CHAPTER 10 FINDINGS AND RECOMMENDATIONS

This chapter provides a summary of the analysis at a county-wide scale, highlighting shoreline functions, key impairments, shoreline use conflicts, as well as public access and restoration opportunities. Management recommendations based on the analysis are provided for shorelines in Clark County to assist the update process through its next phases.

10.1 County Overview

10.1.1 Shorelines of the State

Based upon the inventory and GIS analysis, there are a total of 370 miles of shoreline within Clark County, Washington (Table 10-1). These shoreline miles include 274 stream miles and 96 miles of lakeshore. Shorelines of statewide significance include the Columbia River, Vancouver Lake, portions of the Washougal River, portions of the East Fork Lewis River, Lewis River, Lake Merwin and Yale Lake. Shorelines of statewide significance total 158 miles of county shorelines.

<table>
<thead>
<tr>
<th>Waterbody Type</th>
<th>Number of Waterbodies</th>
<th>Number of Reaches</th>
<th>Shorelines of Statewide Significance (in miles)</th>
<th>Total Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers and Streams</td>
<td>42</td>
<td>77</td>
<td>97</td>
<td>274</td>
</tr>
<tr>
<td>Lakes</td>
<td>18</td>
<td>19</td>
<td>61</td>
<td>96</td>
</tr>
<tr>
<td>TOTAL</td>
<td>60</td>
<td>96</td>
<td>158</td>
<td>370</td>
</tr>
</tbody>
</table>

The shorelines of Clark County span the foothills and mountainous regions, through the broad terraces, and down into the floodplain of the lower Columbia River. Land uses vary through these regions, with the high elevations dominated by managed forest land. Agricultural and urban land uses dominate the lower lying areas.

10.1.2 Existing Land Uses

Land uses within shoreline planning areas in Water Resource Inventory Area (WRIA) 27 are mainly vacant lands (30 percent), managed forest resource lands (28 percent), and single-family residential (27 percent). Land uses within shoreline planning areas in WRIA 28 are mainly vacant lands (35 percent) and single-family residential (30 percent), along with mobile homes (11 percent). Commercial/industrial uses are concentrated in the port areas and represent two percent of land use in shoreline planning areas of WRIA 27 and six percent in WRIA 28.

Parcels identified as vacant generally indicate that no structural improvements have been made or assessed for taxes on the property. “Vacant” parcels may not always accurately reflect current conditions (such as properties developed for vehicle parking or material storage, or properties that are protected open space). Because nearly one third of the land uses were classified as
vacant, an analysis was conducted to understand the potential future uses that measurement. In WRIA 27, most vacant lands are zoned for agriculture (39 percent), forest (25 percent), and single-family residential (29 percent). In WRIA 28, vacant lands are mostly zoned for agriculture (42 percent) and parks/open space (29 percent) with some industrial (13 percent) and single-family residential (13 percent) designations. Generally, vacant lands would remain in low intensity uses.

The majority of impervious area in the county occurs in the Camas, Vancouver and Washougal areas. Other urban areas are also characterized by impervious surfaces, including Battle Ground, Ridgefield, La Center and Yacolt. Vacant, undeveloped lands that are in a natural or naturalized state (i.e., unpaved) can serve to prevent flooding, reduce stormwater runoff through infiltration, allow for groundwater and surface water interaction to remove pollutants from runoff and provide habitat. Open space and undeveloped lands are an important part of watershed health to protect streams and shorelines.

Agriculture occurs throughout the central and western portions of the county. Agricultural uses are concentrated in the floodplain areas surrounding Vancouver Lake, in the Lacamas Creek and Fifth Plain Creek area and along the East Fork Lewis River, Salmon Creek and their tributaries. With good management practices, these land uses will be helpful in maintaining floodplain functions.

10.1.3 Existing Shoreline Environment Designations

The County and cities currently regulate their respective shorelines of the state through the adopted Shoreline Master Programs (SMPs) in each jurisdiction. Shorelines under regulation have been assigned Shoreline Environment Designations (SED). Existing SEDs for Clark County, including all incorporated within, are summarized as shown in Table 10-2 below:

<table>
<thead>
<tr>
<th>Existing SED</th>
<th>Percent (%) of County Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservancy</td>
<td>39.7</td>
</tr>
<tr>
<td>Rural</td>
<td>38.8</td>
</tr>
<tr>
<td>Urban Conservancy</td>
<td>9.9</td>
</tr>
<tr>
<td>Urban (including Urban High, Medium and Low Intensity)</td>
<td>10.7</td>
</tr>
<tr>
<td>Urban Natural</td>
<td>0.5</td>
</tr>
<tr>
<td>Natural</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Currently, the majority of the shorelines (80 percent) of Clark County are designated as Conservancy or Rural Environments. Less than one percent of the shorelines are designated as Natural. The existing shoreline environment designations are illustrated on Map 29 (Appendix
A). These results will be helpful as the update moves into the next phases of determining new SEDs for the shoreline planning areas.

### 10.1.4 Projected Population Growth

The Clark County *20-Year Comprehensive Growth Management Plan 2004-2024* (Clark County, 2007d) provides population projections for 2024 based on a 2 percent growth rate or a projected population of 584,310 (90 percent to the urban area and 10 percent to the rural area) for the entire county. Table 10-3 outlines the projected growth by city with the assumption that city limits will grow through annexation to fill the adopted urban growth areas (UGAs). Although these population estimates are not specific to shoreline planning areas, they indicate general growth trends that are expected to occur by 2024 and influence demands and impacts to the shorelines.

**Table 10-3. 2024 Population Estimates by Jurisdiction**

<table>
<thead>
<tr>
<th>UGA</th>
<th>2004 Population</th>
<th>2004-2024 % Change</th>
<th>2024 Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clark County</td>
<td>391,674</td>
<td>49%</td>
<td>584,310</td>
</tr>
<tr>
<td>Battle Ground</td>
<td>15,152</td>
<td>250%</td>
<td>52,974</td>
</tr>
<tr>
<td>Camas UGA</td>
<td>18,205</td>
<td>91%</td>
<td>34,809</td>
</tr>
<tr>
<td>La Center UGA</td>
<td>2,363</td>
<td>239%</td>
<td>8,008</td>
</tr>
<tr>
<td>Ridgefield UGA</td>
<td>2,651</td>
<td>882%</td>
<td>26,032</td>
</tr>
<tr>
<td>Vancouver UGA</td>
<td>213,452</td>
<td>26%</td>
<td>267,928</td>
</tr>
<tr>
<td>Washougal UGA</td>
<td>11,248</td>
<td>106%</td>
<td>23,148</td>
</tr>
<tr>
<td>Yacolt UGA</td>
<td>1,262</td>
<td>43%</td>
<td>1,806</td>
</tr>
<tr>
<td>Total</td>
<td>656,007</td>
<td>52%</td>
<td>999,015</td>
</tr>
</tbody>
</table>

Source: Table 1.2 in *20-Year Comprehensive Growth Management Plan 2004-2024*

### 10.2 Shoreline Analysis

An analysis of shoreline ecological functions is a required part of the shoreline inventory and characterization (WAC 173-26-201). Nearly all shoreline areas, even substantially developed or degraded areas, retain important ecological functions. For example, an intensely developed harbor may also serve as a fish migration corridor and refuge area critical to species survival. Ecosystems are also interconnected. For example, the life cycle of anadromous fish depends upon the viability of freshwater, marine, and terrestrial shoreline ecosystems. Many fish and wildlife species associated with the shoreline depend on the health of both aquatic and nearby terrestrial environments. Shoreline functions as defined in the Washington Administrative Code are shown in Table 10-4.

This analysis focuses on shoreline ecological functions for Clark County and ties the watershed characterization to the reach-scale characterization. Watershed or ecosystem-wide processes described by waterbody in Chapter 3 include the flow and movement of water, sediment
Shoreline Inventory and Characterization

transport, water quality, and delivery of large woody debris. These processes affect the formation and quality of shorelines, especially streams and rivers. Reach-scale characteristics described in Chapters 5 through 9 are the localized characteristics such as the nature of shoreline vegetation, soils, and configuration of lake and stream beds and banks of waterbodies, including associated wetlands. Overall shoreline functions in Clark County are described by major sub-basin in Sections 10.2.1-10.2.6.

### Table 10-4. Shoreline Ecological Functions (WAC 173-26-201(d))

<table>
<thead>
<tr>
<th>Process or Characteristic</th>
<th>Ecological Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrologic</strong></td>
<td>Functions related to surface water flow and as part of the watershed within which a water resides: Transport of water and sediment; attenuating flow, wave and/or tidal energy; developing in-stream habitat such as riffles, pools, etc. or side channel habitat; and recruitment and transport of large woody debris.</td>
</tr>
<tr>
<td><strong>Shoreline Vegetation (Riparian)</strong></td>
<td>Functions provided by the presence of riparian vegetation, especially forested cover: Maintaining temperature; removing excessive nutrients and toxics through filtration; stabilization; attenuation of flow or wave energy; and provision of large woody debris and other organic matter.</td>
</tr>
<tr>
<td><strong>Hyporheic</strong></td>
<td>Functions provided in the “hyporheic zone” of a river or stream (i.e., area of groundwater and surface water exchange within the beds of streams and rivers): Removing excessive nutrients and toxic compounds; water storage; support of riparian vegetation; sediment storage; and maintenance of stream base flow.</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>Functions provided in shoreline areas that support the life cycles of plants and animals and support fish and wildlife populations: Habitat for aquatic and shoreline-dependent birds, invertebrates, mammals; amphibians; and anadromous and resident native fish. Habitat functions may include but are not limited to: space or conditions for reproduction, resting, hiding and migration; and food production and delivery.</td>
</tr>
</tbody>
</table>

A series of tables in Appendix E summarize the analysis of shoreline ecological functions for Clark County by sub-basin and reach. The four processes or characteristics required by the WAC (i.e., hydrologic, shoreline vegetation, hyporheic, and habitat) were evaluated for each shoreline waterbody and reach. The descriptive criteria in Table 10-5 were used as guidance in determining high value ecological functions.
Table 10-5. Criteria Used for Determining High Value Ecological Function

<table>
<thead>
<tr>
<th>Process</th>
<th>Criteria Used to Determine High Value Ecological Function</th>
</tr>
</thead>
</table>
| Hydrologic                     | • Watershed assessment score for hydrology = Functional (or not impaired)  
                                  • Important areas for hydrologic processes based on Clark County Watershed Characterization (Ecology, 2009)  
                                  • Tidal influence  
                                  • Lacks levees, modifications or confinement  
                                  • Channel migration zone = high  
                                  • Stream health report or Stormwater Needs Assessment (SNAP) report indicates stream is healthy |
| Shoreline Vegetation (Riparian)| • Watershed Assessment score for riparian = Functional or Moderate (not impaired)  
                                  • Aerial photographs show forested cover  
                                  • Forest cover in the reach is greater than 50%  
                                  • Developed areas in the reach as observed in land cover data is less than 5% |
| Hyporheic                      | • Watershed assessment score for sediment = high  
                                  • Watershed characterization shows high removal of nitrogen  
                                  • Water quality not included on Ecology 303(d) list of impaired waterbodies  
                                  • Large floodplain and/or wetland areas  
                                  • Critical aquifer recharge areas (CARA) |
| Habitat                        | • Salmon Recovery Priority = Tiers 1 or 2  
                                  • Presence of multiple Priority Habitats and Species present (PHS data)  
                                  • Rare plants documented  
                                  • High quality associated wetlands  
                                  • Healthy fish populations |

The presence of a majority of the descriptors outlined in Table 10-5 was used to determine whether a shoreline is providing high function for the specific process. For example, if the Washougal River meets four out of the five criteria outlined above for habitat processes, then it ranked “high” for hydrologic processes. Criteria tables for “moderate” and “low” functions are provided in Appendix E.

The results for the analysis of ecological functions are illustrated on four maps provided at the end of this chapter (Maps 10-1 through 10-4). Broad summaries of shoreline condition by sub-basin are described the following sections. In general, the analysis results indicate similar priorities as identified in other watershed planning documents (LCFRB, 2006; LCFRB, 2010). As anticipated, the lower Columbia River is of paramount importance, as are the floodplains associated with it, particularly lands held in public trust as National Wildlife Refuges. The next highest priority shorelines are:
• **East Fork Lewis River**: valued for fish habitat, salmon recovery, and natural hydrologic processes;
• **Washougal River**: valued for fish habitat, upper basin in protected forest lands, clean water and natural hydrologic processes;
• **Lewis River (North Fork)**, with a focus on Cedar Creek: valued for fish habitat and natural hydrologic processes;
• **Lacamas Creek/Lacamas Lake**: valued for fish habitat at the mouth, stream base flow support and high value wetlands in the upper watershed, and wildlife value; and
• **Fifth Plain Creek**: valued for stream baseflow support and high value associated wetlands.

### 10.2.1 Lower Columbia River

The lower Columbia River mainstem and estuary represent two of the major sub-basins in the Washington portion of the lower Columbia River basin. These sub-basins historically supported thousands of adult chum and fall Chinook salmon, as well as millions of juvenile salmon and steelhead. The lower Columbia River mainstem and estuary are unique in that all Columbia River salmon and steelhead must pass through a portion of these sub-basins during their life cycle. The Clark County section of the lower Columbia River is located on the mainstem upstream of the estuary in an area considered to be tidally influenced or designated “tidal freshwater” (LCFRB, 2010).

Thirteen salmon and steelhead populations (Evolutionarily Significant Units or ESUs and Distinct Population Segments or DPSs) in the Columbia River, as well as bull trout, Pacific eulachon and five other fish species, have been listed as threatened or endangered under the Endangered Species Act (ESA) and others are proposed for listing. The decline in fish populations has occurred over decades. Construction and operation of hydroelectric dams has altered river flows, habitat, and migration conditions. Freshwater and estuary habitat quality has been reduced by agricultural and forestry practices. Significant habitats have been isolated or eliminated by dredging, channel modifications and diking, as well as filling or draining floodplains and associated wetlands. Altered habitat conditions have increased predation and reduced habitat areas. Large woody debris recruitment is low due to the lack of forested riparian zones upstream.

Numerous areas of biological significance and ecological importance for wildlife habitat occur along the lower Columbia River. Within Clark County, these areas include:

• Steigerwald Lake National Wildlife Refuge;
• Vancouver Lake lowlands and Shillapoo Wildlife Recreation Area; and
• Ridgefield National Wildlife Refuge.

Despite habitat alterations, numerous federally listed species of salmonids and other fish use the lower Columbia River for passage and rearing. These include fall Chinook, chum, spring Chinook, winter steelhead, summer steelhead, coho salmon, Pacific lamprey, Pacific eulachon, and green and white sturgeon. In addition, numerous priority wildlife species are found along the Columbia River and within its floodplain including: Steller sea lion, California sea lion, bald eagle, Columbia white-tailed deer, purple martin, cavity-nesting ducks, Caspian tern, osprey, numerous waterfowl concentrations, great blue heron, and sandhill crane.
Shoreline areas rated as highly functioning within the lower Columbia River sub-basin include the floodplain areas surrounding the national wildlife refuges and Vancouver Lake and Ridgefield lowlands. These areas provide high quality habitats for multiple priority species, especially waterfowl and other birds, experience tidal influence, provide water storage and flood storage, and are in public ownership. Columbia River shorelines within Vancouver are developed with industrial and other uses and are currently not considered highly functioning. While systematic changes have occurred in this area, certain sections of the Columbia in Vancouver do contain high value habitats and important wetlands such as the Marine Park Wetland area.

10.2.2 Washougal River Sub-basin

The Washougal River drains from the southwest slopes of Mt. Adams and enters the Columbia River at river mile (RM) 121. Major tributaries include the Little Washougal, West Fork Washougal and Lacamas Creek. The upper section of the Washougal River flows through a deep canyon until reaching Sunset Falls at RM 14.5. Downstream of the falls, the river valley widens as it enters into the Columbia River floodplain. The watershed is largely managed in timber production both in the Gifford Pinchot National Forest and in private timber lands.

In the upper watershed, timber harvest and high road densities have affected watershed processes. Effects on the upper sub-basin include increased temperature and sediment loading from roadway runoff. Urbanization around the cities of Washougal and Camas and development within the city of Vancouver’s UGA affect the lower reaches. Land ownership is mostly private (61 percent) with significant state land (30 percent) and federal lands (8 percent) also present in the basin (LCFRB, 2010). Land cover analysis for the Washougal River basin (based on Landsat data obtained from the U.S. Geological Survey [USGS] National Land Cover Dataset) indicate that 74 percent of the basin is forested. Only 26 percent of the basin is non-forest or developed (LCFRB, 2010).

Salmon and steelhead numbers have declined in the Washougal River sub-basin to only a fraction of their historical levels. Chum salmon were historically abundant in the Washougal River sub-basin. ESA-listed anadromous fish in the Washougal River include fall Chinook, coho salmon, summer and winter steelhead and chum salmon. Degradation of in-stream and riparian habitat quality and quantity are the largest factors threatening salmonid populations in the Washougal River sub-basin for all species except fall Chinook. Fall Chinook and coho salmon are heavily impacted by harvest and fishing pressure. According to the Ecosystem Diagnosis and Treatment (EDT) Model (LCFRB, 2010), multiple segments of the Washougal River within Clark County are rated as Tier 1 or rated as high priority for the recovery of salmonids. See Map 28 in Appendix A. The remainder of the Washougal mainstem is rated as Tier 2.

Habitats within the Washougal River sub-basin are important for fish and wildlife. Impacts include loss of habitat diversity, impacts to streamflow, increased sediment, high summer temperatures, lack of food, and channel instability. Underlying watershed issues include impaired hydraulic conditions, increased sediment supply, and degraded riparian and floodplain conditions due to timber management in the upper basin and urban development in the lower basin.
The Lower Columbia Fish Recovery Board (LCFRB) (2010) identifies the following key recovery priorities for the Washougal River sub-basin:

- Protect intact forests in headwater basins;
- Manage forest lands to protect and restore watershed processes;
- Manage growth and development to protect watershed processes and habitat conditions;
- Restore passage at culverts and remove barriers;
- Restore lowland floodplain function, riparian function and stream habitat diversity; and
- Address immediate risks with short-term habitat improvements.

Despite alterations and development impacts, the Washougal River and the Little Washougal River are shorelines in Clark County that maintain a high level of ecological function. The lower sections of the Washougal River exceed 1,000 cubic feet per second mean annual flow and are designated as shorelines of statewide significance. These two rivers have overall water quality that is not impaired, and the upstream watersheds are forested and undeveloped, thereby maintaining water quality. No dams or impoundments occur on either the Washougal or Little Washougal Rivers, although dams exist on certain tributaries. The Washougal River supports many species of priority salmonids and other habitats and species. Lacamas Lake and Lacamas Creek and their tributaries are not accessible to anadromous fish due to a dam, but they contain large areas of associated wetlands, and are therefore important in supporting stream baseflow and downstream habitat through maintenance of water quality and habitat-forming processes.

10.2.3 Lower Columbia River Tributaries

Other smaller tributaries to the lower Columbia River not included in the Washougal River sub-basin in Clark County are Gibbons and Lawton Creeks. These streams are located near the Columbia River Gorge and flow down steep valley walls and into the Columbia River floodplain. These streams are relatively high gradient with the upper reaches in forest resource lands. Development is expanding in various areas, especially around the city of Washougal where transportation corridors parallel the Columbia River. Both streams lie within the Columbia River Gorge National Scenic Area. Neither Gibbons nor Lawton Creeks were rated using the EDT model.

Key recovery priorities for the lower Columbia River Gorge tributaries including Gibbons and Lawton Creeks are to:

- Address immediate risks with short-term habitat fixes;
- Manage forest lands to protect and restore watershed processes;
- Restore riparian function and stream habitat diversity; and
- Manage growth and development to protect watershed processes and habitat conditions.

10.2.4 Salmon Creek Sub-basin

Salmon Creek flows into Lake River on its way to the Columbia River. The Lake River/Salmon Creek sub-basin includes major tributaries like Whipple Creek. Burnt Bridge Creek, which flows directly into Vancouver Lake, is also included in this sub-basin. The basin is a rain-dominated system with a peak elevation of approximately 2,000 feet. The dominant uses in this sub-basin are urban and rural residential development. Much of the historic floodplain habitat
Shoreline Inventory and Characterization

and associated wetlands have been converted to urban uses or agriculture. There is significant development pressure due to the location within the UGAs of Vancouver and Battle Ground. Land ownership within the Lake River/Salmon Creek basin is mostly private (89 percent). Land cover analysis for the basin (based on Landsat data obtained from the USGS National Land Cover Dataset) indicates that 71 percent of the basin is non-forest, developed as either urban or agricultural uses (LCFRB, 2010).

Salmon species that use Salmon Creek are chum, coho salmon, winter steelhead and fall Chinook. Impairments to this stream and sub-basin include loss of in-stream and riparian habitat. Loss of estuary habitat is also important. Watershed issues include impaired hydraulic conditions, increased sediment loading and degraded riparian and floodplain conditions. Rivers and streams in this sub-basin generally have degraded water quality. These impacts are related to urban and rural development. There are no Tier 1 or 2 stream reaches in the Salmon Creek sub-basin according to the EDT data (LCRFB, 2010).

Key recovery priorities identified by the LCFRB (2010) for the shorelines in the Salmon Creek sub-basin are to:

- Manage growth and development to protect watershed processes and habitat conditions;
- Restore floodplain function, riparian function and stream habitat diversity;
- Manage forest lands to protect and restore watershed processes; and
- Address immediate risks with short-term habitat enhancements.

 Overall, Salmon Creek and its tributaries do not maintain a high level of ecological function relative to other shorelines in Clark County. This stream system has impaired hydrology and water quality; increasing amounts of impervious surfaces and stormwater runoff; supports few priority habitats; and is generally degraded due to urban development and activities. On the other hand, lower sections of the stream provide higher habitat functions within the Salmon Creek Greenway Park, supporting waterfowl concentrations, bald eagle, and wood duck. In addition, certain tributaries to Salmon Creek, such as Curtin Creek and Mill Creek, provide some of the coolest summer water in the sub-basin to maintain stream temperatures. A TMDL Study is currently in place to address water quality issues in Salmon Creek.

Lake River is highly impaired for water quality, especially temperature due to stormwater runoff and degraded riparian areas that do not provide adequate shade. Although this shoreline is impaired, yet it maintains high function for hydrologic processes, due to its tidal influence and location within the Columbia River floodplain.

10.2.5 East Fork Lewis River

The East Fork Lewis River originates in the Gifford Pinchot National Forest in Skamania County. Elevations in the sub-basin range from about 4,400 feet down to sea level. The East Fork Lewis River flows into the North Fork 3.5 miles upstream from its confluence with the Columbia River. Tidal influence from the Columbia River extends up the East Fork to RM 6. The sub-basin is a rainfall-dominated system, although a significant portion of the upper watershed lies within the rain-on-snow zone. The major tributaries (also shorelines of the state) are Yacolt Creek, Rock Creek, Copper Creek, Mason Creek and Lockwood Creek. The basin has developed through volcanic, glacial and erosion processes. Due to the steep slopes in the
upper watershed, and the weathered soils of volcanic origin, the basin has a relatively high potential for surface erosion.

Land ownership within the East Fork Lewis River basin is predominately private (63 percent) with 20 percent held in federal ownership and 16 percent in state ownership as forest resources (LCFRB, 2010). The basin is primarily forested with only 25 percent in non-forest cover.

The East Fork Lewis River basin has been identified by the LCFRB and Clark County as critical to salmon recovery. The LCFRB convened private landowners and Clark County, forming the Lower East Fork Lewis River Work Group. Together they have agreed to develop a community-based habitat restoration strategy for future project implementation, and authored the *Lower East Fork Lewis River Community-Based Habitat Restoration Plan* (April 2009) which identifies habitat restoration needs for the East Fork Lewis River watershed. All salmonid populations in this basin have drastically declined and are at a high risk of becoming endangered. At RM 12.3, Lucia Falls is a natural barrier to anadromous fish except steelhead. The East Fork Lewis River runs through canyons and narrow steep valleys below Lucia Falls until approximately RM 14, where the valley broadens and sediment is deposited. Channel migration is high in the lower river within this broad valley.

The upper half of the watershed is forested and managed as commercial timber lands. Much of the upper watershed lies within U.S. Forest Service lands within Skamania County. The lower basin is in rural residential development and agriculture. Gravel mining occurs within the floodplain of the river in the lower basin. The largest city is La Center along with its UGA. Population in this basin is expected to double by 2020.

Key recovery priorities according to the LCFRB (2010) for the East Fork Lewis River basin are to:

- Protect intact forest in headwater basins;
- Restore lowland floodplain function, riparian function and stream habitat diversity;
- Manage growth and development to protect watershed processes and habitat conditions;
- Manage forest lands to protect and restore watershed processes;
- Restore fish passage at culverts and other barriers; and
- Address immediate risks with short-term habitat fixes.

Based upon the EDT model data (LCRFB, 2010), high priority reaches identified for habitat protection and restoration actions in the East Fork Lewis River basin are classified as Tiers 1 and 2. Tier 1 and 2 reaches include shoreline tributaries such as Big Tree Creek, Cedar Creek, Copper Creek, Lockwood Creek, Mason Creek, and Rock Creek, as well as many reaches along the East Fork Lewis River itself.

The East Fork Lewis River is impaired for water quality, specifically for high temperatures and fecal coliform bacteria. Water quality impairments are especially apparent in lower tributaries such as Jenny, McCormick and Lockwood Creeks. Despite impairments to water quality, the river and its upper watershed tributaries maintain a high level of shoreline function. The East Fork supports priority fish and wildlife species and habitats, and contains no dams or artificial barriers (in fact, natural falls and barriers have been modified to improve fish passage).
Infrastructure in the shoreline area is minimal and development overall in the basin is low. East Fork Lewis River supports large expanses of associated wetland within its floodplain and has a wide channel migration zone. The lowest sections of the East Fork Lewis River are considered shorelines of statewide significance.

10.2.6 Lewis River

The Lewis River (also known as the North Fork) has its headwaters in the Cascades from the slopes of Mt. Adams and Mount St. Helens. The North Fork Lewis River enters the Columbia River at RM 87 in Clark County. The North Fork is a snow-dominated river system, with snow and glacier meltwaters contributing to streamflow in the summer. The upper and lower sections of the North Fork are very different. The upper section of the river system contains three reservoirs and three hydroelectric dams. Two of these reservoirs (Lake Merwin and Yale Lake) lie within Clark County. The third, Swift Reservoir, is located entirely in Skamania County. Merwin Dam is a complete barrier to anadromous fish, blocking 80 percent of the historical habitat. Reintroduction of anadromous fish is planned for the upper watershed as part of a settlement agreement through the Federal Energy Regulatory Commission (FERC) relicensing process with PacifiCorp, the owner and operator of the hydropower system. Most of the upper basin lies within the Gifford Pinchot National Forest or Mount St. Helens National Monument, but no Clark County shorelines lie within federal forest lands. Below Merwin Dam, the river enters a broad alluvial plain at about RM 12. Tidal influence on the Lewis River extends upstream to approximately RM 11.

Predominant land uses in this sub-basin include forestry and timber harvest in the upper watershed, and rural residential and agricultural uses in the lower sub-basin (below the dams). Large portions of the sub-basin burned in fires between 1902 and 1952, resulting in impacts to riparian zones, sediment transport and basin hydrology.

The upper watershed in Clark County includes major tributaries such as Canyon Creek and Siouxon Creek. The upper watershed is largely owned by commercial timber companies and PacifiCorp, a private utility company that owns and operates the dams. The lower watershed includes Cedar Creek and its tributaries and the section of the Lewis River mainstem below Merwin Dam. The lower Lewis River watershed is 84 percent privately owned with 16 percent as state lands. Approximately 80 percent of the land in the lower watershed is forest lands.

The human population within this sub-basin is small. The sub-basin includes the small rural communities of Chelatchie and Amboy. The largest city is Woodland, which is expected to grow in population at an annual rate of 3.5 percent (City of Woodland, 2002). Continued population growth is anticipated in the lower elevations along with increased pressure for conversion of forest and agricultural uses to residential development.

The reservoirs and upper basin are important for resident trout and bull trout. The lower section below Merwin Dam is important for fall and spring Chinook, chum and other anadromous fish. The EDT Model tiering suggests that Siouxon Creek is a Tier 2 level stream for fish recovery in Clark County in the upper North Fork Lewis River sub-basin (LCRFB, 2010). Other Tier 1 and 2 stream reaches above Merwin Dam that are designated by the LCFRB lie within Cowlitz or Skamania Counties.
In the lower Lewis River sub-basin, the mainstem river has a Tier 1 rating from just upstream of tidal influence to just upstream from its confluence with Cedar Creek. Cedar Creek itself is Tier 2 in some sections and Tier 3 in others (LCFRB, 2010). Cedar Creek is considered important primarily for winter steelhead. Agricultural and rural residential uses have impacted the riparian habitat and floodplains along Cedar Creek.

Key recovery priorities (LCFRB, 2010) for the Lewis River sub-basin are to:
- Manage regulated streamflows through the hydropower system;
- Provide upstream and downstream fish passage through the hydropower system;
- Protect intact forests in headwater basins;
- Manage forest lands to protect and restore watershed processes;
- Restore floodplain function, riparian function and stream habitat diversity;
- Restore passage at culverts and other artificial barriers;
- Address immediate risks with short-term habitat fixes; and
- Manage growth and development to protect watershed processes and habitat conditions.

The Lewis River is considered highly functioning in its lower river sections below Merwin Dam. This section of river is free-flowing and supports anadromous fish. Cedar Creek is also considered highly functioning for hydrology and habitat. However, the reservoirs are considered highly functioning for water storage, upland habitat and recreation. Streams above the dams do not currently support anadromous fisheries, but do support bull trout.

As mentioned above, plans are underway for reintroduction of anadromous fisheries as part of the mitigation requirement associated with FERC relicensing of PacifiCorp’s hydrosystem. The reintroduction program will allow salmon to access their historical range upstream of Merwin Dam (PacifiCorp and Cowlitz PUD, 2004a). Fish will be trapped at Merwin Dam and transported upstream by truck to above Swift Reservoir. Eventually, unless otherwise directed by National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service, the species will be reintroduced to Lake Merwin and Yale Lake via constructed upstream and downstream fish passage facilities at Yale Lake, Swift Reservoir, and Lake Merwin.

### 10.3 Key Impairments

Based upon the inventory and characterization, several key impairments to shorelines of the state in Clark County have been identified. The impairments include flow alterations, water quality degradation, water quantity and withdrawals, alteration and loss of associated wetlands, loss of riparian functions, alteration and loss of floodplain, modification and bank armoring, and hydropower/dams.

#### 10.3.1 Flow Alterations

Increased surface water runoff from forest practices in the upper watersheds and urban land uses in the lower basin affect county rivers and streams. Land use, development practices, forest practices, and modification of floodplains and wetlands all affect how much and how fast precipitation distributes through the watershed. When precipitation or floodwater runs off more quickly, it concentrates peak flows and can cause erosion and flood damage in streams. In
addition, some of these activities reduce natural storage in groundwater, floodplains and riparian wetlands. Reductions in natural storage result in less surface and groundwater entering streams during the dry summer season, negatively affecting stream baseflow.

The upper watersheds in Clark County lie within forest resource lands and are subject to timber harvest. The Forests and Fish Law, the Washington Department of Natural Resources Habitat Conservation Plan, and the Northwest Forest Plan provide a regulatory framework for forest practices. These programs are intended to improve water quality and support natural flow regimes in streams and rivers over time. Forest cover is anticipated to increase in the upper watershed over time and runoff rates are anticipated to drop.

The watershed planning documents for WRIAs 27 and 28 identify the need for additional policies in the area of stormwater management, floodplain protection and wetlands management (LCFRB, 2006). Stormwater runoff from urban areas and impervious surfaces continues to degrade steam flows in developed areas. Shoreline streams that are at the greatest risk for flow alterations due to impending development and considered highest priority are:

- East Fork Lewis River;
- Washougal River;
- Lacamas Creek;
- Fifth Plain Creek;
- Lewis River (North Fork);
- Salmon Creek; and
- Gee Creek.

10.3.2 Water Quality Degradation

Many of the SMA-designated rivers and lakes in Clark County are polluted due to stormwater runoff, industrial contamination, and/or agricultural land uses. Pollutants from non-point sources are most commonly documented. The quality of water within many streams and rivers is poor, particularly within Lacamas Creek, Lacamas Lake, Burnt Bridge Creek, Lake River, Whipple Creek, Salmon Creek and East Fork Lewis River. The lower Columbia River and Vancouver Lake also have significant water quality issues, including chemical contamination in sediments. Table 10-6 shows the parameters that have exceeded acceptable levels according to the Washington State Department of Ecology 303(d) list of impaired state waterbodies (Ecology, 2008).
Table 10-6. Ecology Listed Impaired Waters

<table>
<thead>
<tr>
<th>Shoreline Waterbody</th>
<th>Pollutant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Columbia River</td>
<td>Fecal coliform, dissolved oxygen, and temperature. There are also listings for impaired sediment including PCBs and sediment analysis.</td>
</tr>
<tr>
<td>Vancouver Lake</td>
<td>Total phosphorous, fecal coliform bacteria, 4,4-DDE (in tissue), toxaphene (in tissue), 2, 3, 7, 8-TCDD (in tissue), PCBs (in tissue), and dieldrin.</td>
</tr>
<tr>
<td>Lacamas Creek</td>
<td>Exceedance of dissolved oxygen, fecal coliform, pH, and temperature limits.</td>
</tr>
<tr>
<td>Lacamas Lake</td>
<td>Total phosphorous, PCB, dissolved oxygen, fecal coliform, pH, and temperature.</td>
</tr>
<tr>
<td>Burnt Bridge Creek</td>
<td>Fecal coliform, pH, dissolved oxygen, and temperature.</td>
</tr>
<tr>
<td>Lake River</td>
<td>Fecal coliform and temperature, as well as impaired sediment including dieldrin, 4-4’ DDE and 2,3,7,8, - TCDD.</td>
</tr>
<tr>
<td>Whipple Creek</td>
<td>Temperature and fecal coliform.</td>
</tr>
<tr>
<td>Salmon Creek</td>
<td>pH, dissolved oxygen, and temperature.</td>
</tr>
<tr>
<td>East Fork Lewis River</td>
<td>Fecal coliform and temperature.</td>
</tr>
</tbody>
</table>

The most common parameters that exceed acceptable levels for the waterbodies listed above are fecal coliform bacteria and stream temperature. Protection and restoration of riparian zones is important for improvement of water quality in these shorelines and in downstream waters. In particular, control of agricultural runoff and septic system leaching are important to reduce fecal coliform bacteria in rural areas. Restoration of riparian zones is an important action to improve stream temperature, protect streams from pollution, and improve overall water quality (NRC, 2002). Management measures to control and reduce non-point source pollution, especially from urban and urbanizing areas, are needed to protect water quality while accommodating development and population growth (EPA, 2005).

10.3.3 Water Quantity and Withdrawals

Critical aquifer recharge areas are located throughout both WRIAs 27 and 28. Water withdrawals in many areas contribute to low instream flow conditions and impaired water quality. Consumptive use of groundwater through municipal wells has lowered groundwater levels. Groundwater levels declined five feet or more throughout the western portion of WRIA 28, and larger declines have occurred in the unconfined and upper Troutdale gravel aquifers within the Burnt Bridge and Salmon Creek drainages. These reductions in groundwater levels signal that consumptive use of groundwater has exceeded the natural recharge of groundwater in these areas (Wildrick et al., 2002). Watershed plans for WRIA 27/28 and Water Management Rules have closed basins to withdrawals and established in-stream flow standards for basins like Salmon Creek.
10.3.4 Alteration and Loss of Associated Wetlands

Historically, wetlands were a dominant feature in Clark County. The alteration and loss of wetland areas has been significant. Floodplain wetlands along the lower Columbia River have been diked, altered, drained and modified. Wetlands associated with wet prairies at the headwaters of Fifth Plain Creek and Lacamas Creek have been ditched, dredged and filled. Urban development results in alteration to wetlands across the landscape. The loss of wetland function associated with shorelines of the state is a key impairment in Clark County.

10.3.5 Loss of Riparian Function

Riparian areas are transitional zones between terrestrial and aquatic ecosystems that provide important and unique functions. Riparian areas are distinguished by gradients in physical conditions, ecological processes, and habitats (NRC, 2002). They are areas through which surface and subsurface hydrology connect water bodies with their adjacent uplands. Riparian areas are those lands adjacent to stream, rivers, lakes and estuarine shores that influence exchanges of energy and matter with aquatic ecosystems, and provide benefits to aquatic habitats. Riparian areas play a central role in maintaining the health and integrity of aquatic and terrestrial ecosystems (Desbonnet et al 1994; NRC 2002). Many of the functions of freshwater riparian areas are similar to marine or estuarine riparian areas, although marine riparian areas also provide functions that are unique to nearshore ecosystems due to differences in chemical processes, ocean influences and differences in the biota between freshwater and coastal environments.

Riparian areas provide a broad suite of ecological function. These include water quality improvement (filtration and processing of contaminants); fine sediment control; inputs of large woody debris (LWD); shade and microclimate; litter fall/organic matter input; hydrology and slope stability; and fish and wildlife habitat. Other functions provided by riparian areas include recreation, cultural and aesthetic resources, and providing protection from threats of coastal hazards.

Land use and development including diking, draining, introduction of contaminants and non-native invasive species, loss of woody vegetation, and the isolation of side-channel habitats have impaired the ability of riparian areas to provide the full range of functions originally available. The loss of riparian function associated with shorelines of the state is a key impairment in Clark County.

10.3.6 Alteration and Loss of Floodplain

Loss of floodplain area and connectivity is a significant impairment in Clark County. Levees and dikes have disconnected historical floodplain areas associated with the lower Columbia River. Floodplain has been filled to accommodate development, urban uses and industrial facilities. Other floodplain areas at risk in Clark County include channel migration zones on the East Fork Lewis River as well as floodplains on Salmon, Morgan, Lacamas and Fifth Plain Creeks in the UGAs of Battle Ground and Vancouver.
10.3.7 Modifications and Armoring

Riverbanks along the lower Columbia River and other shoreline rivers are modified, armored or protected with riprap. This is especially true at bridge abutments, in marinas, within Port properties, at docks, or surrounding other in-water structures. There are a total of 155 mapped docks/piers and 30 bridges crossing shorelines in Clark County. Roads and other infrastructure are located close to the riverbanks along the Columbia River on the Washington side and very little natural beach remains. Modifications include dikes and levees. Beach and unmodified shores are found at Frenchman’s Bar and in many areas north of the Flushing Channel.

10.3.8 Hydropower and Dams

Dams block passage of anadromous fish and disrupt the natural delivery of upstream sediments. Major dams and hydroelectric facilities are located on the Lewis River and upstream on the Columbia River. Dams are considered permanent facilities in this shoreline inventory, but are recognized as a significant impairment affecting water quality, water temperature, sediment transport, fish habitat, flood flow and natural hydrology, and anadromous fish populations. The reintroduction of anadromous fisheries through the dam system on the Lewis River may reduce the extent of impairment that the dams have on fish habitat and anadromous fish populations.

10.4 Key Shoreline Use Issues

Land use within Clark County is changing, with the major trends of increasing urban cover in cities, and transition of agricultural land to residential and commercial land uses (LCFRB, 2006). Annexation of UGAs is expected to occur, with greater development pressure on shorelines in these areas. Population predictions for 2020 indicate that many areas of the county will double in numbers of people. This section identifies major use conflicts that will need to be addressed during the development of SMPs.

Conflicts exist in Clark County between agricultural uses, other adjacent uses and protection of shoreline ecological functions. These can often be addressed through improved management practices. Water quality degradation due to excess nutrients entering streams and rivers is one conflict typically associated with agricultural uses. Sources of nutrients are livestock waste and fertilizers. 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 hours of operation. The historic trend of converting agricultural land to residential and commercial land uses is generally inconsistent with Clark County’s goal to: maintain and enhance productive agricultural lands and minimize incompatibilities with adjacent uses (Clark County, 2007d).

Use conflicts also exist where timber harvest is the principal use. This covers much of the eastern portion of the county. Where land is converted to non-forestry uses, the local SMP would apply. Forestry activities in the state of Washington are regulated by the Forest Practices Act (RCW 76.09) and implementing rules (WAC 222.08). Changes to the act in response to ESA listings have improved timber harvest practices adjacent to shorelines. The Forest Practices Rules require a riparian management zone (RMZ) around all streams where timber harvests are more closely regulated (WAC 222.30.020). The RMZ is composed of three concentric buffers, each with specific management rules. Timber harvest is only prohibited in the inner ring, which is generally 50 feet. The SMP jurisdiction is a minimum of 200 feet. Substantial developments
associated with forestry activities (e.g., roads, bridges) which occur within shoreline jurisdiction require shoreline substantial development permits (WAC 222-50). In addition, SMA (RCW 90.50.150) further regulates timber harvests within shorelines of statewide significance. In those areas, SMA allows only selective commercial timber cutting in which no more than 30 percent of the trees are removed in any 10-year period. These provisions create potential conflict with the need to maintain riparian vegetation and in particular recruitment of LWD.

Potential conflicts exist in Clark County between gravel and mining uses and protection of shoreline ecological functions. Gravel extraction is commonly associated with the shorelines of rivers, as they provide concentrated sources of gravel. For example, gravel mining is an issue along the East Fork Lewis River. 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 channel migration zone.

Installation of utilities in riparian buffers may be a potential use conflict in Clark County. Sanitary sewer utilities are typically designed to allow for gravity flow or require pumping facilities if there are topographic limitations. Such utilities tend to be located within shoreline areas either as outfalls discharging treated wastewater or as utility crossings. Pumping facilities, in some cases, also need to be located within shoreline areas. Establishing utility facilities is often in conflict with protecting riparian vegetation. Treated effluent may affect water quality and water quantity. Sanitary sewer outfalls could result in streambank erosion.

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.

### 10.5 Planned Park and Public Access Facilities

This section summarizes the public access facilities proposed by the Parks, Recreation and Open Space (PROs) plans for the Cities of Battle Ground, Camas, La Center, Ridgefield, Vancouver and Washougal, and Clark County. More detail on proposed facilities can be found in Volume 2, Chapters 1 through 6. Public access facilities proposed in the PROs plan include:

- **City of Battle Ground** - Salmon Creek forested upland acquisition.
- **City of Camas** - Picnic area on Fallen Leaf Lake, boat launch and recreation center on the Washougal River, and a viewpoint for the Columbia River. A network of trails is also proposed along the Columbia River, Lacamas Lake, Fallen Leaf Lake, Washougal River, and Lacamas Creek.
- **City of La Center** – Boat launch, water trail, and waterfront trail on East Fork Lewis; and trail on Brezee Creek.
- **City of Ridgefield** – New park, regional connector trail, and water trail on Lake River; and trail on Gee Creek.
City of Washougal – Two parks, trail and water trail on Washougal River; public access to Gibbons Creek; Cedar-View Steigerwald NWR route; and water trail on Columbia River.

City of Vancouver – New park, park improvements, and trails on the Columbia River; boathouse, restoration, and trails on Vancouver Lake; new park and trails on Burnt Bridge Creek; park development, park improvements, greenway acquisition, and trails on Salmon Creek; park development and trails on Curtin Creek.

Clark County – Trail network totaling 240 miles along or across the following shorelines of the state: Columbia River, Vancouver Lake, Burnt Bridge Creek, Battle Ground Lake, East Fork Lewis River, Lacamas Lake and Salmon Creek. Boat launching facilities proposed throughout the county as well.

As part of this SMP update, visioning meetings were conducted to garner public input on shoreline management. Findings of the questionnaire distributed during the meetings reflect a general sentiment to increase public access; however, concerns were expressed about unregulated public access.

10.6 Restoration Opportunities

Restoration and protection opportunities are described by waterbody in previous chapters of this report. Restoration and protection classifications are presented from Ecology’s Watershed Characterization for Clark County, Washington (Stanley, 2009). General restoration opportunities identified in the Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (May 2010) are summarized along with other programmatic restoration opportunities identified in regional watershed reports. A detailed framework for restoration opportunities in the shoreline will be developed as part of the Restoration Planning element of the SMP update. At that time, goals, policies, and programs to prioritize and implement restoration of shorelines in Clark County will be addressed.

Ecology’s Watershed Characterization provides one method for identifying protection and restoration areas at the basin level. The summary map of potential management areas (Figure 10-1) combines the results of the important areas and impaired areas discussed in Chapter 3 to display basins where protection and restoration will be most effective. High priority restoration and protection areas are therefore targeted for the Columbia River floodplain, East Fork Lewis, Lewis River and Washougal River subbasins (i.e., drainage basin areas in yellow or green) on Figure 10-1. More specific opportunities in each major subbasin are discussed below.
Figure 10-1. Priorities for Protection and Restoration of Hydrologic Processes

(Stanley, 2009) combined with salmon recovery priorities (LCFRB, 2010).
10.6.1 Lower Columbia River

The major floodplain areas of the lower Columbia River (including Vancouver Lake, Ridgefield National Wildlife Refuge and Steigerwald Lake National Wildlife Refuge) have been classified as Priority Protection and Restoration Management Zones by Ecology in its watershed characterization (Stanley, 2009). This means that the river floodplain areas are deemed highly functioning areas for hydrologic and denitrification processes, and that impairments are low. Ecosystem-wide processes are relatively intact and restoration has a high chance of success.

On the other hand, the Vancouver section of the lower Columbia River was classified as an Urban Restoration and Development Management Zone. The shoreline of the Columbia River within the urban areas of Vancouver has a high level of impairment but also has important areas for recharge and denitrification (Stanley, 2009).

Restoration programs and policies for the lower Columbia River have been developed by a wide variety of agencies, watershed entities and stewardship groups including the Lower Columbia River Estuary Partnership (LCREP), LCFRB, Columbia River Estuary Study Taskforce (CREST), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service, and others. Restoration opportunities are determined at a programmatic level through these various plans and programs. Restoration projects have been funded by NMFS, LCFRB, CREST, LCREP, Salmon Recovery Funds, National Wildlife Refuges, and others.

General restoration priorities for the lower Columbia River shorelines in Clark County are to:

- Protect remaining floodplain, associated wetlands and priority habitats;
- Restore off-channel habitats;
- Restore degraded water quality in major contributing tributaries; and
- Restore floodplain function and connectivity.

The Vancouver Lake lowlands and associated floodplains near the Ridgefield National Wildlife Refuge are important areas for the lower Columbia River in Clark County. These lowlands and floodplains support numerous waterfowl concentrations and priority habitats and species. Continued preservation and restoration of this area, including Green Lake, Post Office Lake, Campbell Lake, Canvasback Lake and lower Gee Creek, are important for maintenance of priority habitats particularly birds and waterfowl.

10.6.2 Washougal River Sub-basin

The Washougal River sub-basin falls within a Priority Protection Management Zone according to the Ecology (2009) watershed characterization. This area includes the Washougal River mainstem and Cougar Creek, as well as Gibbons and Lawton Creeks.

Lacamas Lake, Lacamas Creek, Fifth Plain Creek and other tributaries fall within a Priority Restoration and Protection Management Zone. These are important areas for denitrification, recharge and surface storage to support downstream discharge and streamflow (Stanley 2009).
Restoration priorities developed by the LCFRB (2010) are summarized in Table 10-7.

Table 10-7. Washougal River Sub-basin Restoration Opportunities

<table>
<thead>
<tr>
<th>Priority</th>
<th>Restoration Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Protect stream corridor structure and function.</td>
</tr>
<tr>
<td>2</td>
<td>Protect and restore hillslope processes</td>
</tr>
<tr>
<td>3</td>
<td>Restore riparian conditions throughout the basin, including upstream in timber harvest zones</td>
</tr>
<tr>
<td>4</td>
<td>Restore degraded water quality with emphasis on temperature impairments</td>
</tr>
<tr>
<td>5</td>
<td>Provide for adequate instream flows during critical periods for fish</td>
</tr>
<tr>
<td>6</td>
<td>Restore access to habitat by removing barriers</td>
</tr>
<tr>
<td>7</td>
<td>Restore floodplain function and channel migration processes</td>
</tr>
<tr>
<td>8</td>
<td>Restore channel structure and stability</td>
</tr>
<tr>
<td>9</td>
<td>Restore off-channel habitat and associated wetlands</td>
</tr>
</tbody>
</table>

The Washougal River and Little Washougal River are important for salmonid recovery. These rivers have good water quality and provide exceptional habitat for salmonid species.

Important restoration opportunities in the Washougal River sub-basin include protection and restoration of extensive wetlands in the upper Fifth Plain Creek basin and upper Lacamas Creek. These areas include rural residential and agricultural lands with large areas of wetlands associated with each of these shoreline streams. The wetlands are important for maintaining stream water quality and baseflow.

### 10.6.3 Salmon Creek Sub-basin

Salmon Creek is designated both Restoration and Development (in the lower reach) and Priority Restoration and Protection in rural lands upstream of Battle Ground (Stanley 2009). Salmon Creek is considered impaired for hydrologic processes within the UGAs. Due to a high level of impairment within its basin, Burnt Bridge Creek falls within a Development and Restoration Management Zone. It has relatively low function for hydrologic and denitrification processes, and restoration options are more limited (Stanley, 2009).

Lake River is deemed highly valuable for restoration due to its location in the Columbia River floodplain. It is therefore included in the Priority Protection and Restoration Management Zone (Stanley 2009).

Restoration priorities developed by the LCFRB (2010) are summarized in Table 10-8.
Table 10-8. Salmon Creek/Lake River Subbasin Restoration Opportunities

<table>
<thead>
<tr>
<th>Priority</th>
<th>Restoration Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Protect stream corridor structure and function</td>
</tr>
<tr>
<td>2</td>
<td>Protect and restore hillslope processes</td>
</tr>
<tr>
<td>3</td>
<td>Protect critical aquifers to provide for adequate instream flow</td>
</tr>
<tr>
<td>4</td>
<td>Restore riparian conditions throughout the basin</td>
</tr>
<tr>
<td>5</td>
<td>Restore floodplain function and channel migration processes</td>
</tr>
<tr>
<td>6</td>
<td>Restore degraded water quality with emphasis on temperature impairments</td>
</tr>
<tr>
<td>7</td>
<td>Restore channel structure and stability</td>
</tr>
<tr>
<td>8</td>
<td>Limit intensive recreation use during critical periods</td>
</tr>
</tbody>
</table>

10.6.4 East Fork Lewis River Sub-basin

According to the watershed characterization, the East Fork Lewis River sub-basin lies within a Priority Restoration Management Zone (Stanley 2009). Headwaters for the river are considered high priority for protection due to their critical position in the landscape and potential for rain-on-snow events. The East Fork Lewis River is also considered the highest priority for the recovery of salmonid species.

Restoration priorities developed by the LCFRB (2010) are summarized in Table 10-9.

Table 10-9. East Fork Lewis River Sub-basin Restoration Opportunities

<table>
<thead>
<tr>
<th>Priority</th>
<th>Restoration Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Protect stream corridor structure and function.</td>
</tr>
<tr>
<td>2</td>
<td>Protect and restore hillslope processes</td>
</tr>
<tr>
<td>3</td>
<td>Restore floodplain function and channel migration processes in the mainstem and major tributaries.</td>
</tr>
<tr>
<td>4</td>
<td>Restore riparian conditions throughout the basin.</td>
</tr>
<tr>
<td>5</td>
<td>Restore degraded water quality with emphasis on temperature impairments.</td>
</tr>
<tr>
<td>6</td>
<td>Provide for adequate instream flows during critical periods for fish</td>
</tr>
<tr>
<td>7</td>
<td>Restore access to habitat by removing barriers.</td>
</tr>
<tr>
<td>8</td>
<td>Restore channel structure and stability</td>
</tr>
<tr>
<td>9</td>
<td>Restore off-channel habitat and associated wetlands</td>
</tr>
</tbody>
</table>

The Watershed plan for WRIA 28 recommends that the East Fork Lewis River subbasin be the highest priority for a cleanup plan, which is underway. Significant changes in land use are anticipated in the East Fork Lewis River sub-basin with future planned development. Water quality in rapidly developing and developed watersheds is already showing signs of degradation.
from land use and other growth activities. The East Fork is in violation of temperature standards through its entire length within Clark County.

10.6.5 Lewis River Sub-basin

In the watershed characterization, the Lewis River is considered to be in a Priority Restoration Management Zone downstream of Merwin Dam (Stanley 2009). Above the dam, the reservoirs and rivers were not specifically classified, although these areas are important for hydrologic processes.

Restoration priorities developed by the LCFRB (2010) are summarized in Table 10-10.

Table 10-10. Lewis River (Lower) Sub-basin Restoration Opportunities

<table>
<thead>
<tr>
<th>Priority</th>
<th>Restoration Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Protect stream corridor structure and function</td>
</tr>
<tr>
<td>2</td>
<td>Protect and restore hillslope processes</td>
</tr>
<tr>
<td>3</td>
<td>Manage regulated stream flows to provide for critical components of the natural flow regime</td>
</tr>
<tr>
<td>4</td>
<td>Restore floodplain function and channel migration processes in the mainstem and major tributaries</td>
</tr>
<tr>
<td>5</td>
<td>Restore access to habitat by removing barriers</td>
</tr>
<tr>
<td>6</td>
<td>Create/restore off-channel and side channel habitat</td>
</tr>
<tr>
<td>7</td>
<td>Restore riparian conditions throughout the basin</td>
</tr>
<tr>
<td>8</td>
<td>Restore degraded water quality with emphasis on temperature impairments</td>
</tr>
<tr>
<td>9</td>
<td>Provide for adequate instream flows during critical periods for fish</td>
</tr>
<tr>
<td>10</td>
<td>Restore channel structure and stability</td>
</tr>
<tr>
<td>11</td>
<td>Limit intensive recreation use during critical periods</td>
</tr>
</tbody>
</table>

The prioritized restoration measures for the upper North Fork Lewis River are similar to the lower, except the highest priority for the upper Lewis River is restoring fish access through the hydropower system. Emphasis is also placed on the full implementation of the Forest Practices Act, which requires riparian area management zones and where other protections for streams and tributaries are also emphasized.

10.7 Other Programs

Salmon recovery planning under the Endangered Species Act (ESA) began in 2000 for the lower Columbia River. An interim draft Salmon Recovery Plan was developed in 2004 and approved by NOAA Fisheries in 2006. The plan was recently updated in May 2010 and is titled Washington Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plan (LCFRB, 2010). In addition, other ESA planning documents have been prepared, including the ESA Recovery Plan Module described below.
The Columbia River Estuary ESA Recovery Plan Module is part of a larger regional planning effort to develop recovery plans for ESA-listed salmon and steelhead in the Columbia River basin (LCREP, 2007). The plan was prepared for NOAA Fisheries by the Lower Columbia River Estuary Partnership in 2007 and released by public notice on January 2, 2008 in the Federal Register (73 FR 161). The goal of the module is to identify management actions that, if implemented, would improve the survival of salmon and steelhead during their migration and rearing in the estuary and lower Columbia River. The management actions apply broadly to both the Columbia River shorelines and the tributaries within Clark County that flow into the lower Columbia River.

Twenty-three management actions were identified as part of salmon recovery for the lower Columbia River region. Of these management actions, the following (Table 10-11) are applicable to shoreline management in Clark County.

Table 10-11. Management Actions Identified in the Columbia River Estuary ESA Recovery Plan Module.

<table>
<thead>
<tr>
<th>Management Identifier</th>
<th>Action Description</th>
<th>Potential Implementer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRE -1</td>
<td>Protect intact riparian areas in the estuary and restore riparian areas that are degraded.</td>
<td>Cities and Counties</td>
</tr>
<tr>
<td>CRE-6</td>
<td>Reduce the export of sand and gravels via dredge operations by using dredged materials beneficially.</td>
<td>Port Districts</td>
</tr>
<tr>
<td>CRE-7</td>
<td>Reduce entrainment and habitat effects resulting from main- and side-channel dredge activities in the estuary.</td>
<td>Port Districts, Cities, Counties</td>
</tr>
<tr>
<td>CRE-8</td>
<td>Remove pilings and pile dikes with low economic value when removal clearly would improve ecosystem health.</td>
<td>Port Districts, Cities and Counties, LCREP</td>
</tr>
<tr>
<td>CRE-9</td>
<td>Protect remaining high-quality off-channel habitat from degradation.</td>
<td>LCREP, Port Districts, Cities and Counties</td>
</tr>
<tr>
<td>CRE-10</td>
<td>Breach or lower dikes and levees to improve access to off-channel habitats.</td>
<td>LCFRB, LCREP, Cities and Counties</td>
</tr>
<tr>
<td>CRE-11</td>
<td>Reduce the square footage of over-water structures in the estuary.</td>
<td>WDFW, Cities and Counties</td>
</tr>
<tr>
<td>CRE-15</td>
<td>Implement education and monitoring projects and enforce existing laws to reduce the introduction and spread of noxious weeds in riparian areas.</td>
<td>Cities and Counties, Conservation Districts</td>
</tr>
<tr>
<td>CRE-20</td>
<td>Implement best management practices to reduce estuary and upstream sources of toxic contaminants (pesticide and herbicides) entering the estuary.</td>
<td>Cities and Counties, Conservation Districts</td>
</tr>
<tr>
<td>CRE-21</td>
<td>Identify and reduce industrial, commercial, and public sources of pollutants.</td>
<td>Washington Department of Ecology</td>
</tr>
<tr>
<td>CRE-22</td>
<td>Monitor the estuary for contaminants and/or restore contaminated sites.</td>
<td>LCREP, Washington Department of Ecology, Port Districts</td>
</tr>
<tr>
<td>CRE-23</td>
<td>Implement stormwater best management practices in urban areas.</td>
<td>Cities and Counties</td>
</tr>
</tbody>
</table>
10.8 Shoreline Management Program Opportunities

Shoreline characteristics, and existing/proposed uses should be taken into account when determining whether public access or habitat restoration are appropriate uses for specific areas. For example, providing public access to Hathaway Lake, Post Office Lake, and Unnamed Lake 03 may not be appropriate since there are protected wildlife areas adjacent to the lakes in the Ridgefield National Wildlife Refuge. Similarly, encouraging wildlife near airport properties may not be advisable due to safety concerns. Opportunities to increase public access to shorelines of the state and restore ecological functions and processes in Clark County can be assessed by identifying properties that are currently under public ownership. Clark County and its cities have a reasonable supply from which to consider. Public ownership in this context refers to federal, state, county and city governmental agencies. Map 30 in Appendix A shows the properties in public ownership (excluding port districts). The Public Ownership Tables in Appendix E identify the acreages within each reach that is currently under public ownership. The tables are organized in a manner similar to the manner in which shorelines were characterized in Section 10.2.

The East Fork Lewis River basin has the highest total percentage of shoreline planning area under public ownership (37 percent). The remaining sub-basins rank as follows: Salmon Creek sub-basin is second (28 percent); Lower Columbia River is third (27 percent); Lower Columbia River tributaries is fourth (17 percent); Lewis River is fifth (11 percent); and the Washougal River sub-basin is sixth (8 percent). The Lower Columbia River has the highest total acreage of public ownership (4,832 acres) out of all the subbasins. Nearly 20 shorelines lack public access and lack opportunities for providing access or restoration on publicly owned properties. Restoration along shorelines that have little to no public ownership will be challenging since acquiring property or conservation easements typically involve additional time and money than restoring sites that are already in public ownership. Management recommendations will need to take creative approaches.
10.9 Management Recommendations

The 2003 WAC Shoreline Guidelines require management recommendations to be included in the shoreline inventory and characterization. The management recommendations included below are at a programmatic level for Clark County shorelines and could be incorporated into goals, policies, and regulations as appropriate.

Protection and Restoration

- Consider coordination with Cowlitz County, U.S. Forest Service, U.S. Fish and Wildlife Service, Tribes, and other regional entities whose land management practices affect Clark County shorelines.
- Rivers with high value for salmonid habitat recovery and demonstrated use by multiple salmonid species (determined by EDT modeling) should be considered for the highest levels of protection to remain in an unaltered condition or should be targets for restoration. These include LCFRB Tier 1 and 2 priority reaches and/or relatively healthy tributaries or reaches in lower priority watersheds like Salmon Creek.
- Shorelines that support high value habitat or high quality associated wetlands should be considered for the highest level of protection to remain in an unaltered condition.
- Restoration efforts should consider a focus on floodplain reconnection where rivers are confined by levees.
- Water pollution should be prevented at its source. Consider efforts to retrofit stormwater management facilities to improve water quality and require low impact development strategies or higher levels of water quality improvement for new development within Clark County and partnering cities.
- Mitigation sites within the shoreline jurisdiction should be dedicated to the City or County as part of shoreline development plans so that these areas may provide future restoration opportunities and long-term stewardship by public agencies.
- Consider restoring natural shoreline functions during redevelopment. For example, use larger bridge spans when replacing bridges, replace undersized culverts, use soft-shore bioengineering techniques instead of hardened armoring, relocate utilities where feasible, and remove fill from floodplains.

Vegetation Management

- Riparian areas and vegetation conservation zones should be restored to remove non-native and invasive plant species. Native trees and shrubs should then be planted. Salmon habitat is supported by riparian zones that contain native trees and shrubs, which provide food sources, shading and large woody debris to lakes, rivers and streams.
- Vegetation conservation measures and setbacks and buffers from the ordinary high water mark should be required for all future development along shorelines.
- Prevent the introduction of non-native invasive species and encourage rapid eradication. Develop an invasive plant inventory to track changes and prioritize areas for eradication.
Development of SMPs

- Consider the importance of confluence areas (areas where tributaries join the mainstem Columbia River) for juvenile salmonid rearing when developing goals, policies, and regulations.
- Regulatory language should be written in a manner that is easy to understand and provides options for compliance.
- Develop an implementation, monitoring and adaptive management plan at the county level in order to track changes in the shoreline jurisdiction and determine successes, failures and corrective actions.
- Consider improving the shoreline permitting process to ensure adequate review of impacts, public noticing, compliance with regulations and agency coordination.
- Consider developing an inventory of archaeological sites that contribute to the history and understanding of past human activities in Clark County.

Development Regulations – Hard Armoring

- Consider regulations that encourage and facilitate levee setback projects (e.g., pulling back an existing levee to allow for a larger floodplain area contiguous to a waterbody) and other shoreline enhancement projects.
- Consider requirements for soft-shore bioengineering techniques where new armoring or retrofits cannot be avoided.
- Consider alternatives to new armoring such as setbacks and vegetated riparian zones. New developments should be located on the property in such a manner as to not require shoreline armoring in order to protect the house and other structures.

Development Regulations-Overwater Structures

- Consider size limitations for overwater structures, including new docks, piers or floats.
- Consider joint-use docks prior to construction of single-use residential docks to minimize dock proliferation and shading impacts.

Development Regulations-Mitigation

- Consider requirements for new development to provide an analysis during permit approval of existing and newly proposed impacts to the site-specific ecological functions and values in order to focus and improve the effectiveness of any required mitigation.
- Consider requiring public access that is commensurate with the scale and character of future development and avoids adverse effects on the natural shoreline character and functions.

Education and Enforcement Actions

- Consider providing educational materials describing natural shoreline ecological processes like bank erosion, flooding, and the value of riparian buffers and their role in creating and sustaining habitat for fish and wildlife.
- Provide educational materials on shoreline uses and restoration measures to private property owners to encourage appropriate shoreline management.
• Provide greater incentives for shoreline permit compliance (and disincentives for violations).
• Consider establishing enforcement procedures for ensuring septic tanks meet maintenance and operation regulations to address fecal coliform bacteria levels exceeding water quality standards.

10.10 Use of the Shoreline Inventory and Characterization Report

The shoreline inventory and characterization report and map folio are the foundation for the updates to the Coalition’s SMPs. Based on the findings of this report, the relationships between ecological processes, shoreline functions, and the built environment can be better understood to assist in the development of goals and policies for shoreline management measures to protect and restore shoreline functions, encourage public access and promote water dependent uses.

Next, this report will be used to inform the development and assignment of appropriate shoreline environment designations. Using the results of the shoreline analysis, local governments will move forward to determine shoreline environment designations that are compatible with the existing condition, ecological function, character and vision for the shoreline reaches. The analysis tables in Appendix E will serve as a reference, providing a quick summary and analysis of conditions by reach. The shoreline environment designations will serve as the framework for development of the implementing regulations for each jurisdiction’s SMP.

Additionally, the report establishes a baseline of existing conditions for shorelines in the county and identifies restoration and public access opportunities. As local governments develop their SMPs, they will need to demonstrate “no net loss” of ecological functions over time from this baseline of existing conditions. The restoration opportunities identified in this report will also assist in the preparation of a county-wide restoration plan, a separate document to be prepared in subsequent phases of the SMP update process.
Legend
Ecological Function - Hydrologic

- Low
- Low to Moderate
- Moderate
- High

SMP Update Waterbodies

Major Roads
County Boundary

Cities
Urban Growth Areas
National Wildlife Refuge

Map 10-1
Reach Scale Ecological Functions - Hydrologic

Data Sources: LCRFRA, 2004 (2000); Clark County, 2009; DNR, 2007; Department of Ecology, 2000; E3RI, 2008

SMA Grant Agreement No. G1000058
Task G07
Coordinate System: State Plane WAD83 (ft)
Washington South FIPS 4602
6/25/09. Maps depict where there is likely potential
for ecological impacts to present or future aquatic
resources near land, and floodplains.
Use any aspect of these depictions with caution;
interpretation may vary.
Legend

Ecological Function - Riparian
- Low
- Low to Moderate
- Moderate
- High

SMP Update Waterbodies
Major Roads
County Boundary

Cities
Urban Growth Areas
National Wildlife Refuge

Map 10-2
Reach Scale Ecological Functions - Riparian

Data Sources: LCRFB, 2004 (2008); Clark County, 2009; CNW, 2007, Department of Ecology, 2000; EDH, 2006
NOTE: Map data shown here are the property of the sources listed below. Inaccuracies may exist.

Data Sources:
- LCRFRB, 2004 (2008)
- Clark County, 2009
- City of Ridgefield, 2004
- National Wildlife Refuge
- Steigerwald Lake
- Yale
- Environmental Stewardship
- Lower Columbia
- Columbia River Estuary
- Battle Ground Lake

Legend
Ecological Function - Hyporheic
- SMP Update Waterbodies
- Major Roads
- County Boundary

Legend
- Low
- Low to Moderate
- Moderate
- High

Map 10-3
Reach Scale Ecological Functions - Hyporheic

SMA Grant Agreement No. G1000058
Task 4.01
Coordinate System: State Plane NA083 (ft)
Washington South FIPS 4602
6/7/10: Map data are from various sources
including county, local government, and State agencies.
SMA has no warranty or liability regarding any aspect of these data.

Data Sources:
- LCRFRB, 2004 (2008)
- Clark County, 2009
- City of Ridgefield, 2004
- National Wildlife Refuge
- Steigerwald Lake
- Yale
- Environmental Stewardship
- Lower Columbia
- Columbia River Estuary
- Battle Ground Lake
of the sources listed below. Inaccuracies
Data Sources: LCRFRB, 2004 (2008); Clark County, 2009; Map 10-4

Legend
Ecological Function - Habitat

- Low
- Low to Moderate
- Moderate
- High

SMP Update Waterbodies
Major Roads
County Boundary

Cities
Urban Growth Areas
National Wildlife Refuge

Map 10-4
Reach Scale Ecological Functions - Habitat

Data Sources: LCRFRB, 2004 (2008); Clark County, 2009; DNRA, 2007, Department of Ecology, 2000; ESRI, 2008