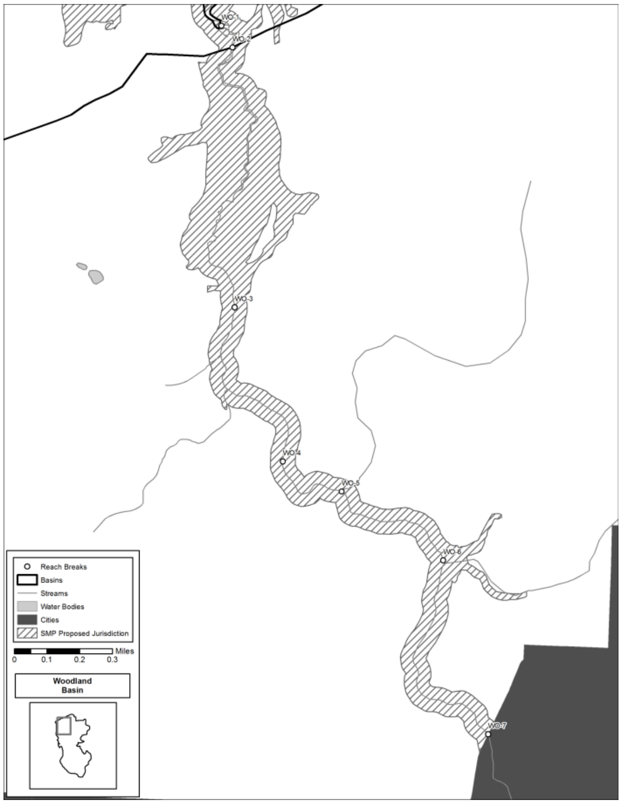
View and/or direct public access to the shoreline jurisdiction may be obtained from the Chehalis Western trail and from 36th Avenue NE.

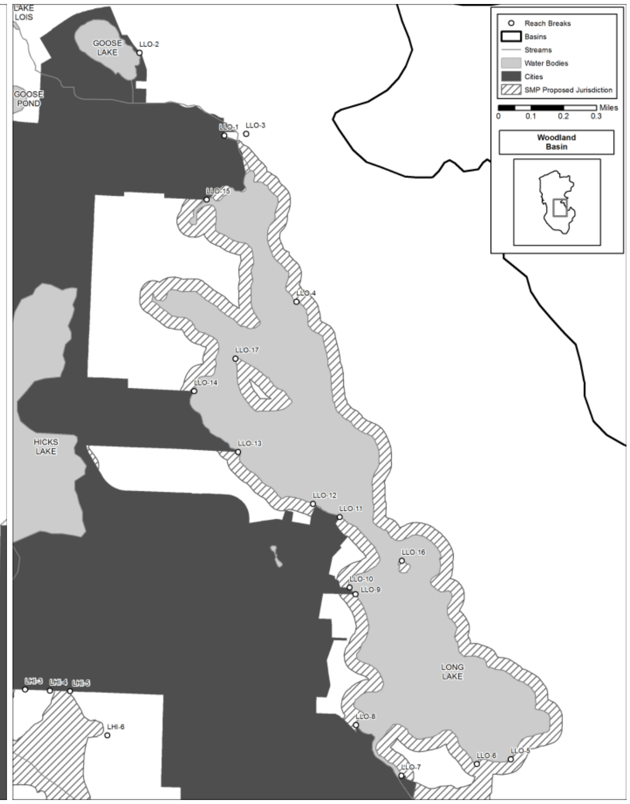
Management Issues and Opportunities

Henderson Inlet Watershed Characterization Report (Thurston County, 2007) identified three wetland sites as potential restoration or protection locations (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
The northeast corner of Shincke Lake is recommended for highest protection. The remainder of Shincke Lake is recommended for restoration.

Woodland Basin





Basin Overview

Woodland basin is located in the central-northeast portion of the County. The basin is approximately 18,877 acres in size. The majority of the basin, 18,369 acres, is located in WRIA 13. A small portion, 508 acres, is located in WRIA 11. As the majority of the Woodland basin is located in WRIA 13, review of it is provided in this chapter.

Woodland Creek flows north into Henderson Inlet. The watershed is relatively flat with extensive wetlands between the lakes. The majority of this basin is located in either the City of

Lacey or the Lacey Urban Growth Area. The basin also contains small portions of unincorporated Thurston County as well as the City of Olympia and Olympia Urban Growth Area.

The basin still contains substantial areas of undeveloped forests, though the dominant land use is suburban-density residential development. Residential subdivisions are spreading rapidly primarily in the southern portion of the basin in the City of Lacey in the areas around the headwater lakes and near the mouth of the stream basin.

Woodland basin contains 3.31 miles of SMA jurisdictional stream shoreline along Woodland Creek, in five reaches (Reach series name: WO) and 15.51 miles of SMA jurisdictional lake shoreline, around four lakes. Woodland basin's SMA jurisdictional lakes are: Southwick Lake (one reach, reach series name: LSO) Pattison Lake (seven reaches, reach series name: LPA) Hicks Lake (four reaches, reach series name: LHI) and Long Lake (13 reaches, reach series name: LLO). See Appendix A.

Woodland Creek

Physical and Biological Characterization

Woodland Creek is a low gradient, primarily confined, small tributary to Henderson Inlet. The creek is a geologically sensitive area surrounded by steep slopes for the majority of its length. The 100-year flood plain is mapped along the entire length of Woodland Creek. High ground water flood hazard areas are associated with the creek in several places.

Woodland Creek drains north from a series of four lakes (Hicks, Pattison, Long, and Lois) to Henderson Inlet. Several unnamed tributaries feed Woodland Creek. These tributaries are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. The lower three reaches contain extensive associated wetlands, including a small area of estuarine wetland at the stream outlet. The upper reaches contain riverine associated wetlands.

Woodland Creek is mapped as supporting chum, coho, largemouth bass, sea-run cutthroat, winter steelhead, and largemouth bass. The creek may provide habitat for mink, and wood duck. The creek is also mapped as supporting an estuary zone and coastal salt marsh (near the creek mouth).

The majority of the Woodland Creek riparian vegetation appears unmodified. There are some areas of clearing on both banks of the upper reach for residential development. The mid-reaches exhibit some clearing for agriculture, but there a sizable forested riparian buffer remains. The lower reaches have areas of remaining forest interspersed with areas cleared for agriculture and residential development.

Woodland Creek is on the Ecology 2012 303(d) polluted waters list for temperature. It is also listed as a Category 4C (impaired by non-pollutant) for instream flow. In Henderson Inlet Watershed, a Total Maximum Daily Load (TMDL) study for Fecal Coliform Bacteria, Dissolved

Oxygen, pH, and Temperature was completed in 2006 by the Washington Department of Ecology.

Woodland Creek is categorized with ‘fair’ water quality. This rating is due to Woodland Creek failing both parts of the fecal coliform standard in 2009/10 but meeting both in 2010/11. This creek is also listed on the 303d list for violations of fecal coliform and dissolved oxygen, and temperature in the upper reach. Woodland Creek’s major issues are: urban stormwater discharges contributing to water quality problems, and non-point pollution from failing on-site septic systems and livestock.

In 2000, bacterial pollution caused a shellfish harvesting area downgrade and triggered a legal requirement to form a shellfish protection district. In 2001, Thurston County created the Henderson Shellfish Protection District and a stakeholder committee was convened to consider the actions needed to improve water quality and reopen the shellfish beds. This report was completed in 2003 and can be found at: www.co.thurston.wa.us/shellfish. Some of the resulting pollution reduction activities included: construction of stormwater treatment facilities, farm planning and installation of agricultural best management practices, installation of pet waste collection stations, septic system inspections and repairs, and public education. In 2005 the Thurston County Board of Health created an “area of special concern” called the Henderson Watershed Protection Area, which established inspection requirements for all on-site sewage systems within the area. The requirements went into effect in this area in 2007. In 2010, improved marine water quality in Henderson Inlet resulted in a 240 acre commercial shellfish harvest area upgrade to approved status.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is agricultural, residential, undeveloped, and timber/forest land. Woodland Creek originates in a lakes system in the City of Lacey and its urban growth area in the upper basin. The lake chain empties into a series of wetlands on the Saint Martin’s Abbey property and crosses under 1-5 within the City of Lacey. Thurston County shoreline jurisdiction of Woodland Creek begins where the creek flows north from the City of Lacey. Impervious surfaces within County jurisdiction are limited to areas of low density residential development and roads. They are most concentrated on the left bank (west) of the uppermost reach, and on the right bank (east) of the most downstream reach. Water oriented uses include fishing and wildlife viewing.

Woodland Creek is currently designated Conservancy. Zoning in the upper reaches is primarily Low Density Residential 0-4 with a small area of Institutional Open Space. The mid and lower reaches are primarily Rural Residential Resource 1/5, with an area of Public Parks Trails and Preserves in the wide area of associated wetland, and a small area of Residential LAMIRD 1/2 on the right bank (east) of the middle reach. Under current zoning regulations, there are approximately 123 lots within shoreline jurisdiction, 12 of which are developable. There are seven vacant single lots, two subdividable vacant lots, and three parcels with the potential for additional infill.

Shoreline modifications along Woodland Creek include roads, bridges, culverts, and a dam. Non-barrier culverts are located under Johnson Point Road SE where it parallels the creek, Johnson

Point Road SE where it crosses the creek, Hawks Prairie Road NE to the east of the Creek, Pleasant Glade Road NE, and the Draham Street NE crossing. Mackie Dam is located in a lower reach on the right bank (E). There are bridges located at the crossing of Hawks Prairie Rd NE and Pleasant Glade Road NE where these roads cross Woodland Creek.

Public access is available via the following roads: Johnson Point Road NE, Hawks Prairie Road NE, Pleasant Glade Road NE, and Draham Street NE. Public access is also available via Woodland Creek Wetlands Park (a County Park) and Pleasant Glade Park (an undeveloped park owned by the City of Lacey).

Management Issues and Opportunities

Henderson Inlet Watershed Characterization Report (Thurston County, 2007) identified 41 sites as potential restoration or protection locations (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
The lowest reach of Woodland Creek is recommended for highest protection. The remainder of Woodland Creek is recommended for development/restoration.

Southwick Lake

Physical and Biological Characterization

Southwick Lake is located entirely within the McAllister Geologically Sensitive Area. It is within a wellhead protection area, high groundwater hazard area, and entirely within the 100-year floodplain.

Southwick Lake is mapped as an open water/aquatic bed/emergent wetland with no mapped surface water inlet or outlet. The lake does not have any associated wetlands.

Southwick Lake may contain western gray squirrel and wood duck breeding habitat. Prairie soils are mapped around Southwick Lake. This basin contains habitat for mountain quail, mink, waterfowl concentrations, and bald eagles. The basin contains multiple oak habitat areas including: oak-conifer forest, oak woodlands, oak dominated, conifer deciduous, and urban canopy woodlands.

Riparian vegetation is submersed and emergent within the wetland and forested to shrub upslope of the wetland. The area adjacent to the wetland contains unmodified forest cover. Some forest clearing has occurred in the outer shoreline jurisdiction, and this area is now covered in shrubs.

There is no data on water quality for Southwick Lake.

Shoreline Use Patterns

Southwick Lake is located almost entirely within the City of Lacey, with only a short reach within the Lacey UGA in Thurston County shoreline jurisdiction.

Land use within the City of Lacey's shoreline jurisdiction is residential, transportation, and undeveloped. Land use within Thurston County's portion of shoreline jurisdiction is undeveloped. The zoning is Low Density Residential 0-4. It is currently designated Conservancy under the existing SMP. Under current zoning regulations, there is approximately one parcel within shoreline jurisdiction, which is not developable.

There are no shoreline modifications within the Thurston County shoreline jurisdiction. Within the City of Lacey's shoreline jurisdiction, Ruddell Road SE runs through shoreline jurisdiction. Residential development and associated impervious surfaces are located along the west side of the lake. The native forest cover has been fragmented along the west and south sides of the lake for residential development.

There is no public access to Southwick Lake within the Thurston County shoreline jurisdiction.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Southwick Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Southwick Lake is recommended for development/restoration.

Pattison Lake

Physical and Biological Characterization

Pattison Lake is approximately 270 acres, with a mean depth of 13 feet, and a maximum depth of 22 feet, located at approximately 154 feet elevation. Decades ago, placement of fill material for a railroad divided the lake into a north and south basin. Pattison Lake is second in a series of four lakes that begins with Hicks Lake and ultimately flow into Woodland Creek, a tributary stream to Henderson Inlet. Hicks Lake drains into Pattison, which drains to Long Lake, which drains to Lois Lake, and then out to Woodland Creek (Thurston County Water Resources Report, 2012)

Pattison Lake has steep slopes along the western side of both north and south basins, and steep slopes along the south and lower east side of the southern basin. Pattison Lake is located entirely with the McAllister Geologically Sensitive Area and 100-year floodplain. The north basin is located within a wellhead protection area.

Pattison Lake is fed in its north basin by a stream draining south from Hicks Lake through a large associated wetland. The wetland is associated with the Hicks Lake shoreline jurisdiction but not Pattison Lake's jurisdiction. Pattison Lake's outlet is a stream flowing north out of the north shoreline of the southern basin through an associated wetland into Long Lake. In past years, blockages to the outlet channel have resulted in elevated lake levels and flooded docks and yards (Thurston County Water Resources Report, 2012). An area of potential channel migration zone is mapped along Pattison Lake's outlet. All of Pattison Lake is mapped as a wetland. Pattison Lake has two large associated wetlands: off the southeast side of the southern basin; and on the north side of the south basin surrounding the lake outlet stream.

Pattison Lake may provide habitat for bald eagle, wood ducks, and waterfowl concentrations. Prairie soils and oak habitat are mapped within shoreline jurisdiction. Pattison Lake is stocked with rainbow trout by WDFW.

The riparian vegetation around Pattison Lake has been extensively cleared and fragmented by residential use with the exception of the areas containing large associated wetlands. In the areas of residential development, forest cover has been cleared to the water in places, and there are many residential plantings.

Pattison Lake has 'fair' water quality. At times, algae blooms, filamentous algae growth, and aquatic plant growth impair water clarity and fishing and boating activities, particularly in the south basin. In general, water quality is better in the north basin than it is in the south basin. In the south basin, abundant nutrients have caused toxic algae blooms, which in 2011 were found to be above the state recreational limit (Thurston County Water Resources Report, 2012).

Shoreline Use Patterns

Land use within shoreline jurisdiction is primarily residential, with small areas of undeveloped, recreation, and open space use. Primary lake uses are fishing, swimming, and boating.

Residential development lines both lake basins although appears slightly more dense around the north basin. The south basin contains two areas with associated wetland that remain undeveloped, located on the north and east side of the basin. Impervious surfaces associated with residential development may exceed thirty percent of the shoreline jurisdiction around the north basin.

Within Thurston County shoreline jurisdiction, all of Pattison Lake is zoned McAllister Geologically Sensitive Area. Also within the County jurisdiction, Pattison Lake is designated Rural under the existing SMP with the exception of several areas containing large associated wetlands which are designated Conservancy. Under current zoning regulations, there are approximately 257 lots within shoreline jurisdiction, 20 of which are developable. Eight parcels are vacant single lots, four parcels are subdividable vacant lots, and eight parcels have the potential for additional infill.

Shoreline modifications include a railroad, docks, armoring, a culvert, and roads. Pattison Lake is divided into two basins, north and south, by placement of fill material for a railroad. Numerous docks and shoreline armoring are present along residential areas within both lake basins. One culvert is located within shoreline jurisdiction at the intersection of Mullen Road SE and the tributary stream to Pattison Lake. Mullen Road SE and Atchinson Drive SE cross into shoreline jurisdiction but do not provide direct access to the water. Public access is available via a WDFW boat launch located on the north shoreline of the south basin.

Management Issues and Opportunities

The Deschutes Watershed Characterization Report (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Pattison Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Pattison Lake is recommended for restoration/development.

Hicks Lake

Physical and Biological Characterization

Hicks Lake is a relatively small lake of approximately 160 acres, with a mean depth of 18 feet and a maximum depth of 35 feet. It is located at approximately 162 feet elevation. Hicks Lake is first in a series of four lakes (Hicks, Pattison, Long, and Lois Lakes) which ultimately discharge via Woodland Creek to Henderson Inlet. There is an extensive associated wetland on the south side of Hicks Lake (Thurston County Water Resources Report, 2012). The south side of this associated wetland is the only portion of the Hicks Lake shoreline jurisdiction within Thurston County jurisdiction and discussed in this document. The remainder of the lake and wetland fall within the City of Lacey.

The Hicks Lake associated wetland lies entirely within the McAllister Geologically Sensitive Area. It is located within a wellhead protection area and within the 100-year floodplain.

An unnamed tributary stream flows south out of this scrub-shrub wetland to feed Pattison Lake. This stream is not mapped as meeting the shoreline jurisdiction requirements. However, this stream is likely to qualify as critical areas pursuant to TCC 24.

Hicks Lake is stocked with rainbow and triploid rainbow trout by WDFW. The Hicks Lake's associated wetland may contain wood duck habitat. Prairie soils are mapped within shoreline jurisdiction.

Riparian vegetation is primarily shrub, with areas of emergent and forested vegetation. The riparian vegetation is unmodified for the majority of the wetland with the exception of the eastern edge which contains some clearing for residential development.

Hicks Lake water quality is categorized as 'good' with phosphorus concentrations below state standards. Major issues for Hicks Lake water quality are low water levels during summer months, especially during periods of drought such as in 2001. High lake levels can also occur during higher than normal winter rainfall conditions. Extreme high lake levels causing flooding of some lakeshore structures. The outlet channel is on private property, is not maintained, and restricts the flow of water out of the lake. High density residential land use, storm water discharges, and other non-point pollution in this urban setting could degrade water quality if measures are not taken to prevent it (Thurston County Water Resources Report, 2012).

Shoreline Use Patterns

Existing land use within shoreline jurisdiction (associated wetland in the County) is primarily undeveloped, other-cultural, and residential. The entire wetland is undeveloped with the exception of the eastern fringe, where clearing, impervious surfaces, and structures have occurred for a few residences. At least half of the wetland area within Thurston County's shoreline jurisdiction is part of the Mullen Habitat Area, an undeveloped natural area owned by the City of Lacey.

Current zoning is Low Density Residential 0-4. The existing shoreline designation is primarily Conservancy, with the residential area designated Rural. Under current zoning regulations, there are approximately ten lots within shoreline jurisdiction, two of which are developable. One parcel is a vacant single lot, and one parcel has the potential for additional infill.

Residential development and associated vegetation clearing along the wetland's eastern border is the only shoreline modification.

Public Access is available via Mullen Road SE in the Mullen Road Habitat Reserve (undeveloped) owned by the City of Lacey. The habitat reserve is currently undeveloped. The City of Lacey plans to keep the habitat reserve undeveloped or minimally developed with passive or interpretive trails and wildlife observation areas.

Management Issues and Opportunities

<u>The Deschutes Watershed Characterization Report</u> (Thurston County, 2011) identified potential riparian, wetland, and floodplain restoration or protection sites around Hicks Lake.

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
Hicks Lake is recommended for restoration/development.

Long Lake

Physical and Biological Characterization

Long Lake is approximately 330 acres, with a mean depth of 12 feet, and a maximum depth of 21 feet. Long Lake is located at roughly 150 feet elevation. Long Lake has two major basins, a north and south basin, which are connected by a narrow, shallow channel. Long Lake is third in a series of four lakes (Hicks Lake, Pattison Lake, Long Lake, and Lois Lake) which drain to Woodland Creek (Thurston County Water Resources Report, 2012).

Long Lake lies within the McAllister Geologically Sensitive Area. Steep slopes are present around the west side of the southern basin, and the lower east side of the northern basin. All of Long Lake and its associated wetlands fall within the 100-year floodplain. The associated wetlands at the north end of the lake also lie within high groundwater hazard areas.

Long Lake's inlet is at the south end, and its outlet is at the north end. The outlet stream is Woodland Creek which flows to Henderson Inlet. The outlet stream is likely to qualify as a critical area pursuant to TCC 24. The lake is also in continuity with the shallow groundwater (Thurston County Water Resources Report, 2012). The entire lake is mapped as wetland. In addition, there are large associated wetlands at the south end of the south basin and at the north end of the north basin.

Long Lake may contain rainbow trout, and wood duck habitat. Oak habitat and prairie soils are mapped within shoreline jurisdiction.

The riparian vegetation has been substantially modified around the majority of the lake due to residential development. In residential areas, forest cover has been fragmented and cleared in places to the lakeshore, and residential plants are present. Within the associated wetlands, riparian vegetation is still intact.

Long Lake's water quality is rated as 'fair'. The lake experiences bluegreen algae blooms and many areas of the lake have emergent aquatic plants that interfere with recreational activities. The north basin generally has better water quality than the south basin. Two invasive aquatic plants, Eurasian water milfoil and fragrant waterlily are present in the lake. These plants are being controlled through a combination of chemical and non-chemical methods (Thurston County Water Resources Report, 2012). Long Lake is on the Ecology 2012 303(d) polluted waters list for total phosphorus, 2,3,7,8-TCDD in fish tissue, and PCB in fish tissue. Long Lake is also listed as a Category 4C for impairment by a non-pollutant – Invasive Exotic Species. Woodland Creek is on the 303(d) polluted waters list for temperature and Category 4C (impaired by non-pollutant) for instream flow.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential, with some areas of undeveloped, parks, aquatic, open space, commercial, industrial, and other land use. Dense residential development exists around the lakeshore and impervious surfaces may exceed 30% in some reaches. Long Lake's shoreline jurisdiction is primarily within Thurston County; however, there are sections of Long Lake's shoreline that fall within the City of Lacey. The primary lake uses are fishing, boating, swimming, and water sports.

Current zoning is Low Density Residential 0-4, Moderate Density, Light Industrial, and Open Space Institutional. Under the existing SMP, Long Lake is designated entirely Rural with the exception of the associated wetland area at the south end of the southern basin, which is designated Conservancy. Under current zoning regulations, there are approximately 378 lots within shoreline jurisdiction, 15 of which are developable. Four parcels are vacant single lots, nine parcels are subdividable vacant lots, and two parcels have the potential for additional infill.

A railroad crosses Woodland Creek at the northern end of Long Lake's shoreline jurisdiction. The associated wetland extends under the railroad, connecting Goose Lake (as a wetland) to Long Lake.

Numerous roads enter shoreline jurisdiction but do not provide direct access to the water. A bridge along Holmes Island Road SE connects the mainland to Holmes Island. Numerous docks are present along Long Lake's shoreline. Five private boat launches are located around Long Lake, primarily along the north basin.

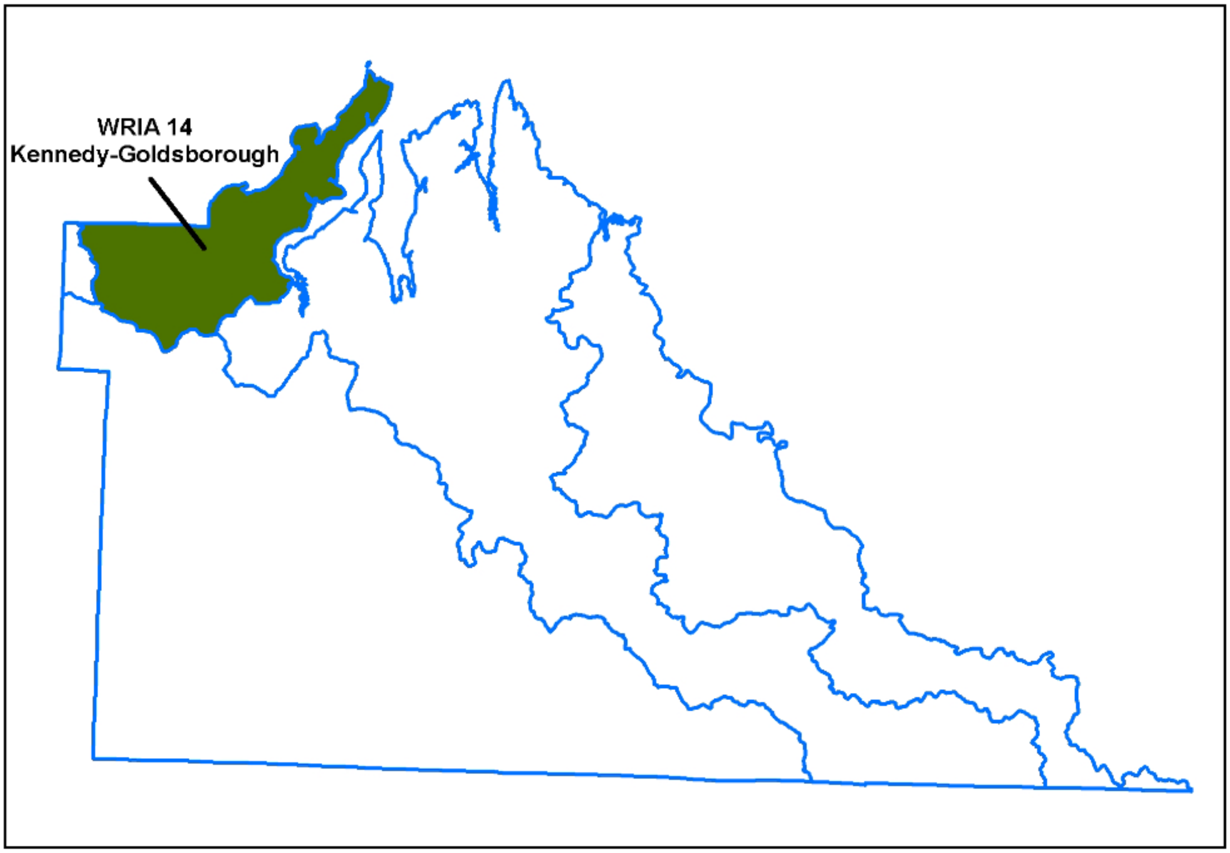
Public Access to Long Lake may be obtained from a WDFW boat launch located on the west side of the north lake basin, and through the City of Lacey Long Lake Park located just north of the WDFW boat launch. Public access to the associated wetlands located at the north end of Long Lake's shoreline jurisdiction is available through the City of Lacey's Woodland Creek Park.

Management Issues and Opportunities

Henderson Inlet Watershed Characterization Report (Thurston County, 2007) identified seven sites as potential restoration or protection locations (See Appendix A).

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
The main body of Long Lake is recommended for restoration/development. The wetland complex at the north end of Long Lake (including Goose Lake) is recommended for development/restoration.

7 WRIA 14 (KENNEDY GOLDSBOROUGH)



Map 7.1. WRIA 14 (Kennedy-Goldsborough)

After an initial introduction to the WRIA as a whole, the data provided in this chapter are divided into subsections by basins and SMA jurisdictional waterbodies located within the Kennedy Goldsborough Water Resource Inventory Area (WRIA 14). Each subsection includes information regarding water bodies, physical and biological characterization, shoreline land use, and management options.

WRIA 14 Characteristics

WRIA 14 covers about 381 square miles of the southwest terminus of Puget Sound. Approximately 48 square miles are located within Thurston County. Nine percent of the County is located within this WRIA. The majority of the Thurston County portion of WRIA 14 is located on what is known as the Steamboat Island Peninsula. WRIA 14 also contains forested hills in the Black Hills. SMA lake shorelines within WRIA 14 are: Summit Lake, Unnamed Pond 1, and Unnamed Pond 2. Kennedy Creek is the only SMA streams in WRIA 14. In addition, the SMA covers the marine shoreline surrounding Steamboat Island Peninsula, including Oyster Bay and Totten Inlet to the west, Squaxin Passage to the north, and Eld Inlet and Mud Bay to the east.

LANDSCAPE ANALYSIS

Process Controls

Geology (Maps 11 and 12)

The hills in the southern half of WRIA 14 are composed primarily of erosion resistant basalt flows and flow breccias. The river valleys of Kennedy Creek, Schneider Creek, and Perry Creek, as well as the Steamboat Island Peninsula are composed of glacially derived deposits. The majority of Steamboat Island Peninsula is covered by impermeable glacial till.

Topography (Map 10)

The topography in WRIA 14 is divided into two distinct types. North of Highway 101 on Steamboat Island Peninsula, the topography is relatively flat with low elevations up to 200 feet. South of Highway 101, the topography is composed of low hills, with elevations up to 2000 feet in the southernmost section of WRIA 14.

Land Use/Land Cover

Current Land Use (Map 39 and 41b)

The predominant land uses in WRIA 14 are: Single family residential (20 %) Designated Forest Land (27%) and Undeveloped Land (37 %). The predominant zoning designations in WRIA 14 are: Long Term Forestry (47 %) and Rural Residential - One Dwelling Unit per Five Acres (45 %).

The majority of WRIA 14's marine shoreline and Summit Lake's shoreline has been developed for residential use. 2006 aerials reflect that large portions of the marine and Summit Lake shoreline have been armored and the vegetation adjacent to the shoreline has been modified.

Projected Future Use (Map 41)

TRPC analysis of future land use within this WRIA reflects that this area will experience increased residential and commercial development. Increased development will primarily occur on the Steamboat Island Peninsula, along Mud Bay, around Summit Lake, and Highways 101 and 8. The majority of the area south of Highway 101 will remain in forestry use. Please refer to specific basins for additional data.

Land Cover (Map 25)

The predominant land covers in WRIA 14 are: evergreen forest (44.2%), mixed forest (15.5%), and scrub/shrub (13.5%). There is 3.7% low intensity development land cover.

Landscape Process Important Areas and Alterations

Coastal

Important Areas (Map 14)

Drift cells are important areas for the movement of beach sediment. Drift cells in Oyster Bay and Totten Inlet are primarily Right to Left. Drift cells in Eld Inlet are primarily Left to Right. The bottom of Oyster Bay and Mud Bay are both areas of no appreciable drift. Gallagher Cove, Sanderson Harbor, Frye Cove, and Young Cove have undefined drift.

Coastal landslides are the primary contributor of sediment to beaches and net shore-drift systems. Coastal landslides occur on bluffs with unstable slopes and past landslides. The majority of WRIA 14 marine shoreline contains unstable slopes. Past landslides have been mapped south of Burns Point, along Elizan Beach, in Gallagher Cove and north, the tip of the Steamboat Island Peninsula with large areas around Hunter Point, north of Frye Cove, and north of Sunrise Beach.

Rivers and streams influence the nearshore in numerous ways, including salinity changes, sediment supply, altered littoral drift, and habitat formation. In WRIA 14, there are seven unnamed streams that drain into Totten and Eld Inlets. Perry Creek drains to Mud Bay. Schneider Creek and Kennedy Creek drain to Oyster Bay, although their river deltas are not within Thurston County jurisdiction.

River deltas are process intensive areas for beach processes and fluvial processes. The largest deltas in WRIA 14 are Mud Bay and Oyster Bay.

Estuaries, tidal inlets, tidal marshes, and lagoons are process intensive areas for circulation and beach processes. All of Totten Inlet and Eld Inlet are estuaries. There are eight pocket estuaries mapped within WRIA 14. Tidal inlets in WRIA 14 include Burns Cove, Gallagher Cover, Sanderson Harbor, Frye Cove, Young Cove, Mud Bay, as well as numerous smaller unnamed inlets. Estuarine emergent wetlands are scattered along both shorelines of the Steamboat Island Peninsula, with concentrations in the coves.

Riparian vegetation areas are process intensive areas for coastal erosion, water quality, and organic debris. Please see the Large Woody Debris Important Areas and Alterations section within this chapter for details.

Indicators of Alteration (Map 15)

Shoreline armoring reduces sediment supply to the beach. Shoreline armoring is extensive along Steamboat Island peninsula, particularly around the tip and along Eld Inlet. More than 50% of the Eld Inlet (west) shoreline appears armored, versus roughly 20% of the Totten Inlet shoreline. Much of the armoring coincides with areas of coastal fill.

Overwater structures such as docks and marinas impact the nearshore through alteration of light, wave energy, sediment, and water conditions. Docks are present on both sides of the Steamboat Island Peninsula, though in more abundance along Eld Inlet. There are concentrations of docks along Elizan Beach, Gallagher Cove, Steamboat Island, Edgewater Beach, Young Cove, Madrona Beach, and Mud Bay. There is one private marina at the tip of the peninsula owned by the Carlyon Beach Association.

Loss of marine riparian habitat alters erosion rates, water quality, and abundance of woody debris. There are areas of the marine shoreline where the built environment is within 100 feet of the shoreline, primarily along Madrona Beach, south of Sanderson Harbor, and at the Carlyon Beach area. There are few areas of non-forested land cover on high mass wasting hazard areas, indicating minimal impairment to LWD delivery to the marine shoreline via mass wasting. Please see the Large Woody Debris Alterations Map 23.

Shoreline Degradation (Map 15a)

Shoreline degradation as found by the Strategic Needs Assessment: Analysis of Nearshore Process Degradation in Puget Sound (Schlenger et al., 2011) study, is shown in tables below by basin.

Table 7.1. Totten Inlet Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011))

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	Bottom of Oyster Bay to Burns Cove; east side of Gallagher Cove	MTO-00 to MTO-05; MTO-13; MTO-16 to MTO-20
Less Degraded	Area between Burns Cove and Gallagher Cove	MTO-05 to MTO-17
Moderately Degraded	Area north of Gallagher Cove to top of Totten Inlet	MTO-19 to MTO-23
More Degraded	None	None
Most Degraded	None	None

Table 7.2. Squaxin Passage Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011))

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	None	None
Less Degraded	None	None
Moderately Degraded	West side of tip of Steamboat Island Peninsula	MTO-23-MSQ-00
More Degraded	Northwest side of Steamboat Island; shoreline east of tip of Steamboat Island Peninsula along	MSQ-00-MSQ-01; MSQ-00 to MSQ-05

	Carlyon Beach to Hunter Point and south along Edgewater Beach	
Most Degraded	Southwest and east side of Steamboat Island	MSQ-00-MSQ-01 and MSQ-01-MSQ-00

Table 7.3. Eld Inlet (west) Basin Marine Nearshore Shoreline Degradation (PSNERP Strategic Needs Assessment (Schlenger, 2011)).

Shoreline Degradation Category	General Location	Reaches
Not Degraded	None	None
Least Degraded	Just north of Frye Cove	MEL-04 to MEL-07
Less Degraded	South of Sanderson Harbor through Frye Cove	MEL-02 to MEL-04; MEL-07-MEL-08
Moderately Degraded	Shoreline around Flapjack point, through Young Cove, and along Sunrise and Madrona beach and south	MEL-08 to MEL-13; MEL-15 to MEL-19
More Degraded	Shoreline south of Hunter Point along Edgewater Beach, and south of Young Cove but north of Sunrise Beach	MSQ-05 to MEL-02; MEL-13 to MEL-15
Most Degraded	None	None

Hydrology

Important Areas (Map 16)

Areas important for water delivery are areas with relatively higher precipitation, and rain-on-snow areas. The southwest boundary of WRIA 14 falls within the Black Hills, and contains large areas mapped as “rain-dominated zones” as well as areas of “rain-on-snow zones”. The highest levels of annual precipitation in Thurston County, up to 127 inches per year, occur within the Black Hills. Much of the precipitation that falls in the Black Hills runs off because of the impermeable basalt that dominates the landform.

Important areas for surface water storage are areas containing depressional wetlands, wetlands, lakes, 100-year floodplain, and unconfined river channels. Summit Lake is the only lake within WRIA 14. Unnamed Pond 1 and 2 are the only wetlands exceeding the 20 acre threshold to qualify for SMA jurisdiction. There are numerous small, Palustrine wetlands and depressional wetlands scattered through the center of Steamboat Island Peninsula. Depressional wetlands are also found associated with Schneider Creek, the upper reach of Kennedy Creek, and with the small streams that drain to Totten and Eld Inlets. There is a small area of 100-year floodplain mapped at the west end of Summit Lake. All of WRIA 14’s marine shoreline is within the 100-year floodplain. Unconfined river channels are found along the upper reach of Kennedy Creek and some of its tributaries, the entirety of Schneider Creek and some of its tributaries, and several of the creeks draining to Young Cove, Frye Cove, and an unnamed inlet north of Burns Cove.

Shallow subsurface flow important areas contain low permeability soils. The majority of WRIA 14 occurs on low permeability soils.

Areas with high permeability soils are important for recharge. Kennedy Creek, and Schnieder Creek contain the longest stretches of high permeability soils within WRIA 14. High permeability soils are also found adjacent to Gallagher Cove, next to Madrona Beach, and under several of the wetland/stream complexes that drain to Totten and Eld inlets.

Indicators of Alteration (Map 17)

Water delivery timing is impaired when non-forested land cover occurs in rain-on snow zones, and in "rain-dominated" zones. There are some small areas of non-forest landcover, due to timber harvest, in the rain-dominated and rain-on snow zones in the hills to the south and east of Summit Lake in Capitol Forest. These areas are infrequent and small, and likely do not significantly impair water delivery.

Water movement via overland flow may be impaired by the occurrence of impervious cover within a watershed. Overall, WRIA 14 has low levels of impervious surface and therefore probably has low levels of altered overland flow. The areas of most concentrated impervious surface are along Highways 8 and 101, along Madrona Beach, at the tip of Steamboat Island Peninsula and Steamboat Island.

Surface storage may be impaired by the loss of depressional wetlands and the presence of the built environment adjacent to streams. In general, there are few areas where depressional wetland have been lost or where there is built environment adjacent to streams in WRIA 14.

Shallow sub-surface flows may be impaired by the presence of land cover with impervious surfaces and non-forested vegetation on low permeability soils. These areas are most prevalent north of Highway 101 along the Steamboat Island Peninsula and are associated primarily with low density residential development. Since most of the Steamboat Island Peninsula is composed of low permeability soils, the peninsula's shallow sub-surface flows are sensitive to the impacts of development. South of Highway 101, there are a few small areas of non-forested vegetation on low permeability soils due to timber harvest in Capitol Forest.

Recharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils. In WRIA 14, there are not many areas of high recharge potential, and therefore, there are not many areas where recharge is impaired. There are a few areas of non-forested vegetation on areas of high permeability soil near Kennedy Creek, due to timber harvest, and a few small areas north of Highway 101 due to low density residential development.

Vertical and lateral flows may be impaired by roads, ditches, and culverts. The major roads in WRIA 14 are Highway 101 and Highway 8. In the section of WRIA 14 south of Highway 101, and north of Highway 8, the roads are fairly limited to a few logging roads and the road surrounding Summit Lake. North of Highway 101, there are more frequent roads, with the highest concentration at the tip of the Steamboat Island Peninsula. Numerous culverts are located around Summit Lake, along Schneider Creek south of Highway 101, along Steamboat Island Road, and are concentrated along the waterfront near Burns Point, Gallagher Cove, Flapjack Point and Young Cove, Madrona Beach and south into Mud Bay and Perry Creek.

Discharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils that intersect floodplains. There are no significant areas of impaired discharge in WRIA 14.

Sediment

Important Areas (Map 18)

Process intensive areas for sediment delivery are areas of surface erosion, mass wasting, and in-channel erosion. Sediment delivery via surface erosion occurs in areas with steep slopes and erodible soils. There is a large concentration of areas with potential for surface erosion south of Highway 8, in the hills of Capitol Forest. Surface erosion potential is very limited in the remainder of WRIA 14, to small areas around lower Kennedy Creek and lower Schneider Creek, and around some of the unnamed streams draining to Totten and Eld Inlets.

Sediment delivery via mass wasting occurs in high mass wasting hazard areas and landslide areas. There are substantial areas of potential mass wasting located in the forested hills south of Highway 101 and concentrated along tributaries and the main stems of Kennedy and Schneider Creeks, Perry Creek, and Summit Lake. North of Highway 101, potential mass wasting areas exist along most of the marine shoreline, with concentrations located at the base of Oyster Bay, along Elizan Beach, north of Gallagher Cove to the tip of Steamboat Island Peninsula, at Hunter Point and south through Edgewater Beach, around Sanderson Harbor, Frye Cove, and north of Sunrise Beach.

Sediment delivery via in-channel erosion occurs in unconfined channels or those channels with gradients less than 4%. Almost all of the unnamed tributaries draining to Totten and Eld Inlets, as well as all of Kennedy Creek, Schneider Creek, and Perry Creek have the potential for in-channel erosion.

Sediment storage occurs in depressional wetlands, floodplains, depositional stream channels, and lakes. Sediment storage occurs in Summit Lake, Unnamed Pond 1 and 2, the depressional wetlands scattered across the middle of the Steamboat Island Peninsula, and in Kennedy Creek, Schneider Creek, Perry Creek, and the unnamed tributaries to Totten and Eld Inlets.

Indicators of Alteration (Map 19)

Sediment delivery via surface erosion may be impaired in areas of non-forested land cover on highly erodible slopes adjacent to streams, as well as locations with roads within 200’ of aquatic ecosystems or road crossings. Only a few small areas of non-forested landcover on highly erodible slopes adjacent to aquatic ecosystems exist in WRIA 14, with no significant concentrations. These are primarily due to active timber harvest within Capitol Forest. Roads within 200 feet of aquatic ecosystems are not very prevalent in WRIA 14, but some are found around Summit Lake, near Kennedy Creek, Perry Creek, and Schneider Creek, as well as scattered along Steamboat Island Peninsula with concentrations at Burns Cove, Steamboat Island, Sanderson Harbor, Young Cove/Sunrise Beach, and Highway 101 near Mud Bay.

Sediment delivery via mass wasting may be impaired when roads or non-forested vegetation occur in high mass wasting hazard areas. There are very few roads in high mass wasting hazard areas. The most concentrated areas are Highways 8 and 101. Only a few small areas of non-forested landcover on high mass wasting hazard areas exist in WRIA 14, with no significant concentrations.

Sediment delivery via in-channel erosion may be impaired when the built environment is adjacent to unconfined channels. The portion of Schneider Creek where it crosses Highway 101 may have impaired in-channel erosion due to the built environment adjacent to the stream.

Sediment storage may be impaired when depressional wetlands are lost, or in the presence of dams. There are no significant areas of where depressional wetlands have been lost. There is a dam at the southwest end of Summit Lake, where a stream outlet draining the lake to Kennedy Creek is mapped.

Water Quality

Important Areas (Map 20)

Areas important for maintaining water quality are streams, wetlands (particularly depressional wetlands) floodplains, and areas of high and low permeability. Depressional wetlands adsorb pathogens, phosphorus, and toxins. Nitrification and pathogen sedimentation also occur in depressional wetlands. Floodplains are another important area for sedimentation of pathogens. Pathogens are moved along the surface via streams, rivers, and wetlands with a surface water connection. Pathogens move underground in areas with shallow subsurface flow and recharge areas. Please see the “Hydrology Important Areas” for locations.

Indicators of Alteration (Map 21)

Water quality alterations can occur from failing septic systems, agricultural operations, loss of depressional wetlands, and the clearing and impervious surface areas that occur from the built environment. The built environment is most dense at the tip of Steamboat Island Peninsula, along Madrona Beach, around Summit Lake, and along the major roads (Highways 8 and 101, and Steamboat Island Road). The built environment is minimal adjacent to streams and wetlands. Most of the built environment in WRIA 14 occurs on low permeability soils, which may alter the movement, adsorption, and sedimentation of toxins and pathogens. Increased inputs of nutrients and pathogens may occur on parcels with failing septic systems. Parcels with assumed on-site septic are prevalent along the upper reach of Kennedy Creek, along Schneider Creek and Perry Creek, around Summit Lake, and throughout the Steamboat Island Peninsula, particularly along the marine shoreline.

There are four contaminated terrestrial sites mapped within WRIA 14. These sites are located near the headwaters of Perry Creek close to Highway 8, west of Highway 101 near Madrona

Beach, just south of Gallagher Cove, and at the tip of the Steamboat Island Peninsula. There are four areas within WRIA 14 on the 303(d) polluted waters list. Summit Lake is on the 303(d) polluted waters list for toxins (PCBs in fish tissue). The lower reach of Kennedy Creek is on the 303(d) polluted waters list for dissolved oxygen, and has a TMDL for bacteria and temperature. Burns Cove is on the 303(d) polluted waters list for bacteria. The lower portion of Schneider Creek is on the 303(d) list for dissolved oxygen, and it has a TMDL for bacteria. Shellfish harvesting between Steamboat Island and Hunter Point is prohibited due to contaminants. All other shellfish growing areas within WRIA 14 are approved for harvest. WRIA 14 contains two areas designated as mineral lands. One is located on the south side of Unnamed Pond 1, which drains to Schneider Creek. The other is located upland of Madrona Beach. There are no areas zoned Long Term Agriculture in WRIA 14. However, agricultural uses may also occur on parcels zoned rural. There are many such parcels located on the Steamboat Island Peninsula.

Large Woody Debris

Important Areas (Map 22)

Important areas for large woody debris delivery occur in areas of mass wasting, windthrow, and stream bank erosion. These areas are located in unconfined channels, mass wasting areas, and the area 100’ from all water bodies and streams. Unconfined channels are located on the majority of Kennedy Creek, Schneider Creek, Perry Creek, and many of the streams draining to Totten and Eld inlets. Please see the sediment important areas section for mass wasting areas.

Important areas for large woody debris storage are channels with less than 4% slope or unconfined channels. In addition to the areas of unconfined channels described above, streams with less than 4% slope are found in the lower reach of Kennedy Creek, and in some of the unnamed streams draining to Totten and Eld Inlets.

Indicators of Alteration (Map 23)

There are few areas of non-forested land cover on high mass wasting hazard areas, indicating minimal impairment to LWD delivery to streams via mass wasting. These small areas are primarily located in Capitol Forest.

There is minimal impairment to large woody debris delivery via windthrow. There are no areas of built environment within 100 feet of streams, and very minimal areas of non-forest landcover within 100 feet of streams. Large woody debris delivery to Summit Lake via windthrow is somewhat impaired with substantial built environment within 100 feet of the lake.

WDFW Local Habitat Assessment (Map 23b)

WRIA 14 contains some of the best condition habitat in Thurston County, located in the Black Hills south of Highway 101. Steamboat Island Peninsula contains a mosaic of habitat conditions ranging from medium to low quality. The areas of lowest quality are concentrated along Mud Bay and Madrona Beach, as well as along Highway 101, Highway 8, and at the western tip of the peninsula. The WRIA may contain wood duck breeding areas, as well as habitat for riffle sculpin, mountain quail, tailed frog, osprey, and bald eagle.

WRIA 14 Process-based Management Recommendations

Please see Chapter 9 for a discussion of programmatic management recommendations. These recommendations are discussed at the ecosystem scale and therefore apply throughout the County to areas where important ecological processes have been altered.

Shoreline Reach-Scale Inventory

The shoreline reach-scale inventory is organized by basin and waterbody. Maps used for the shoreline reach-scale inventory are listed in Table 7.1 and located in Appendix H.

Table 7.4. Maps used for the shoreline reach-scale inventory (located in Appendix H).

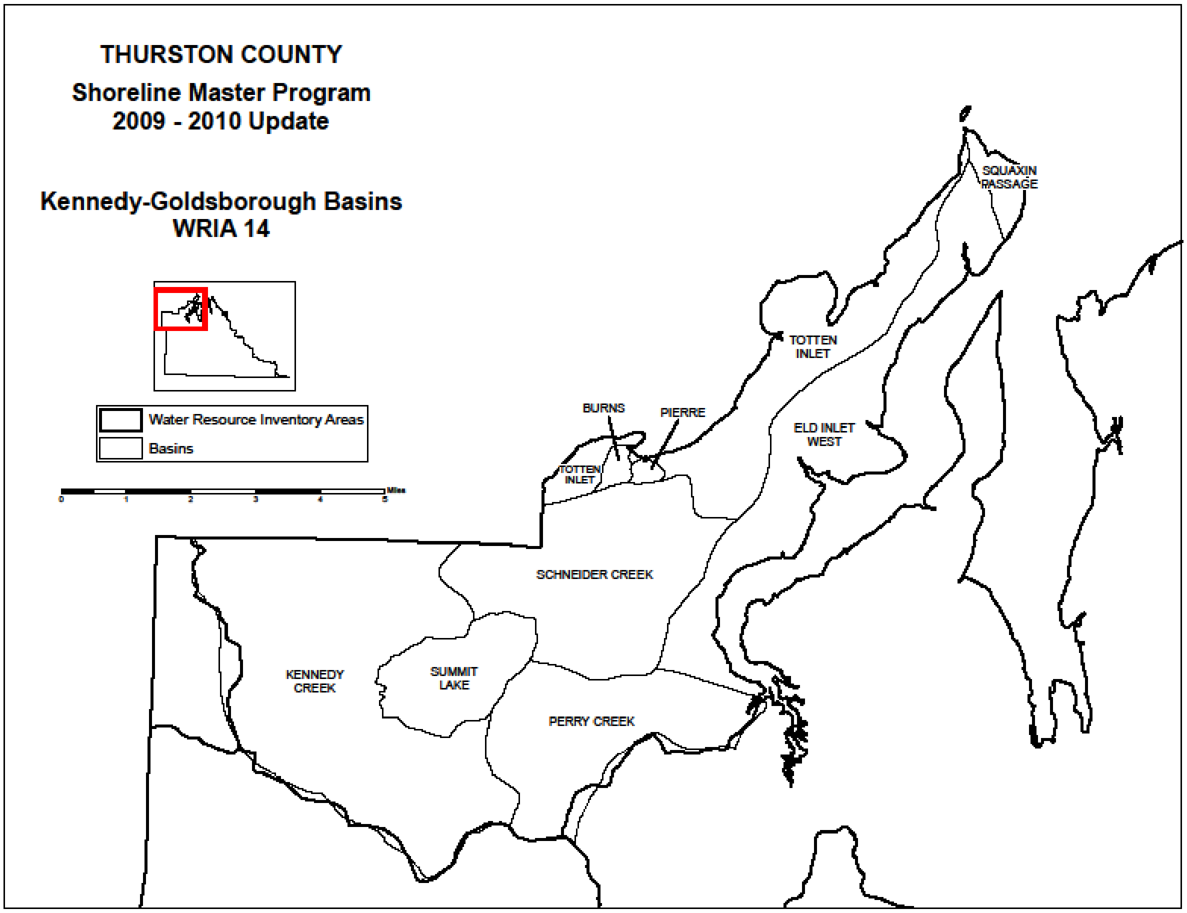
	Map Numbers and Titles	
Shoreline Type	**Physical and Biological Characterization**	**Shoreline Use Patterns**
Marine	10 – Topography and Hydrology 10a – Shoreline Type 14 – Coastal Process Important Areas 21– Water Quality Process Alterations 24 – Arial Photos 29 – Critical Areas - Biological 31– Critical Areas - Hydrologic 32 – Critical Areas - Geologic 34b – Kelp and Eelgrass 34c – Saltmarsh 35 – Marine Fisheries 36 – Shellfish Areas	15 – Coastal Process Alterations 17 – Hydrologic Process Alterations 26 – Impervious surfaces 24 – Arial Photos 37 – Aquatic Land Ownership 38 – Nationwide Permit 48 39 – Current Land Use – Generalized from the Office of the Assessor 41a – Future Land Use 41b – Current Zoning 41c – Future Development Potential 43 – Public Access and Public Lands 44 – Existing Shoreline Environment Designations
Freshwater	10 – Topography and Hydrology 21– Water Quality Process Alterations 24 – Arial Photos 29 – Critical Areas - Biological 31– Critical Areas - Hydrologic 32 – Critical Areas - Geologic	17 – Hydrologic Process Alterations 26 – Impervious surfaces 24 – Arial Photos 39 – Current Land Use – Generalized from the Office of the Assessor 41a – Future Land Use 41b – Current Zoning 41c – Future Development Potential 43 – Public Access and Public Lands 44 – Existing Shoreline Environment Designations

Basins

Table 7.5. The basins located within WRIA 14 (Kennedy-Goldsborough)

Basin	Area within WRIA (Acres)	Percent Area of WRIA
Burns	165.75	0.54
Eld Inlet (West)	4911.57	16.05
Kennedy Creek	9575.74	31.29
McLane Creek	113.03	0.37
Perry Creek	3869.98	12.65
Pierre	103.20	0.34
Porter Creek	121.25	0.40

Basin	Area within WRIA (Acres)	Percent Area of WRIA
Schneider Creek	5242.86	17.13
Squaxin Passage	488.94	1.60
Summit Lake	1899.70	6.21
Totten Inlet	4107.19	13.42
Waddell Creek	0.40	0.00

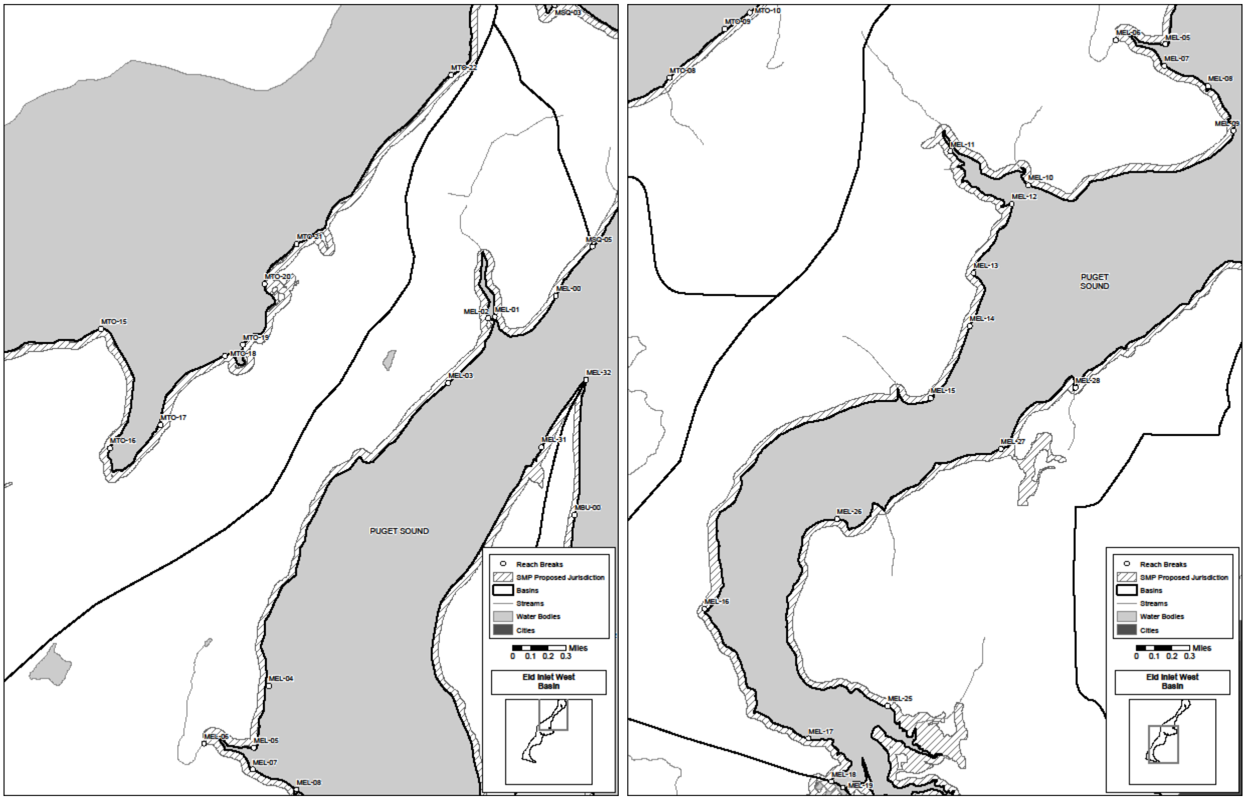


Map 7.2. The basins located within WRIA 14 (Kennedy-Goldsborough)

Burns Basin

Burns basin drains to Totten Inlet. The shoreline within Burns basin is discussed as part of the Totten Inlet basin section.

Eld Inlet (West) Basin



Basin Overview

Eld Inlet (west) is approximately 4,912 acres in size and is located entirely within WRIA 14. Eld Inlet (west) contains 13.96 miles of SMA jurisdictional shoreline, broken into 18 reaches (Reaches series name: MEL. Appendix A).

Perry Creek basin drains into Eld Inlet and is discussed as part of Eld Inlet (west) in this section. Perry Creek contains 0.99 miles of SMA jurisdictional shoreline, contained in one marine reach (Reach: MEL-18 to MEL-19. See Appendix A).

Eld Inlet (west)

Physical and Biological Characterization

All of the marine and major stream tributary shoreline in Eld Inlet (west) is mapped as a geologically sensitive area. The marine shoreline has steep slopes, slide hazard areas, and unstable slopes mapped along the majority. Steep slopes and slide hazard areas are also mapped along the east side of the Perry Creek shoreline jurisdiction. Past landslide areas are mapped around Hunter Point, north of Fry Cove, and north of Sunrise beach. Shoreline Drift is primarily left to right with no appreciable drift at the bottom of Mud Bay. The shoreline type is primarily sand beach, and mud flat, with smaller areas of sand and gravel beach, sand flat, and estuary wetland. Mud flats are found in the southern terminus of Mud Bay, in Young Cove, and in Fry

Cove and northward. Sand and gravel beaches surround Sanderson Harbor, and just south of Fry Cove, and Young Cove. Estuary wetlands are found in Sanderson Harbor.

Perry Creek empties into Eld Inlet in the Mud Bay estuary. A small number of other streams flow into Eld Inlet. These streams are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Several of the streams drain to inlets including Sanderson Harbor, Frye Cove, and Young Cove. Young Cove and Frye Cove creeks have high levels of sand and fine sediment. There are some small areas of Palustrine wetlands mapped in shoreline jurisdiction, as well as a few areas of high groundwater hazard along the northern marine shoreline. Salt marsh is mapped along approximately 30 percent of the west Eld Inlet shoreline at Edgewater beach, Sanderson Harbor, north and south of Frye Cove, around Young Cove, along Sunrise and Madrona Beach, and at the southern terminus of Mud Bay. Small areas of estuarine emergent wetland are mapped around Sanderson Harbor, Fry Cove, Young Cove, and the bottom of Mud Bay. Sanderson Harbor and the inlet at Sunrise Beach are mapped as pocket estuaries. All of the marine shoreline is within the 100-year floodplain.

Eld Inlet (west) contains spawning tributaries for coho salmon, harbor seal haulouts, and areas of prairie soils. Oak habitat is mapped in this basin near Steamboat Island Road and the Highway 101 interchange.

The Eld Inlet (west) shoreline jurisdiction is mapped as supporting smelt, rock sole, sand lance, coho salmon, chum salmon, searun Cutthroat Trout, and shellfish. Perry Creek supports chum and coho salmon, winter steelhead, and resident cutthroat trout. Eld Inlet (west) shoreline jurisdiction is mapped as providing habitat for wood duck, bald eagle, osprey, purple martin, shorebird and seabird concentrations. Patchy, non-floating kelp lies along the northern shoreline south to Flapjack Point.

Shoreline vegetation is primarily fragmented forest and shrubs that extend upslope into mostly residential areas, with some areas of undeveloped shoreline. There are some small areas of heavily forested shoreline vegetation with little evidence of development or clearing, including Frye Cove County Park.

There are no areas in Eld Inlet (west) on the 303(d) list. The DOH shellfish growing areas in Eld Inlet all have ‘approved’ status.

Perry Creek has ‘good’ water quality. Perry Creek failed part 1 of the fecal coliform standard in 2009/10 but met both parts in 2010/11, as well as failed the turbidity standard in November 2009 and November, December 2010. The major issues potentially affecting water quality in Perry Creek are agricultural practices, on-site septic systems in close proximity to the stream, and forest practices (Thurston County Water Resources Monitoring Report, 2012).

Shoreline Use Patterns

Primary land use within the shoreline jurisdiction of Eld Inlet (west) (including the Perry Creek basin) is residential and undeveloped, with small areas of other-tidelands, timber/forest lands, and parks. Low density residential use is distributed along the majority of the shoreline, and most of the shoreline has a rural environment designation. Impervious surfaces are below 30 percent throughout the shoreline. Areas with the highest level of impervious surface are all currently designated rural, and are located north and south of the entrance to Sanderson Harbor, north and south of the entrance to Young Cove, and along Madrona Beach. There are also some areas with larger parcel sizes, and lower residential density, which coincide with areas with an existing shoreline designation of Conservancy. These areas are located in areas mapped as slide hazard and steep slope areas at Hunter Point, Edgewater Beach, in and north of Frye Cove, and the southern shoreline of Young Cove. Aquatic tidelands are privately owned throughout Eld Inlet (west).

Eld Inlet (west) contains some aquaculture use. Reaches MEL-03-MEL-04 and MEL-14-MEL-15 each contain parcels with a Nationwide 48 shellfish aquaculture permit. MEL-16-MEL-17 appears to have aquaculture use per the aerial photograph.

Roads within shoreline jurisdiction are limited to reach MEL-18-MEL-19, where Madrona Beach Road NW and US Hwy 101 cross over the inlet via bridges. Bulkheads are mapped along approximately 50 percent of the Eld Inlet (west) shoreline. Docks are concentrated between Hunter Point and Edgewater Beach, around Sanderson Harbor, Flapjack Point, Young Cove, along Madrona Beach and south into Mud Bay. Frye Cove creek and Young Cove creek have culverts that pose as barriers to fish passage.

Frye Cove Park provides marine public access within Eld Inlet (west) basin. The public access at this park may be utilized for waterfront, view and swimming access. Public access to the marine shoreline is also available via Madrona Beach Road NW and Highway 101 where they cross Oyster Bay via bridges.

Existing shoreline designations are Rural and Conservancy. Existing zoning is Rural Residential Resource 1/5, Residential LAMIRD 1/1, and Public Parks Trails and Preserves. Under current zoning regulations, there are approximately 568 lots within shoreline jurisdiction, 48 of which are developable. There are 44 vacant single lots, and four subdividable vacant lots. There are no parcels with the potential for additional infill.

Management Issues and Opportunities

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified much of Eld Inlet (west) as beneficial to all juvenile salmon and appropriate for conservation (See Appendix A).

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified many areas of marine shoreline in Eld Inlet (west) as containing high priority areas for forage fish habitat restoration/protection (see Appendix A).

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified 18 sites as potential restoration or protection locations (See Appendix A).

<u>PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound</u> (Cereghino et al., 2012). (See Appendix A).

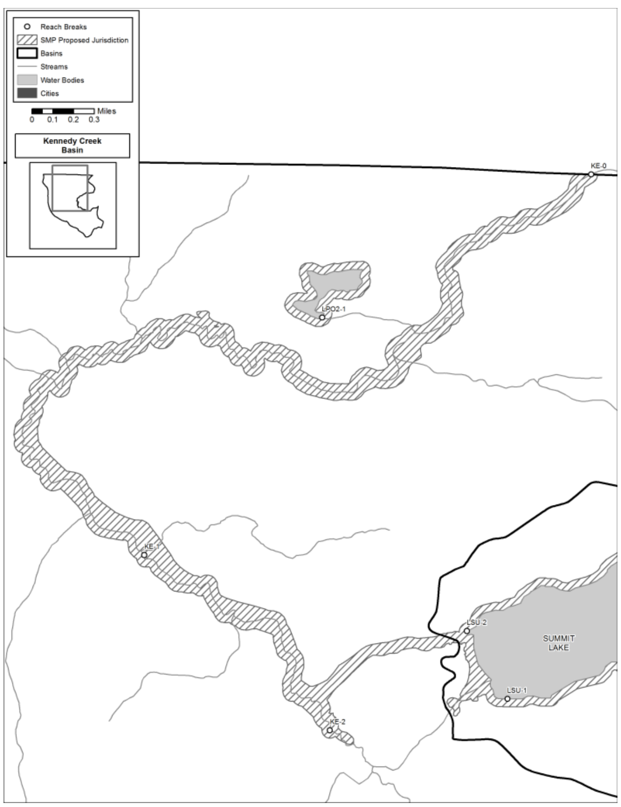
Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	Elizan Beach	None	Oyster Bay, Young Cove, and Mud Bay
Protect	Just north of Elizan Beach, and just north of Frye Cove	Northeast portion of Gallagher Cove, Sanderson Harbor and south to north of Frye Cove	Northeast side of Burns Cove, inlet at north end of Elizan Beach, Gallagher Cove, Sanderson Harbor, Frye Cove, and inlet at Sunrise Beach
Restore High	Burns Point and south, beach south of Sanderson Harbor and north of Frye Cove	None	None
Restore	Burns Cove, Gallagher Cove and north to tip of peninsula, southeast of Frye Cove	All of Totten Inlet, except for the small area identified for protection, Hunter Point south through Edgewater Beach, Fry Cove to Flapjack Point, Sunrise Beach south through Mud Bay	Burns Cove, Inlet along Elizan Beach, Carlyon Beach to Hunter Point
Enhance High	Hunter Point and south along Edgewater Beach, Flapjack Point	None	None
Enhance	Steamboat Island and east along Carlyon Beach, just north of Sanderson Harbor, south of Flapjack Point through Madrona beach	Flapjack Point and south through Young Cove	None

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	General Locations	Reaches

Highest Protection	Frye Cove to Flapjack Point	MEL-05 to MEL-09
Protection	None	None
Protection/ conservation	None	None
Conservation	None	None
Highest Restoration	None	None
Restoration	Sanderson Harbor; Flapjack Point south to the north side of Sunrise Beach	MEL-01 to MEL-03; MEL-09 to MEL-15
Restoration/ Development	Edgewater Beach to north of Sanderson Harbor; south of Sanderson Harbor to the north edge of Frye Cove	MSQ-05 to MEL-01; MEL-03 to MEL-05
Development/ Restoration	Sunrise Beach south to WRIA 14/13 boundary	MEL-15 to MEL-19

Kennedy Creek Basin



Basin Overview

Kennedy Creek basin is located in the northeastern portion of the County. It is 9,876 acres in size. The majority of the basin, 9,773 acres, is located in WRIA 14. A small portion of the basin, 103 acres, is located in WRIA 23. As the majority of the Kennedy Creek basin is located in WRIA 14, review of it is provided in this chapter. Water within Kennedy Creek basin generally flows into Kennedy Creek and then to Totten Inlet.

Kennedy Creek basin contains two water waterbodies subject to shoreline jurisdiction: Kennedy Creek and an unnamed pond, herein named Unnamed Pond 2. Kennedy Creek is 7.17 miles of SMA jurisdictional shoreline, broken into two reaches (Reaches: KE-0 through KE-2. See Appendix A). Unnamed Pond 2, contains 1.15 miles of SMA jurisdictional shoreline, in one reach (Reach LPO2-01-LPO2-01. See Appendix A).

Kennedy Creek

Physical and Biological Characterization

Kennedy Creek originates in the Black Hills and discharges into the head of Totten Inlet. It has a gradual slope to the lowlands except for a location 2.5 miles from the mouth where natural falls drop more than 60 feet within 300 yards, blocking anadromous fish passage.

This basin contains Kennedy Creek as well as several unnamed tributaries. Some portions of Kennedy Creek contain shoreline jurisdiction and have reaches described in Appendix A. The remainder of Kennedy Creek and its associated tributaries are not mapped as meeting the shoreline jurisdiction requirements. However, these streams are likely to qualify as critical areas pursuant to TCC 24.

Steep slopes and slide hazards are mapped along Kennedy Creek downstream of KE-1. Upper Kennedy Creek is an unconfined large tributary river channel. Lower Kennedy Creek is a moderately confined to confined, large tributary between steep slopes. Kennedy Creek contains a few channel and side bank associated wetlands. The creek has a naturally occurring high level of fine sediment. Upper Kennedy Creek and a portion of mid-Kennedy Creek contain 100-year floodplain. Just downstream of the 20 cfs point, the 100-year floodplain connects the Kennedy Creek shoreline jurisdiction to the western side of the Summit Lake shoreline jurisdiction.

Kennedy Creek supports coho and chum salmon, searun and resident cutthroat trout, and winter steelhead downstream of a natural waterfall/insufficient flow barrier. Resident cutthroat trout live in Kennedy Creek above the falls. Kennedy Creek has one of the largest chum runs in the South Sound, averaging 30,000 spawners a year. Riffle sculpin, tailed frogs, osprey, and mountain quail habitat are mapped within this basin. Prairie soils are mapped along Kennedy Creek.

The forest around Kennedy Creek is a mosaic of different stand ages from active harvest. The lower stream corridor is forested, generally undisturbed adjacent to the stream but with active forestry in the shoreline jurisdiction and surrounding areas. The upper stream corridor is generally forested, with some cleared/maintained areas adjacent to residences.

The lower reach of Kennedy Creek is on the 303(d) polluted waters list for dissolved oxygen. It also has a TMDL for bacteria. The Washington Department of Ecology total maximum daily load study determined that late summer season fecal coliform bacteria levels in Kennedy Creek must be reduced to ensure compliance with part 2 of the water quality standard. Investigation for potential sources was conducted in 2006 and 2007. A water quality implementation plan was completed in November 2007, and includes recommended actions for Kennedy Creek focused on investigation, monitoring, incentives, outreach, and technical assistance. Water quality issues related to forest practices on Green Diamond timberland are covered by a habitat conservation plan.

The Thurston County Water Resources Monitoring Report (2012) rated Kennedy Creek's water quality as good. Kennedy Creek met part 1 and failed part 2 of the fecal coliform water quality standard both water years. There were occasional dissolved oxygen violations during the summer low flow period. Turbidity exceeded the standard during periods of high flow in December 2009 & 2010 and March 2011. While there is no water quality standard for nitrate in surface water, the average nitrate concentration for Kennedy Creek is roughly two times the regional reference condition (reference condition found in EPA Publication 822-B-00-015). Kennedy Creek is also slightly above the reference condition for total phosphorus.

Shoreline Use Patterns

The current primary uses of this basin are rural residential, designated forest and undeveloped land. Capitol state forest is located within Kennedy Creek basin south of Highway 101, east of Summit Lake, and south of Highway 8.

The lower Kennedy Creek reach contains two mapped private drives plus additional logging access. The upper reach contains one road (Summit Lake Road NW) which crosses Kennedy Creek over a bridge and provides public access.

Kennedy Creek's existing Shoreline Designation is Conservancy. In Kennedy Creek's upper reach, the right bank (northeast side) approximately 50% Long Term Forestry (owned by Green Diamond Resource Company) and roughly 50% Rural Residential Resource 1/5. The left bank (southwest side) is zoned entirely Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 31 lots within shoreline jurisdiction, four of which are developable. There are three vacant single lots and one subdividable vacant lot. There are no parcels with the potential for additional infill.

Management Issues and Opportunities

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified riparian and wetland sites along Kennedy Creek as potential restoration sites (see Appendix A).

Salmonid Habitat Limiting Factors, WRIA 14 (Kuttel, 2002) and Salmon Habitat Protection and Restoration Plan for the Water Resource Inventory Area 14, Kennedy-Goldsborough (Mason County, 2004) recommended:

- Encourage continued outreach activities. Support continued management of the Kennedy Creek trail to promote a stewardship ethic for students and the community.
- Maintain the upper watershed in managed forestry. If the status changes, propose acquisition along key areas.

- Off-channel assessment to fill data gaps. Assess off-channel habitat, riparian condition and floodplain connectivity.
- Provide long-term conservation of Kennedy Creek riparian corridor within the first 5 miles. Preserve areas within the Kennedy Creek watershed that are not already in a protective status.
- Explore opportunities to keep Kennedy Creek watershed in commercial forestry.
- Restore riparian corridor in the upper and middle reaches to provide shade, stabilize streambanks, and recruit LWD. Plant appropriate species including conifers.
- Increase LWD key piece abundance to encourage pool formation and sorting of sediments. Develop a strategy to place instream LWD for immediate benefits until riparian conditions improve to allow natural recruitment.
- Identify and correct areas where livestock have direct access to the Creek (upper reaches).

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012)
Kennedy Creek's upstream reach is recommended for highest protection. The downstream reach is suggested for conservation.

Unnamed Pond 2

Physical and Biological Characterization

Unnamed Pond 2 is an openwater wetland with fringing emergent vegetation. Steep slopes are mapped around the entire perimeter of Unnamed Pond 2. Unnamed Pond 2 drains to the east by a creek that flows into Kennedy Creek. This stream is not mapped as meeting the shoreline jurisdiction requirements, however, is likely to qualify as a critical area pursuant to TCC 24.

Intact forested shoreline vegetation surrounds Unnamed Pond 2, although the forested buffer is narrow in places. Active forestry and logging roads are present within shoreline jurisdiction. The forest outside the buffer around Unnamed Pond 2 is a mosaic of different stand ages caused by active harvest. Unnamed Pond 2 is on land owned by the Green Diamond Resource Group, which has a habitat conservation plan to manage any water quality issues related to forest practices. There are no known water quality issues for Unnamed Pond 2. No priority habitats or species are mapped within shoreline jurisdiction.

Shoreline Use Patterns

Unnamed Pond 2 is zoned Long Term Forestry, and is not currently designated under the SMA. Under current zoning, there are approximately two lots within shoreline jurisdiction, none of which are developable.

Unnamed Pond 2 is on land owned by the Green Diamond Resource Group. There are multiple private logging roads within the shoreline jurisdiction.

Management Issues and Opportunities

<u>Totten and Eld Inlets Watershed Characterization Report</u> (Thurston County, 2009) identified two sites as potential restoration or protection locations (See Appendix A).

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2012) Unnamed Pond 2 is recommended for conservation.

McLane Creek Basin

The majority of this basin is located in WRIA 13. Please refer to the WRIA 13 chapter for information on this basin.

Perry Creek Basin

Perry Creek is discussed within the Eld Inlet (west) section.

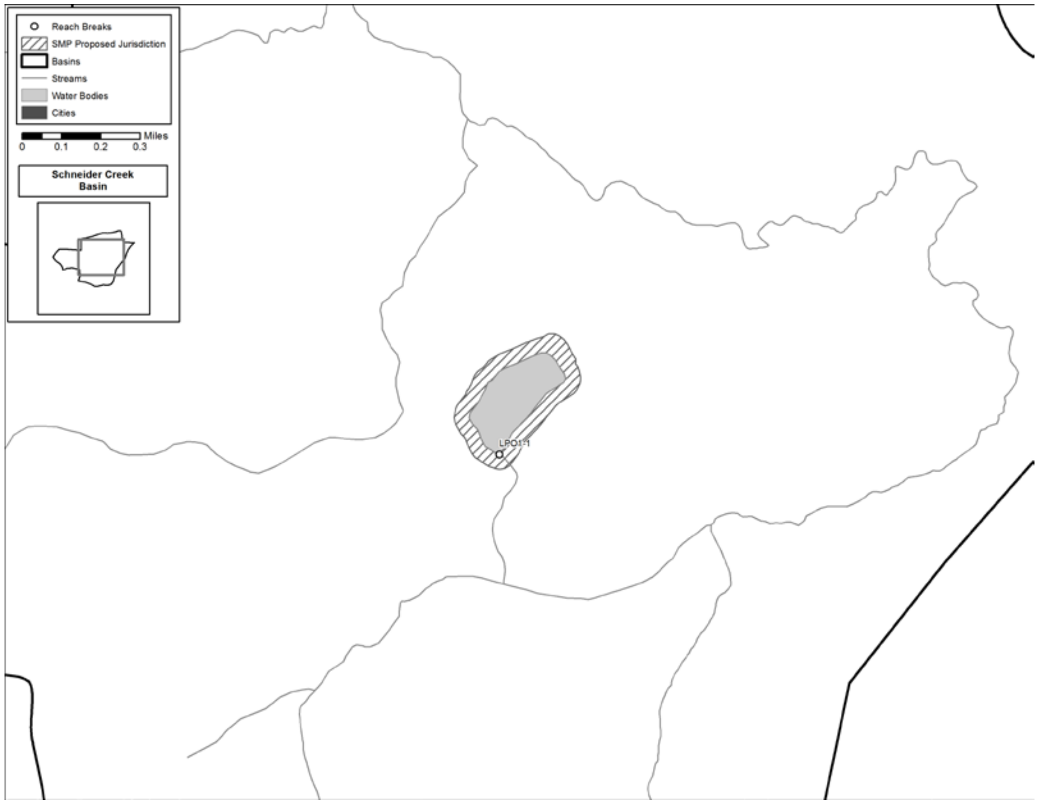
Pierre Basin

Pierre basin drains to Totten Inlet. The shoreline within Pierre basin is discussed as part of the Totten Inlet section.

Porter Creek Basin

The majority of this basin is located in WRIA 23. Please refer to the WRIA 23 chapter for information on this basin.

Schneider Creek Basin



Basin Overview

Schneider Creek basin is located in the northeast corner of the County. It is 5,243 acres in size. Water in Schneider Creek basin generally flows towards Schneider Creek and Totten Inlet. Schneider Creek basin contains 0.74 miles of SMA jurisdictional shoreline in one reach around one unnamed pond (Reach: LPO1-1- LPO1-1. See Appendix A).

Unnamed Pond 1

Physical and Biological Characterization

Unnamed Pond 1 is surrounded by steep slopes on all but the south side, and a landslide hazard area on the east side. The pond is drained to the south by a creek that feeds into Schneider Creek. The stream is not mapped as meeting the shoreline jurisdiction requirements; however, it is likely to qualify as a critical area pursuant to TCC 24. Unnamed Pond 1 is an area of high groundwater hazard.

Unnamed Pond 1 is an emergent and open water wetland containing emergent and floating vegetation. The shoreline vegetation is composed of trees and shrubs that are intact except for a mining area on the southwest side. The basin may contain wood duck habitat and prairie soils.

Unnamed Pond 1 drains to Schneider Creek, which is mapped as supporting resident and searun cutthroat trout, chum and coho salmon, and winter steelhead. The pond has no known water quality issues.

The lower reach of Schneider Creek is on the 303(d) polluted water list for dissolved oxygen, and has a TMDL for bacteria. Fine sedimentation in Schneider Creek, which lead to limited anadromous fish spawning success, is a product of the actively managed forests in the headwaters.

Shoreline Use Patterns

Land use within shoreline jurisdiction is undeveloped and timber/forestland. There is active timber harvest within and adjacent to the shoreline jurisdiction. One unpaved logging road is located within the shoreline jurisdiction. A mine is also mapped within and adjacent to shoreline jurisdiction on the south side of the lake, where a stream drains to Schneider Creek. There is no public shoreline access to Unnamed Pond 1.

Current zoning is RRR 1/5. Unnamed Pond 1 is not designated under the existing SMP. Under current zoning regulations, there are approximately two lots within shoreline jurisdiction, none of which are developable.

Management Issues and Opportunities

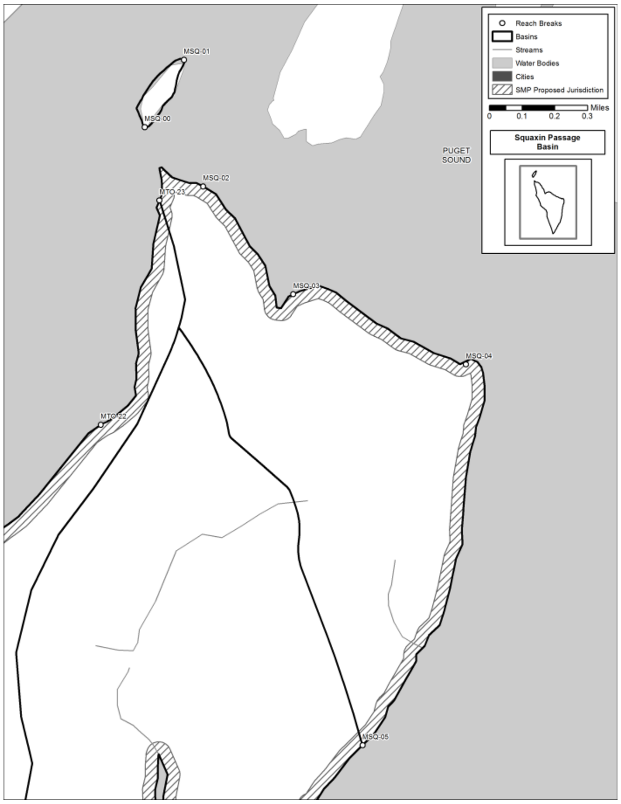
Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified two sites as potential restoration or protection locations (See Appendix A).

Salmonid Habitat Limiting Factors, WRIA 14 (Kuttel, 2002) and Salmon Habitat Protection and Restoration Plan for the Water Resource Inventory Area 14, Kennedy-Goldsborough (Mason County, 2004) identified the following high priority actions:

- Maintain vegetative cover to reduce runoff and erosion that lead to fine sediment deposition. Best management practices to reduce sediment on active forest lands and mining lands
- Reforest any degraded portions of the riparian buffer with native riparian vegetation, particularly conifers
- Preserve coniferous trees in the riparian zone
- Build fewer, maintain existing, and close unneeded logging roads

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Unnamed Pond 1 is recommended for restoration/development.

Squaxin Passage Basin



Basin Overview

Squaxin Passage basin is located on the northern tip of the Steamboat Island peninsula. It is 489 acres in size and is located entirely within WRIA 14. Water in this basin generally flows into south Puget Sound. Squaxin Passage basin contains 3.23 miles of SMA jurisdictional shoreline, broken into seven reaches (Reaches MTO-23 through MSQ-05).

Squaxin Passage

Physical and Biological Characterization

The shoreline type in Squaxin Passage is sand beach. Net shore drift is primarily left to right. Geologically sensitive areas are mapped along the marine shoreline south from Hunter Point. Steep slopes and slide hazard areas are mapped along the majority of the marine shoreline, excluding Steamboat Island and the tip of Steamboat Island Peninsula. Unstable slopes are mapped along the entire marine shoreline of this basin. Areas of past landslides are extensive, covering more than three quarters of the shoreline. A large landslide occurred along the north edge of Squaxin Passage (between MSQ-03-MSQ-04) in 1999, called the Carlyon Landslide.

This basin contains one un-named stream that flows into the Puget Sound on the east side of the Steamboat Island Peninsula. This stream is not mapped as meeting the shoreline jurisdiction requirements. However, this stream is likely to qualify as critical areas pursuant to TCC 24.

Estuarine emergent wetlands are mapped along much of the north shoreline of Squaxin Passage Inlet, between the tip of Steamboat Island Peninsula and Hunter Point. There is a small area of patchy saltmarsh in the inlet near MSQ-03, and another along Edgewater Beach.
The marine environment adjacent to this basin is mapped as supporting rock sole, sand lance, smelt, herring, geoduck, hardshell clams, and seabirds. Patchy, non-floating kelp is mapped along the entire marine shoreline in this basin. The basin may provide habitat for purple martins and bald eagle. Areas of prairie soils are mapped near Hunter Point.

The top of Steamboat Island Peninsula and Steamboat Island have almost no remaining marine riparian habitat, due to dense residential development. The remaining vegetation in these areas is primarily shrubs, with occasional scattered trees. Residences are built close to the shoreline. Between MSQ-03 and MSQ-04, the marine riparian habitat is almost entirely forested and intact, due to landslide hazards precluding development. South of Hunter Point, and along Edgewater beach, the shoreline jurisdiction is a mix of areas with intact marine riparian forest cover, and areas of low density development with little remaining tree cover.

The shellfish harvest areas on the west side of Steamboat Island and south of Hunter Point are open. However, the shellfish harvest areas between the east side of Steamboat Island and Hunter Point are closed due to pollution.

Shoreline Use Patterns

Landuse is primarily undeveloped and residential, with small areas of recreation and parks. Steamboat Island and the tip of Steamboat Island Peninsula south to MSQ-03 is densely developed with private residences and may exceed 30% impervious surface. Between MSQ-03 and MSQ-04, the shoreline jurisdiction is primarily forested and undeveloped due to landslide hazards. South of Hunter Point, and along Edgewater Beach, there is low density residential development, interspersed with small areas of intact forest cover. Water oriented uses include recreation and wildlife viewing from private lands.

This basin contains the area known as the Carlyon Landslide area. The landslide area is located along the marine shoreline between MSQ-03-MSQ-04, is approximately 3,000 feet in length and extends inland 900 feet. Landslide scarps associated with the slide reach up to 15 feet high. The landslide area had been largely dormant for the majority of recent history. Residential houses had been built within the slide area. The landslide area began to move again in February 1999. The slide was slow moving and homeowners were requested to evacuate because of severe structural damage caused by the slide. In total, 41 homes were damaged by the slide, and 33 homes in the area were declared uninhabitable. Building of new residential homes in this area is not allowed at this time.

The Carlyon Beach Homeowners Associate manages a private marina (with associated overwater structures) on the northeast tip of the Steamboat Island Peninsula. The Edgewater Beach area contains several parcels with Nationwide 48 shellfish aquaculture permits. Docks are scattered along the shoreline with the majority occurring in the inlet on the north side of Squaxin Passage and along Edgewater Beach. Armoring is spread along more than fifty percent of the shoreline. Steamboat Island Loop NW and its bridge, Steamboat Island Bridge, is the only road within shoreline jurisdiction.

Public access within reach is available informally via Steamboat Island Bridge which is on a public road (Steamboat Island Loop NW). The Carlyon Beach Home Owners association provides semi-public access to the community in the form of a beach and marina.

The tip of Steamboat Island Peninsula and Steamboat Island are currently zoned RL 2/1 and have a shoreline designation of Rural. East of MSQ-03 and south along Edgewater Beach the zoning is RRR 1/5 and the current shoreline designation is Conservancy. Under current zoning regulations, there are approximately 201 lots within shoreline jurisdiction, ten of which are developable. Nine parcels are vacant single lots and one parcel is a subdividable vacant lot. There are no parcels with the potential for additional infill.

Management Issues and Opportunities

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified reach MSQ-04-MSQ-05 as beneficial to all juvenile salmon and appropriate for conservation in the southern half of the reach (See Appendix A). The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) also identified this reach as containing high priority areas for forage fish habitat restoration/ protection.

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified two sites as potential restoration or protection locations (See Appendix A).

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). (See Appendix A).

Management Strategy	Beach	Barrier Embayment	Coastal Inlets
Protect High	None	None	None
Protect	None	None	None
Restore High	None	None	None
Restore	West side of tip of Steamboat Island Peninsula	West side of tip of Steamboat Island Peninsula; east side of Carlyon Beach to Hunter Point and south along Edgewater Beach	East side of Carlyon Beach to Hunter Point
Enhance High	East side of Carlyon Beach to Hunter Point and south along Edgewater Beach	None	None
Enhance	Steamboat Island and east along Carlyon Beach	None	None

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) All of Squaxin Passage is recommended for restoration/development.

Summit Lake Basin

Basin Overview

The Summit Lake basin is located in the northwestern portion of the County. The basin is 1,900 acres in size. Summit Lake is the only SMA shoreline within this basin. Summit Lake contains 5.6 miles of shoreline and has been broken into two reaches (LSU 1 through LSC 2. Appendix A).

Summit Lake basin is bordered by Schneider Creek basin to the north, Perry Creek basin to the east and Kennedy Creek basin to the west. Water within Summit Lake basin generally flows towards Summit Lake.

Summit Lake

Physical and Biological Characterization

Summit Lake is approximately 530 acres, with a maximum depth of 100 feet and a mean depth of 53 feet. The drainages feeding into the lake are steep and rugged with slopes up to 80 percent. There are numerous springs and intermittent streams that flow into the lake. The outlet, at the west end of the lake, is controlled by flash boards and flows into Kennedy Creek. Summit Lake has an un-named stream mapped as connection to Kennedy Creek. The northern portion of this connection is part of the Summit Lake shoreline jurisdiction.

Hazardous slopes/slide areas are mapped around the majority of Summit Lake. The wetland areas mapped within this basin are associated with the lake and are located primarily at the northern and western ends of the lake. The reach at the southwestern end of the lake is entirely wetland and 100-year flood plain. Within this reach, the 100-year floodplain connects Summit Lake shoreline jurisdiction to Kennedy Creek's shoreline jurisdiction (just downstream of the creek's 20 cfs point).

Summit Lake is mapped as supporting resident cutthroat trout. In addition, WDFW stocks Summit Lake with kokanee and rainbow trout.

Riparian vegetation surrounding Summit Lake has been substantially modified by residential development in all but the southwest end of the lake. Some areas contain trees or shrubs at the shoreline, but the shoreline jurisdiction is primarily composed of landscaping or and/or buildings. The reach at the southwestern end of the lake is composed of emergent and shrub vegetation.

Water quality in Summit Lake is important as the lake is the primary drinking water source for most lake residents. Summit Lake's water quality was rated as excellent based on low nutrient and chlorophyll a levels as well as high visibility. Steep slopes, shallow soils, and generally small lot sizes make siting and functioning of on-site sewage systems around the lake difficult. Fecal contamination is a concern for the lake. In addition, the high density residential activities along the shoreline and forestry activities in the upper watershed are a concern for water quality (Thurston County Water Resources Monitoring Report, 2012). Summit Lake is also on the 303(d) list for PCB's in fish tissue.

Shoreline Use Patterns

Primary use of this basin is undeveloped land and designated forest with dense residential development concentrated within the shoreline jurisdiction. Timber and forestland use is mapped within the shoreline jurisdiction of this basin. Reach LSU-2-LSU-1 makes up the majority of Summit Lake's shoreline. This reach is almost entirely developed (residential) with a few owned but undeveloped parcels. There are several areas of high impervious cover within this reach, so that overall it appears to have impervious surface greater than 30%. The reach at the southwest end of the lake is primarily recreational land associated with the Boy Scout Camp.

The majority of the lake is zoned RL 2/1. The recreational area at the southwest side of the lake is zoned RRR 1/5. The majority of Summit Lake's shoreline is currently designated rural shoreline. There is a small area of conservancy shoreline in the southwest part of the lake (Map 44). Under current zoning regulations, there are approximately 522 lots within shoreline jurisdiction, 38 of which are developable as vacant single lots.

The majority of Summit Lake's shoreline is armored with bulkheads. In addition, Summit Lake contains a large number of overwater structures, such as docks and boat lifts, as well as modification to shoreline vegetation. Most parcels include docks and/or floats (including undeveloped uplands). There is a fish passage barrier at the intersection of an unnamed stream and Summit Lake Road (WDFW, 2000). Summit Lake Road is the only road within shoreline jurisdiction.

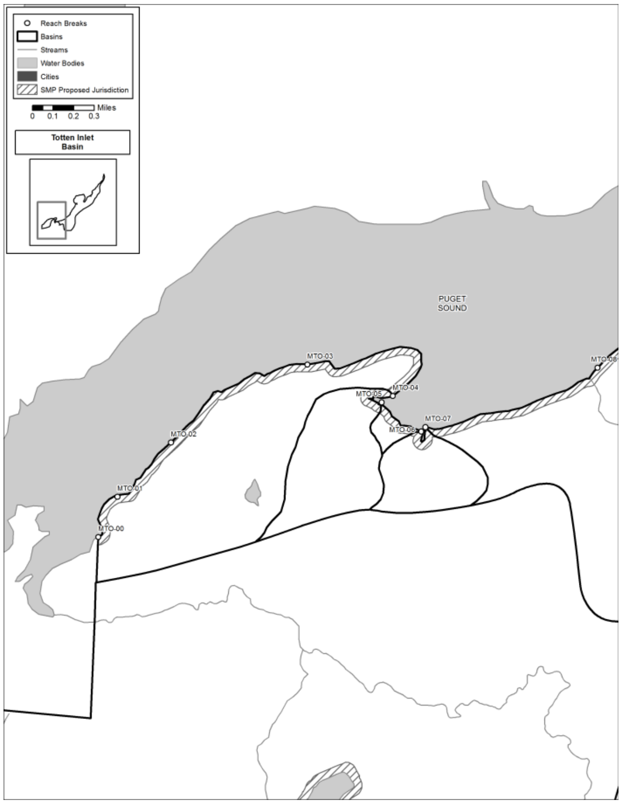
Public access to Summit Lake is available via a Washington Department of Fish and Wildlife public boat launch, and off of Summit Lake Road. Semi-public access may be considered available through three small private community accesses, and via a 126-acre Boy Scout camp at the west end of the lake.

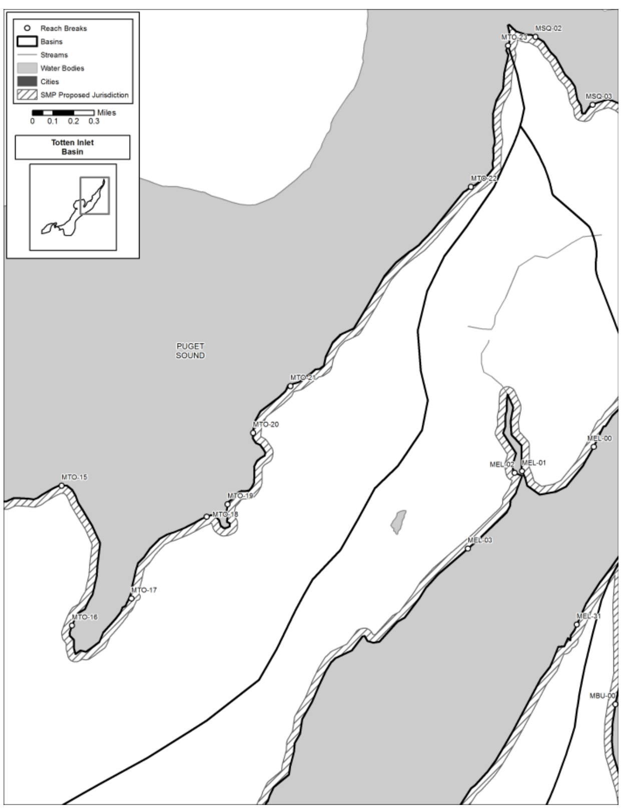
Management Issues and Opportunities

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified potential wetland, riparian, and floodplain restoration sites around Summit Lake.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012) Summit Lake is recommended for restoration/development.

Totten Inlet Basin





Basin Overview

Totten Inlet is located in the northwest corner of the county, entirely within WRIA 14. Several basins drain to Totten Inlet: Totten Inlet basin, Burns basin, and Pierre Basin. Totten Inlet contains 13.5 miles of SMA jurisdictional shoreline, broken into 21 reaches (Reaches: MTO-00 through MTO-23, Appendix A).

Totten Inlet

Physical and Biological Characterization

The majority of the Totten Inlet marine shoreline is mapped as containing slide hazard and unstable slopes. Mudflats are present in the bottom of Oyster Bay, Burns Cove, and Gallagher Cove. The remainder of the Totten Inlet shoreline is a mixture of sand beach and sand flat. Shoreline drift is primarily right to left with no appreciable drift at the bottom of Oyster Bay.

A small number of mapped un-named streams flow into Totten Inlet. These streams are not mapped as shorelines of the state as they are not currently identified as exceeding a 20 cubic feet per second mean annual flow. However, these streams are likely to qualify as critical areas pursuant to TCC 24. Freshwater wetlands are mapped throughout Totten Inlet basin. Small areas of estuarine emergent wetlands are mapped sporadically along Totten Inlet's shoreline. Five pocket estuaries are mapped along Totten Inlet, with locations in Burns Cove, the Elizan Beach area, and Gallagher Cove. Patchy saltmarsh is located at the base of Oyster Bay south of Burns Point, along Burns Cove, an inlet at the north end of Elizan Beach, and in Gallagher Cove.

Habitat for rock sole, smelt, sand lance, and hardneck clams is mapped along the entire length of Totten Inlet's marine shoreline. Herring habitat is mapped along the northern marine shoreline. Waterfowl concentrations, bald eagle, and purple martin habitat is mapped near or within the shoreline in several areas. There are some small areas of prairie soils and anadromous fish presence mapped in the Gallagher Cove area. Geoduck aquatic tracks are mapped along the northern shoreline. Patchy, non-floating kelp is mapped in two locations midway up the Steamboat Island Peninsula, on either side of Gallagher Cove.

Marine riparian vegetation within the shoreline jurisdiction is a mix of heavy forest cover in undeveloped areas as well as areas with some clearing for low density residential development. Vegetation clearing is more pronounced around Burns Point and is heaviest at Cooper Point where residential development is greatest. Most homes have retained forested cover along the shoreline due to steep slopes.

Water quality is in relatively good condition within Totten Inlet, with the exception of Burns Cove which is on the 303(d) polluted waters list for bacteria. The Department of Health shellfish harvest ratings are approved for the majority of Totten Inlet, with two small areas of conditional approval.

Shoreline Use Patterns

Primary land use in Totten Inlet's shoreline jurisdiction is divided among rural residential, undeveloped land, timber/forest land, and agriculture. Residential is the dominant land use. Residential use is low density, with the highest concentration at the tip of Steamboat Island Peninsula in the areas zoned Residential LAMIRDS. There are large areas of undeveloped, forested land dispersed along the entire inlet. Homes are typically set back from the shoreline due to the predominance of steep, unstable slopes.

Existing zoning is PP, RRR 1/5, RL 1/1, and RL 2/1. Currently, Totten Inlet's Shoreline Environmental Designations is primarily Conservancy with four smaller areas of Rural designation. Under current zoning regulations, there are approximately 397 lots within shoreline jurisdiction, 76 of which are developable. There are 68 vacant single lots, seven subdividable vacant lots, and one parcel with the potential for additional infill.

There are numerous vacant single lots spread along all of Totten Inlet's shoreline. There are six vacant subdividable lots in the area of Elizan Beach. One partially-used subdividable lot exists in Burns Cove. There are two recently permitted parcels and three subdivision lots.

The tidelands are privately owned for approximately 50% of the shoreline. There is one parcel on the northern tip of Totten Inlet that has a Nationwide 48 permit.

Docks exist in Burns Cove, along Elizan Beach, and in the Gallagher Cove areas. Bulkheads are mapped along approximately 50% of the shoreline. There are no roads or utilities mapped within the Totten Inlet shoreline jurisdiction.

Kennedy Creek Natural Area is owned by Washington State DNR and contains known public access to both upland and tideland shoreline areas. Louise H. Meyers County Park, currently undeveloped, may be able to provide access in the future.

Management Opportunities

The Juvenile Salmonid Nearshore Project Selection Tool (Squaxin Island Tribe, 2009) identified areas between MTO-07 through MTO-13 as beneficial to all juvenile salmon and appropriate for conservation (See Appendix A).

The Marine Shoreline Sediment Survey and Assessment - Thurston County, Washington (Herrera Environmental and TRPC, 2005) identified many areas of marine shoreline in Totten Inlet as containing high priority areas for forage fish habitat restoration/protection (See Appendix A).

Totten and Eld Inlets Watershed Characterization Report (Thurston County, 2009) identified eleven sites as potential restoration or protection locations (See Appendix A).

PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012). (See Appendix A).

Management Strategy	**Beach**	**Barrier Embayment**	**Coastal Inlets &Watersheds**
Protect High	Beaches beginning north of Burns Cove and stretching north along Elizan Beach. *Note: This is the only beach area in Thurston County that PSNERP identifies as a high potential protection opportunity.	None	Bottom of Oyster Bay
Protect	North of the inlet at north end of Elizan Beach	Small area east of Gallagher Cove	East side of Burns Cove; Inlet at north end of Elizan Beach; Gallagher Cove
Restore High	Burns Point and south	None	None
Restore	Burns Cove; Gallagher Cove area and all beaches north of Gallagher Cove	All other barrier embayments	West side of Burns Cove to Burns Point; inlet in northern section of Elizan Beach
Enhance High	None	None	None
Enhance	None	None	None

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2012)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Highest Protection	None	None
Protection	None	None
Protection/restoration	Northern half of Elizan Beach and north to point at western edge of Gallagher Cove	MTO-11 to MTO-15
Conservation	Bottom of Oyster Bay to Burns Point	MTO-00 to MTO-04
Highest Restoration	Southern half of Elizan Beach	MTO-08 to MTO-11;
Restoration	Gallagher Cove	MTO-15 to MTO-17
Restoration/ Development	Burns Point and northeast through Burns Cove; east side of Gallagher Cove and north to Carlyon Beach	MTO-04 to MTO-08; MTO-17-MTO-23
Development/Restoration	None	None

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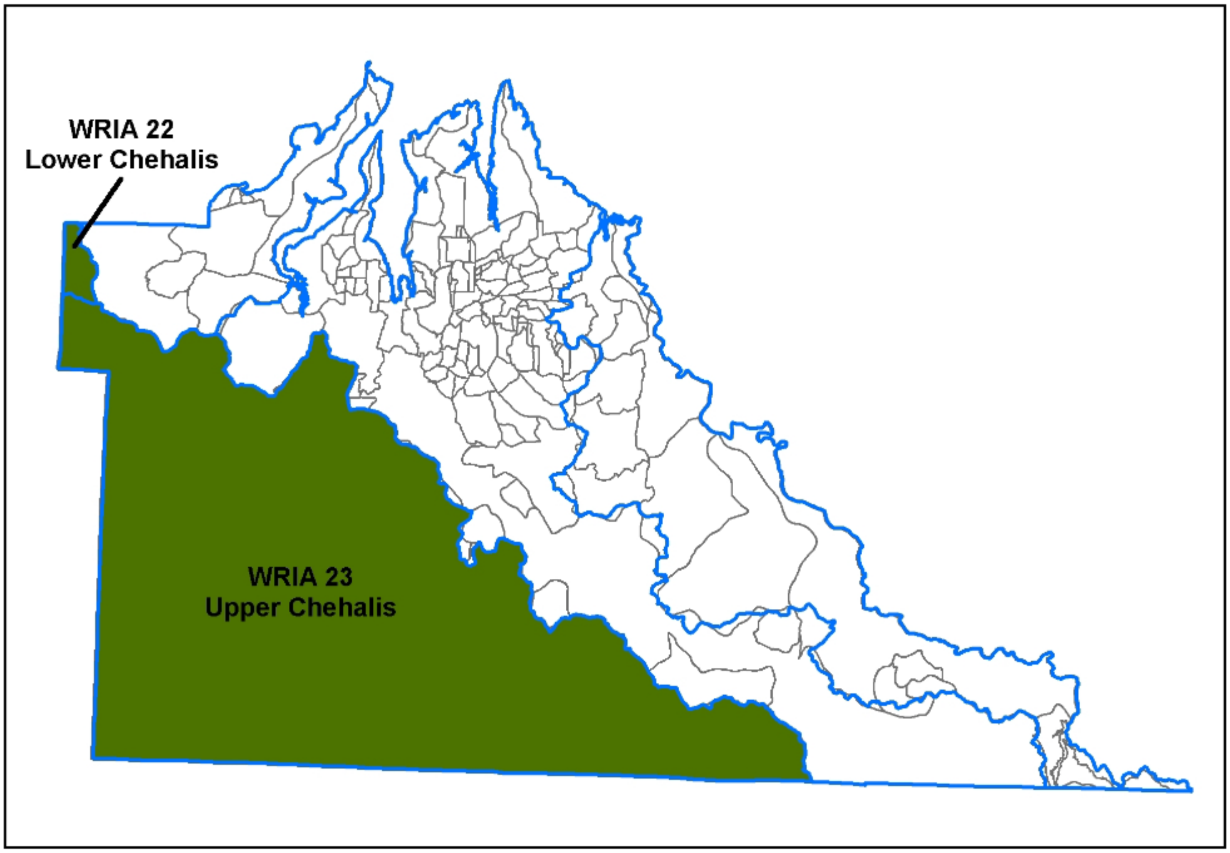
8 WRIA 23 (UPPER CHEHALIS)



Map 8.1. WRIA 23 (Upper Chehalis)

After an initial introduction to the WRIA as a whole, the data provided in this chapter are divided into subsections by basins and SMA jurisdictional waterbodies located within the Upper Chehalis Water Resource Inventory Area (WRIA 23). Each subsection includes information regarding water bodies, physical and biological characterization, shoreline land use, and management options.

Note: Thurston County contains a small portion of WRIA 22 – Lower Chehalis. However, WRIA 22 does not contain any jurisdictional shoreline and is therefore not further discussed in this document.

WRIA 23 Characteristics

WRIA 23 is located within the southern central portion of the county. WRIA 23 is approximately 1,298 square miles, of which 319 square miles is located in Thurston County. Forty two percent of the County is located in this WRIA. The cities of Rochester, Bucoda, Grand Mound and Tenino are located within this WRIA.

SMA jurisdictional waterbodies in WRIA 23 include:

Rivers: Black River, Chehalis River, Skookumchuck River, Dempsey Creek, Salmon Creek, Waddell Creek, Beaver Creek, Mima Creek, Sherman Creek, North Fork Porter Creek, Scatter Creek, Johnson Creek, and Thompson Creek (Skookumchuck).

Lakes: Black Lake, Skookumchuck Lake, Unknown Mine 1, Unknown Mine 2, Unknown Mine 3, Pond 3, Pond 4, Pitman Lake, Deep Lake, Scott Lake, and Lake Unknown 2, and Lake Unknown 4.

LANDSCAPE ANALYSIS

Process Controls

Geology (Maps 11 and 12)

The hills within Capitol State Forest along the western boundary of WRIA 23 are composed of erosion resistant basalt flows. The hills along the southern County border surrounding Skookumchuck Lake and the upper reaches of the Skookumchuck River are composed of erosion resistant andesite flows. The river valleys of the Black River, Chehalis River, and Skookumchuck River are primarily composed of glacially derived deposits. The river beds themselves are composed of alluvium. South of Scatter Creek and surrounding the Skookumchuck River, glacially derived deposits are mixed with areas of nearshore sedimentary rocks.

Topography (Map 10)

WRIA 23 contains steep hills along the western County border (in Capitol State Forest) and along the southern County border surrounding the upper reaches of the Skookumchuck River and Skookumchuck Lake. The hills in both areas are highest at approximately 2500 feet elevation. The remainder of WRIA 23 is composed of rolling hills and relatively flat areas.

Land Use/Land Cover

Current Land Use (Map 39 and 41b)

The predominant land uses within WRIA 23 are as follows: Single family residential (12 %) Designated Forest Land (30%) and Undeveloped Land (33%).

The predominant zoning designations within WRIA 23 are as follows: Long Term Forestry (39 %) and Rural Residential - One Dwelling Unit per Five Acres (41 %).

Many of the areas adjacent to the rivers within this WRIA are utilized for agriculture. Review of the 2006 aerials of this area indicated that natural shoreline vegetation, associated habitat and occasionally water courses have been modified as a result of the agricultural practices within these areas.

Projected Future Use (Map 41)

TRPC's analysis of future basin use within this WRIA reflects that this area will experience increased commercial and residential development in the Grand Mound and Rochester areas. Additionally, it is projected that this area may also experience an increase in industrial development. Please refer to specific basins for additional data.

Land Cover (Map 25)

The predominant land covers in WRIA 23 are: Evergreen Forest (33%) Scrub/shrub (17%) and mixed forest (10%). High and medium intensity development is below 1% combined. Low intensity development is 3%. Agriculture is relatively high with Pasture/Hay (9%) and cultivated crops (2.5%).

Landscape Process Important Areas and Alterations

Hydrology

Important Areas (Map 16)

Areas important for water delivery are areas with relatively higher precipitation, and rain-on-snow areas. The western boundary of WRIA 23 falls within the Black Hills, and contains large areas mapped as "rain-dominated zones" as well as areas of "rain-on-snow zones". The highest levels of annual precipitation in Thurston County, up to 127 inches per year, occur within the Black Hills. The hills surrounding the upper reaches of the Skookumchuck River and Skookumchuck Lake also contain large areas mapped as "rain-dominated zones" as well as areas of "rain-on-snow zones". Much of the precipitation that falls in the Black Hills and hills surrounding the Skookumchuck River runs off because of the impermeable basalt and andesite that dominates the landform.

Important areas for surface water storage are areas containing depressional wetlands, wetlands, lakes, 100-year floodplain, and unconfined river channels. There are numerous lakes, ponds, and mines located in WRIA 23 and listed in the WRIA 23 characteristics section above. The area east of Black River between Scott Lake and Scatter Creek contains numerous wetlands. The Dempsey Creek area and the Black River also contain numerous wetlands. Depressional wetlands are extensive throughout the Black River and Dempsey Creek area, as well as east toward Pitman Lake. Depressional wetlands are also located in the headwater area of Scatter Creek, and around tributaries to the Skookumchuck River. The 100-year floodplain is very wide and extensive around the Black River, Dempsey Creek, the Chehalis River, the Skookumchuck River, and Scatter Creek. It is also extensive along Waddell Creek, Mima Creek, Johnson Creek, Thompson Creek (Skookumchuck) Beaver Creek/Allen Creek, Bloom's Ditch and Salmon Creek. Unconfined river channels are found along the Black River, Dempsey Creek, Beaver Creek, Allen Creek, Mima Creek, the Chehalis River, Scatter Creek, the Skookumchuck River, Johnson Creek, and Thompson Creek (Skookumchuck).

Shallow subsurface flow important areas contain low permeability soils. The majority of WRIA 23 occurs on low permeability soils with the exceptions of the low-lying valley areas.

Areas with high permeability soils are important for recharge. High permeability soils are found along all of the river valleys. They are extensive in the southwest corner of the county near the Chehalis River, Scatter Creek, and the Black River. Large areas of high permeability soils are also located between Beaver Creek and Black Lake.

Indicators of Alteration (Map 17)

Water delivery timing is impaired when non-forested land cover occurs in rain-on snow zones, and in "rain-dominated" zones. There are some areas of non-forest landcover, due to timber harvest, in the rain-dominated and rain-on snow zones in the Black Hills and in the hills surrounding the Skookumchuck River upper reaches.

Water movement via overland flow may be impaired by the occurrence of impervious cover within a watershed. Impervious surface cover concentrations occur near Black Lake and around the Tumwater urban growth area. Impervious surface concentrations are also located in the Grand Mound and Rochester areas, around the towns of Tenino and Bucoda, and near Littlerock and Scott Lake.

Surface storage may be impaired by the loss of depressional wetlands and the presence of the built environment adjacent to streams. In general, there are few areas where depressional wetlands have been lost. The western and northern sides of Scott Lake appear to have lost depressional wetlands. Built environment adjacent to streams occurs near Littlerock along the Black River, along Beaver Creek near the railroad and Interstate 5, along the Chehalis River close to Grand Mound, and in places along Scatter Creek due to rural development.

Shallow sub-surface flows may be impaired by the presence of land cover with impervious surfaces and non-forested landcover on low permeability soils. There are few areas of impervious surfaces on low permeability soils in WRIA 23. These infrequent areas are primarily located east of the Black River and north of Beaver Creek. Non-forested landcover on low permeability soils occurs primarily in the hill areas of WRIA 23. These areas include the hills south of the Skookumchuck River surrounding Unknown Mines 2-4 and the areas of timber harvest surrounding the upper river reaches; the hills of Capitol Forest where timber harvest has removed vegetated cover; and areas around the town of Tenino and Beaver Creek.

Recharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils. WRIA 23 contains extensive areas of non-forested vegetation on areas of high permeability soils. Impervious surfaces on high permeability soils are found in highest concentration around the Tumwater UGA, along Beaver Creek near the railroad and I-5 and near Littlerock, along Scatter Creek, and in the Rochester/Grand Mound area. The river valleys of the Black River, Chehalis River, Scatter Creek, and the Skookumchuck River, as well as Beaver Creek, and Bloom Ditch have non-forested vegetation on high permeability soils. Although many of these areas have been modified by clearing for agriculture, residential development, or transportation, other areas are native prairies and historically do not have forest cover.

Vertical and lateral flows may be impaired by roads, ditches, and culverts. The major roads in WRIA 23 include Interstate 5, US Highway 12, and State Highway 507. WRIA 23 also contains several railroad tracks. Roads are most concentrated in the Rochester/Grand Mound area, the towns of Tenino and Bucoda, and around the Tumwater UGA. Capitol Forest contains numerous roads. The hills east and south of Skookumchuck Lake contain infrequent private logging roads. Culverts are concentrated in the low elevation areas of WRIA 23.

Discharge may be impaired by land cover with impervious surfaces and non-forested vegetation on areas with high permeability soils that intersect floodplains. Discharge may be impaired along the Chehalis River, the lower Black River, Scatter Creek, the Skookumchuck River (downstream of the dam) and Beaver Creek.

Sediment

Important Areas (Map 18)

Process intensive areas for sediment delivery are areas of surface erosion, mass wasting, and in-channel erosion. Sediment delivery via surface erosion occurs in areas with steep slopes and erodible soils. Concentrations of these areas are located east of Waddell Creek, and east of Sherman Creek, along the upper reaches of the Skookumchuck River (upstream of Skookumchuck Lake), extending north around the headwaters of Scatter Creek.

Sediment delivery via mass wasting occurs in high mass wasting hazard areas and landslide areas. Landslide areas are mapped in the headwater areas of the Skookumchuck River and around Skookumchuck Lake. Very limited, small locations of high mass wasting hazard areas are mapped in the Black Hills, south of the Chehalis River, east of Grand Mound, in the hills east of Tenino, and in the hills around the Skookumchuck River.

Sediment delivery via in-channel erosion occurs in unconfined channels or those channels with gradients less than 4%. All of the major tributaries and SMA jurisdictional streams in WRIA 23 have the potential for in-channel erosion.

Sediment storage occurs in depressional wetlands, floodplains, depositional stream channels, and lakes. For sediment storage locations, please see the list of areas important for surface water storage above.

Indicators of Alteration (Map 19)

Sediment delivery via surface erosion may be impaired in areas of non-forested land cover on highly erodible slopes adjacent to streams, as well as locations with roads within 200’ of aquatic ecosystems or road crossings. Only a few small areas of non-forested landcover on highly erodible slopes adjacent to aquatic ecosystems exist in WRIA 23, with no significant concentrations. These are primarily due to active timber harvest around the Skookumchuck River headwaters and in the hills south of the Chehalis River. WRIA 23 contains a number of roads within 200 feet of aquatic ecosystems, with concentrations located in the lowland areas around Black Lake, the Black River, the Chehalis River and the area south of the Tumwater UGA and north of Scatter Creek.

Sediment delivery via mass wasting may be impaired when roads or non-forested vegetation occur in high mass wasting hazard areas. Only a few very small such areas exist in WRIA 23 with no significant concentrations.

Sediment delivery via in-channel erosion may be impaired when the built environment is adjacent to unconfined channels. This may occur in the floodplain area between the Black River and the Chehalis River near Grand Mound, around mid-Scatter Creek, and the Skookumchuck River (downstream from Bucoda).

Sediment storage may be impaired when depressional wetlands are lost, or in the presence of dams. Depressional wetlands have been lost on the west and north side of Scott Lake. Depressional wetlands have also been lost in smaller areas in and around the Tumwater UGA. WRIA 23 contains 17 dams.

Water Quality

Important Areas (Map 20)

Areas important for maintaining water quality are streams, wetlands (particularly depressional wetlands) floodplains, and areas of high and low permeability. Depressional wetlands adsorb pathogens, phosphorus, and toxins. Nitrification and pathogen sedimentation also occur in depressional wetlands. Floodplains are another important area for sedimentation of pathogens. Pathogens are moved along the surface via streams, rivers, and wetlands with a surface water connection. Pathogens move underground in areas with shallow subsurface flow and recharge areas. Please see the “Hydrology Important Areas” for locations.

Indicators of Alteration (Map 21)

Water quality alterations can occur from failing septic systems, agricultural operations, loss of depressional wetlands, and the clearing and impervious surface areas that occur from the built environment. The built environment is most dense around Black Lake, in and around the Tumwater UGA, and in the Rochester/Grand Mound area. Increased inputs of nutrients and pathogens may occur on parcels with failing septic systems. Most of WRIA 23’s lowland areas contain parcels with assumed on-site septic.

WRIA 23 contains extensive areas of agriculture, including eleven dairy farms. Areas zoned Long Term Agriculture are located along the western portion of the Black River, throughout the Chehalis River Valley, and along the Skookumchuck River between Bucoda and Skookumchuck Lake. In addition, many areas zoned Rural Residential Resource 1/5 also contain agricultural uses. This zoning is extensive in WRIA 23.

WRIA 23 contains four landfills. The towns of Bucoda and Tenino each have a landfill located to the southeast of town. The other two landfills are located just east of the Black River.

There are thirty-five contaminated terrestrial sites mapped within WRIA 23 (including those within the town of Tenino). These sites are located in and around the Tumwater UGA, in the town of Tenino, in the Chehalis River Valley, along the Black River, in the headwaters of Beaver

Creek, and in Capitol Forest. There are two areas within WRIA 23 on the 303(d) polluted waters list. Black Lake is on the 303(d) polluted waters list for Total Phosphorus and PCB’s in fish tissue. A small stream at the headwaters of Scatter Creek is on the 303(d) list for temperature.

Large Woody Debris

Important Areas (Map 22)

Important areas for large woody debris delivery occur in areas of mass wasting, windthrow, and stream bank erosion. These areas are located in unconfined channels, mass wasting areas, and the area 100’ from all water bodies and streams. Unconfined channels are located on the majority of major tributaries in WRIA 23. Please see the sediment important areas section for mass wasting areas.

Important areas for large woody debris storage are channels with less than 4% slope or unconfined channels. In addition to the areas of unconfined channels described above, streams with less than 4% slope are found in most of the tributaries to major tributaries.

Indicators of Alteration (Map 23)

There are few areas of non-forested land cover on high mass wasting hazard areas, indicating minimal impairment to LWD delivery to streams via mass wasting. These small areas are primarily located around the mines south of the town of Bucoda, along Skookumchuck Lake, and in Capitol Forest.

There is some impairment to large woody debris delivery via windthrow. There are some small areas of built environment within 100 feet of streams, and areas of non-forest landcover within 100 feet of streams. These areas are concentrated on the Black River near Littlerock, and the western County boundary, along the Chehalis River Valley, along Scatter Creek, the Skookumchuck River, Beaver Creek, and Allen Creek.

WDFW Local Habitat Assessment (Map 23b)

WRIA 23 contains numerous large patches of good quality wildlife habitat. These areas are concentrated in the Black Hills (Capitol Forest area) along the Black River, in the eastern portion of WRIA 23 around Pitman Lake, around Skookumchuck Lake, and the upper reaches of the Skookumchuck River. The areas of lowest quality habitat are concentrated in Grand Mound, the Towns of Tenino and Bucoda, the Rochester area, the Interstate 5 corridor, Scott Lake, the Tumwater UGA, and Black Lake. WRIA 23 contains areas of numerous priority habitats and species (please see the waterbody descriptions for further details). WRIA 23 contains many public preserves managed to conserve wildlife and habitat. These areas include: the USFWS Black River Unit of the Nisqually National Wildlife Refuge, Millersylvania State Park, Scatter Creek and Black River State Natural Areas, Mima Mounds State Natural Area, and Thurston County Glacial Heritage Preserve. In addition, although the Capitol State Forest is actively harvested for timber, it provides an expansive area free from residential development.

Process-based Management Recommendations

Please see Chapter 9 for a discussion of programmatic management recommendations. These recommendations are discussed at the ecosystem scale and therefore apply throughout the County to areas where important ecological processes have been altered.

SHORELINE REACH-SCALE INVENTORY

The shoreline reach-scale inventory is organized by basin and waterbody. Maps used for the shoreline reach-scale inventory are listed in Table 8.1 and are located in Appendix H.

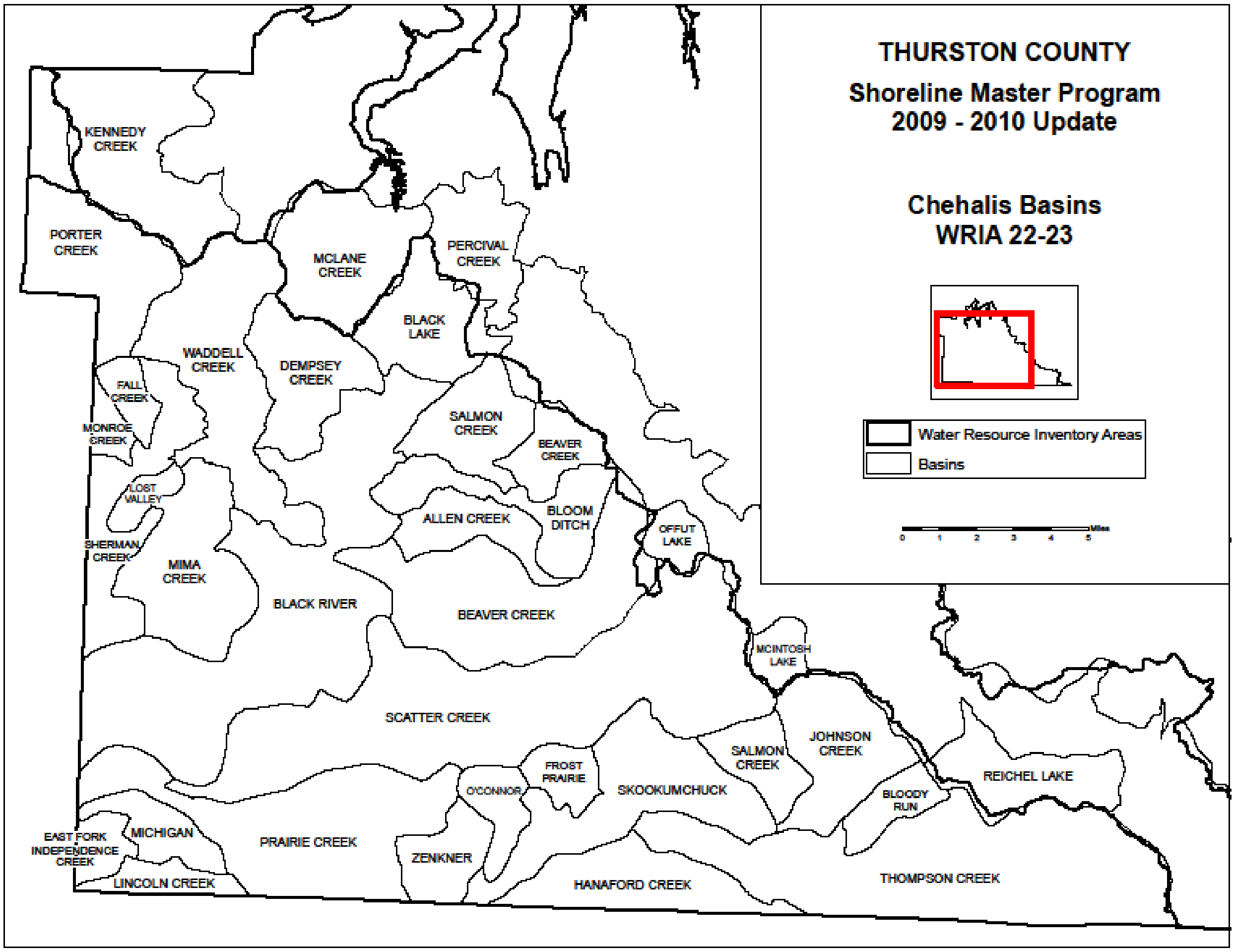
Table 8.1. Maps used for the shoreline reach-scale inventory (located in Appendix H).

<table>
<tr><th></th><th colspan="2">Map Numbers and Titles</th></tr>
<tr><th>Shoreline Type</th><th>Physical and Biological Characterization</th><th>Shoreline Use Patterns</th></tr>
<tr><td>Marine</td><td>10 – Topography and Hydrology
10a – Shoreline Type
14 – Coastal Process Important Areas
21– Water Quality Process Alterations
24 – Arial Photos
29 – Critical Areas - Biological
31– Critical Areas - Hydrologic
32 – Critical Areas - Geologic
34b – Kelp and Eelgrass
34c – Saltmarsh
35 – Marine Fisheries
36 – Shellfish Areas</td><td>15 – Coastal Process Alterations
17 – Hydrologic Process Alterations
26 – Impervious surfaces
24 – Arial Photos
37 – Aquatic Land Ownership
38 – Nationwide Permit 48
39 – Current Land Use – Generalized from the Office of the Assessor
41a – Future Land Use
41b – Current Zoning
41c – Future Development Potential
43 – Public Access and Public Lands
44 – Existing Shoreline Environment Designations</td></tr>
<tr><td>Freshwater</td><td>10 – Topography and Hydrology
21– Water Quality Process Alterations
24 – Arial Photos
29 – Critical Areas - Biological
31– Critical Areas - Hydrologic
32 – Critical Areas - Geologic</td><td>17 – Hydrologic Process Alterations
26 – Impervious surfaces
24 – Arial Photos
39 – Current Land Use – Generalized from the Office of the Assessor
41a – Future Land Use
41b – Current Zoning
41c – Future Development Potential
43 – Public Access and Public Lands
44 – Existing Shoreline Environment Designations</td></tr>
</table>

Basins

Table 8.2. The basins located within WRIA 23 (Upper Chehalis).

Basin	Area within WRIA (Acres)	Percent Area of WRIA
Allen Creek	3418.65	1.68
Beaver Creek	15123.30	7.41
Black Lake	4870.04	2.39
Black River	25092.30	12.30
Bloody Run	2061.79	1.01
Bloom Ditch	5005.49	2.45
Dempsey Creek	5820.26	2.85
Deschutes River	994.19	0.49
East Fork Independence Creek	1550.91	0.76
Fall Creek	1443.02	0.71
Frost Prairie	1843.46	0.90
Hanaford Creek	6094.57	2.99
Johnson Creek	6481.10	3.18
Kennedy Creek	88.70	0.04
Lincoln Creek	1879.04	0.92
Lost Valley	1143.31	0.56
McIntosh Lake	48.17	0.02
McLane Creek	126.97	0.06
Michigan	2630.15	1.29
Mima Creek	7940.43	3.89
Monroe Creek	1072.12	0.53
O'Connor	2189.08	1.07
Offut Lake	98.52	0.05
Percival Creek	142.41	0.07
Perry Creek	7.83	0.00
Porter Creek	7463.76	3.66
Prairie Creek	13550.90	6.64
Reichel Creek	405.93	0.20
Salmon Creek (Black)	4620.25	2.26
Salmon Creek (Skookumchuck)	2830.57	1.39
Scatter Creek	27169.20	13.32
Sherman Creek	6187.11	3.03
Skookumchuck	9471.62	4.64
Thompson Creek (Skookumchuck)	20966.50	10.28
Waddell Creek	11160.40	5.47
Zenkner	3002.16	1.47



Map 8.2. The basins located within WRIA 23 (Upper Chehalis).

Allen Creek Basin

Basin Overview

Allen Creek basin is located in the central portion of the County. It is 3,419 acres in size and is located entirely within WRIA 23. Water in Allen Creek basin generally flows toward Allen Creek, Scott Lake, and Deep Lake. Allen Creek flows into Beaver Creek and ultimately Black River. The basin contains Millersylvania Park. Millersylvania State Park is an 842-acre park. The park contains approximately 3,300 feet of freshwater shoreline on Deep Lake.

Allen Creek basin contains 3.01 miles of SMA jurisdictional lake shoreline. Scott Lake contains four reaches (Reach name series: LSL). Deep Lake contains three reaches (Reach name series: LDE). See Appendix A.

Deep Lake

Physical and Biological Characterization

Deep Lake is 66 acres, with a mean depth of 12 feet and a maximum depth of 17 feet. The lake is located at roughly 200 feet elevation and situated between gentle hills (elevation 300 feet).

Deep Lake is within the 100-year floodplain. The 100-year floodplain is also present along Deep Lake's inlet and outlet streams, and is extensive along the west side of the lake. Deep Lake's inlet is a high ground water flood hazard area.

Deep Lake is fed by a small unnamed stream on the southeast side of the lake. The inlet stream flows through an associated wetland. Deep Lake's outlet flows out of the northwest side of the lake through a large associated wetland into Scott Lake. The outlet creek is officially unnamed but is referred to as Spruce Creek by Millersylvania State Park. In addition, there are two other associated wetlands extending as lobes off of the northeast and southwest corners Deep Lake.

The unnamed creek is mapped as supporting coho salmon, sea-run cutthroat and resident cutthroat. WDFW stocks Deep Lake with rainbow trout. Deep Lake may also provide habitat for mink, green heron, Olympic mudminnow, wood duck, and osprey.

Riparian vegetation along the north lake shoreline is a mix of intact scrub/shrub wetland and somewhat fragmented forest. The forest has been cleared in a few areas for recreational purposes. The east side of the lake contains very little riparian vegetation. This area has been cleared for a mobile home park. The south and west side of the lake contains some areas with intact forest or scrub/shrub wetland interspersed with areas cleared for lawns and low density development.

Water quality in Deep Lake is categorized as 'good' with good water clarity and low nutrient levels. Deep Lake receives heavy recreational usage in the summer, which increases the risk of the spread of a communicable disease associated with poor personal hygiene and facility over-usage. Swimmer's itch is a regular summer problem in Deep Lake, so preventative measures should be taken by bathers. Eurasian water milfoil, an invasive, non-native aquatic plant, was discovered in the lake in 2003. Washington State Parks and Recreation is taking steps to control its spread in the lake (Thurston County Water Resources Monitoring Report, 2012). The Millersylvania State Park Headquarters, located on the northeast corner of Deep Lake, is a contaminated site for soil.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is residential, open space, other, parks, commercial, and timber/forest land. Approximately two-thirds of Deep Lake's shoreline is within Millersylvania State Park. The southern lakeshore is low density residential development. An area on the east side of the lake is used as a mobile home park and may exceed 30% impervious surface. The north lake shoreline contains a road and several parking lots. Impervious surfaces are associated with residential buildings but are low on the south and west shorelines. Deep Lake's water oriented uses include swimming, boating, and fishing.

Deep Lake's existing Shoreline Environment Designation is Conservancy. The west and north shorelines are zoned Public Parks Trails and Preserves. The east and southeast shorelines are zoned Rural Residential Resource 1/5, with a small area of Neighborhood Convenience Commercial on the east shoreline. Under current zoning regulations, there are approximately 18 lots within shoreline jurisdiction, three of which are developable as subdividable vacant lots.

The east side of Deep Lake has a road, private driveways for the mobile home park, and a dock. The southern shoreline contains two docks and a road. The west and north shorelines contain two docks, two roads, and some cabin recreation structures.

There is public access to the north shoreline of Deep Lake from Millersylvania Park. This public access to Deep Lake provides opportunities for boating, fishing and swimming. The park has three swimming beaches that are used heavily in the summer and a motor boat launch and a hand launch.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Deep Lake is recommended for restoration.

Scott Lake

Physical and Biological Characterization

Scott Lake is a 69 acre lake with a mean depth of 11 feet and a maximum depth of 18 feet. It is located to the northwest of Deep Lake. Scott Lake and the creek flowing in and out of the lake are within the 100-year floodplain. High groundwater hazard areas are located along the south, east, and north sides of Scott Lake.

An unnamed creek flows into the east side of Scott Lake through an extensive associated wetland from Deep Lake. Allen Creek flows out of the west side of Scott Lake. Scott Lake has extensive associated wetlands located on its southern, eastern, and northern shorelines.

Scott Lake may provide habitat for coho salmon, searun cutthroat, resident cutthroat, and wood duck. Riparian vegetation within the associated wetlands on the southeast and eastern shorelines appears unmodified. It is a mix of shrub and emergent wetland vegetation. The southwest shoreline riparian vegetation is highly modified by a golf course and recreational uses. Very little riparian vegetation remains in this area. The riparian vegetation along the northern half of the lake has been highly modified for residential development to the water edge. Little riparian vegetation remains in the northern half of the lake. A Washington Department of Ecology survey (2000) of Scott Lake found Eurasian water-milfoil, an invasive exotic species. There is no other data on water quality.

Shoreline Use Patterns

The east and southeast sides of Scott Lake are primarily agriculture. The south and southwest shoreline is open space, recreation, and other. The north half of Scott Lake is primarily residential with some undeveloped parcels. Scott Lake's southeast and south shorelines are free of impervious surfaces. The western and northern shorelines have estimated impervious cover above 10%. Water oriented uses include swimming, boating, and recreation.

The northern half of Scott Lake is designated Rural, and the southern half is designated Conservancy under the existing SMP. The northwest shoreline is zoned Residential LAMIRD 2/1. The remainder of Scott Lake is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 84 lots within shoreline jurisdiction, five of which are developable. Three parcels are vacant single lots, one parcel is a subdividable vacant lot, and one parcel has the potential for additional infill.

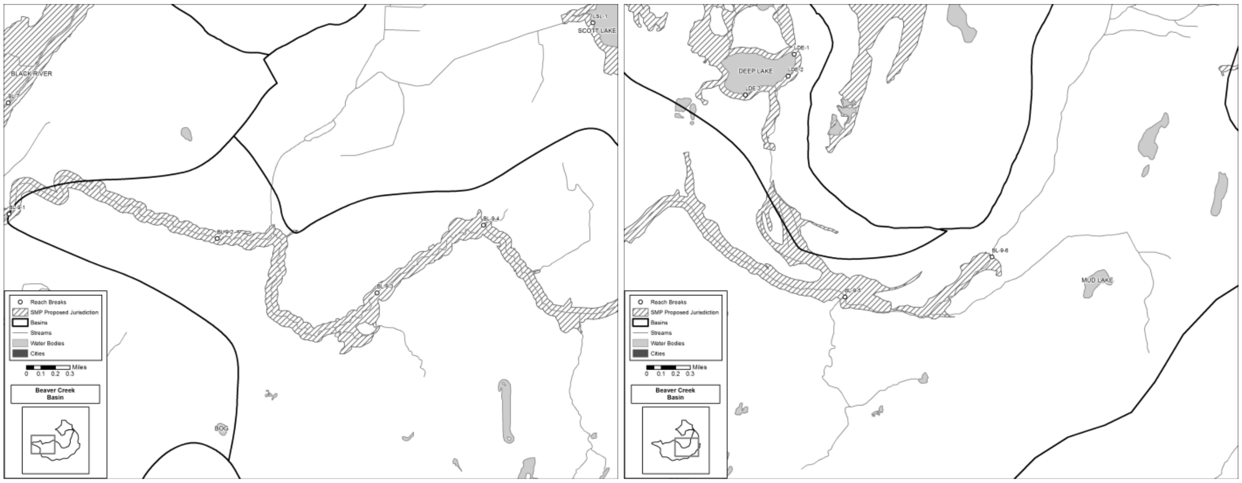
The northern half of the lake contains numerous private docks and occasional bulkheads. There is also a private community dock and boat ramp on the southwest shoreline. A golf course has modified the vegetation along much of the south shoreline. Several roads have limited the extent of associated wetlands around Scott Lake. On the north shoreline, 113th Avenue SW is the outer limit of shoreline jurisdiction. On the south and west sides of the lake, Scott Creek Drive SW and several associated culverts form the boundary of shoreline jurisdiction.

Public Access is available through a nine-hole golf course located on the south side of the lake. Informal public access to shoreline jurisdiction but not to the water is available via Par Court SW. Semi-public access is available through the private community dock and boat ramp on the southwest shoreline.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
Scott Lake is recommended for restoration.

Beaver Creek Basin



Basin Overview

Beaver Creek is located in the central portion of the county. It is 15,854 acres in size. The majority of the basin, 15,181 acres, is located in WRIA 23. A small portion of the basin, 673 acres, is located in WRIA 13. As the majority of the basin is located in WRIA 23, review of it is provided in this chapter. Water in Beaver Creek basin generally flows into Beaver Creek and ultimately Black River.

Beaver Creek basin contains 8.19 miles of SMA jurisdictional shoreline along Beaver Creek, broken into five reaches (Reach series name: BL-9). See Appendix A.

Beaver Creek

Physical and Biological Characterization

Beaver Creek is located in a relatively flat area of the county. In the upper reaches, it is a low gradient, moderately confined to unconfined, small tributary or seasonally flooded wetland. In the lower reaches, Beaver Creek is a low gradient, moderately confined, small tributary.

The 100-year flood plain is mapped along all of Beaver Creek within shoreline jurisdiction. The potential channel migration zone may extend beyond the 100-year floodplain in several places along Beaver Creek. A small area of steep slopes is mapped along the left bank (south) of the uppermost reaches. High groundwater hazard areas are mapped along the majority of Beaver Creek.

Beaver Creek is a tributary to the Black River and drains to the east side of the Black river basin. Beaver Creek has extensive associated wetlands, particularly in the upper reaches. There are also numerous wetlands located within the Beaver Creek basin that are associated with unnamed tributaries to Beaver Creek. The 100-year floodplain, together with extensive associated wetlands, connects a portion of the Beaver Creek drainage to Deep Lake and Scott Lake. Deep

Lake drains to Scott Lake, which drains to Allen Creek, which drains to Beaver Creek. Beaver Creek also drains directly to the Black River.

Beaver Creek may support the following species: coho salmon, sea-run cutthroat and resident cutthroat, chum, winter steelhead, Olympic mudminnow, riffle sculpin, reticulate sculpin, Pacific Lamprey, harlequin duck, wood duck, Oregon spotted frog, mardon skipper, valley silverspot, Puget blues, and Taylor's (Whulge) checkerspot. Prairie soils are mapped along the majority of Beaver Creek. Oak habitat is mapped near the lower and upper reaches of Beaver Creek. A large, approximately 600 acre Conservation Area owned by WDFW is located along the upper reaches of Beaver Creek basin.

Riparian vegetation in Beaver Creek's uppermost reaches, upstream of Tilley Road South, is unmodified wetland vegetation (primarily forest and shrub). This area is a large wetland complex. Downstream of Tilley Road South and upstream of Reeder Road SW, riparian vegetation is a mix of intact forest/shrub areas and some areas cleared of vegetation for agriculture and very low density residential development. Downstream of Reeder Road SW, and upstream of Case Road SW, riparian vegetation on the left bank (south) is primarily intact forest and emergent, with cleared areas for a parking lot, State Route 121, and Interstate 5. Vegetation on the right bank (north) is primarily emergent and grasses, with a few shrubs. It has been cleared for agriculture, highways, and commercial activities. Downstream of Case Road SW and upstream of Littlerock Road SW, vegetation along the right bank has been primarily cleared for agriculture or fragmented for low density residential development. Vegetation on the left bank is primarily intact forest cover; however, there are several areas where the forest cover has been cleared for agriculture or for powerlines. In the lowest reach, riparian vegetation on both sides of the creek is patchy trees with the understory cleared for agriculture.

Water quality in Beaver Creek is categorized as 'Good'. Overall, the water quality has improved. Both parts of the fecal coliform standard were met in the last two water years. In fall of 2009, there was a turbidity violation. The spawning criteria temperature standard may be exceeded occasionally. Water quality issues of concern include nonpoint source pollution, especially from livestock, and increasing development (Thurston County Water Resources Monitoring Report, 2012).

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential, undeveloped, and agriculture. The upper and mid-reaches contain some open space. Near Interstate 5 and the Weyerhauser Railroad , there is an area of commercial, industrial, and transportation. Timber/forestland use is most common on the creek's left bank and is patchy along the length of Beaver Creek.

Impervious surfaces are generally low within Beaver Creek shoreline jurisdiction. The area around Interstate 5, State Route 121, and the Weyerhauser Railroad contains the highest concentration, but this still does not appear to exceed ten percent. Water oriented uses include fishing and wildlife viewing.

The existing Shoreline Environment Designation for the majority of Beaver Creek is Conservancy. The area around Interstate 5, State Route 121, and the Weyerhauser Railroad is currently designated Urban. The uppermost reach is not currently designated. Zoning along Beaver Creek is primarily Rural Residential Resource 1/5. The lowest reaches contain an area of Rural 1/20. The area around Interstate 5 is zoned Rural Resource Industrial. The uppermost reach is zoned Public Parks Trails and Preserves. Under current zoning regulations, there are approximately 168 lots within shoreline jurisdiction, 37 of which are developable. There are 22 vacant single lots, 12 subdividable vacant lots, and three parcels with the potential for additional infill.

Beaver Creek has been modified by roads, bridges, culverts, railroads, utility structures, and contaminated sites. Interstate 5 crosses mid-Beaver Creek. This area has the highest concentration of roads within shoreline jurisdiction and includes Case Road SW and its associated bridge, Maytown Road SW/State Route 121, Reeder Road SW and its associated bridge. This area also contains three railroad crossings of the Weyerhauser Railroad. Upstream of this area, Beaver Creek Road SW and Tilley Road SW (with its associated bridge) cross Beaver Creek's shoreline jurisdiction. In the lower reaches, Littlerock Road SW and its associated bridge and Maytown Road SW cross shoreline jurisdiction. In addition to the public roads just mentioned, in the lower three reaches, there are several private drives that cross into shoreline jurisdiction. Also in the lower three reaches, there are two sets of powerlines that cross Beaver Creek. In reach BL-9-2-BL-9-3, there are five mapped culverts within shoreline jurisdiction, though none of them are on Beaver Creek itself. Four are associated with Maytown Road SW, and one is associated with Case Road SW. In reach BL-9-4-BL-9-5, there is a mapped culvert on Beaver Creek associated with Beaver Creek Drive SW, and a culvert on an unnamed creek associated with Gunstone Street SW. In the uppermost reach, there are several culverts associated with Tilley Road SW that limit the extent of shoreline jurisdiction through associated wetlands.

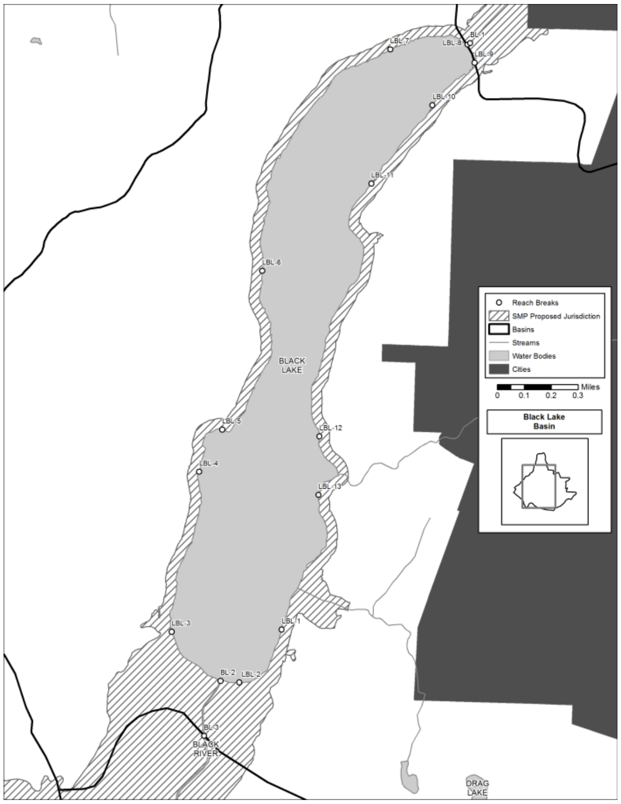
Just north of shoreline jurisdiction in the uppermost reach, there is a superfund site located at 13120 Tilley Road South, Maytown. The site is also known as the former Pacific Powder site. The soil and groundwater contamination on the site is related to the manufacturing dynamite and other explosives that occurred on site from the early 1940's until 1994. Clean up activities occurred on site in 1995 and 1997. Additionally, public access to the site is limited by a fence and locked gate, which limits potential exposure to humans due to any remaining contaminants on site.

There is no defined public access to Beaver Creek. Informal public access is available through all the roads listed above.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Beaver Creek is recommended for restoration/least impact to process.

Black Lake Basin



Basin Overview

Black Lake basin is located in the central portion of the county. It is 5,526 acres in size. The majority of the basin, 4,885 acres, is located in WRIA 23. A small portion of the basin, 641 acres, is located in WRIA 13. As the majority of the basin is located in WRIA 23, review of it is provided in this chapter. Water within the Black Lake basin generally flows towards Black Lake. Black Lake flows north to Percival Creek and Capitol Lake, ultimately reaching Budd Inlet.

Black Lake basin contains two waterbodies subject to SMA jurisdiction, Black Lake and the Black River. Black Lake has 6.08 miles of jurisdictional lake shoreline, broken into thirteen reaches (Reach series name: LBL). In this basin, the Black River has 0.22 miles of jurisdictional stream shoreline, in one reach (Reach series name: BL). See Appendix A. The Black River reach in this basin is discussed in the Black River basin section of this chapter.

Black Lake

Physical and Biological Characterization

Black Lake is one of the largest lakes in Thurston County. It is roughly 570 acres with a mean depth of 19 feet and a maximum depth of 29 feet. Black Lake is oriented in a north/south direction and is located at approximately 130 feet in elevation.

Black Lake has a few areas of steep slopes located along its northwest side and around an east-side tributary. There are no landslide hazard areas. One small area of high ground water hazard lies on the northwest shoreline. The entire lake is within the 100-year floodplain. At both ends of the lake, but particularly at the south end, the 100-year floodplain is broad.

Black Lake's historic outlet was to the south via the Black River, which is now obstructed by numerous beaver dams and vegetation. Since the Black Lake ditch was dug, Black Lake's outlet has changed to flow north via Black Lake Ditch which flows to Percival Creek. The Black River flows from the wetland complex just south of the lake. Fish Pond Creek and an unnamed stream flow into the east side of the lake. A major wetland complex begins at the south end of the lake and continues along the Black River. Another large wetland area extends from the north end of the lake along Black Lake Ditch. These wetlands and the shallow groundwater system have an influence on the water quality characteristics of the lake.

WDFW stocks Black Lake with rainbow trout. Black Lake may contain fall Chinook, coho, sea-run cutthroat, and resident cutthroat. Black Lake may provide habitat for green heron, wood duck, and waterfowl concentrations.

The south end of the lake is largely undeveloped with intact vegetation (primarily emergent/shrub). The majority of Black Lake's west side is developed residential with very little intact vegetation. The north end of the lake has a greater amount of intact vegetation in a narrow strip between the lake and Black Lake Boulevard SW and Black Lake/Belmore Road SW. The greater part of the east side of the lake is also developed residential with little vegetation except for areas surrounding the two small streams flowing into the lake.

Black Lake's water quality is categorized as 'fair' due to moderate to high nutrient concentrations which frequently result in late summer and fall nuisance blue-green algae growth. The algae blooms cause pea-green water color and thick scums on the lake surface which interferes with recreational uses. Lake users should stay out of the lake and avoid recreational uses during these severe algae blooms. Swimmer's itch is a regular summer problem in Black Lake. Beaver activity in Black Lake ditch and the Black River outlet to the south can cause the lake level to rise and flood yards and docks.

Black Lake is listed on the Ecology 2012 303(d) list of polluted waters for PCBs (tissue) and phosphorus. Black Lake ditch (adjacent to the north shore of Black Lake and Black Lake's outlet), is listed on the Ecology 2012 303(d) list of polluted waters for temperature, dissolved oxygen, and pH. Black Lake grocery is a contaminated groundwater and soil site on the northwest side of the lake.

Shoreline Use Patterns

The east side of Black Lake is within the City of Tumwater Urban Growth Area. The majority of existing land use within shoreline jurisdiction is moderate density residential and undeveloped. There are two large mobile home parks on the east shoreline and two RV commercial resorts on the west side of the lake. The east shoreline contains several large open space and recreation parcels. There is a County owned park on each side of the lake. Kennydell Park is developed on the east side. Guerrin Park is undeveloped on the west side. Black Lake Boulevard runs through shoreline jurisdiction on the northwest side of the lake. The south and north ends of Black Lake are dominated by extensive wetland systems.

Impervious surfaces are relatively high along the west and northeast lake shorelines. Impervious surfaces are estimated to be above 30% along the northwest and northeast lake shoreline. Water oriented uses of Black Lake include boating, fishing, and swimming.

Existing Shoreline Environment Designations are Natural around the south end of the lake, Conservancy and mostly Rural up the west shoreline, Percival SMA at the outlet to Black Lake Ditch, and Rural and Conservancy along the east shoreline.

Zoning along the east side of Black Lake is primarily Single Family Low Density Residential 4-7, with two areas of Multifamily Medium Density Residential 9-15, and two areas of open space. The wetland area at the north end of the lake is zoned Green Belt. The wetland area at the southern end of the lake is zoned Rural 1/20 and Rural Residential Resource 1/5. The west side of Black Lake is primarily zoned Residential LAMIRD 1/2 and 2/1, with areas of Rural Residential Resource 1/5 and Public Parks Trails and Preserves.

Under current zoning regulations, there are approximately 200 lots within shoreline jurisdiction, 26 of which are developable. Three parcels are vacant single lots, six parcels are subdividable vacant lots, and 17 parcels have the potential for additional infill.

Black Lake has approximately 180 piers, docks, or boat ramps distributed around the entire shoreline except with the exception of Guerrin Park and the north end of the lake. Evidence of shoreline armoring is present around much of the lake, with the only unarmored shoreline at the south end of the lake near the Black River, in Guerrin Park, and near Black Lake Ditch. There are three culverts mapped at the north end of the lake. Roads are prevalent all around the northern half of the lake. A bridge crosses Black Lake Ditch within shoreline jurisdiction at the north end of the lake.

There are multiple accesses to Black Lake located within this basin. These access points include the following: WDFW public boat launch and Thurston County's Kenneydell Park. Kenneydell Park provides both swim and waterfront view access areas. In addition to the public access points, there are five semi-public access points. These semi-public access points include: a church camp, two private resorts, and 2 private community access points. Future access to Black Lake may be provided when Guerin Park is developed. Informal public access is available along the northern lake shoreline via Black Lake Boulevard and Black Lake-Belmore Road SW.

Management Issues and Opportunities

The wetlands at the southern end of Black Lake include an area of additional property to be acquired and/or restored within the U.S. Fish and Wildlife Service Black River Unit approved boundary.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Black Lake is recommended for restoration.

Black River Basin

Basin Overview

The Black River basin is located in the central portion of the county. It is 25,092 acres in size and is located entirely within WRIA 23. Water within this basin generally flows into Black River. Black River converges with the Chehalis River and ultimately flows into the Pacific Ocean.

Small portions of this basin are located within the Tumwater Urban Growth Area; small portion of the western most tip of the basin is located in the Capitol Forest.

The Black River basin contains 24.06 miles of jurisdictional SMA stream shoreline along the Black River, Salmon Creek, and Beaver Creek. The Black River is broken into 15 reaches (Reach series name: BL). Salmon Creek is broken into two reaches (Reach series name: BL-5). Beaver Creek is broken into one reach (Reach series name: BL-9. See Appendix A). Please see the Salmon Creek basin and Beaver Creek basin sections for a discussion of those waterbodies.

Black River

Physical and Biological Characterization

The Black River is a low gradient, unconfined, large tributary with extensive wetlands along most of its length. The land on the east side of the river is prairie, while the Black Hills lie on the west side.

There are no significant areas of steep slopes or landslide hazard areas along the Black River. The 100-year floodplain is very wide in most places along the Black River. For the most part, the potential channel migration zone appears to stay inside the mapped 100-year floodplain. Downstream of the Beaver Creek confluence there is an area where the potential channel migration zone may exceed the mapped 100-year floodplain. There are several high groundwater hazard areas mapped within the Black River shoreline jurisdiction.

Tributaries to the Black River include Dempsey Creek, Salmon Creek, Bloom's Ditch, Waddell Creek, Beaver Creek, Mima Creek, and numerous unnamed tributaries. The Black River has a large number of associated wetlands. The formation of wetlands along the Black River is primarily associated with two factors. One factor is that the water table within this area is commonly at or above the ground surface. This has prevented development from occurring near the river. The other factor is flooding along the Black river that occurs due to back-flow from the Chehalis River (Andrews, 2003).

The northern portion of the Black River in this basin is mapped as supporting resident cutthroat, largemouth bass, fall Chinook, sea-run cutthroat, and coho salmon. The southern portion of the Black River is mapped as supporting resident cutthroat, sea-run cutthroat, fall Chinook, largemouth bass, winter steelhead, and coho salmon. The Black River may also provide habitat for wood duck, harlequin duck, Taylor's (Whulge) checkerspot, valley silverspot, osprey, mardon skipper, streaked horned lark, Olympic mudminnow, reticulate sculpins, speckled dace, green heron, mink, Oregon spotted frog, Oregon vesper sparrow, waterfowl concentrations, and providing federal critical habitat for Marbled Murrelets. Prairie soils are mapped along much of the Black River. Oak habitat is mapped occasionally along the Black River from the mid-reaches downstream. Parks along the Black River, such as the Black River Unit of the Nisqually National Wildlife Refuge, and Glacial Heritage County Park, are recognized as providing quality habitats.

The upper reaches of the river are largely undeveloped and comprise a continuous wetland/stream corridor as far south as the Littlerock area. Going through Littlerock, riparian vegetation becomes narrow and sometimes fragmented with large areas cleared for agriculture or other purposes. Between Littlerock and the west Rochester area, jurisdiction once again becomes a largely vegetated wetland complex/stream corridor. From the west side of Rochester to the county border the land is primarily cleared for agriculture and residential use, although a narrow band of riparian vegetation is relatively intact.

Water quality is categorized as 'Fair' due to chronic high summer temperatures and low dissolved oxygen during summer low flow conditions. Non-point pollution from rural land uses is an issue of concern for Black River water quality.

Shoreline Use Patterns

Land use along the Black River is primarily undeveloped and residential. Large areas of undeveloped land are located south of Black Lake and north of Littlerock. These areas are owned by the United States Department of Fish and Wildlife Service (USDFW) as part of the Black River Unit of the Nisqually National Wildlife Refuge. Land acquisition for the Black River Unit is still in progress. A large area of undeveloped land is located south of Littlerock and upstream of Mima Creek, primarily on the Black River's right bank (west). This area is a County Natural Area called Glacial Heritage Preserve. Downstream of the Mima Creek confluence, the Black River Unit of the Scatter Creek Wildlife Area provides undeveloped habitat. Timber/forestland use is located in numerous places along the river. Agriculture is a major land use in the lower reaches northwest of Rochester. The reaches around Littlerock and to the south also contain industrial, commercial, and transportation land uses. Impervious surfaces are generally very low within the Black River shoreline jurisdiction. The highest concentration of impervious surface is located in Littlerock at Maytown Road SW, although this area does not appear to exceed ten percent impervious. Water oriented uses of the Black River include wildlife viewing and boating.

The existing Shoreline Environment Designation of the upper reaches to just north of the Waddell Creek confluence is Natural. The area around Littlerock is primarily designated Conservancy with a small section of Urban. South of Littlerock as far as the railroad tracks is also designated Natural. The lowest two reaches before the Black River leaves Thurston County change to a mix of Conservancy adjacent to the river, and Rural within the 100-year floodplain.

The Black River is primarily zoned Rural 1/20 and to a lesser extent, Rural Residential Resource 1/5. The river's left bank (south) west of Rochester is zoned Long Term Agriculture. An area south of Littlerock but upstream of Mima Creek is zoned Public Parks Trails and Preserves. A small area within Littlerock is zoned Rural Resource Industrial. Under current zoning regulations, there are approximately 382 lots within shoreline jurisdiction, 73 of which are developable. There are 53 vacant single lots, 18 subdividable vacant lots, and two parcels with the potential for additional infill.

Culverts, roads, and bridges are concentrated around Littlerock and Rochester. Numerous bridges cross over the Black River including: Bloom Bridge over 110th Avenue SW, Volmer Bridge over 123rd Avenue SW, Black River Bridge over 128th Avenue SW, and Gate Bridge over Moon Road SW. In the downstream reaches, there are bridges within shoreline jurisdiction, but not over Black River itself, including: West Ulry Bridge over Littlerock Road SW, School Land Bridge (culvert), and McCormick Road Bridge over 175th Avenue SW.

The Burlington Northern Railroad crosses the Black River just upstream of BL-16. It crosses shoreline jurisdiction, but not the river itself, in two other places in the southwest portion of shoreline jurisdiction.

There are two WDFW motorboat launches on the Black River. One is located on the left bank (east) of the Black River across the river from Glacial Heritage Preserve. The second is located west of Rochester off of School Land Road SW on the left bank (south).

Other shoreline modifications include utility structures, a contaminated site, and a dam. A gas line (William's pipeline) passes through the upper reaches of the river near the Dempsey Creek confluence. A contaminated site for soil, groundwater, surface water, and air is located at Rhodes Chemical Company, at 10500 Gate Road SW, just outside shoreline jurisdiction in the Black River State Natural Area. Havvaski Waterski Pond has a dam within shoreline jurisdiction to the southwest of Littlerock, but not affecting the Black River. The Rochester Sand and Gravel mine is located in the shoreline jurisdiction within the Black River basin between the Black River and the Chehalis River.

Multiple public access points are available to the Black River. These access points include two WDFW public boat launches (locations described above). Informal public access may be obtained from the bridges listed above.

The WDFW owns and manages the Scatter Creek Wildlife Area, Black River Unit. Public access is available via a rough cut trail from the parking area to the river.

Thurston County owns and manages the Black River-Mima Prairie Glacial Heritage Preserve, known as Glacial Heritage. Glacial Heritage Preserve is an excellent example of the now rare Puget Prairie ecosystem. The park is currently closed to public use. Arrangements may be made in advance to access this site for educational or environmental activities.

Future public access, either direct or view, may occur through the planned "rails to trails" Gate to Belmore trail. The proposed Gate to Belmore multi-use trail would provide access in reaches south of Littlerock to west of Rochester.

The Black River Unit of the Nisqually Wildlife Refuge is currently closed to public access, however, the river itself is open to the public by boat. Informal and undeveloped boat launch areas are located at 110th Ave SW and 123rd Ave SW.

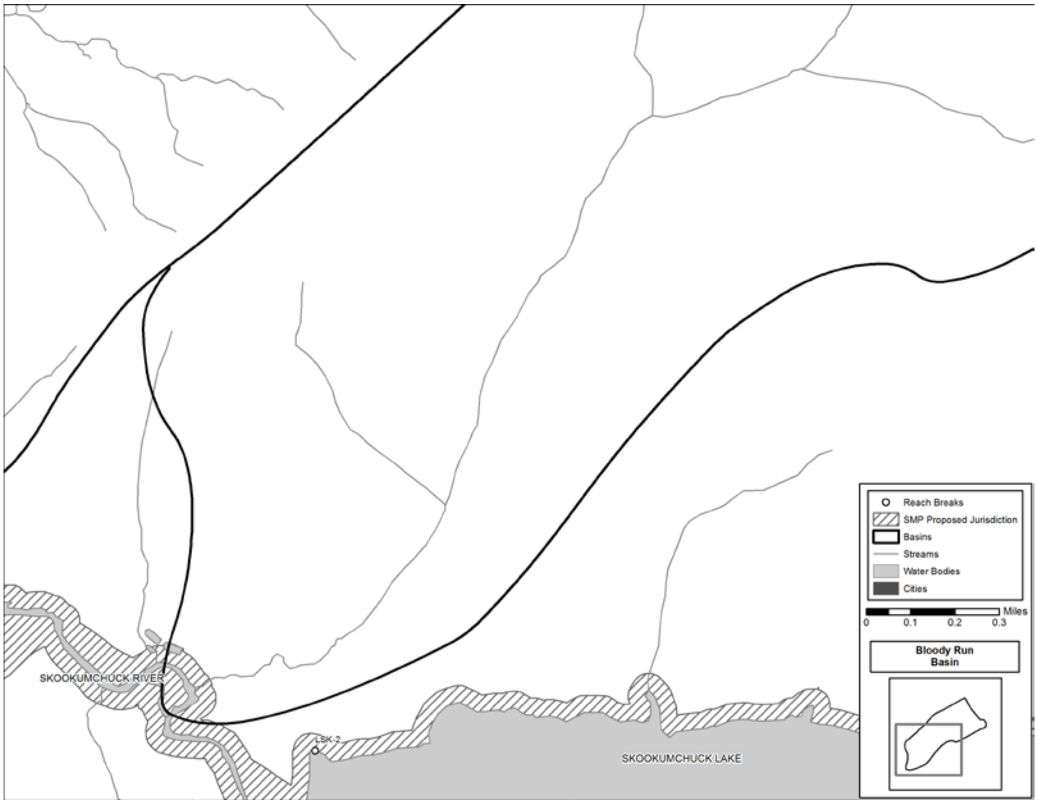
Management Issues and Opportunities

South of Black Lake reaches BL-2-BL-3 to BL-7-BL-8 all include U.S. Fish and Wildlife Service land in the Black River Unit with additional property to be acquired and/or restored.

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Protection	None	None
Protection/restoration	None	None
Conservation	None	None
Restoration	1. Black Lake south to Waddell Creek confluence 2. Northwest of the railroad to western county border	1. BL-0 to BL-8 2. BL-14 to BL-17
Restoration/ Less impact to processes	Waddell Creek confluence south to Mima Creek confluence	BL-8 to BL-12
Less impact to processes	Mima Creek confluence to northwest of the railroad	BL-12 to BL-14

Bloody Run Basin

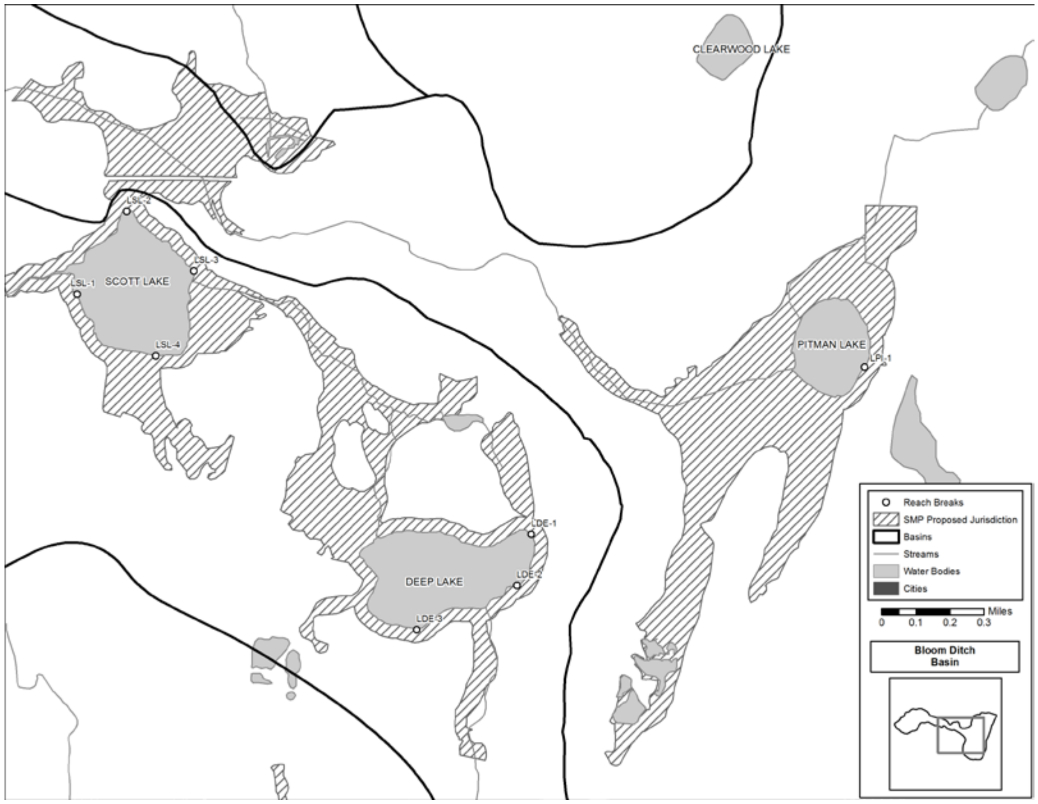


Basin Overview

Bloody Run basin is located in the southern central section of the county. It is 2,062 acres in size and is located entirely within WRIA 23. Water within Bloody Run basin generally flows towards Bloody Run and the Skookumchuck River.

Bloody Run basin contains 0.19 miles of SMA jurisdictional stream shoreline along the Skookumchuck River, as a portion of one reach (SK-15-SK-16). Since reach SK-15-SK-16 is part of the Skookumchuck River, it is discussed as part of the Skookumchuck River waterbody within the Skookumchuck/Thompson Creek (Skookumchuck) basin section in this chapter as well as within Appendix A.

Bloom Ditch Basin



Basin Characteristics

Bloom Ditch basin is located in the center of the county. It is 5,010 acres in size and is located entirely within WRIA 23. Water within Bloom Ditch basin generally flows towards Bloom Ditch and the Black River.

Bloom Ditch basin contains 0.84 miles of SMA jurisdictional lake shoreline along Pitman Lake, in one reach (Reach series name: LPI). See Appendix A.

Pitman Lake

Physical and Biological Characterization

Pitman Lake is surrounded by a large wetland complex that extends approximately 1 ¼ mile to the southwest. An unnamed stream flows into the north side of Pitman Lake. Bloom's Ditch drains Pitman Lake to the west through an extensive associated wetland. Hydric soils underlie the vast majority of the area in shoreline jurisdiction. High groundwater hazard areas underlie Pitman Lake and the majority of its associated wetlands. The 100-year floodplain is extensive around Pitman Lake and in combination with associated wetlands account for the majority of the jurisdiction area.

Pitman Lake may provide habitat for resident cutthroat, Olympic mudminnow, wood duck, waterfowl concentrations, and mink. The lake and shoreline jurisdiction is almost completely undeveloped with shrub vegetation surrounding an extensive wetland that includes emergent/shrub and forest components and a pond complex. An area on the right bank (north) of Bloom's Ditch and an area on the northwest side of Pitman Lake along the unnamed tributary have been cleared for agriculture. There is no data on Pitman Lake's water quality.

Shoreline Use Patterns

Land use around Pitman Lake consists of residential, undeveloped, agriculture, and timber/forestlands. The shoreline jurisdiction itself is almost completely undeveloped, with a few areas cleared for agriculture. A small portion of the western shoreline jurisdiction extends into Millersylvania State Park. There is no impervious surface within Pitman Lake's shoreline jurisdiction. Although part of the jurisdiction extends into Millersylvania State Park, there is no public access in this area.

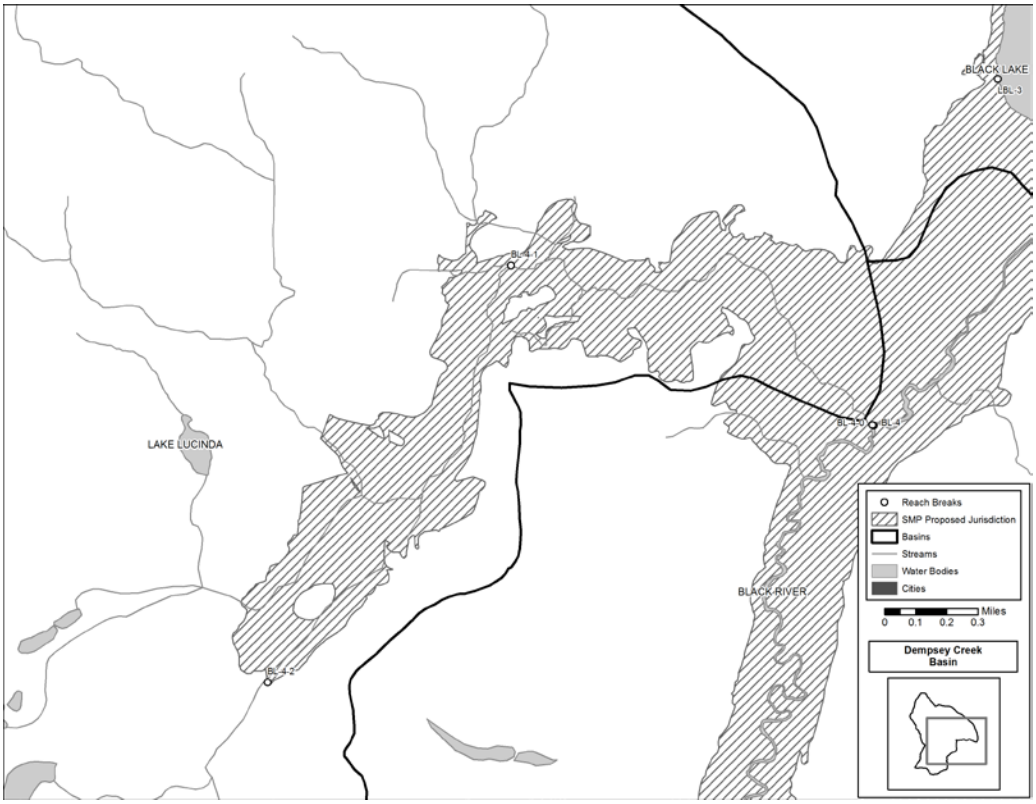
Zoning is Rural Resource Residential 1/5 and Public Parks, Trails, and Preserves. The current Shoreline Environment Designation is Conservancy. Under current zoning regulations, there are approximately 21 lots within shoreline jurisdiction, 14 of which are developable. Three parcels are vacant single lots, ten parcels are subdividable vacant lots, and one parcel has the potential for additional infill.

Shoreline modifications include an unpaved road which crosses the southern portion of shoreline jurisdiction. A culvert under 113th Ave SE limits the extent of shoreline jurisdiction to the north.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Pitman Lake is recommended for conservation.

Dempsey Creek Basin



Basin Overview

The Dempsey Creek basin is located in the western portion of the county. It is 5,844 acres in size. The majority of the basin, 5,832.1 acres, is located in WRIA 23. A small portion of the basin, 11.1 acres, is located in WRIA 13. As the majority of the basin is located in WRIA 23, review of it is provided in this chapter. Water within Dempsey Creek basin generally flows towards Dempsey Creek. Dempsey Creek flows into the Black River. A portion of the eastern border of Capitol Forest is located in this basin.

Dempsey Creek basin contains 1.64 miles of SMA jurisdictional stream shoreline along Dempsey Creek, broken into two reaches (Reach series name: BL-4). See Appendix A.

Dempsey Creek

Physical and Biological Characterization

Dempsey Creek is classified as a low gradient, unconfined and moderately confined seasonally flooded wetland and small tributary. Dempsey Creek has an extensive 100-year floodplain. High groundwater hazard areas are prevalent in the upper reach.

Dempsey Creek is fed by Darlin Creek, Pants Creek, Stoney Creek, and several other unnamed tributaries. Extensive associated wetlands are mapped in both reaches.

Dempsey Creek is mapped as supporting coho, winter steelhead, sea-run cutthroat and resident cutthroat. Dempsey Creek may also provide habitat for the Olympic mud minnow, Oregon spotted frog, green heron, wood duck, and waterfowl concentrations.

The lower reach is almost entirely vegetated with an extensive shrub/forest wetland. The upper quarter of the lower reach has some areas cleared for agriculture within shoreline jurisdiction off the right bank (south). The lower half of the upper reach is generally cleared to the creek banks. The upper half of the upper reach is entirely forested.

There is no data on Dempsey Creek water quality.

Shoreline Use Patterns

Existing land use within Dempsey Creek's lower reach is timber/forest land with small areas of residential and undeveloped land use. Existing land use within Dempsey Creek's upper reach is agriculture, residential, open space, undeveloped, and timber/forestland. Impervious surfaces are extremely low within Dempsey Creek's shoreline jurisdiction and are limited to Delphi Road SW. Water oriented uses include wildlife viewing and fishing.

Dempsey Creek is designated natural under the existing SMP. It is zoned Rural 1/20 near its confluence with the Black River. The remainder of Dempsey Creek shoreline jurisdiction is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 47 lots within shoreline jurisdiction, 10 of which are developable. Three parcels are vacant single lots, five parcels are subdividable vacant lots, and two parcels have the potential for additional infill.

In Dempsey Creek's upper reach, Delphi Road SW, its associated bridge, and several associated culverts have modified the shoreline. In the lower reach, the shoreline has been modified by a structure for a gas line utility, as well as a private drive and its associated unmapped bridge. The Buckeye Court gasoline spill contaminated site is located just on the outside of shoreline jurisdiction on the north side.

Informal public access is available via Delphi Road SW.

Management Issues and Opportunities

Both of Dempsey Creek's reaches include additional property to be acquired and/or restored within the USFWS Black River Unit approved boundary. In addition, there are several parcels in private conservation in the upper reach.

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
The upper reach of Dempsey Creek is a mixed recommendation between protection/restoration (south end) and restoration/least impact (north end). The lower reach of Dempsey Creek is recommended for restoration.

Deschutes River Basin

The majority of this basin is located in WRIA 13. Please refer to the Deschutes River section of the WRIA 13 chapter.

East Fork Independence Creek Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

Fall Creek Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

Frost Prairie Basin

Basin Overview

Frost Prairie basin is located in the southern portion of the County. It is 1,844 acres in size and is located entirely within WRIA 23. Water in Frost Prairie basin generally flows towards Frost Prairie and ultimately the Skookumchuck River. The basin is located to the north of the northern limits of the town of Bucoda.

Frost Prairie basin contains 1.46 miles of SMA jurisdictional lake shoreline along Pond 4, in one reach (Reach series name: LPO4, See Appendix A). Pond 4's single reach extends east into the Skookumchuck basin and includes the wetland along Pond 4's unnamed outlet stream. As the majority of Pond 4's shoreline jurisdiction is contained in Frost Prairie basin, it is discussed in this section. A portion of reach CH-4-7-CH-4-8 along Scatter Creek extends into the Frost Prairie basin. Please see the Scatter Creek basin section for a description of Scatter Creek.

Pond 4

Physical and Biological Characterization

Steep slopes and landslide hazard areas lie along the right bank (south) of Pond 4's outlet stream. Pond 4 lies entirely within a high groundwater hazard area. The 100-year floodplain is not mapped within shoreline jurisdiction. Pond 4 is a wetland and drains east to the Skookumchuck River via an unnamed outlet stream, which includes an associated wetland.

Pond 4 and its shoreline jurisdiction may provide habitat for the following species: coho, winter steelhead, searun cutthroat, resident cutthroat, harlequin duck. Oak habitat may be present in shoreline jurisdiction. Pond 4 is entirely forest/shrub with in-water emergent/shrub vegetation. The riparian vegetation appears intact with the exception of one unpaved road. There is no data on water quality for Pond 4.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction includes timber/forestland, agriculture, and undeveloped. Shoreline jurisdiction is unmodified with the exception of an unpaved road which crosses the outflow stream. 185th Avenue SE/Yates Road SE limits the northern side of shoreline jurisdiction and the Bucoda Highway SE/SR 507 limits the eastern extent of shoreline jurisdiction. These roads provide access to shoreline jurisdiction, but not to the water. There is no impervious surface within shoreline jurisdiction.

Pond 4 is not designated under the existing SMP. Existing zoning is Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 13 lots within shoreline jurisdiction, 12 of which are developable. Five parcels are vacant single lots, and seven parcels are subdividable vacant lots.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
Pond 4 is recommended for restoration.

Hanaford Creek Basin

Basin Overview

Hanaford Creek basin is located along the southern County border, south of the Skookumchuck River. It covers 6,095 acres within Thurston County and is located entirely within WRIA 23. A small portion of the basin is located in Lewis County. Water within the Hanaford Creek basin generally flows towards Hanaford Creek and into the Skookumchuck River.

Hanaford Creek basin contains 5.6 miles of SMA jurisdictional shoreline along two lakes formed from mining activities: Lake Unknown Mine 2, and Lake Unknown Mine 3. Hanaford Creek basin also contains 1.2 miles of shoreline along Lake Unknown 4. Each waterbody contains one reach. Lake Unknown Mine 2 (Reach series name: LUNM-2) Lake Unknown Mine 3 (Reach series name: LUNM-3) and Lake Unknown 4 (Reach series name: LUNK-4). See Appendix A.

Lake Unknown 4

Physical and Biological Characterization

Lake Unknown 4 is a waterbody created by the damming of North Hanaford Creek south of the Skookumchuck River and south east of the town of Bucoda. Steep slopes are mapped around the entire waterbody, and landslide hazard areas are present along the southern side. The lake is located in the headwaters of North Hanaford Creek. The 100-year floodplain is mapped through the waterbody and shoreline jurisdiction. However, the dam has altered the topography and water flow of the area and there is no longer a surface water outlet to North Hanaford Creek visible on the 2012 aerial photos or mapped in the stream layer.

Lake Unknown 4 is fed by two channels of the North Hanaford Creek. It drains via a dam to Lake Unknown Mine 2, and Lake Unknown Mine 3, to eventually drain to North Hanaford Creek. Wetlands are mapped throughout the waterbody.

Shoreline jurisdiction may support the following species and habitats: Harlequin duck; Wood duck; Eastern wild turkey; Rocky Mountain and Roosevelt Elk, and waterfowl concentrations.

Riparian vegetation is almost entirely forested except for western edge where it meets Tono Road SE and is entirely deforested. There is also a swath on the eastern shoreline jurisdiction where shoreline vegetation has been cleared for a powerline. There is no water quality data for Lake Unknown 4.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is timber/forest land. Impervious surfaces within shoreline jurisdiction are minimal and are concentrated at Tono Road SE.

Lake Unknown 4 is not designated in the existing SMP. It is zoned Long Term Forestry. Under current zoning regulations, there are approximately five lots within shoreline jurisdiction, none of which are developable.

The lake was an existing wetland that became a lake when the western shoreline was straightened and dammed by the Centralia Coal Mine Dam No 32B. The western shoreline is also modified by Tono Road SE which runs north/south and has two culverts. The eastern shoreline is modified by a powerline. There is an unpaved access road to the utility line which crosses the southern shoreline jurisdiction. Informal public access is available from Tono Road SE.

Management Issues and Opportunities

There is the opportunity to restore the western shoreline where it has been devegetated.

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
Lake Unknown 4 is recommended for restoration/least impact to processes.

Lake Unknown Mine 2

Physical and Biological Characterization

Lake Unknown Mine 2 is a waterbody created in an active mining depression located south of the Skookumchuck River and southeast of the town of Bucoda. Steep slopes are mapped in places around the waterbody, and landslide hazard areas are mapped as present along the northern shoreline.

The mine is located within the historic drainage of North Hanaford Creek. Extensive areas of 100-year floodplain and wetlands associated with North Hanaford Creek are still mapped within and adjacent to Lake Unknown Mine 2. However, the mine has altered the topography and water flow of the area and North Hanaford Creek is no longer mapped through this mining area. Two dams are located in mining waterbodies upstream of Lake Unknown Mine 2, which likely eliminates or greatly reduces the 100-year floodplain and associated wetland areas. Lake Unknown Mine 2 does not have a surface inlet mapped in the stream layer or visible on the 2012 aerial photos. A small surface outlet at the south end of the waterbody to Lake Unknown Mine 3 is visible in the 2012 aerial photos, although not mapped in the stream layer. It is unknown how the 100-year floodplain or wetlands have been affected by the modified topography and drainage at the site.

Shoreline jurisdiction is mapped to support Coast Resident Cutthroat in North Hanaford Creek. However, since North Hanaford Creek no longer runs through this waterbody, it is assumed that Coast Resident Cutthroat are no longer present in this waterbody. Lake Unknown Mine 2 may support Rocky Mountain and Roosevelt Elk.

Lake Unknown Mine 2 and the adjacent shoreline have been almost completely cleared of vegetation. There is no water quality data for Lake Unknown Mine 2.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is mining and timber/forest land. There are no impervious surfaces with shoreline jurisdiction.

Lake Unknown Mine 2 is not designated in the existing SMP. It is zoned Long Term Forestry. Under current zoning regulations, there are approximately ten lots within shoreline jurisdiction, none of which are developable.

All areas of shoreline jurisdiction terrain have been created and modified by mining activity. An unpaved road enters shoreline jurisdiction. There is no public access to Lake Unknown Mine 2.

Management Issues and Opportunities

When mining activity has stopped, there is the opportunity to restore the area into a functioning wetland, particularly through re-vegetation of currently non-vegetated shorelines.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Lake Unknown Mine 2 is recommended for restoration/least impact to processes.

Lake Unknown Mine 3

Physical and Biological Characterization

Lake Unknown Mine 3 is a waterbody created in an active mining depression located south of the Skookumchuck River and south of the town of Bucoda. Steep slopes and landslide hazard areas are mapped along the waterbody's eastern side.

No surface inlets or outlets are mapped to Lake Unknown Mine 3 within Thurston County. The 2012 aerial photos indicate a surface inlet on the northeast side from Lake Unknown Mine 2.

Shoreline jurisdiction may support Rocky Mountain and Roosevelt Elk. Prairie soils are mapped along the west shoreline.

Lake Unknown Mine 3 and the adjacent shoreline have been almost completely cleared of vegetation. There is a thin band of shrub cover on the northeast shoreline approximately 100 feet back from the water line. There is no water quality data for Lake Unknown Mine 3.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is mining and timber/forest land. There are no impervious surfaces with shoreline jurisdiction.

Lake Unknown Mine 3 is not designated in the existing SMP. It is zoned Long Term Forestry. Under current zoning regulations, there are approximately three lots within shoreline jurisdiction, none of which are developable.

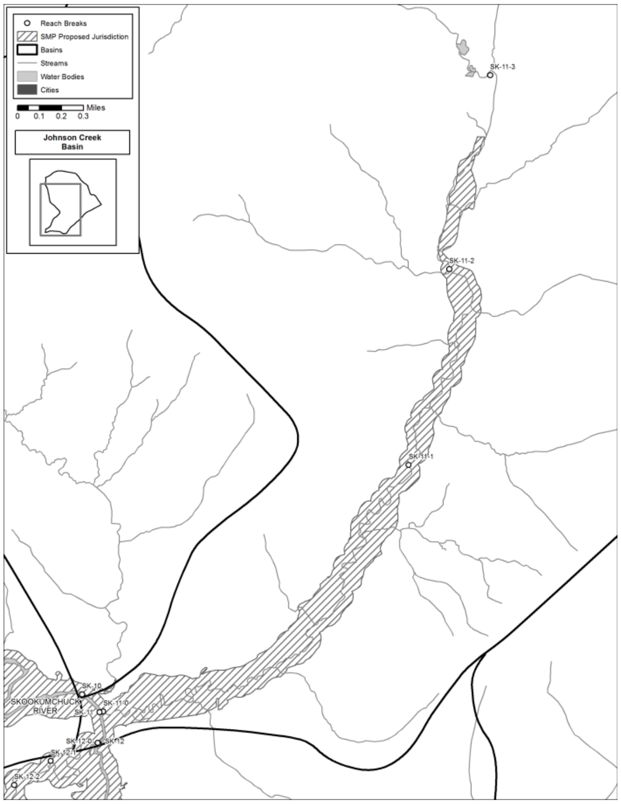
All areas of shoreline jurisdiction terrain have been created and modified by mining activity. An unpaved road enters shoreline jurisdiction. There is no public access to Lake Unknown Mine 3.

Management Issues and Opportunities

When mining activity has stopped, there is the opportunity to restore the area into a functioning wetland, particularly through re-vegetation of currently non-vegetated shorelines.

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
Lake Unknown Mine 3 is recommended for restoration/least impact to processes.

Johnson Creek Basin



Basin Characteristics

Johnson Creek basin is located in the south center portion of the County. It is 6,496 acres in size. The majority of the basin, 6,477 acres, is located in WRIA 23. A small portion of the basin, 19 acres, is located in WRIA 13. As the majority of the basin is located within WRIA 23, review of it is located in this chapter. Water within the Johnson Creek basin generally flows towards Johnson Creek and the Skookumchuck River.

Johnson Creek basin contains 4.64 miles of SMA jurisdictional stream shoreline along Johnson Creek, broken into four reaches (Reach series name: SK-11). See Appendix A. Thompson Creek (Reach series name: SK-12) and the Skookumchuck River (Reach series name: SK) each have one reach that falls within Johnson Creek basin. These reaches are described as part of their respective waterbodies in the Skookumchuck/Thompson Creek (Skookumchuck) basin discussion.

Johnson Creek

Physical and Biological Characterization

Johnson Creek is a low gradient, unconfined/moderately confined, small tributary or seasonally flooded wetland. Johnson Creek has areas of steep slopes and landslide hazard areas mapped along much of its length. The 100-year floodplain is mapped along the length of Johnson Creek's shoreline jurisdiction. There are many areas along mid and upper Johnson Creek where the potential channel migration zone may exceed the 100-year floodplain.

Johnson Creek is fed by numerous unnamed tributaries. Associated wetlands are mapped along the length of the creek.

Johnson Creek is mapped as supporting coho salmon, sea-run cutthroat, and resident cutthroat. Johnson Creek may also support wood duck, osprey, harlequin duck, Eastern wild turkey, and Roosevelt and Rocky Mountain elk. Prairie soils are mapped in places along the upper and lower ends of Johnson Creek.

Riparian vegetation in the upper reach is intact emergent, shrub, and forested wetland vegetation. An area has been cleared for a powerline, but shrub and emergent vegetation are present in the corridor. The mid-reach is primarily vegetated on the right bank (west) except for the lowest section which is cleared on both sides of the creek. The mid-reach's left bank (east) is mainly forested in the upper half, but is cleared for low density residential use in the lower half. There is little riparian vegetation along the stream in the lower half of this reach. Parts of the left bank (east) have also been cleared for Johnson Creek Road SE and the powerline. Johnson Creek's lowest reach exhibits patchy riparian forest cover mixed with cleared areas on the left bank (southeast) and is primarily cleared to the creek on the right bank.

There is no data on Johnson Creek's water quality.

Shoreline Use Patterns

Johnson Creek's upper reach is primarily timber/forest land use. The middle reach is primarily agriculture, residential, and timber/forest land. The lower reach is a mix of agriculture, residential, open space, and commercial. Impervious surfaces are minimal along Johnson Creek, and are mainly associated with Johnson Creek Road SE. Water oriented uses include fishing and wildlife viewing.

Johnson Creek is not designated in the current SMP. Johnson Creek's upper two reaches are zoned Long Term Forestry. The lowest reach is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 34 lots within shoreline jurisdiction, eight of which are developable. There are three vacant single lots, two subdividable vacant lots, and three parcels with the potential for additional infill.

Johnson Creek's shoreline has been modified by structures for three utility lines (power, gas, and fuel). The powerline is within shoreline jurisdiction for the length of Johnson Creek. Johnson Creek Road SE parallels the creek for much of shoreline jurisdiction. It crosses Johnson Creek via two bridges in the lower half of the creek. There are more than ten culverts associated with Johnson Creek Road SE in shoreline jurisdiction. There are also two private driveways with associated unmapped private bridges within shoreline jurisdiction.

Informal public access may be obtained from Johnson Creek Road SE.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Johnson Creek is recommended for protection/restoration.

Kennedy Creek Basin

The majority of this basin is located in WRIA 14. Please refer to the WRIA 14 chapter for further information.

Lincoln Creek Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

Lost Valley Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

McIntosh Lake Basin

The majority of this basin is located in WRIA 13. Please refer to the WRIA 13 chapter for additional information.

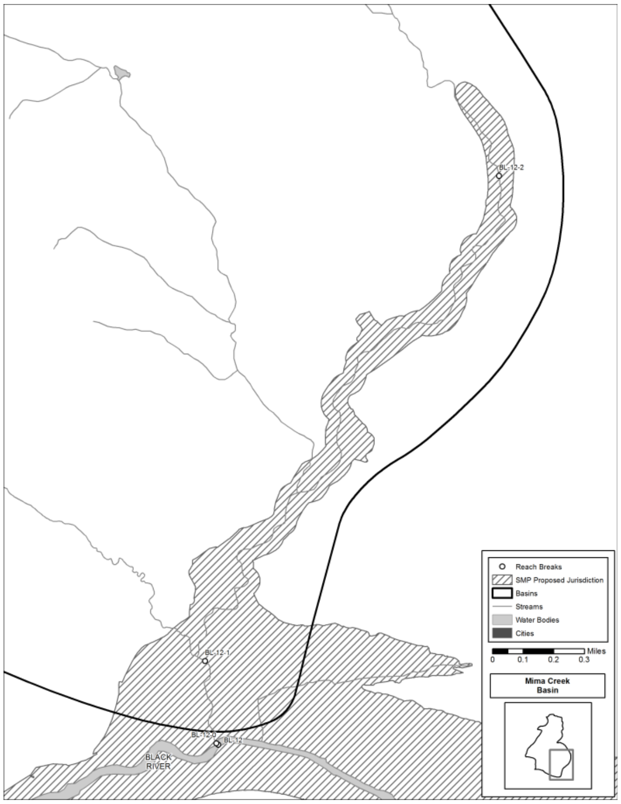
McLane Creek Basin

The majority of this basin is located in WRIA 13. Please refer to the WRIA 13 chapter for additional information.

Michigan Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

Mima Creek Basin



Basin Characteristics

Mima Creek basin is located in the southwestern portion of the county. The basin is approximately 7,941 acres in size and is located entirely within WRIA 23. Water within Mima Creek basin generally flows towards Mima Creek and Black River. The entire basin is located in Capitol Forest.

Mima Creek basin contains 2.58 miles of SMA jurisdictional stream shoreline along Mima Creek, in two reaches (Reach series name: BL-12). See Appendix A.

Mima Creek

Physical and Biological Characterization

Mima Creek has steep slopes and landslide hazard areas mapped adjacent to the right bank (west) of the upper stream reaches, although these areas may not extend into shoreline jurisdiction. The 100-year flood plain is mapped along the entire portion of Mima Creek that falls within shoreline jurisdiction. The potential channel migration zone may exceed the 100-year floodplain boundary in the middle of the upper reach.

Mima Creek is a tributary to the Black River. Mima Creek is fed by a number of unnamed tributaries from the west. Mima Creek has some relatively small associated wetlands in the upper reach. The lower reach, located at the confluence of Mima Creek and the Black River is extensive associated wetlands.

Mima Creek is mapped as supporting Coho salmon, resident cutthroat, and sea-run cutthroat. Mima Creek may also support wood duck and harlequin duck. The Mima Creek basin is mapped as providing federal critical habitat for Marbled Murrelets.

Mima Creek's riparian vegetation has been extensively cleared for agriculture. Most areas of the creek have very little remaining riparian vegetation although there are a few areas of remaining intact riparian vegetation.

There is no data on Mima Creek's water quality.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is a mix of agriculture, undeveloped, and residential. A portion of the upper reach is located within Capitol State Forest, which is owned and managed by the Washington State Department of Natural Resources. Impervious surfaces are very limited along Mima Creek's shoreline jurisdiction. They are limited to two roads and several agricultural buildings. Water oriented uses include wildlife viewing and fishing.

The lower portion of Mima Creek is currently designated natural under the existing SMP. The upper half of Mima Creek is currently designated Conservancy. The upper half of Mima Creek is zoned Rural Resource Residential 1/5 and the lower half is zoned Rural 1/20. Under current zoning regulations, there are approximately 25 lots within shoreline jurisdiction, ten of which are developable. There are four vacant single lots, five subdividable vacant lots, and one parcel with the potential for additional infill.

Two roads and their associated bridges cross Mima Creek: Gate Road SW, and Capitol Forest Road. Two culverts are associated with Gate Road SW. Another culvert is located upstream of Gate Road SW but downstream of Capitol Forest Road.

Informal public access is available through the roads listed above, as well as through Capitol Forest.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
Mima Creek is recommended for restoration/least impact to process in the upper half, and conservation in the lower half.

Monroe Creek Basin

Basin Characteristics

Monroe Creek basin is located along the western border of Thurston County. It is 1,072 acres in size and is located entirely within WRIA 23. Monroe Creek basin contains a very small section (0.02 miles) of the Sherman Creek shoreline jurisdiction (Reach series name: SH). Please see the Sherman Creek basin section for a description of this shoreline area.

O'Connor

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

Offut Lake

This basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information on this basin.

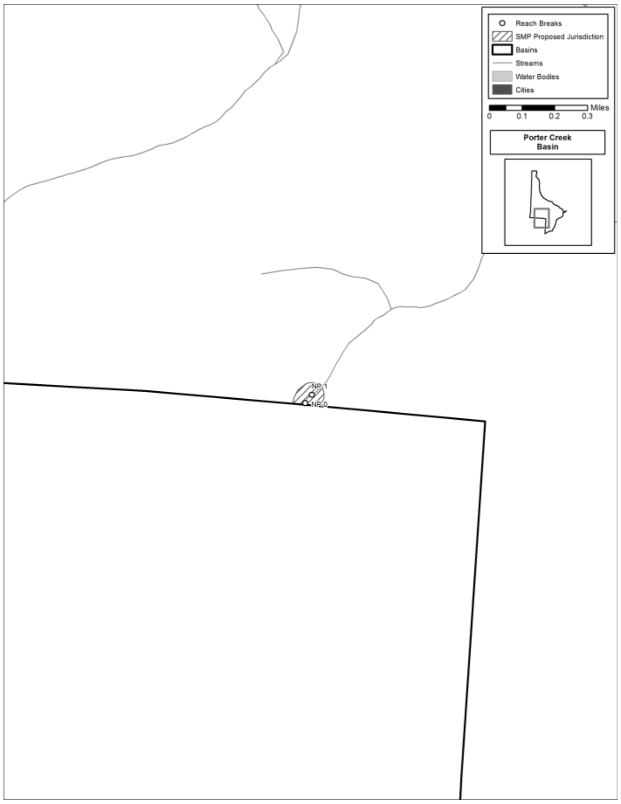
Percival Creek

This basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information on this basin.

Perry Creek

This basin is located primarily in WRIA 14. Please refer to the WRIA 14 chapter for further information on this basin.

Porter Creek Basin



Basin Overview

Porter Creek basin is located in the western panhandle of the county. It is 9,427 acres in size. The northern portion of this basin is located within WRIA 22 – Lower Chehalis. Water within Porter Creek basin generally flows into Porter Creek, Bozy Creek, and Swan Creek. These waters ultimately flow into the Chehalis River in Grays Harbor County.

Porter Creek basin contains 0.03 miles of SMA jurisdictional stream shoreline along North Fork Porter Creek, in one reach (Reach series name: NP). See Appendix A.

North Fork Porter Creek

Physical and Biological Characterization

North Fork Porter Creek is a low gradient, confined, small tributary. The very short stretch of North Fork Porter Creek located within Thurston County is surrounded by steep slopes and landslide hazard areas. This reach does not have mapped 100-year floodplain or potential channel migration zones. North Fork Porter Creek is fed by numerous unnamed tributaries. There are no wetlands associated with this reach.

North Fork Porter Creek is mapped as supporting resident cutthroat. The riparian vegetation within North Fork Porter Creek's shoreline jurisdiction is intact forest cover. There is no data on water quality for this creek.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is undeveloped. The reach is in an area of active forestry, and there are clear-cuts adjacent to shoreline jurisdiction. The shoreline jurisdiction contains no impervious surface or shoreline modifications. Water oriented uses include wildlife viewing and fishing.

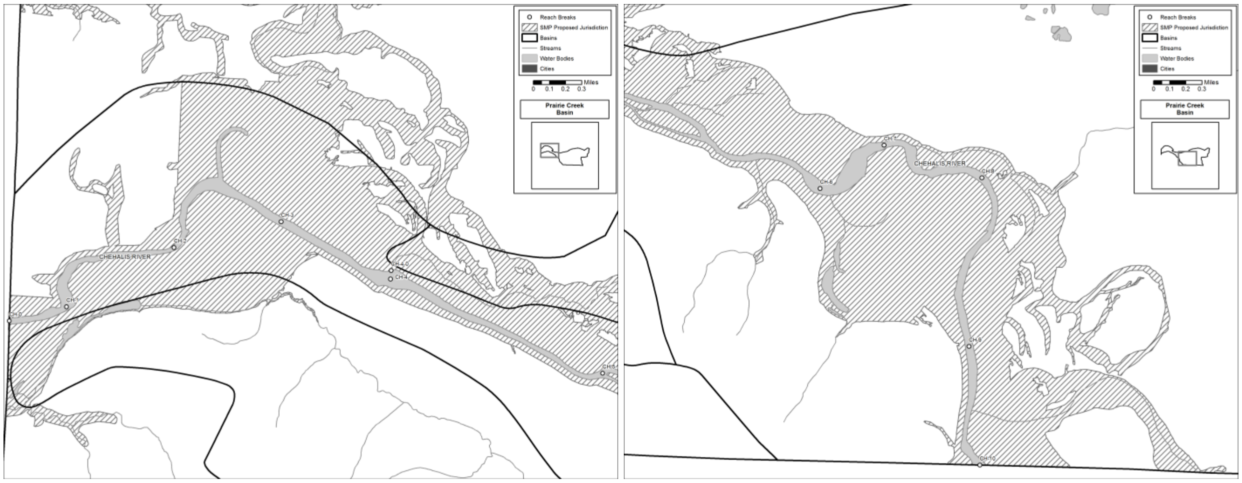
The reach is zoned Long Term Forestry and is not designated under the current SMP. Under current zoning regulations, there is approximately one lot within shoreline jurisdiction which is not developable.

The reach is within Capitol Forest (owned and managed by Washington State Department of Natural Resources) but there are no formal public access opportunities.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
Porter Creek is recommended for protection.

Prairie Creek Basin



Basin Overview

Prairie Creek basin is located in the southwest corner of the county. It is 13,552 acres in size it is located entirely within WRIA 23. Waters within Prairie Creek basin generally flows into Prairie Creek and the Chehalis River.

Prairie Creek basin contains 10.00 miles of SSS jurisdictional stream shoreline along the Chehalis River, broken into ten reaches (Reach series name: CH). See Appendix A.

Chehalis River

Physical and Biological Characterization

The Chehalis River is a low gradient, unconfined, large tributary. The Chehalis River left bank (southwest) is confined in areas by steep slopes and landslide hazard areas. The Chehalis River's 100-year floodplain is extremely wide along the majority of the right bank, and parts of the left bank. The potential channel migration zone does not appear to exceed the 100-year floodplain with the exception of a small area along the right bank (northeast) upstream of the confluence with Scatter Creek. Numerous high groundwater hazard areas are mapped within the 100-year floodplain, primarily upstream of the confluence with Scatter Creek.

The Natural Hazards Mitigation Plan for the Thurston Region (Andrews, et al., 2003) notes the following flooding history of the Chehalis River within Thurston County:

> *The Chehalis River extends for only 8.6 miles in Thurston County, but has an extensive floodplain, covering over eight square miles. Land use is primarily agricultural, houses are scattered sparsely over the area. Some flooding occurs nearly every year, but damage is usually light. Historically, nuisance flooding occurs when the flow rate exceeds about 14,000 cfs. Since 1972, the river has exceeded the flow rate 48 times. The typical year will have a flood in November or December and a second flood in January or February. Moderate flooding occurs when the flow rate exceeds about 26,000 cfs.*

Since 1972, this has occurred 21 times. Major flooding occurs when the rate exceeds about 45,000 cfs. This has happened six times since 1972: January 1972, December 1975, November 1986, January 1990, November 1990, and February 1996. The flood of record was established in February 1996 when the flow rate reached nearly 75,000 cfs.

Within the County, the Chehalis River is fed by Prairie Creek and Scatter Creek as well as numerous unnamed tributaries. The Chehalis River shoreline jurisdiction contains numerous associated wetlands.

The Chehalis River is mapped as supporting fall Chinook, spring chinook, chum salmon, coho salmon, winter steelhead, sea-run cutthroat, resident cutthroat and largemouth bass. The Chehalis River shoreline jurisdiction may also support Olympic mudminnow, wood duck, mink, bald eagle, osprey, Eastern wild turkey and Roosevelt Elk. Prairie soils are mapped along the entire river. Areas of oak habitat are also mapped along the river.

Riparian vegetation differs between the two river banks. The left bank is primarily forested, with a few areas cleared to the river, and areas of clearing for agriculture or timber harvest landward in the shoreline jurisdiction. The right bank is generally cleared to the river line for agriculture, with little to no remaining riparian vegetation. Approaching the western edge of the County, the river's right bank becomes forested.

Water quality in the Chehalis River is categorized as 'good'. The river met the fecal coliform, dissolved oxygen and pH standard. High temperatures occur in mid-summer. Turbidity violations occurred during the winter in both the 2009/10 & 2010/11 water years. In 1994, the Washington Department of Ecology completed a total maximum daily load study in the Chehalis River to address water quality problems that included high temperatures and low dissolved oxygen. Water quality in the Chehalis River is impacted by non-point pollution from rural land-uses and point discharges in the Centralia and Chehalis areas (Thurston County Water Resources Monitoring Report, 2012).

The Chehalis Basin Level 1 Assessment conducted in 2000 by Envirovision et al. notes that: *"Field observations [for the Upper Chehalis basin] have indicated that removal of trees and other vegetation along much of the upper river has reduced shading, which contributes to high dry-season temperatures. The TMDL study recommends increasing vegetative shading along the Chehalis River and its tributaries."*

Shoreline Use Patterns

The right bank of the Chehalis River near the western basin boundary contains a portion of the Confederated Tribes of the Chehalis Reservation. The right bank of shoreline jurisdiction also contains a small portion of the Grand Mound urban growth area.

Existing land use along the Chehalis River's right bank is primarily agriculture, residential, and undeveloped with an area of commercial located near Grand Mound. Existing land use along the river's left bank is primarily agriculture, timber/forest land, undeveloped, residential, and transportation. The Burlington Northern railroad runs along much of the Chehalis River's left bank.

Impervious surfaces are generally limited within the Chehalis River's shoreline jurisdiction. Impervious surfaces are highest where roads cross shoreline jurisdiction, such as James Road SW, Independence Road SW, 201st Avenue SW, and Prather Road SW. Water oriented uses include fishing and wildlife viewing.

Under the existing SMP, the Chehalis River has parallel shoreline environment designations. The area immediately around the Chehalis River, Scatter Creek, and the large area of shoreline jurisdiction along the left bank near the western County border is designated Conservancy. The remainder of the shoreline jurisdiction is designated Rural.

The majority of the river's left bank is zoned Rural Residential Resource 1/5, with a small patch of Rural 1/20, and two areas of Long Term Agriculture. The river's right bank is mainly zoned Long Term Agriculture, with smaller areas of Rural Residential Resource 1/5, and a small area of Planned Industrial Park in the Grand Mound UGA. Under current zoning regulations, there are approximately 321 lots within shoreline jurisdiction, 61 of which are developable. There are 32 vacant single lots, 16 subdividable vacant lots, and 13 parcels with the potential for additional infill.

Shoreline modifications include a railroad, roads, bridges, culverts, and utility structures. The Chehalis River's left bank has been modified by the Burlington Northern Railroad. Numerous roads cross shoreline jurisdiction including two roads which cross the Chehalis River on bridges: Independence Road SW and Prather Road SW (see appendix A for additional roads). Two bridges cross the Chehalis River (listed above) and six other bridges are mapped within shoreline jurisdiction. At least twenty culverts are located within the Chehalis River shoreline jurisdiction. A power line crosses the shoreline jurisdiction in the upper reach, but does not cross the Chehalis River.

Informal public access is available through public roads. Please see the reach matrix in Appendix A for individual road names.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010)
The Chehalis River is recommended for restoration/least impact to process.

Reichel Lake Basin

This basin is located primarily in WRIA 13. Please refer to the WRIA 13 chapter for further information.

Salmon Creek (Black) Basin

Basin Characteristics

Salmon Creek (Black) basin is located in the central portion of the county. It is 4,631 acres in size. The majority of the basin, 4,624 acres, is located in WRIA 23. A smaller portion of the basin, 7 acres, is located in WRIA 13. As the majority of the basin is located in WRIA 23, review of it is located here. Waters within Salmon Creek (Black) basin generally flow towards Hopkins Ditch, Salmon Creek, and ultimately the Black River.

Salmon Creek (Black) basin contains 1.14 miles of SMA stream jurisdictional shoreline along Salmon Creek, in four reaches (Reach series name: BL-5). See Appendix A. A portion of Salmon Creek falls within the Black River basin, however, the entire waterbody is discussed in this section.

Salmon Creek

Physical and Biological Characterization

Salmon Creek is a tributary to the Black River. It drains the prairie on the east side of the Black River basin and includes Hopkins Ditch. Salmon Creek is classified as a low gradient, confined to unconfined, small tributary. The 100-year floodplain is mapped along the entirety of Salmon Creek. The potential channel migration zone may extend beyond the 100-year floodplain in the lower two reaches. An area of high groundwater hazard is mapped in the lowest creek reach. Flooding and high groundwater are a concern for this basin.

Hopkins Ditch flows directly into Salmon Creek near its crossing with Littlerock Rd SW. The upper two reaches of Salmon Creek contain extensive associated wetlands.

Salmon Creek is mapped as supporting coho salmon, winter steelhead, sea-run cutthroat, and resident cutthroat. Salmon Creek may also support green heron, wood duck, mink, waterfowl concentrations, Mazama pocket gopher, Oregon spotted frog, and Olympic mudminnow. This basin is mapped as providing federal critical habitat for Marbled Murrelets. Prairie soils are mapped along portions of Salmon Creek's shorelines.

The riparian vegetation is almost entirely intact with the exception of some small areas of clearing for residential development, utilities, and roads. These cleared areas are more prevalent on the right bank (north) than the left bank.

Salmon Creek water quality is categorized as 'fair'. Salmon Creek met both part 1 and part 2 of the fecal coliform bacteria standard both water years. In dry months, dissolved oxygen levels are low. In the winters of 1996/97 and 1998/99, above average rainfall caused localized flooding, failed septic systems, contaminated drinking water and restricted access to property. Flooding is expected to occur again when there is above average rainfall. In June 2004, Thurston County and the City of Tumwater approved the Salmon Creek Comprehensive Drainage Basin Plan. This plan was developed to address flooding problems.

Shoreline Use Patterns

Land use along Salmon Creek is primarily residential and undeveloped. An area of mining is located mid-way along the creek. Timber/forest land use is present in the associated wetland in the upper reaches. Impervious surfaces are limited, but highest around Littlerock Road SW. Water oriented uses include wildlife viewing and fishing.

The current Shoreline Environment Designation for part of the lower reach is Natural; the rest of this reach and the upper reaches are currently undesignated. The lower two reaches are zoned Rural 1/20. The upper two reaches are zoned Rural 1/10 and Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 56 lots within shoreline jurisdiction, nine of which are developable. Five parcels are vacant single lots and four parcels are subdividable vacant lots. There are no parcels with the potential for additional infill.

Power line structures cross the lower two reaches. Littlerock Road SW and its associated bridge over Salmon Creek, as well as a culvert associated with the road are located mid-way up Salmon Creek.

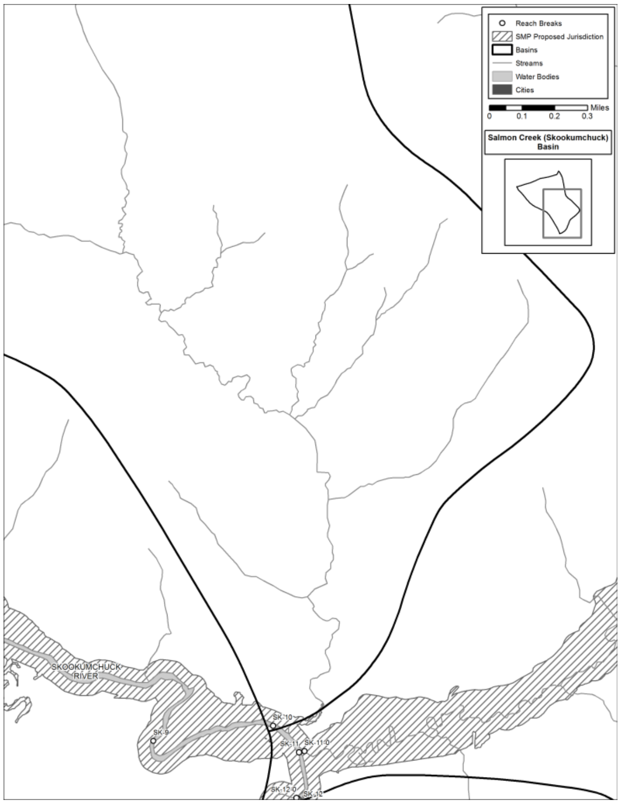
Littlerock Road SW provides informal access to Salmon Creek. The proposed Gate to Belmore trail would provide future access to the upper reach.

Management Issues and Opportunities

These reaches include U.S. Fish and Wildlife Service land in the Black River Unit of the Nisqually National Wildlife Refuge (discussed in the Black River section) with additional property to be acquired and/or restored.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010) Salmon Creek is recommended for restoration.

Salmon Creek (Skookumchuck) Basin

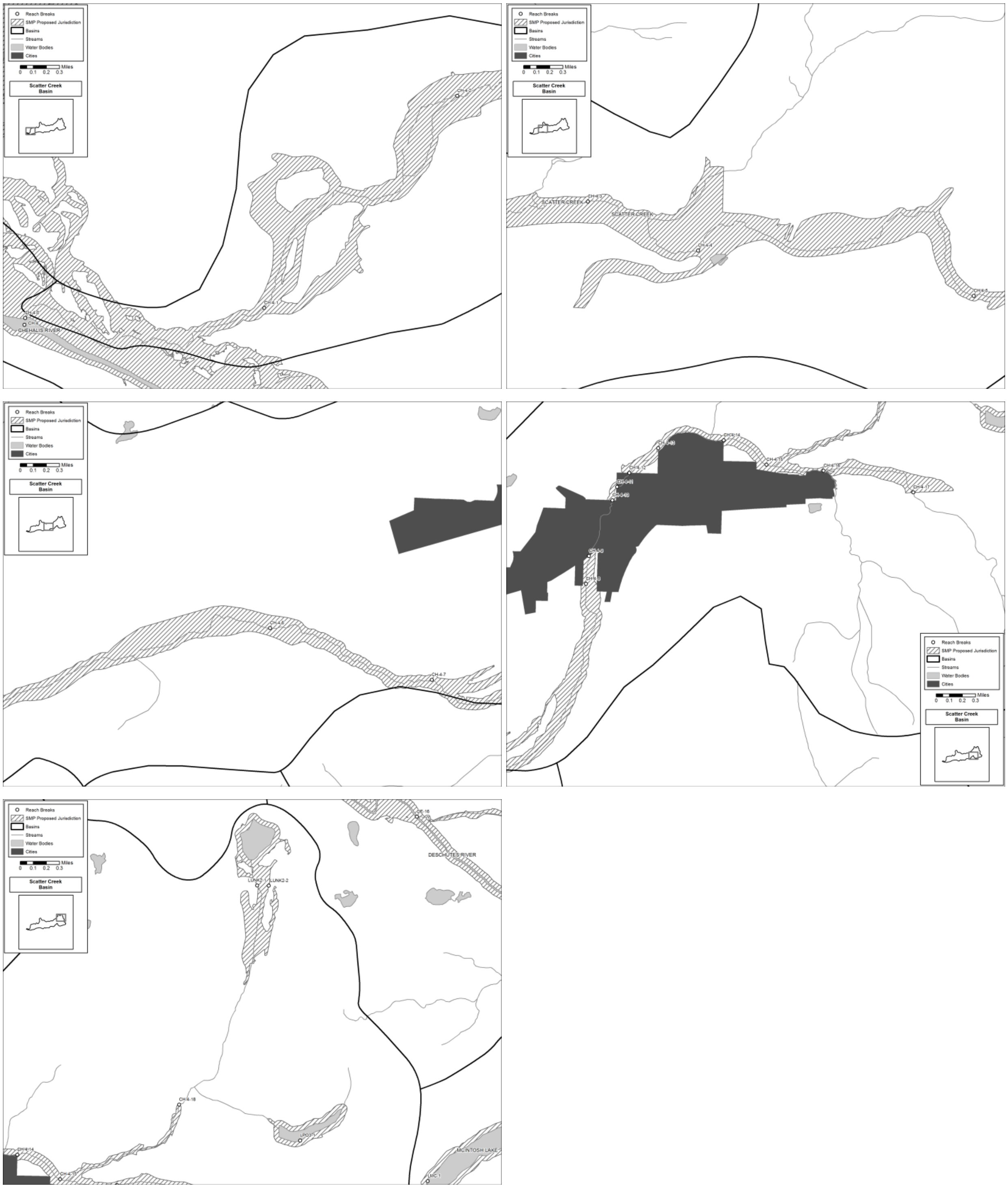


Basin Characteristics

Salmon Creek (Skookumchuck) basin is located southern central portion of the county. It is 2,831 acres in size and is located entirely within WRIA 23. Water within the Salmon Creek (Skookumchuck) basin generally flows into un-named tributaries that flow into the Skookumchuck River.

Salmon Creek (Skookumchuck) contains a very small section (0.04 miles) of the Skookumchuck River's shoreline jurisdiction. This section is described as part of the Skookumchuck River. Please see the Skookumchuck River basin section for a description.

Scatter Creek Basin



Basin Characteristics

Scatter Creek basin is located in the southwestern portion of the county. It is 27,423 acres in size. The majority of the basin, 27,185 acres, is located in WRIA 23; a small portion of the basin, 238 acres, is located within WRIA 13. As the majority of the basin is located in WRIA 23, review of it is provided in this chapter. The waters within the Scatter Creek basin generally flow into Scatter Creek. Scatter Creek flows into the Chehalis River. The City of Tenino as well as its associated urban growth area is located along the upper reaches of Scatter Creek.

Scatter Creek basin contains 19.13 miles of SMA jurisdictional stream shoreline along Scatter Creek, broken into 16 reaches (Reach series name: CH-4). Scatter Creek basin also contains 2.12 miles of SMA jurisdictional lake shoreline around Unnamed Lake 2 in two reaches (Reach series name: LUNK2) and Unknown Pond 3 in one reach (LPO3). See Appendix A.

Scatter Creek

Physical and Biological Characterization

Scatter Creek is a low gradient, unconfined, small tributary. Scatter Creek has several small areas of steep slopes within shoreline jurisdiction. The 100-year floodplain is relatively wide and is mapped along the length of Scatter Creek. The potential channel migration zone may exceed the 100-year floodplain in several places along the creek. High groundwater hazard areas are mapped along the majority of Scatter Creek. Scatter Creek is fed by a number of unnamed tributaries. Associated wetlands are mapped along the entirety of Scatter Creek.

Scatter Creek is mapped as supporting Fall chinook, resident cutthroat, sea-run cutthroat, coho salmon, and winter steelhead. Scatter Creek may also support wood duck, mink, Taylor's (whulge) checker-spot, Puget Blue, Valley silverspot, mardon skipper, and mazama (western) pocket gopher, western grey squirrel, Olympic mudminnow, and reticulate sculpin. Prairie habitat is mapped in two places along Scatter Creek. Prairie soils and oak habitat is mapped along the majority of Scatter Creek.

Riparian vegetation upstream of the City of Tenino contains patches of remaining forest cover interspersed with emergent wetland vegetation. The majority of this area has been cleared and impacted for agricultural uses. Riparian vegetation downstream of the City of Tenino also exhibits patchy remaining forest cover, mixed with emergent wetland vegetation, and significant portions of the shoreline jurisdiction cleared for agriculture and low density residential development. Downstream of CH-4-5, the riparian corridor is relatively intact, with clearing for residential uses prevalent in the outer portion of shoreline jurisdiction. CH-4-4 to CH-4-3 contains intact forest and prairie vegetation as part of the WDFW Scatter Creek Wildlife Preserve. Downstream of the reserve, the riparian vegetation adjacent to the creek is primarily intact forest and emergent wetland vegetation, with fragmented vegetation in the outer portion of shoreline jurisdiction for residential development. The lowest reach is within the 100-year floodplain of the Chehalis River. This reach has been cleared for agriculture to the stream and contains virtually no riparian vegetation.

Water quality in Scatter Creek is categorized as ‘good’. The creek meets most water quality standards, although it has elevated nutrients, especially nitrate, and has possible temperature violations. The high nitrate levels are generally due to the groundwater which provides the base flow for the creek. Scatter Creek has high total phosphorus at James Road. Scatter Creek’s water quality is impacted by non-point source pollution from agriculture, septic systems, and rural residential land uses. Sedimentation and reed canary grass infestation have caused habitat loss. Some areas of the creek lack native riparian vegetation. Groundwater sampling in the Scatter Creek aquifer has shown nitrate and fecal coliform bacteria contamination (Thurston County Water Resources Monitoring Report, 2012).

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential, agricultural, undeveloped, open space, and timber/forest land use. There is an area of transportation land use where Interstate 5 crosses Scatter Creek. Impervious surfaces are low to moderate around Scatter Creek. Impervious surfaces are highest near Old Highway 99 on both river banks and near Interstate 5. Water oriented uses include fishing and wildlife viewing.

Under the existing SMP, the Scatter Creek is designated Conservancy. The upper two reaches are not currently designated. Scatter Creek is primarily zoned Rural Residential Resource 1/5. Along the City of Tenino's north boundary, Scatter Creek is zoned Urban Reserve. Off of Old Highway 99, there is a small area of Rural Commercial zoning. The Scatter Creek Wildlife Area is zoned Public Parks Trails and Preserves. Downstream, there is an area of Rural 1/20 and Residential LAMIRD 1/1. The lowest reach is zoned Long Term Agriculture. Under current zoning regulations, there are approximately 557 lots within shoreline jurisdiction, 57 of which are developable. There are 44 vacant single lots, 13 subdividable vacant lots, and seven parcels with the potential for additional infill.

Scatter Creek has been modified by roads, bridges, culverts, railroads, utility structures, and a contaminated site. Numerous roads enter shoreline jurisdiction, please see Appendix A for a full list of road names per reach. The following roads cross Scatter Creek via bridges: Mull Street SE, Old Military Road SE, Old Highway 99 SE (three times) Fenton Avenue W, Morningside Drive SE, Gibson Road SW, Leitner Road SW, Case Road SW, Interstate 5, Sargent Road SW, 183rd Avenue SW, Highway 12, and James Road SW. There are at least five culverts within Scatter Creek's shoreline jurisdiction. Three railroads cross Scatter Creek: one in the City of Tenino, one parallel to Interstate 5, and the last one parallel to Highway 12. Three sets of power line structures cross Scatter Creek. Jack Wilmarth Triangle General Store is a contaminated site for soil and groundwater located north of Scatter Creek's lowest reach within the shoreline jurisdiction.

Informal access may be obtained from public roads within shoreline jurisdiction. Public access is available via the WDFW Scatter Creek Wildlife Preserve.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Scatter Creek is recommended for least impact to processes in the reaches upstream from the City of Tenino, and the reaches downstream of CH-4-3. Between reaches CH-4-3 and CH-4-8, Scatter Creek is recommended for restoration/least impact to processes. One of the two most upstream reaches is recommended for conservation (CH-4-16-CH-4-17).

Unknown Lake 2

Physical and Biological Characterization

Unknown Lake 2 and its associated wetlands are within high groundwater hazard areas. The 100-year floodplain is not mapped within shoreline jurisdiction. Unknown Lake 2 comprises the headwaters of the north fork of Scatter Creek. The lake drains to Scatter Creek through an extensive wetland complex located on its south side. There are also associated wetlands located around the entire perimeter of Unknown Lake 2.

Unknown Lake 2 may provide support the following species: resident cutthroat, wood duck, and mink. The riparian vegetation around Unknown Lake 2 is primarily intact forest and shrub cover. To the east of the lake, parts of the riparian vegetation have been harvested for timber and replanted. At the reach break between the lake's immediate shoreline and the associated wetland to the south, the riparian vegetation has been cleared along Scatter Creek for agriculture. The creek appears channelized and there is very minimal visible riparian vegetation. The exterior edges of the associated wetland to the south contain shrub cover that appears intact in places and modified for agriculture and timber harvest in other areas. There is no data on water quality for Unknown Lake 2.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily timber/forestland around the lake itself, and residential, agriculture, and undeveloped in the associated wetland area to the south. The lake itself is owned by a Botanical Garden Trust. There is no impervious surface in the northern reach around the lake. The southern reach has minimal levels of impervious surface associated with low density residential development.

Unknown Lake 2 is not designated under the existing SMP. It is currently zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 16 lots within shoreline jurisdiction, six of which are developable. Three parcels are vacant single lots, and three parcels are subdividable vacant lots.

Vantine Road SE limits the western and southern extent of shoreline jurisdiction for the associated wetland to the south. There are three culverts located at the south end of shoreline jurisdiction where Vantine Road SE crosses Scatter Creek. Marshall Road SE enters shoreline jurisdiction on the north side of the lake.

Informal public access to shoreline jurisdiction may be obtained through the roads listed above.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010) Unknown Lake 2 is recommended for conservation.

Unknown Pond 3

Physical and Biological Characterization

Pond 3 is a headwater area for the north fork of Scatter Creek. Pond 3 is located within a high groundwater hazard area. The 100-year floodplain is not mapped around Pond 3. Pond 3 is a wetland and has an associated wetland on the south and west side of shoreline jurisdiction. An unnamed stream feeds Pond 3 on its east side. Pond 3 drains to the west via an unnamed stream to the upstream reaches of Scatter Creek.

Pond 3 may support the following species: coast resident cutthroat, wood duck, and mink. Prairie soils are mapped around the entire shoreline jurisdiction.

Shoreline riparian vegetation almost entirely vegetated (forested/shrub) with emergent plants present in-water. There is minor clearing (including drives) on some residential lots in jurisdiction and active forestry in jurisdiction in designated forest area.

There is no data on water quality for Pond 3.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily residential and undeveloped, with an area of timber/forestlands at the east end of the pond. Impervious surfaces are minimal, but do exist in association with low density residential development.

Pond 3 is not designated under the existing SMP. It is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 14 lots within shoreline jurisdiction, four of which are developable. Three parcels are vacant single lots, and one parcel is a subdividable vacant lot.

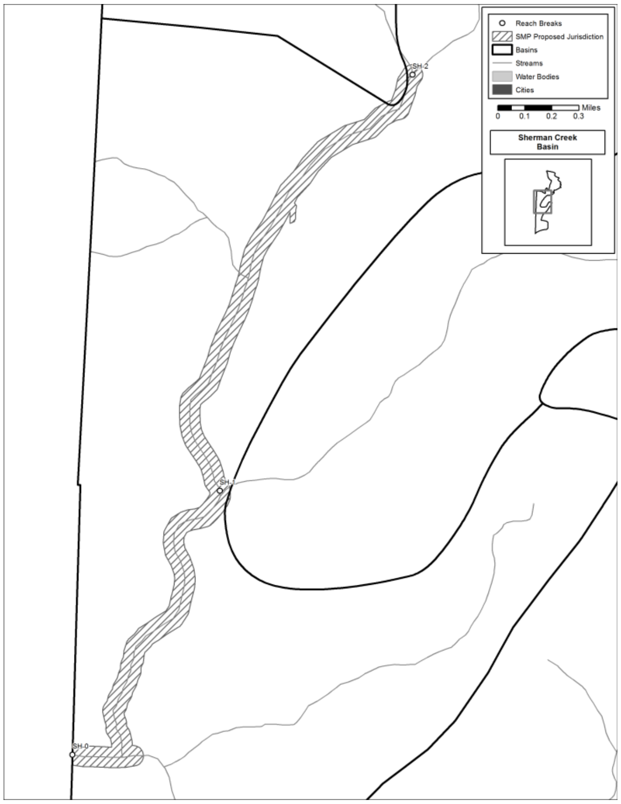
Pond 3's shoreline has been modified by Berger Dam at the west end of the pond. A driveway/residential access road crosses shoreline jurisdiction on top of the dam. Several houses with associated vegetation clearing are within shoreline jurisdiction. There is one dock on the south side of the lake.

There are currently no public access opportunities to Pond 3.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010) Unknown Pond 3 is recommended for conservation.

Sherman Creek Basin



Basin Characteristics

Sherman Creek basin is located along the western border of the county. It is 6,187 acres in size and is located entirely within WRIA 23. Waters from the Sherman Creek basin generally flow into Sherman Creek. Sherman Creek ultimately flows into the Chehalis River.

Sherman Creek basin contains 3.29 miles of SMA jurisdictional stream shoreline along Sherman Creek, in two reaches (Reach series name: SH). See Appendix A.

Sherman Creek

Physical and Biological Characterization

Sherman Creek is a low gradient, confined, small tributary. Sherman Creek has a few small areas of steep slopes and landslide hazard areas located in its lower reach. The 100-year floodplain and potential channel migration zones are not mapped along Sherman Creek.

Monroe Creek, Fall Creek, Lost Valley Creek, as well as numerous unnamed streams are tributaries to Sherman Creek. Sherman Creek joins Cedar Creek shortly before flowing out of the County. There are several small associated wetlands within Sherman Creek's shoreline jurisdiction.

Sherman Creek is mapped as supporting coho, sea-run cutthroat, and resident cutthroat, Winter steelhead, and fall Chinook. The Sherman Creek basin is mapped as providing federal critical habitat for Marbled Murrelets.

Riparian vegetation along Sherman Creek's upper reach is entirely vegetated with trees and shrubs. The lower reach contains active forestry and timber harvest has occurred within shoreline jurisdiction in many places. The shoreline jurisdiction of the lower reach is entirely vegetated; however, the riparian forest cover is very narrow in places, with young tree growth composing the remainder.

There is no data on Sherman Creek's water quality.

Shoreline Use Patterns

Sherman Creek lies entirely within Capitol State Forest, which is owned and managed by Washington Department of Natural Resources. Existing land use within shoreline jurisdiction is undeveloped and timber/forest land use. Impervious surfaces along Sherman Creek are limited to one road in the lower reach. Water oriented uses include fishing and wildlife viewing.

Sherman Creek is zoned Long Term Forestry and is designated Conservancy under the existing SMP. Under current zoning regulations, there are approximately five lots within shoreline jurisdiction, which are not developable.

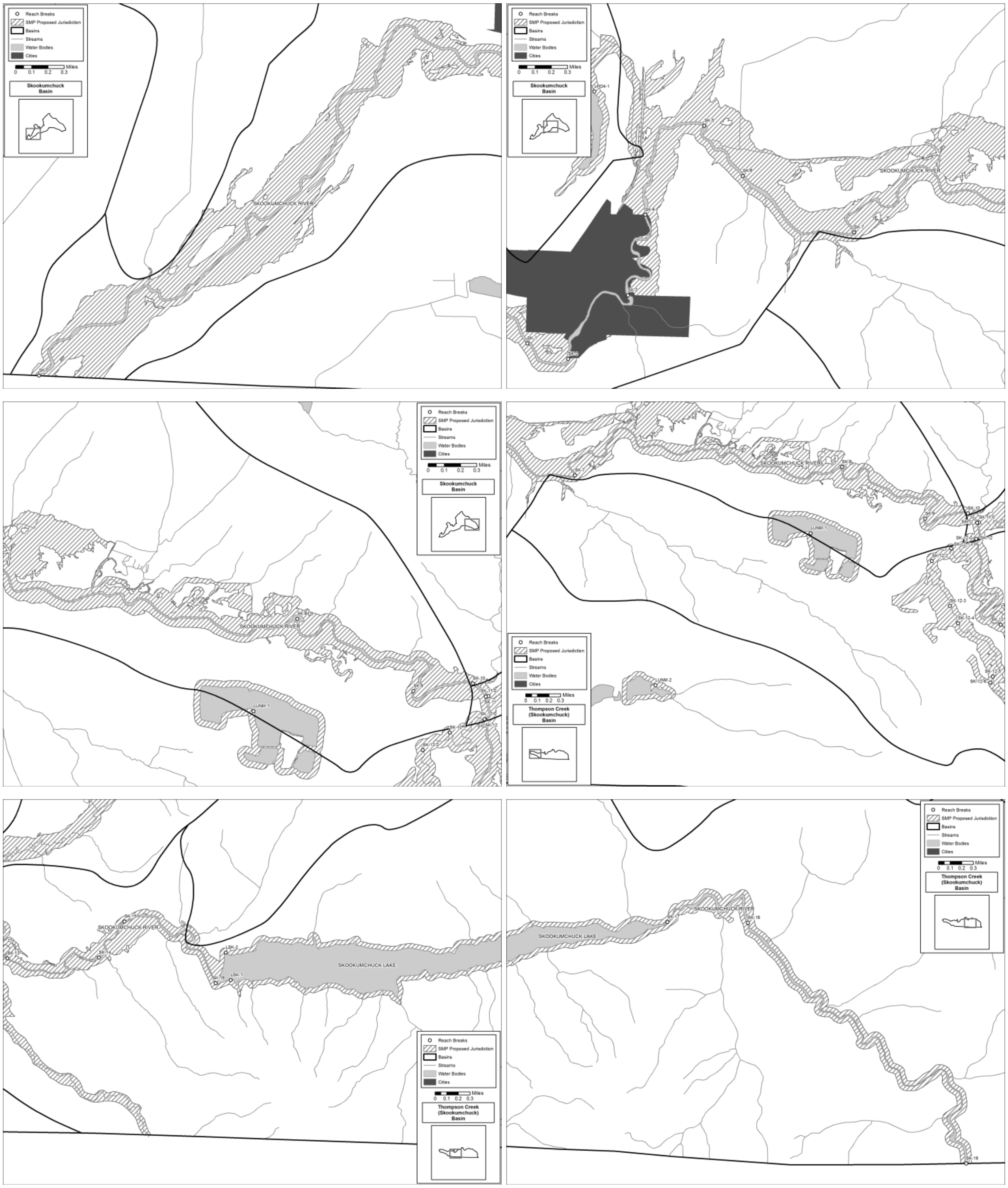
Shoreline modifications include one paved and two unpaved logging access roads (Capitol Forest Roads) located within shoreline jurisdiction. The paved road crosses the lower portion of Sherman Creek (per aerial photograph) but does not have a mapped bridge or culvert.

Sherman Creek is within Capitol State Forest; however, there are no defined public access areas to the creek. Informal public access is available via the several Capitol Forest roads which cross the creek and shoreline jurisdiction.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010) Sherman Creek is recommended for conservation.

Skookumchuck/Thompson Creek (Skookumchuck) Basins



Basin Characteristics

The Skookumchuck River is located in both the Skookumchuck basin and the Thompson Creek (Skookumchuck) basin. In order to describe the Skookumchuck River as a single waterbody in this report, the two basin descriptions have been combined here.

The Thompson Creek (Skookumchuck) basin is located in the southern portion of the county. It is 21,174 acres in size. The majority of the basin, 20,967 acres, is located in WRIA 23; a small portion, 207 acres, of this basin is located in WRIA 13. As the majority of the basin is located in WRIA 23, review of it is provided in this chapter. Waters within the Thompson Creek (Skookumchuck) basin generally flows into Skookumchuck River, Skookumchuck Lake and associated tributaries.

Skookumchuck basin is located in the southern central portion of the county on the west side of Thompson Creek (Skookumchuck) basin. It is 9,472 acres in size and is located entirely within WRIA 23. Water within the Skookumchuck basin generally flows towards Skookumchuck River. The Skookumchuck River flows through the Town of Bucoda and its urban growth area.

The Thompson Creek (Skookumchuck) and Skookumchuck basins combined contain 24.86 miles of SMA jurisdictional stream shoreline, along the Skookumchuck River and Thompson Creek, and 12.66 miles of SMA jurisdictional lake shoreline along Skookumchuck Lake, in two reaches (Reach series name: LSK), and along Lake Unknown Mine 1 (Reach series name: LUNM-1). The Skookumchuck River is described in 16 reaches (Reach series name: SK). Thompson Creek (Skookumchuck) is described in five reaches (Reach series name: SK-12) See Appendix A.

Skookumchuck River

Physical and Biological Characterization

The Skookumchuck River enters the County in an area of steep hills upstream of Skookumchuck Reservoir. In this area, it is a low to moderate gradient, confined, small tributary. Downstream of the Skookumchuck Dam, which controls the downstream flow to some extent, the river flows through rolling hills in the middle and lower basin. In this area it is a low gradient, unconfined to moderately confined, large tributary.

Upstream from the Skookumchuck Reservoir, the river is surrounded by steep slopes and landslide hazard areas. The 100-year floodplain is mapped just above the reservoir in this area. Downstream of the reservoir, there are several small areas of steep slopes and landslide hazard areas mapped adjacent to the river. In this area, the 100-year floodplain is extensive and mapped along the entire river. There is also a lobe of 100-year floodplain and associated wetlands that extends between Thompson Creek (Skookumchuck) and the Skookumchuck River just north of the Town of Bucoda, passing south of Unknown Mine 1. The potential channel migration zone may extend beyond the 100-year floodplain boundary upstream of Skookumchuck Lake. High groundwater hazard areas are mapped along the majority of the river downstream from the Town of Bucoda. There are also a few high groundwater hazard areas mapped just upstream from the Town of Bucoda.

During the inventory process extensive information was identified regarding the flooding history of the Skookumchuck River: The Skookumchuck River extends for approximately 24.7 miles in south-central Thurston County and has a wide floodplain from the county line upstream for 15 miles. The majority of the reports on the flooding of this area note that land use on the floodplain is mostly agricultural and therefore flooding of the area results in little damage.

The Skookumchuck River is fed by numerous tributaries including: Thompson Creek, Johnson Creek, Troller Run, Turvey Creek, Fall Creek, Baumgard Creek, Pheeny Creek, Laramie Creek, Hospital Creek, Run Creek, Bloody Run, as well as several unnamed tributaries. Associated wetlands are mapped along the majority of the river downstream of Skookumchuck Reservoir and just upstream from the reservoir.

The Skookumchuck River is mapped as supporting resident cutthroat, fall Chinook, spring Chinook, sea-run cutthroat, coho salmon, and winter steelhead. The Skookumchuck River shoreline jurisdiction may also provide habitat for Roosevelt and Rocky Mountain elk, harlequin duck, eastern wild turkey, bald eagle, rainbow trout, VanDykes salamander, cascade torrent salamander, and osprey. Prairie soils are mapped along most of the Skookumchuck River downstream of the lake. Oak habitat is mapped along the river upstream of the Town of Bucoda and downstream of the reservoir.

Upstream of Skookumchuck Lake, riparian vegetation is forested with active timber harvest occurring adjacent to and within shoreline jurisdiction. Downstream of the reservoir's dam, and upstream of SK-14, riparian vegetation is mainly forest cover with some fragmentation for roads and other clearing. In SK-14 to SK-12, the left bank is mainly forested, while the right bank is extensively cleared for agriculture, leaving only a thin band of forested riparian cover adjacent to the river. Near the Johnson Creek confluence, the left bank is extensively cleared to the bank in many places for residential development, and the right bank is mainly forested with some clearing for agriculture adjacent to the river. In SK-9 to SK-8, the right bank vegetation is primarily intact forested vegetation, whereas the left bank has a moderate forested riparian buffer with clearing for agriculture landward in the wide shoreline jurisdiction. SK-8 to SK-7 contains minimal riparian vegetation for the majority of the reach. Trees are present in a thin band along the river with the majority of the extensive shoreline jurisdiction cleared for agriculture. In SK-7 to SK-5, the left bank is entirely intact forest while the right bank is mainly cleared to the stream for agriculture. SK-5 to SK-4, just upstream from the town of Bucoda, has mainly intact forested or emergent riparian vegetation throughout shoreline jurisdiction. Along the east side of the town of Bucoda, left bank, riparian vegetation is a thin forested band along the river, with clearing for residences and rural land use behind. Downstream of the town of Bucoda, riparian vegetation is primarily a thin band of trees with clearing for agriculture landward in the extensive shoreline jurisdiction. Some patchy areas of wider forested riparian cover are also present on both banks.

Water quality in the Skookumchuck River is categorized as 'good'. The river met both parts of the fecal coliform standard each water year. There were turbidity measurements above the water quality standard during the 2009/10 and 2010/11 winters. Possible temperature violations may have occurred in August 2010 and July and September of both water years. Water quality issues for the Skookumchuck River include: non-point source pollution; habitat loss from erosion and sedimentation; lack of native riparian vegetation along some shoreline areas; and flooding, especially in the town of Bucoda and the cities of Centralia and Chehalis (Thurston County Water Resources Monitoring Report, 2012).

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is entirely timber/forest land use upstream of Skookumchuck Lake. Downstream of the lake and upstream from the Thompson Creek confluence, existing land use is a mix of timber/forest land use, open space, undeveloped, and commercial. Downstream from the Thompson Creek confluence to the County border, existing land use is a mix of residential, agriculture, undeveloped, timber/forest land use, and some areas of mining.

Impervious surfaces are relatively low within the Skookumchuck River shoreline jurisdiction. Areas of impervious surface concentration include: downstream of the town of Bucoda along State Route 507 and the Burlington Northern railroad areas, and near the Johnson Creek and Thompson Creek confluences. Water oriented uses include hydropower, fishing, and wildlife viewing.

Under the existing SMP, the Skookumchuck River is designated Conservancy with the exception of a small area of Urban shoreline on the right bank upstream from Bucoda.

Zoning upstream of Skookumchuck Lake Dam and in places further downstream is Long Term Forestry. Most of the shoreline jurisdiction in the valley between Bucoda and Skookumchuck Lake Dam is Long Term Agriculture or Rural Residential Resource 1/5. There is an area zoned Residential LAMIRD 1/1 on the river’s left bank near the Thompson Creek and Johnson Creek confluences. The area downstream from the town of Bucoda is primarily zoned Rural Residential Resource 1/5 with a small area of Rural 1/20 and an area of Long Term Forestry. Under current zoning regulations, there are approximately 312 lots within shoreline jurisdiction, 70 of which are developable. There are 40 vacant single lots, 23 subdividable vacant lots, and 7 parcels with the potential for additional infill.

Private logging roads and vegetation removal due to timber/forest harvest are the only shoreline modifications along the river upstream of Skookumchuck Lake. Skookumchuck Lake was formed by an impoundment of the Skookumchuck River and contains 550 acres. The Skookumchuck Dam, completed in 1970 and located approximately 8 miles upstream of Bucoda, has a storage capacity of 42,000 acre-feet. Its major function is water supply for the Centralia Steam-Electric Plant and it provides little protection from large floods. It supplements flows for fish resources.

Downstream of the Skookumchuck Lake Dam and upstream from the Johnson Creek confluence, five utility structures cross the river (two powerlines, a gas line, fiber optic, and a fuel line). Four bridges and at least seven culverts are located within shoreline jurisdiction in this area. Three of these bridges are associated with crossings Skookumchuck Road SE, and one is associated with

Goebel Road SE. There are additional private roads which enter shoreline jurisdiction in this area. Mining is mapped within shoreline jurisdiction in several places.

Downstream of the town of Bucoda, the Burlington Northern Railroad crosses the Skookumchuck River once, and forms a barrier on the left bank for most of this area. State Route 507 is within shoreline jurisdiction for most of this stretch, but does not cross the river. A bridge is associated with the crossing of Conner Road SE. At least two culverts are present within shoreline jurisdiction, but not along the river itself. Power line structures cross the Skookumchuck River within this area. Mining is mapped on the left bank of SK-1-SK-2.

Informal public access to the Skookumchuck River is available from public roads within shoreline jurisdiction. The only formally identified public access within these basins is to the Skookumchuck Lake, where a WDFW boat launch is located.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Protection	Immediately upstream from Skookumchuck Lake	SK-17-SK-18
Protection/restoration	Johnson Creek confluence to the Skookumchuck Lake Dam	SK-11 to SK-16
Conservation	Upstream from Skookumchuck Lake	SK-18-SK-19
Restoration	None	None
Restoration/ Less impact to processes	County border to Johnson Creek confluence	SK-0 to SK-11
Less impact to processes	None	None

Skookumchuck Lake

Physical and Biological Characterization

Skookumchuck Lake is an approximately 550 acre reservoir created by the damming of Skookumchuck River. There is no data available on reservoir depth. Steep slopes and landslide hazard areas are mapped in places along both shorelines of the lake. The entire lake is mapped within the 100-year floodplain, but the floodplain does not extend much beyond the lakeshore.

The Skookumchuck River drains into the east side of Skookumchuck Lake. Turvey Creek, Fall Creek, Baumgard Creek, and 12 unnamed creeks flow also flow into Skookumchuck Lake. Skookumchuck Lake drains west to the Skookumchuck River. Drainage rate is modified by the Skookumchuck dam. Skookumchuck Lake is mapped as a wetland. There are no associated wetlands that extend shoreline jurisdiction.

Skookumchuck Lake is mapped to support Coast resident cutthroat and Rainbow trout. The lake may support mountain quail, osprey, peregrine falcon, bald eagle, eastern wild turkey, harlequin duck, Roosevelt elk and Rocky Mountain elk.

Riparian vegetation is almost entirely forested shoreline and jurisdiction, with a few areas cleared for timber harvest and mining on the north lake shore. The west lake shore at the dam contains no riparian vegetation. There is no data on water quality for Skookumchuck Lake.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is open space, timber/forest land, and mining. Most of the shoreline jurisdiction falls within open space, with timber/forest land use occurring on the outskirts of shoreline jurisdiction on most of the adjacent land. A mine is located on the northeast side of the lake. Impervious surfaces are limited to the dam operations at the western end of the lake. Water oriented uses include hydropower, fishing, and recreation.

Skookumchuck Lake is designated Conservancy under the existing SMP. The lake is primarily zoned Long Term Forestry with the exception of the west end where the dam is located. The dam area is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately 17 lots within shoreline jurisdiction, none of which are developable.

Skookumchuck Dam was completed in 1971 and located approximately 8 miles upstream of Bucoda, has a storage capacity of 42,000 acre-feet, and is located at the western end of the lake. Its major function is water supply for the Centralia Steam-Electric Project and it provides little protection from large floods. The dam prevents anadromous fish passage. A road is present across the top of the dam, and at least two access roads cross shoreline jurisdiction on the western side of the lake.

There is a public WDFW boat launch located on Skookumchuck Lake.

Management Issues and Opportunities

<u>Puget Sound Water Flow Characterization Management Strategies</u> (Stanley et al., 2010) Skookumchuck Lake is recommended for protection.

Thompson Creek (Skookumchuck)

Physical and Biological Characterization

Thompson Creek has a small area of steep slopes mapped on its right bank (east). Thompson Creek has an extensive 100-year floodplain. It is mapped for the length of Thompson Creek shoreline jurisdiction, as well as extending west across the Thompson Creek basin to the Skookumchuck River south of Unknown Mine 1.

Thompson Creek is fed by several unnamed tributaries and drains to the Skookumchuck River. Thompson Creek's upper reaches contain associated wetlands, as does the area within the 100-year floodplain stretching west to the Skookumchuck River.

Thompson Creek is mapped as containing the following species: coho, winter steelhead, sea-run cutthroat, and resident cutthroat. The creek may also support harlequin duck and Roosevelt and Rocky Mountain elk.

Upper Thompson Creek's shoreline jurisdiction contains intact forest cover. Thompson Creek's mid-reaches retain intact forested cover on the right bank (east) with the exception of a large area cleared for several utility lines. The mid-reach left bank (west) is primarily a thin riparian buffer with clearing for agriculture or utilities occupying the remainder of shoreline jurisdiction. Lower Thompson Creek contains sparse and fragmented shoreline vegetation that has been cleared for residential development, utilities, and agriculture.

There is no data on Thompson Creek water quality.

Shoreline Use Patterns

Existing land use within upper Thompson Creek shoreline jurisdiction is timber/forest land use. Along lower Thompson Creek, existing land use is primarily agriculture, residential, and undeveloped. Impervious surfaces are very minimal along Thompson Creek, with the highest concentration in the lowest reach. The lowest reach contains impervious surfaces associated with Skookumchuck Road SE and low density residential development. Water oriented uses include fishing and wildlife viewing.

Thompson Creek's lower two reaches are designated Conservancy, and the upper four reaches are not designated under the existing SMP. The upper two reaches are zoned Long Term Forestry. The middle reaches are zoned Long Term Agriculture and Rural Residential Resource 1/5. The lowest reach is zoned Residential LAMIRD 1/1. Under current zoning regulations, there are approximately 51 lots within shoreline jurisdiction, five of which are developable. One parcel is a vacant single lot and four parcels are subdividable vacant lots. There are no parcels with the potential for additional infill.

Thompson Creek shoreline jurisdiction has been modified by five utility structures: two power lines, a fuel line, a fiber optical line, and a gas line. Skookumchuck Road SE, Steelhead Driver SE, and Whitefish Court SE cross the shoreline jurisdiction in the lowest reach. Whitefish Court SE has an associated culvert. Thompson Creek Road SE parallels Thompson Creek on its right bank (east) and runs through shoreline jurisdiction several times. Thompson Creek Road SE has a bridge and at least four associated culverts within shoreline jurisdiction.

Informal public access may be obtained through the public roads listed above.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
*If a reach falls within two analysis units, the analysis unit that composes the majority of the reach was reported.

Management Strategy	**General Locations**	**Reaches**
Protection	Upper two reaches and right bank of middle reaches	SK-12-3 to SK-12-6
Protection/restoration	Lower two reaches and right bank of middle reach	SK-12-0 to SK-12-3
Conservation	None	None
Restoration	None	None
Restoration/ Less impact to processes	Left bank of middle reaches	SK-12-2 to SK-12-4
Less impact to processes	None	None

Lake Unknown Mine 1

Physical and Biological Characterization

Lake Unknown Mine 1 is a waterbody created in a mining depression located south of the Skookumchuck River and east of the town of Bucoda. There are no geologic or flood hazards present. The lake has formed in a depression left by a mine. It is classified as an open water wetland and drains to the Thompson/Skookumchuck basin through an unnamed stream.

Shoreline jurisdiction may support the following species: Harlequin duck; Rocky Mountain and Roosevelt Elk. Prairie soils are mapped around the entire waterbody. Riparian vegetation is primarily patchy grass and shrub cover with minimal, patchy forest cover. There is no water quality data for Lake Unknown Mine 1.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is utilities. The shoreline is created and modified by mining activity.

The waterbody is surrounded by an unpaved road. Skookumchuck Road SE passes through the northern shoreline jurisdiction. Tyrell Road SE passes through the west side of shoreline jurisdiction. Shoreline jurisdiction contains low levels of impervious surfaces. Impervious surfaces are associated with the two roads (listed above) which briefly enter shoreline jurisdiction.

Informal public access is available from the two public roads listed above.

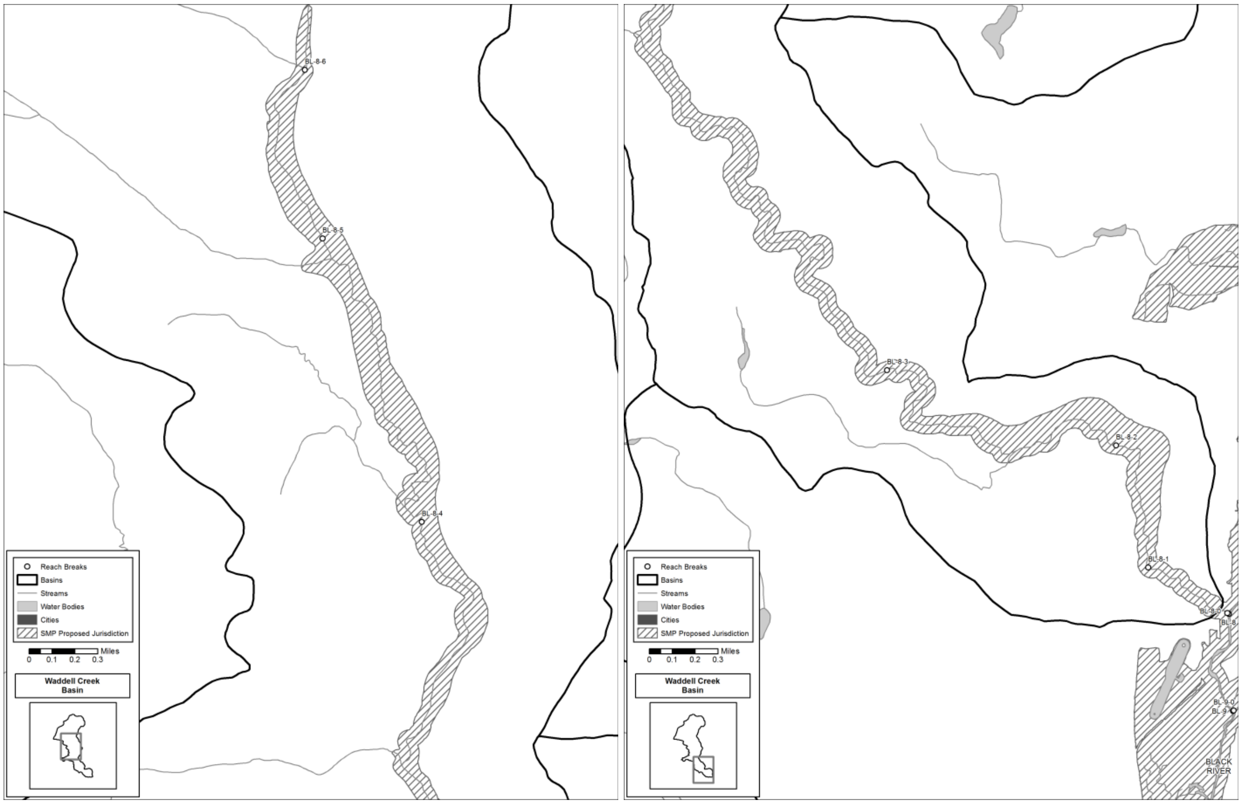
Lake Unknown Mine 1 is not designated in the existing SMP. It is zoned Rural Residential Resource 1/5. Under current zoning regulations, there are approximately eight parcels within shoreline jurisdiction, two of which are developable. There is one vacant single lot and one subdividable vacant lot.

Management Issues and Opportunities

When mining activity has stopped, there is the opportunity to restore the area into a functioning wetland, particularly through re-vegetation of currently non-vegetated shorelines.

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
Lake Unknown Mine 1 is recommended for restoration/least impact to processes.

Waddell Creek Basin



Basin Characteristics

The Waddell Creek basin is located in the central western portion of the county. It is 11,182 acres in size. The majority of this basin, 11,148 acres, is located in WRIA 23. A small portion, 34 acres, is located in WRIA 13. As the majority of the basin is located in WRIA 23, review of it is provided in this chapter. Water within Waddell Creek basin generally flows into Waddell Creek. Waddell Creek flows into the Black River.

Waddell Creek contains 9.10 miles of SMA jurisdictional stream shoreline, in six reaches (Reach series name: BL-8). See Appendix A.

Waddell Creek

Physical and Biological Characterization

Waddell Creek has several areas of steep slopes and landslide hazard areas mapped along the upper reaches. The 100-year flood plain is mapped along the majority of Waddell Creek. The potential channel migration zone may extend beyond the 100-year floodplain in several places in the lower reaches near Waddell Creek Road SW. A small high groundwater hazard area is located in the lower reaches.

Waddell Creek is a tributary to the Black River. Waddell Creek is fed by numerous unnamed tributaries, as well as North Creek. It has very few associated wetlands. The associated wetlands that are present are very small and do not expand the shoreline jurisdiction.

Waddell Creek is mapped as supporting resident cutthroat, fall Chinook, coho salmon, winter steelhead, and sea-run cutthroat. Waddell Creek may also support reticulate sculpin, Pacific lamprey, riffle sculpin, Oregon spotted frog, and tailed frog. Oak habitat is mapped along the lower reaches, and prairie soils are mapped along the majority of the upper reaches. The Waddell Creek basin is mapped as providing federal critical habitat for Marbled Murrelets.

The uppermost reach is entirely forested with evidence of timber harvest in the outer portion of shoreline jurisdiction. The second most upstream reach exhibits fragmented forest cover on the right bank (west) from low density residential development and agriculture. The mid-reach has intact forested riparian vegetation on both banks. Riparian vegetation in the lowest reaches has been fragmented and cleared for low density residential development and agriculture. The lowest reach has very little remaining riparian vegetation on the left bank (north) and on both banks adjacent to the Black River.

There is no data on water quality for Waddell Creek.

Shoreline Use Patterns

Existing land use within shoreline jurisdiction is primarily undeveloped in the uppermost reach and mid/upper reaches. In the lower reaches and the second upstream reach, land use within shoreline jurisdiction is primarily residential with a few areas of agriculture and timber/forest land.

Impervious surfaces along Waddell Creek are generally low. The second lowest reach, and second most upstream reach have the highest level of impervious associated with a road and low density residential development. Neither reach has impervious levels estimated to be greater than ten percent. Water oriented uses of Waddell Creek include fishing and wildlife viewing.

Waddell Creek’s existing environment designation is Conservancy. The upper three reaches are zoned Long Term Forestry. The lower reaches are zoned Rural Residential Resource 1/5 and Rural 1/20. Under current zoning regulations, there are approximately 92 lots within shoreline jurisdiction, 13 of which are developable. There are nine vacant single lots, three subdividable vacant lots, and one parcel with the potential for additional infill.

Several roads cross Waddell Creek, including: Waddell Creek Road SW (over an unmapped bridge); Capitol Forest Road (over an unmapped bridge); and Sherman Valley Road SW (over Weller’s Bridge).

The upper reach and middle reach are within Capitol State Forest which is managed by the Washington State Department of Natural Resources and open to the public. Informal public access is available via the roads listed above.

Management Issues and Opportunities

Puget Sound Water Flow Characterization Management Strategies (Stanley et al., 2010)
The upstream reaches of Waddell Creek (upstream from 8-4) are recommended for conservation. The downstream reaches are recommended for least impact to processes.

Zenkner Basin

This basin has no mapped shoreline jurisdiction and is therefore not reviewed in this document.

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9 MANAGEMENT OPTIONS FOR PROTECTION and RESTORATION

Recommendations and options for managing marine and freshwater shorelines are provided in the following tables. The management options for managing the marine shoreline were taken from "Management Measures for Protecting and Restoring the Puget Sound Nearshore" (Clancy et al., 2009) as well as "Protecting Nearshore Habitat and Functions in Puget Sound" (EnviroVision, et al., 2010). The management options for the freshwater shorelines were taken from "Land Use Planning for Salmon, Steelhead, and Trout" (Knight, 2009) and from "Over-water Structures: Freshwater Issues" (Carrasquero, 2001). Many of the management options may be considered for more than one recommendation.

For each waterbody, readers should look at the general management recommendation outcome from the PSNERP Strategies for Nearshore Protection and Restoration in Puget Sound (Cereghino et al., 2012)(for marine waterbodies), or the Puget Sound Water Flow Characterization (Stanley et al., 2012) (for freshwater waterbodies) studies. If a general recommendation from these studies lists two categories of general recommendations, users should consider the management options for both recommendation categories. The management options listed for each general recommendation may or may not apply, depending on the specifics of each waterbody.

MARINE SHORELINE

Table 9.1. General management recommendations and options for marine shorelines

General Recommendations	**Management Options** General management measures (shown with round bullets) are taken from PSNERP Technical Report 2009-01 "Management Measures for Protecting and Restoring the Puget Sound Nearshore" (Clancy et al. 2009). Definitions for these headings are provided in italics below each heading. http://www.pugetsoundnearshore.org/technical_papers/mangement_measure.pdf Specific policy options (shown with arrow bullets) are taken from "Protecting Nearshore Habitat and Functions in Puget Sound" (EnviroVision, et al. Revised 2010). http://wdfw.wa.gov/publications/00047/wdfw00047.pdf *The suggested management options listed below may also work in the other "Recommendations" categories.
Protect Role: Protect existing resources, limit future impairment, influence human behaviors	Protect important nearshore areas for plants, animals, fish, and people • Habitat Protection Policy and Regulation *The long-term protection of habitats (and associated species) and habitat-forming processes through zoning, development regulations, incentive programs and other means.* ➢ Identify and designate critical habitat features such as forage fish spawning habitat, aquatic vegetation communities, nearshore salmon habitat, feeder bluffs, intact beaches, marine riparian areas, and all marine vegetation within intertidal and subtidal zones(including kelp, eelgrass, and wetland plants) and protect them (and their functions) under a Natural or other type of conservancy shoreline environmental designation and SMP regulations.

	➢ Provide protected shallow water migration corridors, especially between estuaries and marine waters through shoreline designations ➢ Prohibit grounding of floats, rafts, docks and vessels ➢ Prohibit placement of overwater structures over marine vegetation ➢ Prohibit placing docks, piers, and mooring buoys in areas containing sensitive, unique, or high-value fish and shellfish habitat. ➢ Do not allow construction activity during egg deposition and incubation periods • Property Acquisition and Conservation *Transfer of land ownership or development rights to a conservation interest to protect and conserve resources, enable restoration or increase restoration effectiveness.* <u>Work together to ensure continued understanding and enjoyment of nearshore resources</u> • Public Education and Involvement *Activities intended to increase public awareness of nearshore processes and threats, build support for and volunteer participation in protection and restoration efforts, and promote stewardship and responsible use of nearshore resources.*
Restore Role: Exert long-lasting restorative effects on ecosystem processes, remove or prevent physical and chemical disturbances	<u>Remove debris and unneeded structures and protect the nearshore from harmful pollutants or use</u> • Contaminant Removal and Remediation *Removal or remediation of unnatural or natural substances (e.g., heavy metals, organic compounds) harmful to the integrity or resilience of the nearshore. Pollution control, which is a source control measure, is a different measure.* • Debris Removal *The removal of solid waste (including wood waste) debris, and derelict or otherwise abandoned items from the nearshore.* • Pollution Control *Prevention, interception, collection, and/or treatment actions designed to prevent entry of pollutants into the nearshore ecosystem.* • Physical exclusion *Installation of exclusionary devices (fences, barriers, mooring buoys, or other devices) to direct or exclude human and/or animal use of a restoration site.* <u>Remove dikes, culverts, and fill to allow water to flow naturally to the nearshore</u> • Berm or Dike Removal or Modification *Removal or modification of berms, dikes and other structures to restore tidal inundation to a site that was historically connected to tidal waters. Includes dike/berm breaching and complete dike/berm removal.* • Groin Removal or Modification *Removal or modification of groins and similar nearshore structures built on bluff-backed beaches or barrier beaches in Puget Sound.* • Hydraulic Modification *Modification of hydraulic conditions when existing conditions are not conducive to sustaining a more comprehensive restoration project. Hydraulic modification involves removing or modifying culverts and tide gates or creating other engineered openings in dikes, road fills, and causeways to influence salt marsh and lagoon habitat. This measure is used in managed tidal systems (as opposed to naturally maintained systems).* • Channel Rehabilitation or Creation *Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function.*

	• Topography Restoration *Dredging, excavation and /or filling to remove or add layers of surface material so that* *beaches, banks, tidal wetlands, or mudflats can be created.* <u>Remove bulkheads from the nearshore</u> • Armor Removal or Modification – *Removal, modification, or relocation of coastal erosion protection structures such as rock revetments, bulkheads, and concrete walls on bluff-backed beaches, barrier beaches, and other shorelines.* ➢ Avoid and minimize shoreline armoring projects, and require proposed bulkhead rebuild projects to have a geotechnical assessment, reviewed by a qualified third party, to evaluate problems and analyze potential solutions, including the use of alternative designs (e.g., soft-shore approaches) as opposed to in-kind replacement ➢ Avoid placement of shoreline armor or other structures near the beach, especially waterward of OHWM, that may result in downcutting of the beach, substrate change, or alteration of shoreline physical processes <u>Remove or modify piers and docks</u> • Overwater Structure Removal or Modification *Removal or modification of overwater structures such as piers, floats and docks to reduce shading and restore wave regimes.* ➢ Avoid and minimize new over-water structures in areas inventoried as forage fish spawning ➢ Require survey of intertidal and shallow subtidal areas prior to permitting any structures or activities that could impact existing beds ➢ Show preference for the use of mooring buoys and shared facilities rather than individual private docks and piers ➢ Minimize and limit over-water structures and require structure designs that improve light conditions (minimize shading) under these structures through design specifications (minimize width, use grating, orient north-south to minimize shading resulting from new and rebuilt structures) and minimize disturbance of the substrate including from prop wash ➢ Minimize displacement of beach area by pilings or other structures by minimizing the footprint and number of pilings associated with overwater structures. Where such structures are unavoidably necessary, prohibit the use of treated wood in favor of concrete, steel, or recycled plastic ➢ Eliminate grounding of boats and structures ➢ Dock and piers should not be located on shallowly sloped beach areas because of the large footprint required to obtain adequate water depths for launching ➢ Avoid placing docks or piers in tidal flats because these locations require very long structures ➢ Place structures to perpendicularly span the shoreline spawning habitat zone <u>Return native plants to the nearshore</u> • Revegetation *Site preparation, planting, and maintenance to manipulate soils and vascular plant*

<table>
<tr><td></td><td>populations to supplement the natural development of native vegetation.

➢ Require site surveys of existing conditions including vegetation function analysis
➢ Promote retaining or establishing marine riparian vegetation including large trees by requiring a vegetation conservation plan for activities impacting marine riparian vegetation
➢ Avoid and minimize area disturbed during nearshore construction activities by establishing standards for equipment use within riparian areas, and require replacement of native riparian or aquatic vegetation that is directly or indirectly lost through shoreline activities with native species, including long term maintenance provisions
➢ Require development of vegetation conservation plans, including replanting and maintenance standards focused on native species, for any project that impacts marine riparian vegetation
➢ Require enhancement and mitigation of marine riparian areas for expansions or redevelopment of developed areas

<u>Restore important nearshore areas for plants, animals, fish, and people</u>
• Property acquisition and Conservation
Transfer of land ownership or development rights to a conservation interest to protect and conserve resources, enable restoration or increase restoration effectiveness.
➢ Promote off-site mitigation to address cumulative impacts using the restoration component of the shoreline master program</td></tr>
<tr><td>Enhance
Role: Create/ promote structural elements (habitats) and/or mimic natural processes)</td><td><u>Add sand and gravel to rebuild eroded beaches</u>
• Beach Nourishment
The intentional placement of sand and/or gravel on the upper portion of a beach where
historic supplies have been eliminated or reduced.
• Substrate Modification
The placement of materials to facilitate establishment of desired habitat features and improve ecosystem functions, structures, or processes.

<u>Create habitat for native plants and animals</u>
• Large Wood Placement
Installment of large, unmilled wood (large tree trunks with root wads, sometimes referred to as large woody debris) within the backshore or otherwise in contact with water to increase aquatic productivity and habitat complexity.
• Species Habitat Enhancement
Installation or creation of habitat features (sometimes specific structures) for the benefit of native species in the nearshore.
➢ If tree removal is unavoidable, leave felled trees or create snags for wildlife habitat
➢ Require mitigation for lost habitat elements such as trees, logs, and boulders
• Channel Rehabilitation or Creation
Restoration or creation of channels in a restored tidal wetland to change water flow, provide habitat, and improve ecosystem function.

<u>Remove nonnative plants and animals</u>
• Invasive Species Control
Eradication and control of nonnative invasive plants or animals occupying a restoration site and control measures to prevent introduction or establishment of such species after
construction is complete.

<u>Return native plants and animals to the nearshore</u></td></tr>
</table>

	• Reintroduction of Native Animals *Reestablishment of native animal species at a site where they existed or as replacement for lost habitat elsewhere.* • Revegetation *Site preparation, planting, and maintenance to manipulate soils and vascular plant populations to supplement the natural development of native vegetation.* ➢ Require site surveys of existing conditions including vegetation function analysis ➢ Promote retaining or establishing marine riparian vegetation including large trees by requiring a vegetation conservation plan for activities impacting marine riparian vegetation ➢ Avoid and minimize area disturbed during nearshore construction activities by establishing standards for equipment use within riparian areas, and require replacement of native riparian or aquatic vegetation that is directly or indirectly lost through shoreline activities with native species, including long term maintenance provisions ➢ Require development of vegetation conservation plans, including replanting and maintenance standards focused on native species, for any project that impacts marine riparian vegetation ➢ Require enhancement and mitigation of marine riparian areas for expansions or redevelopment of developed areas

Freshwater Shoreline

Table 9.2. General management recommendations and options for freshwater shorelines

General Recommendations	Management Options *The suggested management options listed below may also work in the other "Recommendations" categories.
Protection (High water process importance, low impairment areas) • Extra care given to protecting /maintaining watershed processes	• Protect natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and prohibiting bank hardening • Allow no new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting essential facilities • Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones • Prohibit removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities • Restrict livestock access to streams and rivers to prevent streambank and vegetation degradation, channel widening and heating • Prohibit new development in the 100-year floodplain • Continued protection of critical areas within shoreline jurisdiction • Maintain the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients • Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas • Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer • Maintain septic systems • Increase opportunities for land exchanges that retain or restore floodplain and delta habitats • Maintain native riparian vegetation • Prohibit new overwater structures • Prohibit shoreline armoring
Conservation (low water process importance, low impairment areas) • Protect /maintain watershed processes	• Continued protection of critical areas within shoreline jurisdiction • Protect natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening • Allow no new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting essential facilities or increasing habitat through bioengineered restoration • Discourage new dwelling units or expansion of existing structures within the CMZ • Limit development and shoreline modifications that would result in interference with the process of channel migration that may result in a net loss of ecological functions associated with the rivers and streams • Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones • Prohibit removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities • Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer

	• Maintain septic systems • Restrict livestock access to streams and rivers to prevent streambank and vegetation degradation, channel widening and heating • Use the Low Impact Development (LID) approach and techniques to better manage stormwater for new development, redevelopment and retrofit projects. This includes: limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation • Prohibit new development in the 100-year floodplain • Prohibit new dikes, levees, tide-gates, floodgates, pump stations, culverts, dams, water diversions, and other alterations to the floodplain, excepting habitat improvements such as a wider culvert for fish passage • Avoid new road construction at stream and wetland crossings • Maintain vegetation, limit disturbed areas, and control drainage on steep slopes. • Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible • Increase opportunities for land exchanges that retain or restore floodplain and delta habitats • Maintain or restore the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients • Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas • Minimize and control runoff and soil erosion • Maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting • Remove or modify overwater structures such as piers and docks • Show preference for the use of mooring buoys and shared facilities rather than individual private docks and piers • Minimize and limit over-water structures and require structure designs that improve light conditions (minimize shading) under these structures through design specifications (minimize width, use grating, orient north-south to minimize shading resulting from new and rebuilt structures) and minimize disturbance of the substrate including from prop wash • Minimize displacement of beach area by pilings or other structures by minimizing the footprint and number of pilings associated with overwater structures. Where such structures are unavoidably necessary, prohibit the use of treated wood in favor of concrete, steel, or recycled plastic • Avoid and minimize shoreline armoring projects, and require proposed bulkhead rebuild projects to have a geotechnical assessment, reviewed by a qualified third party, to evaluate problems and analyze potential solutions, including the use of alternative designs (e.g., soft-shore approaches) as opposed to in-kind replacement. For retrofitting projects, bulkheads should be completely eliminated when possible or relocated shoreward of OHWM, and shorelines should be restored with emergent and riparian plant species • Avoid placement of shoreline armor or other structures near the beach, especially waterward of OHWM, that may result in downcutting of the shoreline, substrate change, or alteration of shoreline physical processes
Restoration	• Limit impervious areas

(High water process importance, higher impairment areas) • Restoration of watershed processes should be high priority	• Repair faulty septic systems • Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer • Coordinate restoration plans with salmonid recovery and watershed management plans, water clean-up plans for TMDLs, stormwater management programs, and with stormwater basin plans where they have been developed • Restore the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients • Restore natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening • Plan for and facilitate removal of artificial restrictions to natural channel migration, restoration of off channel hydrological connections and return river processes to a more natural state where feasible and appropriate • Restore natural channel morphology • Increase opportunities for land exchanges that retain or restore floodplain and delta habitats • Encourage the removal or relocation of structures within the channel migration zone to facilitate the natural recovery of channel migration processes • Remove human-made barriers to salmonid migration, such as blocking culverts and tide gates • Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible • Support the removal and control of noxious weeds • Maintain native riparian vegetation and encourage the restoration of degraded riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting. • Close unnecessary roads • Minimize and control runoff and soil erosion • Use the Low Impact Development (LID) approach and techniques to better manage stormwater for new development, redevelopment and retrofit projects. This includes: limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation
Development (Low water process importance, higher impairment areas) • Less impact to watershed processes if development occurs	• Use the Low Impact Development (LID) approach and techniques to better manage stormwater for new development, redevelopment and retrofit projects. This includes: limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation.

10 POTENTIAL SHORELINE USE CONFLICTS

State guidelines for Shoreline Master Program (SMP) updates require that local jurisdictions estimate demand for future shoreline use/space and identify potential use conflicts (WAC 173-26-201)(3)(d)(ii)). Chapters 5-8 characterize the following:

- Current use patterns;
- Public access;
- Future development potential as defined by the County's Comprehensive Plan; and
- Characterization of shoreline ecological processes, functions, and opportunities for restoration and protection.

This chapter focuses on potential use conflicts within Thurston County's shorelines. 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 address conflicts between SMA policy objectives and other interests or regulatory requirements affecting shoreline resources.

SHORELINE POTENTIAL USE CONFLICTS

Overwater Structures

Development of overwater structures (such as piers and docks) has the potential for conflicts with other shoreline uses. Public piers and docks provide public access and recreation for shoreline users, a major policy objective of the SMA. Private docks associated with residential development are typically allowed, and 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 SMA preferred uses by reducing shoreline ecological functions, limiting the potential for recreation and restoration, and potentially interfering with navigation. Areas in which these conflicts may occur include the marine shorelines and the most densely developed lakes. Ecological impacts of overwater structures include alteration of light, wave energy, sediment, and water conditions. These impacts may negatively affect the distribution, behavior, growth, and survival of fish, wildlife, and plants in the area around the structure.

Commercial Aquaculture

Conflicts may exist in Thurston County between commercial aquaculture uses, environmental protection, and other adjacent uses (such as public access, recreation, shoreline residential development, and natural protected areas). "Aquaculture" means the culture or farming of fish, shellfish, or other aquatic plants and animals. Aquaculture does not include the harvest of wild geoduck associated with the state managed wildstock geoduck fishery (WAC 173-26-020(6). Most commercial aquaculture in Thurston County is a water-dependent use under the SMA. This includes fish hatcheries and rearing in rivers and commercial shellfish growing in nearshore marine areas.

Within the category of commercial shellfish growing and potential shoreline use issues, commercial geoduck aquaculture has been the focus of heightened shoreline use conflict. This has occurred to the extent that in 2007, the Washington State legislature passed SSHB 2220 relating to shellfish aquaculture. This bill commissioned a series of intertidal geoduck aquaculture scientific research studies to be led by Washington Sea Grant to gain further insight on the environmental impacts of commercial geoduck aquaculture. This bill also created a Shellfish Aquaculture Regulatory Committee (SARC) with members representing a wide range of perspectives, directed Ecology to add language to the Shoreline Master Program guidelines about the siting and operations of geoduck aquaculture along Washington's marine shorelines, and directed the Washington Department of Fish & Wildlife to expand the information required for aquatic farm registration.

As directed by SSHB 2220, in 2011 Ecology updated the Shoreline Master Program Guidelines (Chapter 173-26 WAC, Part III), with new rules about the siting and operations of geoduck aquaculture along Washington's marine shorelines. The changes incorporated recommendations of the SARC, which met for two years (2007-2009) and submitted a report to the legislature in January 2009. The changes also incorporated current knowledge related to geoduck permitting and research.

Agricultural Uses

Conflicts may exist in Thurston County between agricultural uses in shoreline areas, other adjacent uses and environmental protection. Ecologically related conflicts typically associated with agricultural uses include clearing of riparian vegetation and water quality degradation due to overproduction of nutrients to streams and lakes. Sources of nutrients are livestock waste and fertilizers. Ecological conflicts also occur from livestock walking through stream channels, which leads to slope failures and increased turbidity. In addition to conflicts with environmental conservation, agricultural uses have the potential to conflict with residential and commercial uses because of noise, odors and the hour of operations. Because agricultural uses generally do not create impervious areas, agriculture can provide an overall benefit in watershed processes, such as water retention and detention. Agriculture occurs in numerous locations within the county. Greater concentrations around SMA waterbodies are found along the Nisqually River, Skookumchuck River, Chehalis River, Black River, Deschutes River and Beaver Creek.

Forest Practices

Potential shoreline use conflicts may exist in portions of the County where forestry is the principal use because of riparian buffer requirement inconsistencies between the Forest Practices Act and the SMA. Forestry activities in Washington are regulated by the Forest Practices Act (RCW 76.09) and implementing rules (WAC 222.08). The majority of Long Term Forestry in Thurston County is located along the southeast portion of the County and along the western County border, although forest practice activities occur throughout the County. Department of Natural Resources (DNR) Forest Practices Applications (FPAs) are required to be consistent with the SMP. The County requires a Shoreline Permit for any proposed DNR timber harvest within the Shoreline jurisdiction (200' from OHWM). However, under the current SMP, there are minimal harvest guidelines except within shorelines of statewide significance (SSS). Forestry under the DNR Forest Practice Regulations is not subject to the Critical Areas Ordinance (CAO) or other local regulations; nor are they required to meet Best Available Science criteria. Thus, there may be conflicts due to differences in protection of critical areas, standards for stormwater runoff and erosion control, as well as temporary and permanent disturbance of vegetation from road construction and timber harvest activities.

Because forest practice activities must be consistent with SMP criteria, it is important to include regulations for protection of critical areas in the SMP updates, so that logging and conversion activities will have consistent protections of ecological functions within the SMA jurisdiction. By incorporating protection of critical areas into the SMP, more consistent criteria will be used within the SMA jurisdiction. There will still be potential conflicts outside the SMA jurisdiction that will affect the ecological functions of the shoreline. Until DNR FPAs are consistent with local government Critical Areas Ordinances, these conflicts and impacts will continue. Inherently, the Forest Practices Act and SMA could create potential conflicts between the demands of timber harvest and need for protection of all critical area functions including wetlands, marine bluffs, near shore forage fish habitat, as well as freshwater and marine riparian habitat protection.

Mining and Gravel Extraction

Potential conflicts exist between any resource extraction use occurring on or in shoreline areas and shoreline ecological preservation, including mining and gravel extraction. Gravel extraction is commonly associated with the shorelines of rivers, as they provide concentrated sources of gravel for urban and rural development. Mining and gravel operations can have adverse effects on habitat by causing erosion, increasing turbidity, and removing riparian vegetation. Gravel mining operations can also affect the hydrology and morphology of rivers by removing gravel from the floodplain and /or channel migration zone. In Thurston County, gravel mining operations exist along the Deschutes River, and along Skookumchuck Lake. Active mining also occurs in four locations south of the Skookumchuck River, resulting in the creation of shorelines of the state due to the creation of waterbodies greater than 20 acres in size. Mines are required to create a reclamation plan under DNR to restore the site when mining is complete.

Utilities and Transportation Infrastructure

Installation of dam and electricity lines/utilities in riparian buffers may be a potential use conflict in Thurston County. Establishing utility facilities is often in conflict with protecting riparian vegetation.

Transportation facilities (roads and railways) have traditionally been placed within shorelines following topographically rational routes. However, the introduction of these fixed and impervious structures has resulted in greater stormwater runoff, more shoreline armoring and, in many cases, a separation of shorelines from their associated uplands. Placement of transportation structures in shorelines has resulted in adverse effects to shoreline functions such as habitat and channel migration. The continued use of these transportation corridors and placement of new roadways is often in conflict with protecting riparian vegetation and natural shoreline functions.

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. For example, single-family residential use is treated as a priority use under the SMA where appropriate and when developed without significant impact to ecological functions or displacement of water-dependent uses. Most single family homes and bulkheads are exempt from the requirement to obtain a shoreline substantial development permit.

Cumulatively, residential development in shorelines increases impervious surfaces, clearing of riparian vegetation, and sources of pollution, and if unmitigated, contributes to an overall decline in shoreline functions. The cumulative effects of bulkheads are also known to result in major impact to marine nearshore, riverine, and lake habitat (WAC 173-26-231(3)(ii)). Similar issues are related to docks and piers. These activities are not exempt from the requirement to be reviewed for consistency with the SMP as part of other permit processes (e.g., county building permit; Hydraulic Project Approval, etc) and may require a different type of permit under the SMA.

11 DATA GAPS

This section describes specific data gaps or limitations identified during development of the shoreline analysis and characterization that would be useful to support shoreline program development and implementation as required by Ecology's guidelines. This data gap list is not considered exhaustive, rather a list of sources and/or information needed for future updates. Data missing or not available for this report include:

- **Complete stormwater infrastructure maps** - Thurston County's stormwater infrastructure maps are incomplete. This data is needed to fully understand the delivery and routing of water. Thurston County has initiated a program to collect stormwater infrastructure data in order to better analyze the movement of water.
- **Shoreline Modification Data for Lakes** – Bulkheads and shoreline modification data are available for nearshore marine shorelines and some rivers, but are lacking for many freshwater lakes.
- **Studies/data on marine riparian functions**
- **Inventories (types, locations, size) of shoreline vegetation and community types or associations**
- **Protection, enhancement and restoration standards for marine riparian vegetation**
- **Potential effects of climate change and sea level rise on marine riparian systems**
- **Benthic Index of Biotic Integrity (B-IBI) monitoring data for all streams –** Thurston County does measure B-IBI at a number of locations; however, many streams lack data.
- **Water quality monitoring for all streams and lakes -** Thurston County does measure ambient water quality at a number of locations; however, many streams and lakes lack data.
- **Stream flow data for all streams -** Thurston County does measure stream flow data at a number of locations, however, many streams lack data.
- **Floodplain, substrate, and riparian stream monitoring data -** There is good quality habitat monitoring data regarding floodplain connectivity, presence of LWD, presence of pools, bank stability, and off-channel habitat for the mainstem Deschutes River and individual reaches of Percival, Black Lake Ditch, Schneider, McLane and Swift Creeks. Data on presence of pools and LWD are available for lower Green Cove Creek. These data are not generally available for other streams or reaches in WRIA 13. It is recommended that a comprehensive habitat monitoring strategy be developed for WRIA 13, with particular attention to those streams for which information is not currently available. The strategy could be based on representative subsample reaches or comprehensive evaluation of entire drainages (Salmon Habitat Limiting Factors Report, WRIA 13, 1999).
- **Comprehensive assessment of riparian condition -** Including stand age, species composition, and buffer width. This data could then help guide riparian restoration strategies. The assessment should be repeated on a periodic basis to update condition and trends.
- **Data gaps in WRIA 14:** riparian buffers; streambank condition; floodplain connectivity; large woody debris; water quality; water quantity/dewatering; change in flow regime; biological processes (WRIA 14, Salmonid Habitat Limiting Factors Report, 2002).