SHORELINE RESTORATION PLAN

For

Lewis County, and the Cities of Centralia, Chehalis, Winlock, and Morton

Prepared for:

Lewis County Community Development

Ecology Grant # G1200468

Note:
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SHORELINE RESTORATION PLAN

FOR
LEWIS COUNTY, AND THE CITIES OF CENTRALIA, CHEHALIS, WINLOCK, AND MORTON

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LIMITATIONS

As with any report, there are limitations (inherent or otherwise) that must be acknowledged. This report is limited to the subjects covered, materials reviewed, and data available at the time the report was prepared. The authors and reviewers have made a sincere attempt to provide accurate and thorough information using the most current and complete information available and their own best professional judgment. If you have questions regarding the content of this report please contact staff at Lewis County Community Development department.

INTRODUCTION

This restoration plan serves as a guide for Lewis County and the cities of Centralia, Chehalis, Winlock and Morton (collectively referred to as the Coalition) to achieve improvements in ecological functions of degraded shoreline areas as required by WAC 173-26-201(2)(f). The plan describes current and planned restoration projects at site-specific locations throughout the Coalition using project tracking tools provided by the Washington State Recreation and Conservation Office (Habitat Work Schedule 2013; PRISM 2013). The plan also provides suggestions for additional restoration opportunities not yet in the planning process.

Many of restoration projects identified in this plan are directed towards salmon recovery. Salmon recovery is a regional priority locally implemented by the Chehalis Basin Lead Entity Water Resource Inventory Areas 22 and 23 (WRIAs) and the Lower Columbia Fish Recovery Board Lead Entity WRIA 26. Salmon recovery projects include removal of fish barriers, removal of nonnative riparian vegetation, and reconnection of floodplain habitat with main stem rivers. Other identified restoration projects focus on flood reduction while also providing ecological benefits. These projects include setting back or removing levees, constructing stormwater quality treatment projects, floodplain reconnection (i.e., oxbow lake reconnection), and wetland restoration and creation. Riparian revegetation with native species is also advocated as elevated water temperatures are a common problem throughout the Chehalis Basin.

The proposed, site-specific, restoration projects are grouped by management area, which is an established method of delineating shoreline areas set forth in the Lewis County Inventory and Shoreline Characterization Report (Herrera et al. 2013).

PURPOSE AND INTENT

The purpose of this restoration plan is to identify degraded areas and impaired ecological functioning in the shoreline jurisdiction within the Coalition and identify projects and programs that will restore shoreline ecological functions and processes in those areas.

This restoration plan has been prepared to meet requirements of the Shoreline Master Program (SMP) Guidelines, specifically, WAC Section 173-26-201(2)(f). These requirements are to:

- Identify degraded areas, impaired ecological functions, and sites with potential for ecological restoration.
- Establish overall goals and priorities for restoration of degraded areas and impaired ecological functions.
- Identify existing and ongoing projects and programs that are currently being implemented, or are reasonably assured of being implemented, which are designed to contribute to local restoration goals.
- Identify additional projects and programs needed to achieve local restoration goals, and implementation strategies including identifying prospective funding sources for those projects and programs.
- Identify timelines and benchmarks for implementing restoration projects and programs and achieving local restoration goals.
- Provide for mechanisms or strategies to ensure that restoration projects and programs will be implemented according to plans and to appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals.

In addition to meeting these requirements this restoration plan will support Coalition or other organizations' applications for grant funding to restore shoreline environments.

Scope

The scope of this plan is to identify restoration and programmatic opportunities to improve ecosystem functions along the freshwater shorelines of the Coalition. Shoreline areas included in this plan are defined as waterbodies, and all uplands within 200 feet from the ordinary high water mark of lakes greater than 20 acres and associated wetlands as well as rivers or streams with mean annual flow exceeding 20 cubic feet per second (cfs). There are no marine shorelines in the Coalition. In addition, a number of restoration projects are planned or proposed at the sub-watershed level on tributary streams that, while not within the shoreline jurisdiction, contribute to healthy ecological functioning in jurisdictional waterbodies. Therefore, they are included in the scope of this restoration plan.

Context

This plan relies on multiple strategies that use physical restoration, educational outreach, and acquisition to improve and restore shoreline functions and resources. This plan's success depends on the involvement of a number of government and nonprofit organizations that are stewarding and restoring land in the Coalition. They include, for example, Lewis County Conservation District, Lewis County Public Works, City of Chehalis, Cowlitz Indian Tribe, Washington Department of Natural Resources (DNR), Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (Ecology), and the Lower Columbia Fish Recovery Board. This restoration plan is a part of the Coalition's SMP and is founded on best available science.

Shoreline Master Program

The Washington Department of Ecology (Ecology) *Shoreline Management Plan Master Program Guidelines* (Ecology 2004) require the development of a shoreline restoration plan as part of the SMP update process. This plan supports the goals, policies, and regulations of Lewis County's SMP. The protective and mitigation provisions of the SMP are intended to achieve no net loss of ecological functions from new adverse impacts, and this restoration plan will help ensure that the shoreline ecosystem functions within the County achieve no net loss with potential for improvement over time. As such, this plan serves as a technical companion to the Lewis County SMP.

Best Available Science

Lewis County issued its Best Available Science (BAS) for Fish and Aquatic Resources in June of 2006. It summarizes BAS for Lewis County fish habitat and addresses the habitat requirements and management needs of anadromous fish (Parametrix 2006). This plan is consistent with information on the functions and processes provided by shoreline habitats presented in that report.

Categories of Restoration

Restoration generally encompasses five categories of activities that are directed to improve and protect ecological functions. These are:

- Creation – where new shoreline resource functions are established where none previously existed.
- Re-establishment – restoration of a previously existing resource that no longer exhibits past functions.
- Rehabilitation – restoration of functions that are significantly degraded.
- Enhancement – improvement of functions that are somewhat degraded.
- Preservation – protection of an existing high-functioning resource from potential degradation. Preservation of high value habitats can benefit adjacent and nearby ecological resources as well as the preservation site. Preservation is typically achieved through conservation easements or the purchase of land.

Restoration is not necessarily intended to reestablish historical conditions but rather to improve ecological functions where possible. Restoration may be accomplished through physical activities identified as *projects* in this plan or through *programmatic* strategies that provide landowner education or incentives to restore ecological processes.

Additionally, restoration is not to be confused with mitigation. Mitigation is defined by WAC 197-11-768 as the sequential process of avoiding, minimizing, rectifying and reducing impacts, as well as compensating for unavoidable impacts and monitoring the impact. Mitigation is a regulatory requirement derived from anticipated impacts whereas restoration, as addressed in this plan, is a voluntary activity intended to improve ecological functions above existing conditions.

Restoration Plan Objectives

- Identify restoration recommendations for improving shoreline ecosystem processes and habitats required to support the life cycles of priority or locally important fish and wildlife species.
- Identify restoration projects that are consistent with and, where practicable, prioritized based on the biological recovery goals for several salmonid species (i.e., Chinook, steelhead, coho, etc.), and other species or populations for which a recovery plan is available.
- Identify potential restoration partners including local, state, and federal public agencies, tribes, nonprofit organizations, and landowners to restore shorelines with impaired ecological functions or processes.
- Identify funding sources for restoration, enhancements, easements, or acquisitions including federal, state, county, grant, or other funding sources.
- Identify timelines and benchmarks for implementing effective restoration.

Restoration Policies

Shoreline habitat and natural systems enhancement and restoration projects include those activities proposed and conducted specifically for the purpose of establishing, restoring, or enhancing habitat for priority species in shorelines.

Examples of shoreline habitat and natural systems enhancement projects include floodplain restoration projects, fish passage barrier removal or improvement, and projects to increase shoreline habitat complexity, among others. Projects that qualify as streamlined fish enhancement projects per RCW 77.55.181 will be considered under this section.

The following policies agreed to by the Coalition will guide the Coalition's restoration projects:

- **Policy 1**. Reclaim and restore biologically and aesthetically degraded areas to the greatest extent feasible while maintaining appropriate use of the shoreline jurisdiction.

- **Policy 2.** Restoration and enhancement actions will improve shoreline ecological functions and processes and should be designed using principles of landscape and conservation ecology. The primary goal is to restore or enhance physical and biological ecosystem-wide processes that create and sustain shoreline habitat structure and functions.
- **Policy 3**. Encourage and facilitate cooperative shoreline restoration and enhancement programs between local, state, and federal agencies, tribes, nonprofit organizations, public utilities, conservation districts, and landowners to address shorelines with impaired ecological functions.
- **Policy 4**. Target restoration and enhancement projects that will support the life cycles of special status species identified by WDFW, WDNR, NMFS, or USFWS, such as Chinook, coho, steelhead, and other anadromous fish; locally important plants, fish and wildlife; and other populations or habitats for which a prioritized restoration or recovery plan is available.
- **Policy 5**. Integrate restoration and enhancement with other natural resource management efforts such as the Lower Columbia Salmon Recovery Plan as implemented by the Lower Columbia Fish Recovery Board.
- **Policy 6**. Seek funding from state, federal, private and other sources to implement restoration, enhancement, and acquisition projects; particularly those that are identified in the restoration plan or local watershed plans.
- **Policy 7.** Include provisions for shoreline vegetation restoration, fish and wildlife habitat enhancement, and low impact development techniques (LID) in projects located within the shoreline through site development standards, requirements for compensatory mitigation, and incentive-based restoration such as tax relief.
- **Policy 8**. Develop permit application processing guidelines at the local jurisdictional level that will streamline the review of restoration-only projects.
- **Policy 9**. Allow for the use of tax incentive programs, mitigation banking, grants, land swaps, or other programs, as they are developed, to encourage restoration and enhancement of shoreline ecological functions and to protect habitat for fish, wildlife, and plants.
- **Policy 10**. Avoid adverse impacts on existing freshwater critical areas, fish and wildlife habitat conservation areas, water quality, and water storage capacity in all shoreline restoration and enhancement projects.
- **Policy 11**. Follow the application for relief option from expansion of the shoreline jurisdiction by restoration projects in the shoreline jurisdiction set forth in RCW 90.58.580 when appropriate.

Restoration Project Identification Methods

Information Sources

A variety of information sources were examined and used to develop this plan. Most important were databases of projects proposed, sponsored, and being implemented by local groups, including projects identified on the Habitat Work Schedule and PRISM websites, which catalogs all of the past, present, and future projects funded by or that have applied to receive funding from the Washington State Recreation and Conservation Office, the largest source of restoration funds in the Puget Sound region. In addition, restoration opportunities are defined for each management area based on Lewis County's Shoreline Inventory and Characterization Report, which generally identifies areas with degraded habitat (Herrera et al. 2013). Management area boundaries discussed in this report were taken from the Lewis County Inventory and Shoreline Characterization Report (Herrera et al. 2013), which delineated them based upon Ecology guidance (Ecology 2011).

Other projects were identified using Chehalis Basin Flood Authority documents and other watershed planning reports described under *Project Selection*. Chehalis Basin habitat assessment reports were also used to identify potential restoration opportunities.

To augment existing studies, a site visit was scheduled to evaluate candidate locations and project needs for restoration. The site visit was prefaced by an in-office meeting attended by a geomorphologist, a fisheries biologist, a restoration engineer, and a wetlands scientist, where the best available science described in the Shoreline Inventory and Characterization Report and other related studies was discussed. The entire Coalition shoreline, with a focus on incorporated areas, was examined during this meeting, and potential targets for restoration were identified for more detailed examination on the site visit. Based on the site visit results, new projects were identified and proposed largely based on the restoration priorities identified in the studies and site characteristics discussed below.

Project Selection

Projects were selected based on information from local studies that generally prioritized projects that restore previously modified shorelines, improve salmon recovery, and improve flood control. These studies are:

- The Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan: Volume II, Chapter F. Upper Cowlitz Subbasin (LCFRB 2010a)
- The Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan: Volume II, Chapter G. Lower Cowlitz Subbasin (LCFRB 2010b)
- Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan: Volume II. Chapter E. Cowlitz (LCFRB 2004)

- Chehalis Basin Partnership: Multi-Purpose Water Storage Assessment (Tetra Tech/KCM and Triangle Associates 2003)
- The Chehalis Basin Salmon Habitat Restoration and Preservation Work Plan for WRIA 22 and 23 (CBPHWG 2008)
- Salmonid habitat limiting factory analysis. Chehalis Basin and nearby drainages: Water Resources Inventory Areas 22 and 23 (WSCC 2001)
- Salmonid habitat limiting factor analysis. Water Resources Inventory Area 26 (WSCC 2000)

These studies used field surveys and analytical methods to determine restoration priorities and make recommendations for sites that would provide the greatest gain towards improving critical habitats and shoreline ecological functions. Summaries of their findings are provided in this plan to inform users about already documented priorities for additional restoration and protection in the Coalition. The information provided and the results of these studies can be effectively used as a basis for planning and prioritizing future projects.

Projects were also identified and selected based on the in-office review and accompanying field visit described in the *Information Sources* section above.

Identification of New Restoration Opportunities

New restoration projects (proposed herein) were largely based on the following site characteristics as identified in the Lewis County Shoreline Inventory and Characterization Report (Herrera et al. 2013):

- The site is degraded with respect to key species' habitats and presents an opportunity for restoration that will produce a net gain in shoreline ecological functions and habitat in the future.
- The site has shoreline armoring and infrastructure, which if removed would likely lead to gains in habitat or improvements in physical processes.

Other important criteria considered in restoration site selection included:

- Site has or is adjacent to areas having specific, high-value, biological features such as mature riparian forest or wetland habitats that support important fish species, birds, and other wildlife.
- Site is integral to hydrologic processes such as flooding and areas supporting off-channel habitat, critical to the survival of numerous salmonid species.
- Site shoreline functions are at threat from further development or deforestation.
- Site would provide public access and shoreline recreational use.
- Site has cultural and historical significance.

Overall Coalition Restoration Priorities

The protection and recovery of anadromous salmonid species is a primary focus for shoreline restoration projects in the Coalition as is reflected in many studies management documents (LCFRB 2004, 2010a, 2010b; CBPHWG 2008; WSCC 2000, 2001). The Coalition, resource agencies, tribes, and private interests are coordinating protection and management efforts for salmonid species. However, protection for salmonids also provides significant benefits to shoreline habitats and other species. Restoration priorities derived from the sources identified under *Methods for Identifying Restoration Projects* include the following:

- Restore access to habitats blocked by culverts, dams, or other barriers focusing on those cases with high potential benefits and reasonable project costs.
- Protect and enhance riparian functions and improve riparian conditions throughout Lewis County watersheds through restoration of the native riparian plant community, exclusion of livestock from riparian areas, and eradication of invasive plant species from riparian areas.
- Manage forest practices, agricultural practices, and growth and development to minimize impacts to sediment supply processes, stormwater runoff regime, and water quality.
- Set back, breach, or remove artificial confinement structures. Reduce shoreline armoring and investigate areas for dike removal, and reconnection of the floodplain where appropriate. High impact areas include the main stem Cowlitz River below Mayfield Lake, the main stem Chehalis River in the Centralia/Chehalis and other areas dominated by agricultural, residential, and municipal land uses.
- Improve degraded water quality with emphasis on temperature impairments by increasing riparian shading in tributaries and decreasing channel width-to-depth ratios.
- Restore degraded hillslope processes on forest, agricultural, and developed lands by upgrading or decommissioning problem forest roads; reforesting heavily cut areas not recovering naturally; employing agricultural best management practices (BMPs) to reduce erosion and stormwater runoff; reducing watershed surface imperviousness; and reducing stormwater runoff from developed areas.
- Restore or create off-channel and side-channel habitats where they have been eliminated, particularly on the lower and middle main stems of the Cowlitz and Chehalis Rivers.
- Restore channel structure and stability by placing stable woody debris in streams to enhance cover, pool formation, bank stability, and sediment sorting; modifying

channel morphology to create suitable habitat; and restoring natural rates of erosion and mass wasting within river corridors.

- Provide for adequate instream flows during critical periods through managing water withdrawals (water rights buybacks, closures, and enforcement), hydro-regulation, acquisition of existing water rights, and implementation of water conservation.

Not all these priorities are addressed via restoration projects in this report; however, this list serves as a guide to identifying high priority future restoration efforts as well as the ones herein.

RESTORATION PROJECTS BY MANAGEMENT AREA

Currently planned projects and discussions of additional programmatic priorities and opportunities are organized by management area. Management areas provide a scientific context for organizing restoration and protection projects by like environments. They also facilitate preparation of a coherent strategy for a given area. As discussed in the Methods section, management area boundaries are taken from the Lewis County Inventory and Shoreline Characterization Report (Herrera et al. 2013), which delineated them based upon Ecology guidance (Ecology 2011).

Table 1 identifies conceptual, active, and planned restoration projects for each management area. As stated in the *Restoration Project Identification Method*s section above, restoration projects were identified for each management area from a list of restoration projects obtained from the Habitat Work Schedule and PRSIM websites (Habitat Work Schedule 2015; PRISM 2015) and from an in-office review of Coalition shorelines and site visit. Table 1 shows the project funding source(s), schedule for completion if that information was available, a proposed schedule for completion if it was not, and it identifies a project description table where additional information is provided on each. Figures 1a and 1b show the management area boundaries and the general locations of these planned and proposed projects.

Nisqually (WRIA 11)

Overview

The Nisqually management area comprises 528,000 feet (100 miles) of riverine shoreline and 84,500 feet (16 miles) of lacustrine shoreline that encompass the upper basin of the Nisqually River in northeastern Lewis County. The northern boundary of the management area is located at the confluence of the Nisqually River with Alder Lake (a reservoir created by Alder Dam). The Nisqually management area includes the Little Nisqually River and several large tributary creeks, including Berry Creek, Catt Creek, Mineral Creek, Roundtop Creek, and East Creek. Mineral Lake is also located in the Nisqually management area.

A large proportion of the Nisqually management area is under timber production and contains numerous logging roads. In areas with moderate to steep slopes, landslides from roads are one of the greatest problems leading to erosion and sedimentation of tributary streams.

Restoration Priorities and Opportunities

Overall restoration priorities in this management area include decommissioning forest roads and setting back levees. Decommissioning problematic forest roads and setting back levees would greatly enhance tributary stream habitat and fluvial processes (CBPHWG 2008). An example of a candidate levee setback project is shown in Table 2.

Table 1. List of Conceptual, Planned, and Active Restoration Projects by Management Area.				
Management Area	**Planned Project**	**Project Description Table No.**	**Sponsor/Funding Source(s)**	**Timeline**
Nisqually	Upper Nisqually Channel Migration Setback	2	Floodplains by Design	Data Not Available
	Japanese Knotweed Eradication	3	Pierce County Noxious Weed Control Board	Ongoing
Deschutes	Overall Guidance Provided	NA	NA	NA
Upper Chehalis – Coast Range	Overall Guidance Provided	NA	NA	NA
Upper Chehalis – Willapa Hills	Independence Creek Barrier Removal	4	Lewis County Public Works/SRFB	Completed by 2015
	Nugent – Tributary to South Fork Chehalis River Barrier Removal	5	WA DNR/FFFPP	Data Not Available
	Bunker Creek Barrier Removal	6	Lewis County Conservation District/SRFB	Data Not Available
	Scammon Creek Barrier Removal	7	Lewis County Conservation District/SRFB	Completed by 2015
	Hakola – Tributary to South Fork Lincoln Creek Barrier Removal	8	WA DNR/FFFPP	Data Not Available
Upper Chehalis – Puget Lowlands	Van Ornum Creek Barrier Removal	9	Lewis County Conservation District/SRFB, FFFPP	Data Not Available
	Unnamed Tributary to Bunker Creek Barrier Removal	10	Lewis County Public Works/SRFB	Completed by 2016
	Lucas Creek Tributaries Barrier Removals	11	Lewis County Public Works/SRFB	Completed by 2022
	Middle Fork Newaukum River Barrier Removal	12	Lewis County Conservation District/SRFB	Completed by 2022
	Wisner Creek Reconnection	13	Lewis County Conservation District/SRFB	In Progress by 2022
	Salzer Creek Lower Mile Oxbow Reconnection and Riparian Restoration	14	Not Identified Yet	In Progress by 2022
	Scheuber Ditch Relocation	15	Not Identified Yet	In Progress by 2022
Upper Chehalis – Western Foothills	Overall Guidance Provided	NA	NA	NA

Table 1 (continued). List of Conceptual, Planned, and ActiveRestoration Projects by Management Area.				
Management Area	**Planned Project**	**Project Description Table No.**	**Sponsor/Funding Source(s)**	**Timeline**
Upper Chehalis – Cascade Lowlands	Overall Guidance Provided	NA	NA	NA
Cowlitz – Willapa Hills	Overall Guidance Provided	NA	NA	NA
Cowlitz – Puget Lowlands	Otter Creek Side Channel Improvement	16	Cowlitz Indian Tribe, USFS/SRFB	Completed by 2015
	Cowlitz River Borrow Pit Reclamation	17	Not Identified Yet	In Progress by 2022
	Maninfior – Curtis Creek Tributary Barrier Removal	18	WA DNR/FFFPP	Completed by 2022
Cowlitz – Western Foothills	Overall Guidance Provided	NA	NA	NA
Cowlitz – Cascade Lowlands	Lower Cispus Side Channels Restoration	19	Cowlitz Indian Tribe/SRFB	Completed by 2016
	Lower Yellowjacket Creek Design	20	Cowlitz Indian Tribe/SRFB	Completed by 2015
	Tilton River Railroad Removal	21	Not Identified Yet	In Progress by 2022
Cowlitz – Cascade Highlands	Overall Guidance Provided	NA	NA	NA
City of Centralia	China Creek Headwater Retention	22	City of Centralia/Data Not Available	Completed by 2016
	China Creek Floodwater Retention	23	City of Centralia/Data Not Available	In Progress by 2022
	Alpha Road Floodplain Storage and Riparian Restoration	24	Not Identified Yet	In Progress by 2022
City of Chehalis	Dillenbaugh Creek Restoration	25	City of Chehalis/Data Not Available	In Progress by 2022
	Newaukum River Floodplain Reconnection and Wetland Creation	26	City of Chehalis/Data Not Available	In Progress by 2022
	Fairgrounds Floodplain and Channel Restoration	27	Not Identified Yet	In Progress by 2022
City of Morton	Morton Floodplain Wetland Connection	28	Not Identified Yet	In Progress by 2022
City of Winlock	Winlock Stormwater Management	29	Not Identified Yet	Completed by 2022

Notes:

SRFB – Salmon Recovery Funding Board

FFFPP – Family Forest Fish Passage Program

NA – Not Applicable

Table 2. Upper Nisqually Channel Migration Setback.

Project Name	**Upper Nisqually Community Channel Migration Setback**
Location	**Upper Nisqually River, Lewis County**

Management Area	Nisqually
Reach ID	01-06
Project Sponsor	Nisqually Land Trust
Project Status	Proposed
Target Habitat	Floodplain
Current Ownership	Private
Zoning	Forestland
Hydrogeomorphic Classification	Floodplain
Project Size	134 acres
Strategy	Acquisition, flood control

Existing conditions	Two privately held parcels totaling 130 acres are located within the channel migration zone of the upper Nisqually River.
Project Description	Both privately held parcels would be acquired to provide additional flood storage area for the Nisqually River, benefitting both Pierce and Lewis Counties in terms of flood management and habitat protection.
Future Threats	Volcanic events and future channel migration endangering potential residents or users
Project Rationale	The acquisition of these parcels may eliminate the need for additional flood protection work in Pierce County. In addition, the acquisition of these parcels would bring flood hazard areas in Lewis County into conservation ownership for habitat and flood storage management.
Functions Restored	Natural channel migration, flood control.

In addition, removal of invasive nonnative plant species is a restoration opportunity on the main stem Nisqually River. Pierce County's Noxious Weed Control Board is currently sponsoring a Japanese Knotweed eradication program in the upper Nisqually River basin located in the Nisqually management area (Table 3).

Lewis County, Washington Shoreline Master Program

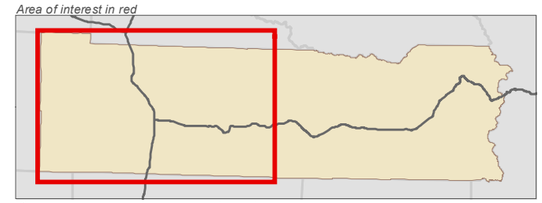
Planned Restoration Projects by Management Area

Figure 1a

Date: 6/10/2015

- Management Areas
- SMA Jurisdiction
- SMA Rivers & Streams
- SMA Lakes
- Highways
- Restoration Site
- Dams
- City
- UGA

Area of interest in red



Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

Data: Lewis County, USFWS NWI, FEMA, WA DNR, WSDOT

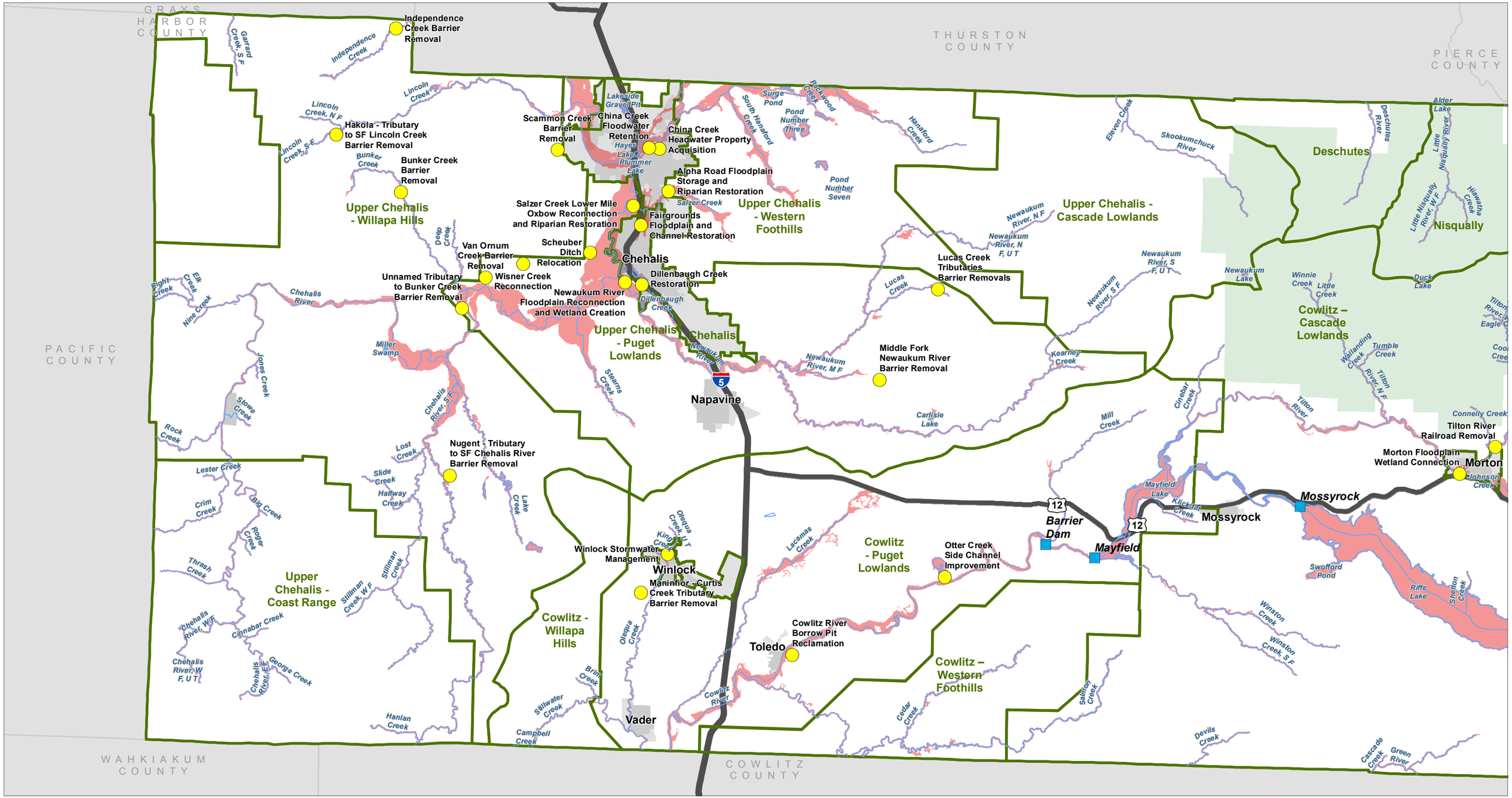
0 1 2 Miles

1:223,000

Lewis County Coalition

City of Morton

City of Winlock



Lewis County, Washington Shoreline Master Program

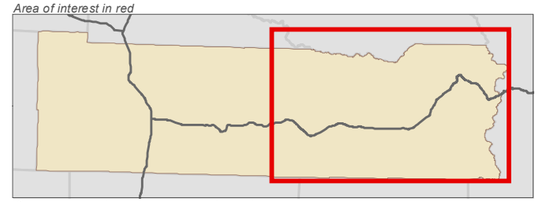
Planned Restoration Projects by Management Area

Figure 1b

Date: 6/10/2015

- Management Areas
- SMA Jurisdiction
- SMA Rivers & Streams
- SMA Lakes
- Highways
- Restoration Site
- Dams
- City
- UGA

Area of interest in red



Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

Data: Lewis County, USFWS NWI, FEMA, WA DNR, WSDOT

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Miles

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Lewis County Coalition

City of Morton

City of Winlock

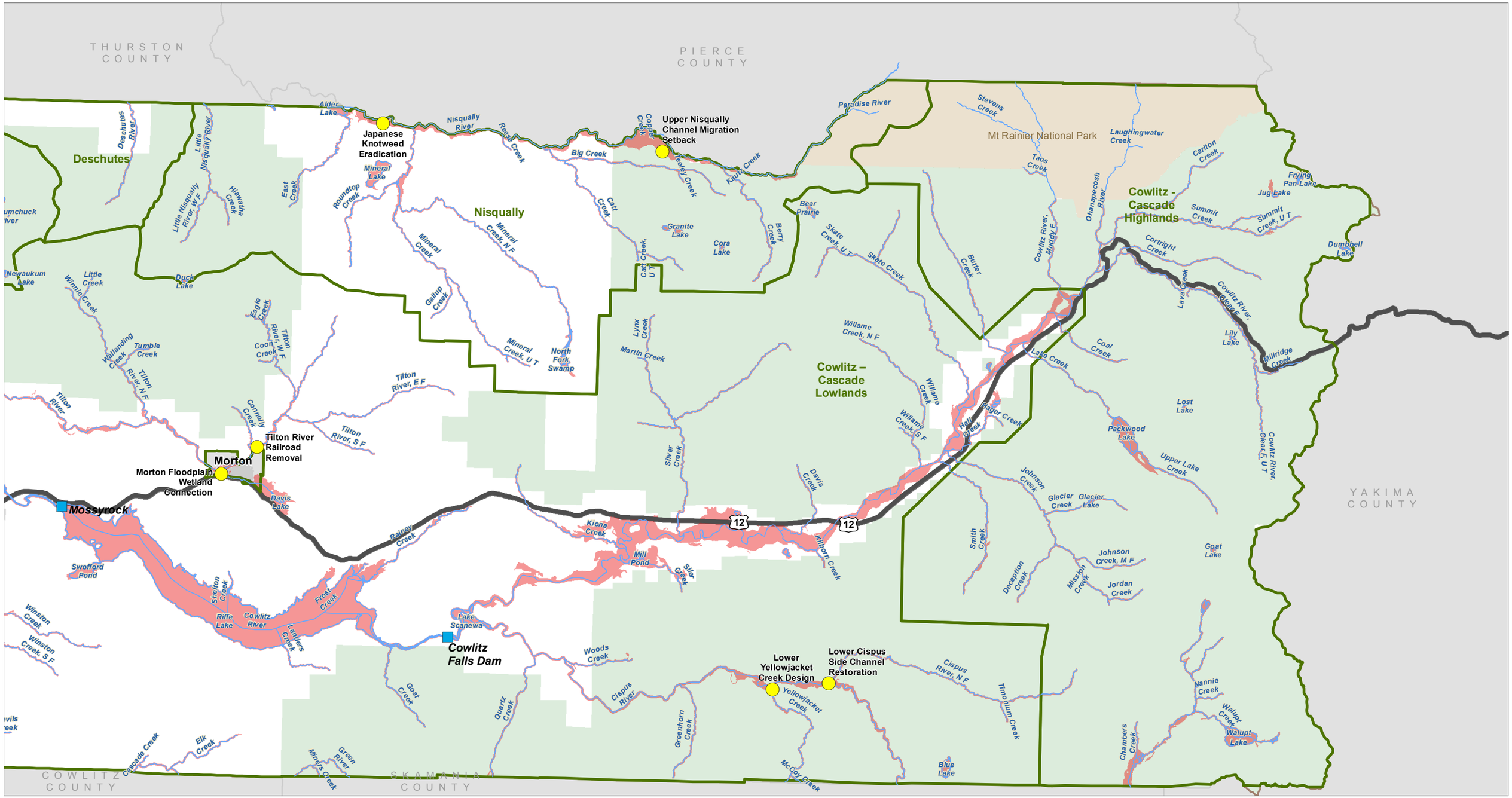


Table 3. Japanese Knotweed Eradication.			
Project Name	**Japanese Knotweed Eradication**		
Location	**Nisqually River Basin**		
		Management Area	Nisqually
		Reach ID	Multiple
		Project Sponsor	Pierce County Noxious Weed Control Board
		Project Status	Active
		Target Habitat	Riparian
		Current Ownership	Public and Private
		Zoning	Variable
		Hydrogeomorphic Classification	Main stem river and tributary streams
		Project Size	> 75 river miles + tributaries
		Strategy	Noxious nonnative plant removal
Existing Conditions	Japanese knotweed (*Polygonum cuspidatum*) infestations have been documented in the Nisqually River basin. Japanese knotweed is a very aggressive escaped ornamental that is capable of forming dense stands that crowd out other vegetation, degrading wildlife habitat. Once established, this nonnative plant is very difficult to control.		
Project Description	This project annually identifies and eradicates Japanese knotweed infestations in the Nisqually River basin.		
Future Threats	Additional planting of Japanese knotweed as an ornamental plant by private landowners.		
Project Rationale	Japanese knotweed is a very aggressive nonnative plant species that can crowd out native plant species, especially in riparian areas, which is the case for the Nisqually River basin. Eradication efforts are important to prevent Japanese knotweed from expanding to other areas within the basin.		
Functions Restored	Improved riparian functioning along the Nisqually River and its tributary streams, and improved salmonid spawning and rearing habitat.		

Habitat Benefits

Decommissioning problematic forest roads would reduce the shoreline and stream habitat degradation that follows severe erosion, particularly in upper elevation streams. This would help to improve instream habitat conditions, including pool quality, spawning gravel conditions, and water quality.

Setting back levees allows for natural channel migration, reduces flood risk, and allows for improved river habitat conditions that better support aquatic and terrestrial species.

Removal of invasive nonnative plant species helps provide more natural ecosystem functioning where removal occurs. Invasive nonnative plant species control is an important means to prevent the spread of the nonnative plant species and to ensure native plant remain well established. Native plant communities provide ecological functions that nonnative plant species cannot provide. In addition, wildlife species are adapted to use native plant species; the presence of native plant species is a key element of the success, resilience, and survival of wildlife species (Diaz et al. 2005).

Deschutes (WRIA 13)

Overview

The Deschutes management area comprises 25,773 feet (4.9 miles) of riverine shoreline that encompasses the upper basin of the Deschutes River in north central Lewis County. The headwaters of the Deschutes River and the Little Deschutes River are located in the Deschutes management area. Mitchell Creek is the largest tributary in the upper basin and is susceptible to bank cutting and mass wasting (Haring and Konovsky 1999). In addition, the headwater areas of several other creeks are located in the management area, including Lincoln Creek, Thurston Creek, and Huckleberry Creek.

Much of the management area is located in Mt. Baker – Snoqualmie National Forest, and is administered by the United States Forest Service. Commercial forestland occurs in the northwestern portion of the management area; this portion of the Deschutes River watershed is heavily impacted by historical logging practices.

Deschutes Falls at river mile (RM) 41.1 on the upper Deschutes River in Thurston County blocks anadromous fish migration from reaching the Deschutes management area. Therefore, it is unlikely that anadromous fish are able to access stream and river habitat in the Deschutes management area.

Restoration Priorities and Opportunities

The small amount of development in the management area, and the presence of a natural fish barrier outside the management area limit the restoration opportunities. Despite the lack of development, historical logging activity in the northwestern portion of the Deschutes management area presents an opportunity to decommission logging roads, especially on steep and geologically sensitive slopes. Conservation could also be used to permanently protect forestlands in the Deschutes management area.

Habitat Benefits

Decommissioning logging roads improves the hydrologic functioning of forestlands and tributary streams while decreasing the risk of catastrophic road failure and landslides, which can contribute significant quantities of fine sediment to rivers and streams producing sedimentation. Stream sedimentation causes physical habitat loss (e.g., filling of pools), degradation (e.g., increased spawning gravel embeddedness), and water quality impairment (e.g., increased turbidity). Conservation of forestland that limits or eliminates logging would improve hydrologic functioning of tributary streams, reduce sedimentation, and potentially reduce flooding impacts downstream on the Deschutes River.

Upper Chehalis – Coast Range (WRIA 23)

Overview

The Upper Chehalis – Coast Range management area comprises 311,842 feet (59.1 miles) of riverine shoreline that encompasses portions of the upper Chehalis River basin in northwestern and southwestern Lewis County. The headwaters of the East Fork and West Fork Chehalis River are located in the southwestern portion of the management area. Major creek systems associated with the Upper Chehalis – Coast Range management area include George Creek, Cinnabar Creek, Roger Creek, Thrash Creek, Crim Creek, Lester Creek, Stillman Creek, and Hanlan Creek.

The land use in the Upper Chehalis – Coast Range management area is dominated by large-scale commercial forest production. Forest road densities are typically high and often predate forest practices regulations, resulting in forest roads that are poorly sited and constructed with undersized culverts used at water crossing structures (Smith and Wenger 2001). For example, the Thrash Creek watershed has a road density of 7.6 miles per square mile (CBPHWG 2008). Correspondingly, fish passage barrier culverts are located throughout the management area, and oftentimes make up over half the culverts screened for fish passage problems (CBPHWG 2008).

Areas of channel incision have been documented in the main stem Chehalis River upstream of Pe Ell to the confluence with the South Fork Chehalis River (Smith and Wenger 2001). Areas of incision have disconnected the main stem Chehalis River from its floodplain, reducing habitat diversity and structure critical to many salmonid species (i.e., Chinook, coho, steelhead, etc.) (MBI 2003).

Two splash dams were historically operated on the Chehalis River in the Upper Chehalis – Coast Range management area near Fisk Falls and the confluence of the Chehalis River and Crim Creek (CBPHWG 2008). Operation of the splash dams resulted in channel bed incision, scouring, removal of gravel as well as large woody debris (LWD) loss.

Restoration Priorities and Opportunities

The Limiting Factors Technical Advisory Group identified restoration actions for subbasins in the Chehalis River watershed overall (Smith and Wenger 2001). The actions were generally broad in nature and included:

- Reconnecting habitats
- Increasing LWD
- Reducing sediment loads
- Rehabilitating old roads
- Restoring riparian vegetation and excluding livestock to reduce bank erosion
- Revegetating open riparian areas with native plants

- Interplanting conifers in forests dominated by deciduous species to accelerate succession, and increase LWD recruitment
- Reducing delivery of livestock waste or other pollutants to streams

Smith and Wenger (2001) found floodplain connectivity problems and a lack of off-channel habitat in Roger Creek, Mack Creek, and lower to middle George Creek. Channel incision in these impacted streams decreases the amount of off-channel habitat available to salmonids. Appropriate LWD placement in incised channels can help reconnect main stem creek systems with side channels, increasing off-channel habitat, and can be used to stabilize stream banks while providing excellent salmonid habitat. However, the limited size and relatively remote character of this management area prohibited field verification of site-specific opportunities.

Habitat Benefits

Correction of these limiting factors would improve salmonids access to spawning and rearing habitat as well as improve habitat conditions overall. Replacement of undersized culverts with larger culverts or bridges would increase salmonid spawning and rearing habitat. Improved native vegetation and increased LWD will improve both aquatic and riparian habitat. Improving water quality draining to streams would also improve aquatic habitat. Salmonid species that benefit in particular from these activities include coho, steelhead, and cutthroat trout.

Improving floodplain connectivity and off-channel habitat benefits several salmonid species, including coho and steelhead. Off-channel habitat provides critical refuge habitat and feeding opportunities for juvenile salmonids, especially during the winter and spring seasons (Smith and Wenger 2001).

Upper Chehalis – Willapa Hills (WRIA 23)

Overview

The Upper Chehalis – Willapa Hills management area comprises 652,595 feet (123.6 miles) of riverine shoreline that encompasses portions of the upper Chehalis River basin in west central Lewis County. The management area includes the main stem of the Chehalis River, and much of the South Fork Chehalis River. Major creek systems associated with the Upper Chehalis – Coast Range management area include Elk Creek, Jones Creek, Rock Creek, Lake Creek, Deep Creek, Bunker Creek, Lincoln Creek, and Independence Creek.

The land use in the Upper Chehalis – Willapa Hills management area is dominated by large scale commercial forest production (CBPHWG 2008). Forest road densities are typically high and often predate forest practices regulations. Private and county road crossings also contain fish passage barrier culverts within the management area.

Farmland and agricultural land use is common along the lower reaches of many creeks and valleys in Upper Chehalis – Willapa Hills management area.

Restoration Priorities and Opportunities

The Lewis County Conservation District performed an assessment of barrier culverts in the management area, including surveys on Bunker Creek, Stearns Creek, Van Ornum, Creek, Mill Creek, Coal Creek, and several unnamed creeks; over 75 percent of the culverts assessed in 2003 were documented as fish passage barriers (Verd 2003a). The Lewis County Conservation District performed a separate assessment of barrier culverts on Lincoln and Scammon Creeks (Verd 2004b), Independence Creek (Verd 2004c), and Scatter and Prairie Creeks (Verd 2004d). Anchor (2012) also documented numerous barrier culverts in the Upper Chehalis – Willapa Hills management area.

These assessments identified numerous fish passage improvement opportunities (projects) in the Upper Chehalis – Willapa Hills management area due to barrier culverts located throughout the management area. Implementation of these project opportunities would open salmonid access to additional habitat area, which is likely to result in increased fish survival and production. Several projects are planned to address barrier culverts in the Upper Chehalis – Willapa Hills management area, including the following:

- Lewis County Public Works has proposed to replace an existing barrier culvert on Independence Creek under Independence Creek Road at milepost 3.17 (Table 4). This culvert is ranked in the top ten of priority barrier culverts in the Chehalis Basin (Habitat Work Schedule 2015).

- DNR has proposed to replace a barrier culvert with a 3-foot outfall drop with a culvert that is 100 percent fish passable on an unnamed tributary stream that discharges to the South Fork Chehalis River (Table 5). Good salmonid habitat was identified upstream of the barrier culvert (PRISM 2015).

- The Lewis County Conservation District has proposed to replace an undersized barrier culvert located under Bunker Hill Road on Bunker Creek with a larger culvert that is 100 percent fish passable (see Table 6). This barrier culvert is the highest ranking barrier culvert in Lewis County identified for replacement (Habitat Work Schedule 2013). More barrier culverts are identified upstream on Bunker Creek and are considered restoration priorities.

- The Lewis County Conservation District has proposed to replace two barrier culverts approximately 1,000 feet apart on Scammon Creek (see Table 7). Both culverts would be replaced with larger, countersunk culverts that are 100 percent fish passable (PRISM 2015). The new culverts would provide salmonid access to 3.6 linear miles of habitat.

- The Lewis County Conservation District has also proposed to replace a barrier culvert on an unnamed tributary stream that discharges to South Fork Lincoln Creek (see Table 8). Although the unnamed tributary stream is channelized and has poor habitat quality, juvenile salmonids (likely juvenile coho) were observed downstream of the barrier culvert in the unnamed tributary stream (PRISM 2015).

Table 4. Independence Creek Barrier Removal.

Project Name	**Independence Creek Barrier Removal**
Location	**Independence Creek, Lewis County**

Photo 2: View of culvert outlet

Management Area	Upper Chehalis Willapa Hills
Reach ID	3B-02
Project Sponsor	Lewis County Public Works
Project Status	Funded
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Lewis County
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	2 culverts
Strategy	Fish passage/ barrier removal

Existing Conditions	An existing cast-in-place rectangular box culvert measuring 6 feet by 8 feet and 68-feet long at milepost 3.17 on Independence Creek Road is estimated to be 0 percent passable for salmonids due to an outfall drop of approximately 22 inches. It is ranked 8th on the County's list of priority culverts. In addition, a corrugated steel culvert located upstream (0.27 miles to the north) was estimated to be 33 percent passable due to riprap at the culvert outlet (ranked 28 on culvert priority list). Both culverts are located on Harris Road Creek near its confluence with Independence Creek.
Project Description	The existing box culvert would be replaced with a new culvert that is 100 percent salmonid passable. Lewis County would remove associated riprap from the upstream culvert to improve fish passage.
Future Threats	Future clogging of the corrugated steel culvert outlet with riprap and/or other material.
Project Rationale	This project would restore salmonid access to over 4.5 linear miles of spawning and rearing habitat and would primarily benefit coho and cutthroat.
Functions Restored	Access to salmonid spawning and rearing habitat.

Table 5. Nugent – Tributary to South Fork Chehalis River Barrier Removal.

Project Name	**Nugent – Tributary to South Fork Chehalis River Barrier Removal**
Location	**Unnamed Tributary to the South Fork Chehalis River, Lewis County**

Management Area	Upper Chehalis Willapa Hills
Reach ID	3B-19L
Project Sponsor	DNR
Project Status	Proposed
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Private
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	1 culvert
Strategy	Fish passage/ barrier removal

Existing Conditions	A culvert is located under a private road on an unnamed tributary creek to the South Fork Chehalis River. The culvert outlet has a drop of approximately 3 feet. However, heavy beaver activity has resulted in backwatered conditions at the outlet and plugging of the inlet. Habitat conditions are good upstream of the barrier culvert.
Project Description	A new, properly designed culvert would be installed that is 100 percent fish passable. A potential barrier culvert is located downstream that needs to be addressed, but does not qualify for the Family Forest Fish Passage Program as it is located on agricultural land.
Future Threats	Logging and road building in the watershed upstream of the unnamed tributary, climate change, development along the unnamed tributary below the barrier culvert.
Project Rationale	A variety of salmonids utilize the South Fork Chehalis River, including chinook, steelhead, coho, and coastal cutthroat trout.
Functions Restored	Improved salmonid access to spawning and rearing habitat on a tributary stream to the South Fork Chehalis River.

Table 6. Bunker Creek Barrier Removal.

Project Name	**Bunker Creek Barrier Removal**
Location	**Bunker Hill Road, Lewis County**

Management Area	Upper Chehalis Willapa Hills
Reach ID	3B-05
Project Sponsor	Lewis County Conservation District
Project Status	Conceptual
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Lewis County
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	1 culvert
Strategy	Fish passage/ barrier removal

Existing Conditions	An undersized culvert (1404W15A) is located near Bunker Hill Road on Bunker Creek at river mile 5.7 that presents a fish passage barrier. High quality salmonid spawning habitat is located upstream and no fish barriers are located downstream of the site on Bunker Creek; this is the highest ranking culvert barrier in Lewis County. Beaver activity regularly blocks the culvert, creating a fish passage barrier. High velocities in the culvert during high flow events also present a fish passage barrier.
Project Description	The existing culvert would be replaced with larger culvert allowing 100 percent salmonid fish passage. Removal of the culvert barrier will open 11.7 miles of habitat including the mainstem and several tributaries.
Future Threats	Increased logging and road building in the Bunker Creek watershed.
Project Rationale	A new culvert would restore salmonid access to an additional 11.7 linear miles of rearing habitat in addition to high quality spawning grounds located several miles upstream of this site.
Functions Restored	Salmonid spawning and rearing habitat, primarily for steelhead, coho, and cutthroat trout.

Table 7. Scammon Creek Barrier Removal.

Project Name	**Scammon Creek Barrier Removal**
Location	**Scammon Creek, Lewis County**

Management Area	Upper Chehalis Willapa Hills
Reach ID	3B-03
Project Sponsor	Lewis County Public Works
Project Status	Active
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Private
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	2 culverts
Strategy	Fish passage/ barrier removal

Existing Conditions	Two culverts (1403W10A and 140310B) are located on Scammon Creek under a private road and are not fish passable. The culverts appear to be undersized and are at risk of catastrophic failure during a 100-year storm event.
Project Description	The two barrier culverts will be replaced with larger, countersunk culverts that are fish passable.
Future Threats	Inaction regarding the removal of four known fish barrier culvert downstream of the project site on Scammon Creek, climate change.
Project Rationale	The two fish barrier culverts prevent salmonids from accessing 3.6 miles of stream habitat. Salmonid species include coho, steelhead, and cutthroat trout.
Functions Restored	Salmonid access to spawning and rearing habitat, including coho, steelhead, and cutthroat trout.

Table 8. Hakola – Tributary to South Fork Lincoln Creek Barrier Removal.

Project Name	**Hakola – Tributary to South Fork Lincoln Creek Barrier Removal**
Location	**South Fork Lincoln Creek, Lewis County**

Management Area	Upper Chehalis Willapa Hills
Reach ID	3B-03
Project Sponsor	DNR
Project Status	Proposed
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Private
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	1 culvert
Strategy	Fish passage/ barrier removal

Existing Conditions	A culvert is located under a private road on an unnamed tributary approximately 200 feet from its confluence with South Fork Lincoln Creek. It has a 5 percent slope and is 2 feet in diameter and approximately 24 feet long. The culvert outlet is armored with tires and is backwatered. The stream is channelized and is forested on the south side of the stream with pasture on the north side. Barrier status is unknown and the habitat quality is rated as poor.
Project Description	The tributary is a fish bearing stream and salmonids were observed downstream (likely juvenile coho). No salmonids were observed upstream of the culvert, indicating that the culvert poses a fish barrier. This project would replace the existing culvert with a 100 percent fish passable culvert.
Future Threats	Increased development of the surrounding watershed, climate change.
Project Rationale	A potential fish barrier will be removed to provide salmonids access to additional rearing habitat.
Functions Restored	Access to juvenile salmonid rearing habitat.

In addition to barrier culverts, landslides from forest roads are one of the greatest problems, in areas with moderate to steep slopes. These landslides lead to erosion and sedimentation of tributary streams (CBPHWG 2008). Sidecast forest roads (i.e., roads that include sidecast material within the road prism) in particular are susceptible to landslides. Additional restoration opportunities include decommissioning forest roads, particularly on geologically

sensitive slopes. Abandoning and decommissioning forest roads can greatly enhance tributary stream habitat and fluvial processes (CBPHWG 2008).

Smith and Wenger (2001) recommended that protection of existing lateral habitat and restoration of potential lateral habitat is a priority for Elk Creek.

Habitat Benefits

Removal of barrier culverts allows salmonids access to additional spawning and rearing habitat. Salmonid species benefitting in particular from barrier culvert corrections on small tributary streams include coho, steelhead, and cutthroat trout. Upgrading culverts also has the added benefit of reducing clogging problems and minimizing the chances of catastrophic road failure during large storm events.

Abandoning and/or decommissioning roads benefits salmonid species by reducing erosion and subsequent sedimentation of tributary streams and main stem rivers.

Upper Chehalis – Puget Lowlands (WRIA 23)

Overview

The Upper Chehalis – Puget Lowlands management area comprises 440,677 feet (83.5 miles) of riverine shoreline that encompasses portions of the upper Chehalis River basin and the Newaukum River basin in Lewis County. Major creek systems associated with the Upper Chehalis – Puget Lowlands management area include Kearny Creek, Lucas Creek, and Stearns Creek.

One of the major land uses in the Upper Chehalis – Puget Lowlands management area is agriculture and commercial forest production (CBPHWG 2008). Forest road densities are typically high and often predate forest practices regulations. Barrier culverts are located throughout the management area. The Lewis County Conservation District performed an assessment of barrier culverts in the Newaukum River watershed; over half of the culverts assessed were rated as impassable (fish passage barriers) (Verd 2002a). Anchor (2012) also documented numerous barrier culverts in the Newaukum River basin.

Restoration Priorities and Opportunities

There are numerous fish passage improvement opportunities (projects) in the Upper Chehalis – Puget Lowlands management area because of fish passage barriers located throughout the management area. Implementation of these project opportunities would open salmonid access to additional habitat area, which is likely to result in increased fish survival and production. Several projects have been proposed to address barrier culverts in the Upper Chehalis – Puget Lowlands management area, including the following:

- The Lewis County Conservation District has also proposed to replace a barrier culvert on Van Ornum Creek upstream of the proposed project by Lewis County Public Works (see Table 9). Replacement of the barrier culvert would open salmonid access to nearly 3 linear miles of tributary stream habitat (Habitat Work Schedule 2015).

- Lewis County Public Works has proposed to replace an existing barrier culvert on an unnamed tributary to Bunker Creek (see Table 10). Replacement of the barrier culvert would open salmonid access to approximately 7.7 linear miles of tributary stream habitat (Habitat Work Schedule 2015).
- Lewis County Public Works has proposed two separate barrier culvert removal projects on tributaries to Lucas Creek (see Table 11). Correction of the barrier culverts will open salmonid access to over 1.5 linear miles of tributary stream habitat (PRISM 2015). The new culverts will be designed for a 100-year storm event, decreasing the risk of catastrophic culvert failure during large storm events.
- The Lewis County Conservation District has proposed to replace a barrier culvert on the Middle Fork Newaukum River (see Table 12). Correction of the barrier culvert would open salmonid access to 3.9 linear miles of main stem river habitat to the next partial barrier culvert (Habitat Work Schedule 2015).

Additional fish barriers are located in the Upper Chehalis – Puget Lowlands management area that present further opportunities to increase habitat access. Also, the Lewis County Conservation District has proposed to create a new channel on the lower reach of Wisner Creek near its confluence with Mill Creek (see Table 13). Historical logging activities destroyed the natural stream channel, causing the creek flow to become dispersed in a flat area dominated by nonnative reed canarygrass. Creation of a new channel will restore the lost channel and will open salmonid access to approximately 1.2 linear miles of tributary stream habitat (PRISM 2015). The new channel would be approximately 500 feet long and would be revegetated using native plant species (such as cedar and cottonwood).

Table 9. Van Ornum Creek Barrier Removal.			
Project Name	**Van Ornum Creek Barrier Removal**		
Location	**Van Ornum Creek, Lewis County**		
		Management Area	Upper Chehalis Puget Lowlands
		Reach ID	3C-05L
		Project Sponsor	Lewis County Conservation District
		Project Status	Active
		Target Habitat	Salmonid spawning and rearing habitat
		Current Ownership	Private
		Zoning	Transportation
		Hydrogeomorphic Classification	Tributary stream
		Project Size	1 culvert
		Strategy	Fish passage/ barrier removal
Existing Conditions	Culvert 1403W32B is located under a private logging road is undersized, measuring 4 feet in diameter and 25 feet long with a slope > 1.5 percent. In addition, the culvert outfall has a drop of approximately 10 inches; it is estimated to be 33 percent passable for salmonids. Additional barrier culverts are upstream but are located near headwater areas.		
Project Description	The existing culvert would be replaced with a more fish-friendly culvert (i.e., larger diameter, non-perched outfall, etc.), which would open up over 4.5 linear miles of stream habitat.		
Future Threats	Two barrier culverts are located downstream, including a minor barrier culvert (1403W32C) and an impassable culvert 021(24034)(02386) should be replaced in the future for this project to be successful, increased logging activity in the watershed above the barrier culvert is also a potential threat.		
Project Rationale	A new culvert would allow salmonid species better access to habitat upstream, including 1,567 square meters of spawning habitat and 10, 275 square meters of rearing habitat.		
Functions Restored	Salmonid access to spawning and rearing habitat on a tributary stream to the Chehalis River, including coho, steelhead, and cutthroat trout.		

Table 10. Unnamed Tributary to Bunker Creek Barrier Removal.

Project Name	**Unnamed Tributary to Bunker Creek Barrier Removal**
Location	**Ceres Hill Road, Lewis County**

Photo 2: View of culvert outlet and plunge pool

Management Area	Upper Chehalis Puget Lowlands
Reach ID	3C-08L
Project Sponsor	Lewis County Public Works
Project Status	Proposed
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Lewis County
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	1 culvert
Strategy	Fish passage/ barrier removal

Existing Conditions	A precast concrete culvert 6-feet in diameter and 44-feet long is located under Ceres Hill Road (milepost 5.815). The existing culvert has a perched outfall of 12 inches and a slope of over 3 percent; the culvert is rated 0 percent passable for salmonids.
Project Description	The existing culvert would be replaced with a properly designed culvert that is 100 percent fish passable. The new culvert would restore salmonid access to an additional 7.66 linear miles of potential habitat.
Future Threats	Increased logging in the watershed above the fish passage barrier, climate change.
Project Rationale	A new culvert would restore salmonid access to an additional 7.66 linear miles of potential habitat, including 0.07 acres of spawning habitat and 2.38 acres of rearing habitat.
Functions Restored	Salmonid spawning and rearing habitat, primarily for coho and cutthroat trout.

Table 11. Lucas Creek Tributaries Barrier Removals.

Project Name	**Lucas Creek Tributaries Barrier Removals**
Location	**Lucas Creek, Lewis County**

Management Area	Upper Chehalis Puget Lowlands
Reach ID	3C-19R
Project Sponsor	Lewis County Public Works
Project Status	Conceptual
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Lewis County
Zoning	Transportation
Hydrogeomorphic Classification	Tributary stream
Project Size	2 culvert replacements
Strategy	Fish passage/ barrier removal

Existing Conditions	Undersized culverts are located under a Lewis County roadway (mile points [MP] 4.2 and 4.3, Lucas Creek Road) on tributary creeks to Lucas Creek that present fish barriers to numerous salmonid species. The culvert at MP 4.2 presents an estimated 33 percent barrier to migrating salmonids and the culvert at MP 4.3 is estimated to act as a fish barrier for 67 percent of migrating adult fish and 100 percent for juvenile fish.
Project Description	This project would replace the existing culverts with a much larger culverts that would meet the design criteria for a 100-year storm event. The culverts will also be realigned 30 degrees to encourage more natural stream functioning and to reduce high velocity and scouring characterized by the mouth of the existing culvert.
Future Threats	Increased logging and road building in the Lucas Creek watershed, climate change.
Project Rationale	The existing culvert poses a barrier to salmonid species; the new larger culvert proposed would provide salmonids access to more than 1.5 miles of spawning and rearing habitat.
Functions Restored	Salmonid access to spawning and rearing habitat, including coho, steelhead, and cutthroat trout.

Table 12. Middle Fork Newaukum River Barrier Removal.

Project Name	**Middle Fork Newaukum River Barrier Removal**
Location	**Middle Fork Newaukum River, Lewis County**

Management Area	Upper Chehalis Puget Lowlands
Reach ID	3C-16
Project Sponsor	Lewis County Conservation District
Project Status	Conceptual
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Public
Zoning	Transportation
Hydrogeomorphic Classification	River
Project Size	1 culvert
Strategy	Fish passage/ barrier removal

Existing Conditions	A significantly undersized culvert is located on the Middle Fork Newaukum River that presents a fish barrier to 3.9 miles of fish habitat. The downstream end of the culvert has a 0.3 meter drop and the culvert has a slope of 11%; it was rated as 33% passable for salmonid species likely using the Middle Fork Newaukum River, including Chinook, steelhead, coho, and coastal cutthroat trout.
Project Description	The culvert located on Middle Fork Newaukum River is undersized and needs to be replaced with a larger, better designed culvert that is 100 percent fish passable.
Future Threats	Additional impassible barriers further upstream (the first of which is located 3.9 miles upstream), increased logging and road building in the Middle Fork Newaukum watershed, increased development in the Middle Fork Newaukum River floodplain.
Project Rationale	Culvert barrier removal will provide salmonids access to 3.9 miles of river habitat upstream of the culvert.
Functions Restored	Salmonid access to spawning and rearing habitat, including chinook, chum, coho, steelhead, and cutthroat trout.

Table 13. Wisner Creek Reconnection.

Project Name	**Wisner Creek Reconnection**
Location	**Wisner Creek, Lewis County**

Management Area	Upper Chehalis Puget Lowlands
Reach ID	3C-05L
Project Sponsor	Lewis County Conservation District
Project Status	Proposed
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Private
Zoning	Forestry
Hydrogeomorphic Classification	Tributary stream
Project Size	~500 feet of stream channel
Strategy	Channel restoration

Existing Conditions	Historic logging activities destroyed a section of the Wisner Creek channel near its confluence with Mill Creek. Local landowners learned that salmon historically utilized Wisner Creek, and contacted the Lewis County Conservation District as to why salmon no longer utilized the creek. An investigation of Wisner Creek found that the creek discharges into a flat grassy area dominated by reed canarygrass, causing the flow to become dispersed. The lack of a defined channel along this area essentially disconnects Wisner Creek and prevents salmonids from utilizing habitat upstream.
Project Description	A new channel approximately 500 feet in length will be constructed through the flat grassy area to reconnect Wisner Creek and to allow salmonids to access approximately 1.2 miles of habitat. The new channel will be planted with native vegetation and measures will be taken to control the reed canarygrass present at the site. Cages will also be installed around tree planting to protect against wildlife damage.
Future Threats	Increased logging in the watershed above the restoration site, climate change, invasive nonnative species (i.e., reed canarygrass, Himalayan blackberries, etc.).
Project Rationale	Salmonids are unable to utilize spawning and rearing habitat on Wisner Creek due to a modification of the stream channel near its confluence with Mill Creek. In addition, local landowners are supportive of the project and remember when salmon used to use the creek over 50 year ago.
Functions Restored	Salmonid passage to spawning and rearing habitat, including coho, steelhead, and cutthroat trout.

Smith and Wenger (2001) also recommended water quality improvement activities in this management area. They include:

- Reduce water withdrawals from both surface and ground sources.
- Restore riparian vegetation in tributaries (prioritize tributaries with warm water problems) and along the main stem Chehalis River, particularly between Porter and Newaukum Creeks.
- Reduce fine sediment transport by addressing excess fine sediment inputs at their sources (sites are prioritized in the main stem Streambed/Sediment section). Activities that promote the maintenance and increase of instream LWD would also help address this problem, particularly in high priority tributaries; upper Chehalis, and Newaukum River.
- Address low dissolved oxygen levels associated with high nutrient concentrations by reducing livestock and urban waste inputs.
- Increase activities that lead to natural recharges in the aquifers. Both flow and water quality are highly dependent on adequate summer flows. These flows are supplied by groundwater. Loss of wetlands, artificial diversion of floodwaters through ditching, and groundwater withdrawals all contribute to a loss of water quality and summer flows in the Chehalis Basin.

Reconnecting the main stem Chehalis River and its tributaries with their floodplains is another restoration priority. The low gradient area where many of the tributaries meet south and west of the City of Chehalis has several site-specific opportunities. These include two projects to restore floodplains in this area (Tables 14 and 15). Reconnecting main stem rivers with oxbow lakes provides an excellent means to accomplish floodplain connectivity while creating high quality habitat for salmonids and other aquatic organisms.

Fish tissue sampling to monitor dioxin levels, and evaluation of pollutant sources and possible corrective actions, is a restoration opportunity in Reach 3C-20. This activity would also apply to the rest of the waterbody located in the Chehalis management area, an unnamed lake and wetland (Reach CH-06) associated with Dillenbaugh Creek.

Habitat Benefits

Removal of barrier culverts allows salmonids access to additional spawning and rearing habitat. Salmonid species benefitting in particular from barrier culvert corrections on small tributary streams include coho, steelhead, and cutthroat trout. Upgrading culverts also has the added benefit of reducing clogging problems and minimizing the chances of catastrophic road failure during large storm events.

Water quality improvement activities would likely result in improved aquatic habitat conditions for fish and wildlife species. These activities are also likely to improve water quantity, thereby increasing effective aquatic habitat area.

Table 14. Salzer Creek Lower Mile Oxbow Reconnection and Riparian Restoration.

Project Name	**Salzer Creek Lower Mile Oxbow Reconnection and Riparian Restoration**
Location	**Chehalis River/Salzer Creek Confluence**

Management Area	Upper Chehalis Puget Lowlands
Reach ID	3C-03
Project Sponsor	Unknown
Project Status	Conceptual
Target Habitat	Floodplain/off-channel, riparian
Current Ownership	Private
Zoning	Agricultural
Hydrogeomorphic Classification	Tributary stream
Project Size	~8 acres
Strategy	Floodplain reconnection, riparian restoration

Existing Conditions	After flowing under I-5 and Airport Road, Salzer Creek flows approximately 1,500 feet before reaching the confluence with the Chehalis River. A Chehalis River oxbow lake/pond is located south of Salzer Creek, but is connected to the creek only during 2-year flow events. The Chehalis River is also 303d listed for temperature, which is due in part to a lack of riparian shading along the main stem and its tributary streams.
Project Description	Salzer Creek would be reconnected with the oxbow by regrading the Salzer Creek channel so that it enters the northeast end of the oxbow and discharges through a new channel at the northwest end of the oxbow. Invasive plants would be removed and replaced with native plantings, with a focus on establishing a 100-foot-wide riparian buffer.
Future Threats	Increased development of the Salzer Creek basin leading to poorer water quality.
Project Rationale	Salzer Creek supports a variety of salmonid species and has experienced flooding problems, both of which would be addressed with this project.
Functions Restored	Oxbow reconnection, riparian restoration and increased stream shading during summer, wetland creation and restoration, improved salmonid resting and rearing habitat, improved riparian habitat and lower water temperatures.

Table 15. Scheuber Ditch Relocation.			
Project Name	**Scheuber Ditch Relocation**		
Location	**Chehalis, Washington**		
		Management Area	Upper Chehalis Puget Lowlands
		Reach ID	3C-03
		Project Sponsor	Unknown
		Project Status	Conceptual
		Target Habitat	Tributary stream
		Current Ownership	Private, City of Chehalis
		Zoning	Agricultural
		Hydrogeomorphic Classification	Tributary stream
		Project Size	More than 2 miles of stream
		Strategy	Floodplain reconnection, flood reduction, stream and wetland restoration
Existing Conditions	Scheuber Ditch collects drainage from several small tributaries to the west and agricultural land to the east, routing drainage to the north to the Chehalis River at approximately RM 71.5. The ditch has experienced flooding problems historically. The City of Chehalis owns a poplar farm on the north side of SR-6. The ditch likely is used by salmonids and other fish species originating the Chehalis River.		
Project Description	A new channel would be excavated and connected to the SR-6 oxbow. A series of wetlands would be excavated on both sides of the new channel for additional floodwater storage and ecosystem functioning. Invasive plant species would be removed and replaced with a 100-foot-wide riparian areas on each side of the channel. LWD would also be placed in the new channel and the SR-6 oxbow for additional habitat value.		
Future Threats	Increased development in the Scheuber ditch watershed decreasing water quality through both pollutant-generating impervious surfaces and agricultural runoff.		
Project Rationale	The Scheuber Ditch experiences flooding problems periodically and provides minimal habitat value; construction of a new channel to the SR-6 oxbow would provide excellent habitat value to a variety of salmonids and would alleviate flooding problems in the Scheuber Ditch area.		
Functions Restored	Natural stream functioning, riparian vegetation and stream shading, wetland restoration and floodwater retention, flood reduction.		

Reconnecting main stem rivers with oxbow lakes improves salmonid access to high quality habitat. Species benefitting in particular include juvenile Chinook, coho, steelhead, and cutthroat trout. These projects also provide the opportunity to increase wetland habitat, which benefits numerous plant and animal species, and provides floodplain connectivity and improved flood control.

Upper Chehalis – Western Foothills (WRIA 23)

Overview

The Upper Chehalis – Western Foothills management area comprises 141,231 feet (26.7 miles) of riverine shoreline that encompasses portions of the upper Chehalis River basin in northwestern Lewis County. The management area includes a small portion of the North Fork Newaukum River and several creek systems, including South Hanaford Creek, Hanaford Creek, and Salzer Creek.

Restoration Priorities and Opportunities

Restoration opportunities in the Upper Chehalis – Puget Lowlands management area should focus on removing fish barriers. Anchor (2012) documented culvert barriers on Salzer Creek, Coal Creek, and several unnamed tributaries to these systems. The Lewis County Conservation District also performed a culvert barrier assessment on Hanaford Creek; over half of the culverts were rated impassable (barrier culverts) (Verd 2002b).

Habitat Benefits

Removal of barrier culverts allows salmonids access to additional spawning and rearing habitat. Salmonid species benefitting in particular from barrier culvert corrections on small tributary streams include coho, steelhead, and cutthroat trout. Replacing a culvert with a bridge has the added benefit of restoring natural hydrogeomorphic processes to Coal Creek and minimizes the chances of catastrophic road failure during large storm events. Construction of the bridge will have the added benefit of allowing proper hydraulic function, passage of woody debris, and decrease flooding issues in the immediate area.

Reconnecting tributary streams with oxbow lakes improves habitat access to a variety of salmonids, including juvenile Chinook, coho, steelhead, and cutthroat trout. These projects also provide the opportunity to increase wetland habitat, which benefits numerous plant and animal species, and provides floodplain connectivity and improved flood control.

Upper Chehalis – Cascade Lowlands (WRIA 23)

Overview

The Upper Chehalis – Cascade Lowlands management area comprises 123,987 feet (23.5 miles) of riverine shoreline that encompasses the upper Newaukum and Skookumchuk basins. The upper Newaukum basin includes the North Fork and South Fork Newaukum River watersheds. Both watersheds have steep terrain with steep stream gradients (CBPHWG 2008). Newaukum Lake is also located in the management area.

The land use in the management area is dominated by large-scale commercial forest production. Sedimentation associated with forest roads can be problematic, especially in cases where sidecast roads are constructed on steep slopes. Poor stormwater management along forest roads and clearcut harvesting on unstable slopes can increase landslide rates (LCCD 2012).

Restoration Priorities and Opportunities

Abandoning and decommissioning forest roads and railroads built before forest practices regulations became established would help reduce the risk of landslides, and other sources of fine and associated sedimentation. A Landslide Hazard Zonation project completed for the upper portions of the North Fork and South Fork Newaukum River watersheds will also help target forest roads in need abandonment or decommissioning (LCCD 2012).

Habitat Benefits

Abandoning and/or decommissioning roads and railroads benefits salmonid species by reducing erosion and subsequent sedimentation of tributary streams and main stem river beds. It also improves water quality by eliminating contamination from old road and railroad materials, such as creosote-treated timbers and road dust.

Cowlitz – Willapa Hills (WRIA 26)

Overview

The Cowlitz – Willapa Hills management area comprises 33,765 feet (6.4 miles) of riverine shoreline that encompasses a western portion of the Lower Cowlitz Basin. The Cowlitz Willapa Hills management area has several creeks, including Stillwater Creek, Brim Creek, and King Creek, all of which ultimately discharge to Olequa Creek.

Much of the management area is under commercial timber production and contains an extensive road network that, in some cases, predates forest practices regulations. The main stem of Stillwater Creek contains potentially productive habitat for coho and winter steelhead and is rated a Tier 1 (highest priority) subwatershed for restoration (LCFRB 2010b).

Restoration Priorities and Opportunities

Restoration opportunities in the Cowlitz – Willapa Hills management area should focus on rehabilitating riparian areas, and the floodplain along the main stem Stillwater Creek (LCFRB 2010b). Improved management and restoration of commercial forestlands in the management area should also be a priority to improve the hydrologic functioning, and habitat value of tributary streams.

Habitat Benefits

Floodplain restoration along the main stem Stillwater Creek would provide a variety of habitat benefits, including improved cover, foraging, resting, and spawning conditions for adult and juvenile salmonids. Projects that include levee setbacks would provide the added benefit of flood control as the creek becomes less restricted.

Cowlitz – Puget Lowlands (WRIA 26)

Overview

The Cowlitz – Puget Lowlands management area comprises 463,043 feet (87.7 miles) of riverine shoreline that encompasses the lower Cowlitz River from the southern Lewis County

border to the confluence of the Cowlitz River with Mayfield Lake. Mayfield Lake is a 13.5-mile-long reservoir created by Mayfield Dam (River Mile 52) built in 1962. A few miles downstream of Mayfield Dam is another dam, Barrier Dam (River Mile 49.5), which was constructed by the salmon hatchery nearby as a collection facility for trapping and hauling fish into the upper basin. The management area also includes the lower Tilton River and several large tributary creeks, including Olequa Creek, Lacamas Creek, Salmon Creek, Mill Creek, Cinebar Creek, and Klickitat Creek.

The natural river flow in this portion of the Cowlitz River has been altered by hydro-regulation associated with the construction of Mayfield Dam (LCFRB 2010b). Under hydro-regulation, the spring freshet in the lower Cowlitz River has been attenuated while higher average flows now occur during the summer, fall, and winter (LCFRB 2010b). In addition, hydro-regulation has changed the sediment transport dynamics of the lower Cowlitz River, disrupting sediment and LWD transport below the series of dams. The system of dams on the main stem Cowlitz River, beginning with Mayfield Dam, blocks all volitional access to the upper basin which consists of over 300 or more miles of habitat for salmonids (LCFRB 2010a, 2010b).

The main stem of the Cowlitz River and many larger creeks are located in areas with agriculture, rural residential, or urban land uses. Channelization and construction of levees has disconnected the main stem Cowlitz River with its floodplain and degraded salmonid habitat (LCFRB 2010b). Riparian vegetation removal and bank hardening along many areas of the lower Cowlitz River has affected critical salmonid habitat. The lack of a mature riparian forest reduces LWD recruitment, and other habitat forming features for salmonids.

Restoration Priorities and Opportunities

Restoring floodplain functioning on the main stem Cowlitz River presents a major restoration opportunity (LCFRB 2010b). The recently completed Brim Bar Side-Channel Rehabilitation project (Habitat Work Schedule 2013) on RM 42.7 of the Cowlitz River is an excellent example of a floodplain restoration project. This project used engineered logjams to enhance flows from the main stem Cowlitz River into a side channel which feeds into beaver ponds at the downstream end, improving holding, rearing, and refuge habitat for salmonids.

Restoring salmonid spawning habitat below Mayfield Dam is another restoration opportunity for the lower Cowlitz River. In 2002, Tacoma Power received a new 35-year license from the Federal Energy Regulatory Commission (FERC) to operate Mayfield Dam, Mossyrock Dam, and the Barrier Dam (LCFRB 2010b). As part of the FERC license, Tacoma Power must augment spawning gravel and LWD in the lower Cowlitz River among other provisions (LCFRB 2010b).

An additional restoration opportunity includes enhancement of existing habitat features on the lower Cowlitz River to mitigate the effects of hydro-regulation. An excellent example is the Otter Creek Side Channel Improvement project proposed by the Cowlitz Indian Tribe in cooperation the United States Forest Service, which intends to increase flow in an existing side channel while maintaining the side channel habitat characteristics (Table 16). Another example of this type of project would be to reconnect borrow pit areas near the Town of Toledo (Table 17). These projects would not only improve off-channel habitat, but would also reduce downstream flooding by increasing flood storage. Abandoned or inactive borrow pits

can serve as a low-cost source of excellent off-channel habitat when located in floodplains (USFWS 1994). Connecting abandoned or inactive borrow pits would also directly address impairments described in the Shoreline Inventory and Characterization report, such as diking and channel simplification (Herrera 2013).

Table 16. Otter Creek Side Channel Improvement.

Project Name	**Otter Creek Side Channel Improvement**
Location	**Downstream of Otter Creek/Cowlitz River confluence, Lewis County**

Management Area	Cowlitz – Puget Lowlands
Reach ID	4B-11R
Project Sponsor	Cowlitz Indian Tribe
Project Status	Active
Target Habitat	Salmonid spawning and rearing habitat
Current Ownership	Private
Zoning	Floodplain
Hydrogeomorphic Classification	Floodplain channel
Project Size	1,750 linear feet of side channel
Strategy	Floodplain connectivity

Existing Conditions	This portion of the Cowlitz River provides spawning and rearing habitat for spring and fall chinook, coho, winter and summer steelhead, and coastal cutthroat trout. Instream and riparian habitat have been simplified due to hydro-regulation of the river below Mayfield and Mossyrock Dams, channel and levee construction, reduced wood inputs from upstream sources, and shoreline development. The lack of habitat quantity and complexity limits juvenile salmonid rearing, especially for juvenile coho, which are designated a Primary population by the Lower Columbia Salmon Recovery Subbasin Plan.
Project Description	The goal of this project is to improve rearing and spawning habitat for salmonids in an existing side channel of the Cowlitz River below the confluence with Otter Creek and Cowlitz River at river mile 42.5. The project seeks to increase flow into the side channel, especially during low flow periods, and will need to perform precise modeling to ensure the project increases flow to the side channel while maintaining the side channel habitat characteristics. The side channel is approximately 1,750 feet long.
Future Threats	Increased development along the mainstem Cowlitz River and Otter Creek watershed, climate change.
Project Rationale	Since natural habitat forming processes are constrained by dams upstream, enhancing existing side channels and mid-channel bars are recommended by the Lower Columbia Fish Recovery Board. The project site falls with tier 1 (highest priority) reach on the Cowlitz River (Mid Cowlitz 6A) for coho and the reach has high production potential for chum and winter steelhead.
Functions Restored	Salmonid spawning and rearing habitat, with coho benefitting the most, improved riparian functioning, improved floodplain connectivity at a range of flows, encourage gravel sorting and pool formation, provide off-channel refuge for salmonids during high flow events.

Table 17. Cowlitz River Borrow Pit Reclamation.

Project Name	**Cowlitz River Borrow Pit Reclamation**
Location	**Lower Cowlitz River near Toledo, Lewis County**

Management Area	Cowlitz – Puget Lowlands
Reach ID	4B-10L
Project Sponsor	Unknown
Project Status	Conceptual
Target Habitat	Off-channel
Current Ownership	Private and Lewis County
Zoning	Agricultural and Recreational
Hydrogeomorphic Classification	Floodplain
Project Size	About 1 square mile
Strategy	Floodplain connectivity

Existing Conditions	Numerous historic borrow pits are located in the floodplain of the Cowlitz River near Toledo. In most cases, roads have been built around the former borrow pits, preventing connection with the main stem river. The parcels are in a mix of ownership, with a few of the lakes owned by private individuals. The central pond is publically owned by Lewis County.
Project Description	A feasibility analysis would need to be performed to determine how connectivity with the former borrow pits would be accomplished. Ideally, the hydrologic connection between the Cowlitz River and one or more of the borrow pits would need to be maintained at a variety of flow rates. Following reclamation, these areas would likely develop into complex ecosystems due to frequent flooding during the wet season. They would also provide off-channel storage of flood flows, decreasing erosion and flooding downstream.
Future Threats	Invasive aquatic plant and nonnative fish establishment in inactive borrow pits.
Project Rationale	Inactive or abandoned borrow pits located on floodplains present a potential opportunity to expand and enhance off-channel habitat and flood storage. These features can be used as rearing areas for a variety of juvenile salmonids and in some cases, spawning habitat. They may also provide off-channel storage for flood flows.
Functions Restored	Off-channel habitat, floodplain connectivity.

As noted in previous management area discussions, improper sizing and angling of culverts located under roads can create fish passage barriers, preventing salmonids from accessing spawning and rearing habitat. In the Cowlitz Puget Lowlands management area, DNR has proposed replacing a barrier culvert located at the confluence of an unnamed creek and Curtis Creek, which ultimately discharges to Olequa Creek (Table 18). A culvert with a 24-inch

outfall drop poses a fish barrier. Replacement with a larger culvert that is 100 percent fish passable would provide salmonids access to 0.2 linear miles of spawning and rearing habitat (PRISM 2015).

Table 18. Maninfior – Curtis Creek Tributary Barrier Removal.

Project Name	**Maninfior – Curtis Creek Tributary Barrier Removal**		
Location	**Curtis Creek, Lewis County**		
		Management Area	Cowlitz – Puget Lowlands
		Reach ID	4B-04R
		Project Sponsor	DNR
		Project Status	Proposed
		Target Habitat	Salmonid spawning and rearing habitat
		Current Ownership	Private
		Zoning	Transportation
		Hydrogeomorphic Classification	Tributary stream
		Project Size	1 culvert
		Strategy	Fish passage/ barrier removal
Existing Conditions	An unnamed tributary stream to Curtis Creek contains partial barrier culvert is located under a logging road. The existing culvert is 30-inches wide, made of corrugated steel, and has an outfall drop of 24 inches, giving it a 33-percent fish passable rating. The tributary is fish-bearing, containing resident cutthroat trout upstream of the culvert. Chinook, coho, steelhead, and cutthroat trout spawn in Olequa Creek approximately 1.2 miles downstream of the project site.		
Project Description	The project would replace the existing culvert with a larger, properly sited culvert resulting in a 100 percent passability rating.		
Future Threats	A county road crossing and 2-foot wide concrete box culvert on the unnamed tributary approximately 0.2 miles upstream poses another fish passage barrier; the barrier assessment form suggested replacing the existing undersized culvert with a 9-foot wide countersunk culvert.		
Project Rationale	Removal of the culvert under the private road in addition to the replacement of the county road crossing/culvert upstream would open approximately 0.2 miles of spawning and rearing habitat upstream.		
Functions Restored	Salmonid access to spawning and rearing habitat on a small tributary stream to Curtis Creek.		

Habitat Benefits

Floodplain restoration along the main stem Cowlitz River would provide a variety of habitat benefits, including improved cover, foraging, resting, and spawning conditions for adult and juvenile salmonids. When implemented, the Otter Creek Side Channel Design project will ensure flow in a side channel under a range of flows in the main stem Cowlitz River,

encourage gravel sorting and pool formation, improve rearing and cover habitat, and provide off-channel refuge during high flow events. The same would be true for the proposed Cowlitz River Borrow Pit Reclamation project. Floodplain restoration projects that include levee setbacks would provide the added benefit of flood control as the river becomes less restricted. Floodplain restoration projects can also result in localized water quality and quantity improvements by increasing groundwater recharge, which moderates summer flows and water temperatures.

Spawning gravel augmentation in the lower Cowlitz River below Mayfield Dam would greatly improve spawning conditions for a variety of salmonids, especially fall Chinook, which primarily spawn in the main stem Cowlitz River (LCFRB 2010b).

Removal of barrier culverts allows salmonids access to additional spawning and rearing habitat. Salmonid species benefitting in particular include coho, steelhead, and cutthroat trout. When designed properly, upgrading culverts can have the added benefit of reducing clogging problems and minimizing the chances of catastrophic road failure during large storm events.

Cowlitz – Western Foothills (WRIA 26)

Overview

The Cowlitz – Western Foothills management area comprises 182,345 feet (34.5 miles) of riverine shoreline that encompasses a western portion of the Lower Cowlitz Basin, including two large tributary systems, Salmon Creek and Cedar Creek.

Much of the management area is under commercial timber production and contains an extensive road network that in many cases predates forest practices regulations. Many forest road culverts have created fish passage barriers that prevent salmonids from accessing spawning and rearing habitat in small tributary streams.

Restoration Priorities and Opportunities

A restoration priority for the Cowlitz Western Foothills management area is the removal of barrier culverts that restrict salmonids' ability to access spawning and rearing habitats. Salmonid species that benefit in particular from culvert retrofits in smaller stream systems include coho, steelhead, and cutthroat trout. Implementation of new forest practices outlined in DNR's Habitat Conservation Plan, State Forest Practices Rules, and the Northwest Forest Plan will improve habitat conditions for a variety of salmonids (LCFRB 2010a).

Another restoration priority should focus on restoring riparian vegetation along Salmon Creek, which contains productive habitat for coho and winter steelhead (LCFRB 2010b). This should include multiple vegetation strata (ground cover, shrubs, and trees) to maximize ecological functions.

Habitat Benefits

Adopting and effectively implementing new forest practices in commercial and private forest operations will provide numerous habitat benefits. Removing fish passage barriers restores

salmonid access to spawning and rearing habitats. Protecting riparian buffers increases stream and river shading, lowers water temperatures, reduces sedimentation, provides a LWD source, and improves habitat diversity for salmonids.

Cowlitz – Cascade Lowlands (WRIA 26)

Overview

The Cowlitz – Cascades Lowlands management area comprises 1,666,781 feet (315.7 miles) of riverine shoreline that encompasses portions of the upper Cowlitz basin. Several large reservoirs are located in the Cowlitz Cascades Lowlands management area, including the 23.5-mile-long Riffe Lake created by Mossyrock Dam. Mossyrock Dam is 606 feet high and does not contain any fish passage structures (LCFRB 2010a). Also included is the 11-mile-long Lake Scanewa created by Cowlitz Falls Dam. Natural lakes in the management area include Davis Lake and Blue Lake. Major river systems in the management area include the Cispus River and Tilton River. Numerous creek systems are located in the management area; larger creeks include Skate Creek, Williams Creek, Silver Creek, Wallanding Creek, Winston Creek, Quartz Creek, Greenhorn Creek, and Yellowjacket Creek.

Hydropower development in the management area has significantly altered the Cowlitz River flows, degraded habitat, and blocked salmonid fish passage and movement to their historical spawning and rearing areas. The hydropower system is the primary factor for the decline in salmonid numbers in the upper Cowlitz basin (LCFRB 2010a). Salmonid access in the management area is currently limited due to several reservoirs; adult and juvenile salmon are currently trucked around the system of dams. Regional recovery objectives for the upper Cowlitz basin include restoring salmonid populations to viable levels, where fish are productive, abundant, exhibit multiple life history strategies, and utilize significant portions of the basin (LCFRB 2010a).

Agricultural land use along the main stem of Cowlitz River and Tilton River has resulted in numerous channel modifications, including diking, filling, and draining of floodplains and wetlands (LCFRB 2010a).

Much of the Tilton River watershed and reservoir tributary basins are managed for commercial timber production (LCFRB 2010a). Historical logging activity in these watersheds has degraded salmonid habitat, including reduced riparian habitat, increased sediment loads, and altered stream flow. Furthermore, many forest road culverts have created fish passage barriers that prevent salmonids from accessing spawning and rearing habitats in small tributary streams.

The Cispus River watershed experienced several major stand replacement fires during the early 20th century (Habitat Work Schedule 2013). In addition, riparian and in-stream salvage logging, stream cleaning, and road building occurred in the watershed for decades. Finally, a large flood event in 1996 caused widespread avulsions in the river, and destroyed riparian stands (Habitat Work Schedule 2013). The result of these activities and the 1996 flood have led to the destabilization of the main stem Cispus River and numerous creeks, which now exhibit low channel stability, a lack of stable LWD, rapid bank erosion, isolation of floodplain terraces, and marginal side channel habitat.

Restoration Priorities and Opportunities

A restoration priority is to augment and restore side channel habitat along the main stem of rivers and creeks. The Lower Cispus Side Channels Restoration project (Table 19) proposed by the Cowlitz Indian Tribe is a good example of off-channel habitat restoration. The project site is located in a Tier 1 reach (highest priority reach) in the Lower Columbia Salmon Recovery Plan (LCFRB 2010a). The project will re-create, restore, and connect off-channel habitat disconnected or destroyed over the past century along two historical side channels on the Cispus River. One side channel is located downstream of the confluence with the Cispus River and the North Fork Cispus while the other side channel is located above the confluence of the Cispus River and Yellowjacket Creek (PRISM 2015). One of the project goals is to excavate the existing side channels to increase the interception of shallow groundwater, which can provide excellent water quality conditions (thermal refugia) for salmonids.

Another restoration priority is to enhance ecosystem functioning in tributary streams. The Lower Yellowjacket Creek project (Table 20) proposed by the Cowlitz Indian Tribe would increase the volume of stable wood in the project reach, increase island stability, encourage riparian growth along stream banks and islands, and increase the overall wood volume in the project reach. Project reaches are located on the main stem Yellowjacket Creek near its confluence with the Cispus River (PRISM 2015). The goal of the project is to evaluate the scale of action required to restore stream habitat in the lower Yellowjacket Creek over the long term. The lower Yellowjacket Creek main stem is also designated as a Tier 1 reach in the Lower Columbia Salmon Recovery Plan (LCFRB 2010a).

Restoring volitional salmonid access above Mayfield, Mossyrock, and Cowlitz Falls Dams is another project opportunity suggested by the Lower Columbia Fish Recovery Board (2010a). The dam system on the Cowlitz River prevents volitional access to 300 or more linear miles of river and stream habitats. A site-specific project in this area might be to remove the decaying and out-of-use Tilton River Railroad (Table 21). This project would not only improve habitat conditions, but would improve water quality by eliminating contamination of the river from the decaying railroad infrastructure. It would also remove alluvial impairments documented in the Shoreline Inventory and Characterization (i.e., armoring and channel simplification: Herrera 2013).

Table 19. Lower Cispus Side Channels Restoration.

Project Name	**Lower Cispus Side Channels Restoration**
Location	**Cispus River, Lewis County**

Management Area	Cowlitz Cascade Lowlands
Reach ID	4D-49
Project Sponsor	Cowlitz Indian Tribe
Project Status	Active
Target Habitat	Salmonid rearing habitat
Current Ownership	Federal
Zoning	National Forest
Hydrogeomorphic Classification	Side channel
Project Size	~1,800 feet of side channel
Strategy	Floodplain connectivity

Existing Conditions	The Cispus River watershed has sustained several large fires in the early 20th century in addition to salvage logging, stream cleaning, riparian logging, diking, and road building on the Cispus River. Several large floods have altered the mainstem Cispus River, resulting in large reductions in low-velocity rearing habitat, isolation of floodplain terraces, rapid bank erosion, and low channel stability. Adult spring chinook, coho, and steelhead are currently trucked from the lower Cowlitz River around several barrier dams (Mayfield Dam, Mossyrock Dam, etc.) and released near the project site.
Project Description	This restoration project will re-create, restore, and connect off-channel habitat disconnected or destroyed over the past century. The Cowlitz Indian Tribe proposes to partner with Gifford Pinchot National Forest to create two off-channel salmonid rearing areas; including, one channel approximately 1,100 feet long excavated into the floodplain terrace parallel to the North Fork Cispus River, and one existing channel approximately 700 feet long to be deepened parallel to Yellowjacket Creek near its confluence with the Cispus River. Each channel will be designed to intercept shallow groundwater and approximately 60 pieces of large woody debris will be placed in the new channels for cover structure and flow diversity for juvenile salmonid rearing.
Future Threats	Increased logging and road building in the Cispus River watershed, climate change.
Project Rationale	Several salmonid species spawn in the vicinity of the project site, including spring Chinook, coho, and steelhead. Historic logging activities have severely degraded habitat in the lower Cispus River, and the main stem is largely disconnected from the floodplain. The lack of side channel habitat is a limiting factor for juvenile salmonids, which use these areas for cover, shelter, and prey acquisition. The principal species benefitting from these off-channel habitats would be juvenile coho and winter steelhead.
Functions Restored	Juvenile coho and winter steelhead rearing habitat, improved riparian functioning, floodplain connectivity restored.

Table 20. Lower Yellowjacket Creek Design.			
Project Name	**Lower Yellowjacket Creek**		
Location	**Yellowjacket Creek, Lewis County**		
		Management Area	Cowlitz Cascade Lowlands
		Reach ID	4D-48
		Project Sponsor	Cowlitz Indian Tribe
		Project Status	Proposed
		Target Habitat	Salmonid spawning and rearing habitat
		Current Ownership	Federal
		Zoning	National Forest
		Hydrogeomorphic Classification	Alluvial
		Project Size	1.1 miles of creek
		Strategy	Installation of LWD
Existing Conditions	Yellowjacket Creek is a large tributary to the Cispus River that supports a variety of salmonids, including spring Chinook, coho, and steelhead. The lower Yellowjacket Creek watershed has sustained several large fires in the early 20th century. Salvage logging, stream cleaning, riparian logging, diking, and road building has also occurred on Yellowjacket Creek. Several large floods, including a very large flood in 1996, altered the Yellowjacket Creek floodplain, resulting in large reductions in low-velocity rearing habitat, isolation of floodplain terraces, rapid bank erosion, decreased riparian vegetation, and low channel stability.		
Project Description	The goal of this project is to produce an engineered design that will mimic more natural conditions through lower Yellowjacket Creek, characterized by stable, well vegetated islands within a network of channels that remain active throughout a range of flows in the creek. The project would increase overall amount of stable wood and wood volumes in the floodplain.		
Future Threats	Increased logging and road building in the Yellowjacket Creek watershed, climate change increasing flows and decreasing hydraulic complexity.		
Project Rationale	The lower Yellowjacket Creek has yet to stabilize following over 100 years of disturbance. Previous restoration projects in the vicinity of the project site have focused on small bank stabilization projects, with varying success. The Cowlitz Tribe and the Forest Service believe a more comprehensive evaluation of lower Yellowjacket Creek is necessary to restore stream habitat over the long term.		
Functions Restored	Improved riparian functioning, increased stable wood and wood volumes in the floodplain, riparian-vegetated islands, salmonid spawning and rearing habitat, salmonid resting and cover habitat.		

Table 21. Tilton River Railroad Removal.

Project Name	**Tilton River Railroad Removal**
Location	**Morton, Lewis County**

Management Area	Cowlitz Cascade Lowlands
Reach ID	4D-08
Project Sponsor	Unknown
Project Status	Conceptual
Target Habitat	Riparian
Current Ownership	City of Tacoma
Zoning	Transportation
Hydrogeomorphic Classification	Floodplain
Project Size	~2,000 feet of riverbank
Strategy	Railroad removal

Existing Conditions	Near the northern border of the City of Morton, a historic railroad track located on the left bank of the Tilton River has been compromised due to bank erosion, causing the railroad tracks to fall into the river. The left bank is also hardened with rip rap at the upstream end. The channel form is simplified and edge habitat is essentially nonexistent.
Project Description	The section of the railroad eroding into the Tilton River should be removed and replaced with engineered logjams (ELJs), where necessary. The railroad tracks and their creosote-treated ties downstream of the erosion should also be removed and the left bank restored with native vegetation. Other locations along the Tilton River where the railroad still exists should also be investigated for removal.
Future Threats	Climate change and clearcutting forests in the Tilton River watershed producing more channel migration and entrainment of contaminated materials. Further erosion of adjacent railroad track and SR-7.
Project Rationale	Replacing the eroded railroad with an engineered log jam structure would provide improved salmonid habitat and more productive channel form. In addition, ELJs along the left bank would provide protection for State Route 7, which is nearby and could be compromised if the bank erosion continues in an uncontrolled fashion.
Functions Restored	Floodplain functioning, salmonid holding and rearing habitat. Improved water quality through the removal of contaminated materials.

The limiting factors report for Cowlitz River watershed (Wade 2000) includes recommendations factors in the Cispus River subbasin include the following:

- Native fish reintroduction efforts in the entire subbasin are dependent upon successful operation of the Cowlitz Falls Fish Collection Facility. It is critical to the recovery of anadromous fish that capture efficiency at the dam be monitored and improved over time.
- The USFS should continue to address road related problems that reduce floodplain connectivity and limit rearing habitat within the subbasin.

- Enhance existing instream habitat by supplementing LWD abundance. Utilize LWD that collects at Mossyrock Dam for projects within the Cispus subbasin.
- Manage early- and mid-structural stands within riparian reserves to develop late structural characteristics in the Cispus subbasin.
- Flow thresholds for drawdowns should be reevaluated, and if possible increased, to assure that juveniles are not flushed over the dam into Riffe Lake.

Habitats that may be suited for restoration in the Cispus River subbasin include the following:

- The North Fork Cispus provides some of the best functional habitat in the subbasin and protection of this system is the highest priority in the subbasin.
- Off-channel habitat within the main stem Cispus between Iron Creek (RM 8.2) and the North Fork Cispus (RM 19.9) provides important rearing habitat for juveniles.
- Enhance the fair-quality habitats in the North Fork Cispus, Yellowjacket Creek, and Greenhorn Creek (in order of priority).

Habitat Benefits

Adopting and effectively implementing new forest practices in commercial and private forest operations will provide numerous habitat benefits. Removing fish passage barriers restores salmonid access to spawning and rearing habitats. Larger culverts or bridges provide the additional benefit of reduced clogging problems and decreased risk of catastrophic road failure during large storm events. Protecting riparian buffers increases stream and river shading, lowers water temperatures, reduces sedimentation, provides an LWD source, and improves habitat diversity for salmonids.

The benefits of restoring off-channel habitat are numerous. Side channels provide critical cover, rearing, and spawning habitat, particularly for spring Chinook, coho, and winter steelhead (LCFRB 2010a). Similarly, stabilizing tributary stream habitat via riparian plantings, LWD installation, and stabilization of stream banks and islands improves spawning and rearing habitat for a variety of salmonids.

Restoring volitional access to the upper Cowlitz River would improve the viability of salmon in the watershed and would result in an increase in adult salmonid productivity.

Cowlitz – Cascade Highlands (WRIA 26)

Overview

The Cowlitz – Cascades Highlands management area comprises 721,395 feet (136.6 miles) of riverine shoreline that encompass the headwaters of the Upper Cowlitz Basin. One reservoir (Packwood Lake) is located in the Cowlitz Cascades Highlands management area. Several natural lakes are located in the management area, including Glacier Lake, Goat Lake, Lily Lake, Jug Lake, and Walupt Lake. Several river systems are also located in the management area, including the Ohanapecosh River and the Clear and Muddy Forks of the Cowlitz River.

Numerous creeks are located in the management area, including Butter Creek, Summit Creek, Lake Creek, Johnson Creek, Smith Creek, and Chambers Creek.

Land use in the Cowlitz – Cascades Highlands management area is dominated by the Gifford Pinchot National Forest (administered by the United States Forest Service). A portion of the National Forest is in wilderness protection including Goat Rocks Wilderness, Tatoosh Wilderness, and the William O. Douglas Wilderness. A small portion of the management area is also located in Mount Rainier National Park.

Restoration Priorities and Opportunities

Restoring riparian and floodplain functioning on Johnson Creek is a restoration priority for the Cowlitz – Cascades Highlands management area. The lower reach of Johnson Creek is designated as a Tier 1 reach (highest priority reach) for restoration (LCFRB 2010a). Riparian restoration can include livestock exclusion, tree planting, road relocation, invasive species eradication, and adjusting current land-use in the riparian zone (LCFRB 2010a).

As described for the Cowlitz – Cascade Lowlands, restoration opportunities may include those identified for subbasins in the management area by Wade (2000). Specific restoration actions in this management area may be relatively limited compared to other management areas due to their relatively intact character and general remoteness, compared to the shoreline jurisdiction overall. Conservation and protection strategies may be more appropriate in this management area due to extensive federal and state land ownership, and existing levels of protection from development. Activities toward conservation, protection, or restoration would need to be coordinated closely with the agencies responsible for managing the lands in this management area.

Habitat Benefits

Riparian and floodplain restoration provides numerous habitat benefits, including increased stream canopy cover, lower stream water temperatures during the summer, increased wood presence, and reduced stream and river sedimentation rates.

City of Centralia

Overview

The City of Centralia management area comprises 48,228 feet (9.1 miles) of riverine shoreline that encompasses the areas around the confluence of the Chehalis and Skookumchuck Rivers. The lower reaches of Salzer Creek and China Creek are also located in the management area.

The primary land use in the management area is characterized by residential and commercial development. Channelization and construction of levees has disconnected the main stems of the Chehalis River and Skookumchuck River with their floodplain and degraded salmonid habitat. In addition, several tributary streams have been channelized. Riparian habitat is also highly degraded, causing elevated water temperatures during the summer and fall.

Restoration Priorities and Opportunities

A restoration priority for the City of Centralia is to restore floodplain and wetland areas to reduce flooding impacts. The City of Centralia has purchased nearly 25 acres of land for retention and storage of elevated flows in China Creek (Table 22). In addition, fish passage barriers are located throughout the City of Centralia management area. A study conducted by the Lewis County Conservation District documented several fish passage barriers in Salzer Creek, China Creek, and several unnamed tributaries (Verd 2004a). As such, there are two other site specific that have been identified, which would improve both habitat conditions and increase off-channel flood storage (Tables 23 and 24). These projects may also have a positive impact on (i.e., reduce) stream temperature, an impairment common in these streams.

Habitat Benefits

Restoration of floodplain and wetland areas creates numerous habitat benefits, including off-channel habitat, increased riparian habitat, decreased sedimentation, and cover and holding areas for adult and juvenile salmonids. In addition, the hydrologic improvements associated with floodplain restoration, and expansion is beneficial because creeks and rivers become less constricted, potentially decreasing flooding problems downstream.

Correction of barrier culverts in tributary creeks, including Salzer Creek, China Creek, and several unnamed tributaries would improve access to habitat for salmonids.

City of Chehalis

Overview

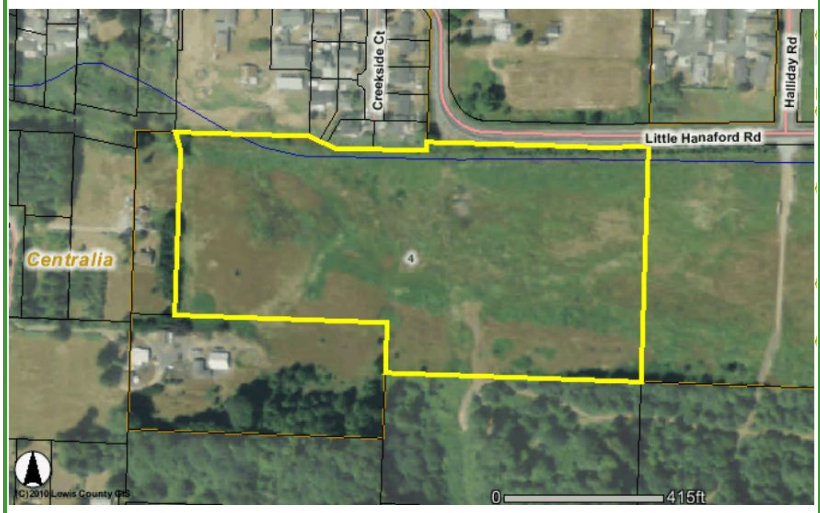
The City of Chehalis management area comprises 17,584 feet (3.3 miles) of riverine shoreline that encompasses the main stem Chehalis River. The lower reaches of Coal Creek, Dillenbaugh Creek, and Berwick Creek are also located in the management area.

The primary land use in the management area is commercial, essential public facilities (i.e., airport, park/playground, school, etc.), and industrial development. Channelization and construction of levees have disconnected the main stem of the Chehalis River with its floodplain, and degraded salmonid habitat. Riparian habitat is also highly degraded, causing elevated water temperatures during the summer and fall.

Fish passage barriers are located throughout the City of Chehalis management area. A study conducted by the Lewis County Conservation District documented several fish passage barriers in Coal Creek, Dillenbaugh Creek, Berwick Creek, and several unnamed tributaries (Verd 2004a). Over half of the culverts assessed on Dillenbaugh Creek were impassible (barrier culverts) (Verd 2004a).

Table 22. China Creek Headwater Property Acquisition.

Project Name	**China Creek Headwater Retention**
Location	**Centralia**



Management Area	Centralia
Reach ID	CE-03
Project Sponsor	City of Centralia
Project Status	Active
Target Habitat	Wetland
Current Ownership	Private
Zoning	Agricultural
Hydrogeomorphic Classification	Wetland and riparian
Project Size	24.8 acres
Strategy	Property acquisition, flood control, stream restoration

Existing Conditions	In the summer of 2014, the City of Centralia purchased two privately owned parcels along Little Hanaford Road, totaling 24.8 acres in size. Both recently acquired properties contain China Creek, which is extensively ditched along the north side. This will serve as the first phase of the China Creek Headwater Retention project; the City of Centralia has acquired additional properties on China Creek for flood control as well, but will be designed and constructed after first phase is completed.
Project Description	The City of Centralia purchased the properties to reduce downstream flooding. Meanders will be designed for China Creek to mimic natural conditions prior to when the creek was ditched and straightened for agricultural purposes in the early 1900s. Large woody debris (LWD) will be strategically placed along the newly designed creek channel to reduce creek velocities. Areas will also be excavated to provide additional floodwater storage The parcel would be used to retain and store flood water from China Creek, reducing downstream flooding.
Future Threats	Continued suburban development in the China Creek/Newaukum River floodplain, contamination of salmon-bearing streams by agricultural runoff.
Project Rationale	China Creek floods regularly and contributes to flooding problems in the City of Centralia. Ditching and wetland removal in the China Creek basin have contributed to the flooding problems. Restoration of natural creek meanders and wetlands along China Creek will promote increased retention of floodwaters and reduce downstream flooding impacts in the City of Centralia.
Functions Restored	Riparian and wetland habitat restoration, improved habitat for coho salmon, improved water quality.

Table 23. China Creek Floodwater Retention.			
Project Name	**China Creek Floodwater Retention**		
Location	**Centralia**		
		Management Area	Centralia
		Reach ID	CE-03
		Project Sponsor	Centralia Public Works
		Project Status	Conceptual
		Target Habitat	Wetland
		Current Ownership	City of Centralia
		Zoning	Agricultural
		Hydrogeomorphic Classification	Wetland/tributary stream
		Project Size	~28 acres
		Strategy	Property acquisition, flood control, stream restoration
Existing Conditions	The City of Centralia accepted a 28-acre parcel of land near the Agnew Mill Ponds that was anonymously donated to the city by an Oregon-based corporation. The property is bounded by a BNSF rail line to the west and North Gold Street to the east and is characterized by series of ponds and wetland habitat. The site is generally undeveloped.		
Project Description	The flood protection project would build earthen berms around the perimeter of the site to provide flood storage during flood events. It is anticipated that the berms will be constructed 2 feet high, which would provide enough storage for a 2.5-inch rainfall event in a 24-hour period on China Creek.		
Future Threats	Development in the China Creek headwater basin, runoff increases due to climate change.		
Project Rationale	Several areas along China Creek have experienced historic flooding problems, inundating developed areas with floodwater, ultimately contaminating downstream water bodies.		
Functions Restored	Improved hydrologic functioning of wetlands and improved water quality.		

Table 24. Alpha Road Floodplain Storage and Riparian Restoration.

Project Name	**Alpha Road Floodplain Storage and Riparian Restoration**
Location	**Centralia**

Management Area	Centralia
Reach ID	CE-05
Project Sponsor	Unknown
Project Status	Conceptual
Target Habitat	Floodplain, wetland, riparian
Current Ownership	Private
Zoning	Agricultural
Hydrogeomorphic Classification	Tributary stream
Project Size	~2,000 feet of stream channel
Strategy	Channel creation

Existing Conditions	Agricultural activities dominate the land use along Salzer Creek at Centralia Alpha Road. Mature riparian vegetation and natural stream sinuosity is lacking throughout this section of Salzer Creek. Flooding problems have also been documented on Salzer Creek downstream of the site.
Project Description	This project would create approximately 2,000 feet of sinuous stream channel with LWD log clusters installed throughout the new channel. The new section of creek would be revegetated with native trees and shrubs. Areas around the creek would be excavated and revegetated with wetland plants to provide flood storage during large storm events. Additional livestock fencing would be installed where needed to protect riparian plantings.
Future Threats	Development in the Salzer Creek basin, heightened flooding downstream due to lack of floodplain storage.
Project Rationale	Flooding is a major problem in Centralia; additional flood storage along Salzer Creek would provide improved flood control and greatly improved habitat conditions for a variety of salmonids.
Functions Restored	Riparian establishment and increased stream shading during the summer, wetland creation and restoration, enhanced flood storage and groundwater recharge, improved salmonid resting, rearing, and spawning habitat.

Restoration Priorities and Opportunities

The restoration priority for the City of Chehalis is to improve tributary stream habitat for salmonids, while improving water quality and reducing flooding. A conceptual project proposed by the City of Chehalis for Dillenbaugh Creek would improve habitat conditions greatly, while simultaneously achieving these other objectives(Table 25). The current configuration of lower Dillenbaugh Creek passes under I-5 at two locations, under railroads in two locations, under SR 6, and a county road. In addition, lower Dillenbaugh Creek is heavily channelized and overgrown with reed canarygrass; the habitat conditions for this reach are

considered poor, and elevated water temperatures during the summer are likely problematic for juvenile salmonids. Finally, the proposed levee system for the City of Chehalis would require a tide gate on Dillenbaugh Creek near its confluence with the Chehalis River (Habitat Work Schedule 2015).

Table 25. Dillenbaugh Creek Restoration.

Project Name	**Dillenbaugh Creek Restoration**		
Location	**Chehalis, Washington**		
Depiction of Potential Project Route		**Management Area**	Chehalis
		Reach ID	CH-04
		Project Sponsor	City of Chehalis
		Project Status	Conceptual
		Target Habitat	Riparian, juvenile salmonid rearing habitat
		Current Ownership	City of Chehalis
		Zoning	Recreation
		Hydrogeomorphic Classification	Tributary stream
		Project Size	1,700 feet of linear stream if diversion is used
		Strategy	Acquisition, stream relocation
Existing Conditions	Dillenbaugh Creek currently undercrosses Rice Road near Interstate 5 (I-5), and then flows northward meandering under I-5 three times. Numerous residential structures and businesses in addition to I-5 are subject to flooding problems during large storm events in this area. Much of Dillenbaugh Creek downstream of I-5 is slow moving, heavily ditched, and lacks sufficient riparian cover, likely resulting in elevated water temperatures during the summer that are lethal to salmonids. Future flood management planning in the area calls for a flood gate on the creek to avoid backwatering, which would compromise fish passage when it is needed most.		
Project Description	A meandering channel would be excavated near the Rice Road undercrossing to divert Dillenbaugh Creek through Stan Hedwall Park to a confluence with the Newaukum River in the Park. Although the project would reduce the length of Dillenbaugh Creek by 1.93 miles, the new channel would create significant habitat enhancement for Dillenbaugh Creek and the Newaukum River. The new alignment would also help prevent flood damage by diverting flood flows through Stan Hedwall Park rather than through the southwest portions of Chehalis and I-5.		
Future Threats	Continued development in the Dillenbaugh Creek and Newaukum River floodplains, climate change.		
Project Rationale	Flooding would be reduced along Dillenbaugh Creek near I-5 and significant habitat enhancement for salmonid migration and spawning. The new channel would also create wetlands and ponding areas for waterfowl and would significantly reduce the cost of widening I-5 along this area in the future.		
Functions Restored	Salmonid migration, spawning, and rearing habitat and wetland habitat for waterfowl.		

In addition to Dillenbaugh Creek, Salzer Creek and the Newaukum River also have potential opportunities to improve floodplain connectivity, improve in-channel habitat, restore riparian areas, improve water quality (primarily through increased shading), and reduce downstream flooding. These opportunities are summarized in Tables 26 and 27.

A lower restoration priority for the City of Chehalis management area is the correction of barrier culverts in tributary creeks, including Coal Creek, Dillenbaugh Creek, and Berwick Creek. When designed properly, upgrading culverts can have the added benefit of reducing clogging problems, flood risk, and minimizing the chances of catastrophic road failure during large storm events.

Habitat Benefits

The proposed stream channel relocation project would divert the creek into the Newaukum River through Stan Hedwall Park. The creek would no longer have to pass under I-5 and other structures, and would have higher stream velocities. The new creek configuration would also provide salmonids permanent access to an abandoned oxbow lake nearby, offering excellent habitat for juvenile salmonid rearing.

Correction of fish passage barriers would provide salmonids access to additional spawning and rearing habitats. Salmonid species that benefit in particular from culvert retrofits in smaller stream systems include coho, steelhead, and cutthroat trout.

Table 26. Newaukum River Floodplain Reconnection and Wetland Creation.

Project Name	**Newaukum River Floodplain Reconnection and Wetland Creation**
Location	**Stan Hedwall Park, Chehalis**

Management Area	Chehalis
Reach ID	CH-03
Project Sponsor	City of Chehalis
Project Status	Conceptual
Target Habitat	Floodplain reconnection, off-channel habitat
Current Ownership	City of Chehalis
Zoning	Recreation
Hydrogeomorphic Classification	Main stem river
Project Size	~40 acres
Strategy	Floodplain reconnection, off-channel habitat

Existing Conditions	The Newaukum River flows along the south side of Stan Hedwall Park; the southern portion of the park contains a low-lying grassy area with minimal use that functioned historically as part of the Newaukum River floodplain. The park road was constructed on a berm that isolates the low-lying area from the river except during flooding events. In addition, a historic side channel of the Newaukum River is located along the south end of the park, but does not flow except during flood events.
Project Description	Restoration activities would include converting the low-lying portion of Stan Hedwall Park into a seasonally inundated wetland. The park road would need to be notched with bridges to allow seasonal flow into the created wetland or the road would need to be relocated to the north. LWD would be placed in the wetlands and Newaukum River to stabilize banks and improve habitat complexity. The historic meander would be excavated in parts to provide seasonal inundation during the wet season. Nonnative plants would be removed and replaced with native riparian species.
Future Threats	Increased development of the Newaukum River basin, further impairing the river both from a hydrologic and water quality perspective.
Project Rationale	Wetland creation and floodplain reconnection would provide improved flood control, enhancement of the historic meander would provide critical off-channel habitat, establishment of native riparian vegetation would improve salmonid habitat and increase shading of the Newaukum River immediately before its confluence with the Chehalis River, which is 303d listed for temperature.
Functions Restored	Floodplain reconnection, wetland creation, flood capacity, salmonid resting, rearing, and spawning habitat, decreased summer water temperatures.

Table 27. Fairgrounds Floodplain and Channel Restoration.

Project Name	**Fairgrounds Floodplain and Channel Restoration**
Location	**Chehalis**

Management Area	Chehalis
Reach ID	CH-01
Project Sponsor	Unknown
Project Status	Conceptual
Target Habitat	Floodplain, wetland, riparian
Current Ownership	Lewis County
Zoning	Agricultural
Hydrogeomorphic Classification	Tributary stream
Project Size	10 acres
Strategy	Levee setback, floodplain reconnection, wetland restoration

Existing Conditions	A levee constructed along Salzer Creek between North National Avenue and railroad line in southern Centralia cut off Salzer Creek from its original floodplain to the north. The confluence of Coal Creek with Salzer Creek occurs at this location. Both creeks have been straightened and lack riparian shading.
Project Description	The levees along Salzer Creek would be set back to provide increased floodplains for the confluence of the creeks, improving flood control conditions. Both creeks would be realigned with added sinuosity providing habitat value. Wetland creation, enhancement, and riparian vegetation would also be performed for additional habitat value.
Future Threats	Continued development in the Salzer Creek and Coal Creek basins impairing water quality and increasing streamflow and downstream flooding.
Project Rationale	Flooding is a major problem in Centralia; setting back the levee along Salzer Creek would provide flood control and greatly improved habitat conditions for a variety of salmonids. The location on the fairgrounds property could provide the opportunity to educate the public about restoration.
Functions Restored	Riparian establishment and increased stream shading during the summer, wetland creation and restoration, improved salmonid resting and rearing habitat.

City of Morton

Overview

The City of Morton management area comprises 17,004 feet (3.2 miles) of riverine shoreline that encompasses a small reach of the Tilton River and its confluence with Johnson Creek. The City of Morton management area is defined primarily by the city's jurisdictional boundary including its UGA, and by the relative difference in development and land use compared to

more rural areas in the Coalition. This management area is essentially located within (i.e., bordered on all sides by) the Cowlitz Cascade – Lowlands management area.

Restoration Priorities and Opportunities

The Tilton River carries a significant sediment load. Fortunately, most development within the City is outside of the floodplain and the river can migrate in response to this sediment load, but removing the remaining infrastructure (e.g., riprap, berms, and commercial development) in the floodplain is a high priority. The largest single opportunity is immediately adjacent to the Morton Wastewater Treatment Plant (Table 28). There is currently fill in the Tilton River floodplain that disrupts floodplain processes, and otherwise covers area that could be used for fish as well as floodwater and sediment storage. The area could also be reforested in those locations where water levels are sufficiently low and woody vegetation sustainable. There may be other opportunities associated with the replacement of the SR-508 Bridge once its design life has been exhausted. The bridge and the fill associated with its abutments constrict the channel and the floodplain, disrupting geomorphic processes and increasing flood elevations further upstream. Removing the abandoned railroad beyond the mill near the city limits should also be considered (see Table 21 for details).

Habitat Benefits

The removal of fill from the floodplain would restore connectivity of the floodplain to the river, allowing fish to access the sparsely forested floodplain, and reducing floodwater surface elevation. Revegetation of those areas that remain cleared could further improve floodplain habitat.

Table 28. Morton Floodplain Wetland Connection.			
Project Name	**Morton Floodplain Wetland Connection**		
Location	**Morton, Lewis County**		
		Management Area	Morton
		Reach ID	MO-01R
		Project Sponsor	Unknown
		Project Status	Conceptual
		Target Habitat	Floodplain
		Current Ownership	Private
		Zoning	Residential
		Hydrogeomorphic Classification	Floodplain
		Project Size	~2,000 feet of shoreline
		Strategy	Floodplain Reconnection
Existing Conditions	A large wetland complex is located along the right bank of the Tilton River in the City of Morton (see red polygon in aerial photograph). There are numerous modifications to the area, including several roads. The area has also been logged in the recent past.		
Project Description	A side channel could be installed along the right bank of the Tilton River to improve floodplain connectivity with the wetland complex; a feasibility study would need to be performed first to determine the benefit of the project.		
Future Threats	Contamination of the Tilton River from pollutant-generating impervious surfaces during periods of flooding. Possible unpermitted development of ecologically critical areas..		
Project Rationale	Creating a better connection with the Tilton River and off-channel habitat such as the aforementioned wetland would provide excellent rearing habitat for juvenile salmonids. The expanded floodplain would also likely result in additional flood storage.		
Functions Restored	Floodplain functioning, salmonid holding and rearing habitat, side channel spawning habitat may also be possible.		

City of Winlock

Overview

The City of Winlock management area comprises 11,974 feet (2.3 miles) of riverine shoreline that encompasses a small reach of the upper Olequa Creek and its confluence with King Creek. The City of Winlock management area is defined primarily by the City's jurisdictional boundary including its UGA, and by the relative difference in development and land use compared to more rural areas in the Coalition. This management area is located within (i.e., bordered on all sides by) the Cowlitz – Puget Lowlands management area.

Restoration Priorities and Opportunities

Wade (2000) recommended focusing riparian restoration efforts in the more productive streams of the lower Cowlitz River subbasin, including Olequa Creek. Olequa Creek runs through developed areas throughout the City. Most of this land is in private ownership. There

are several parcels within the City limits where woody riparian vegetation has been completely removed along Olequa Creek. These areas could be revegetated, thereby providing food sources (e.g., insects) to fish and lowering stream temperatures in the summer. Stormwater improvements could complement these efforts (Table 29). Outreach to the community may be useful in encouraging riparian planting, revegetation, and stormwater improvements. Land acquisition and revegetation by the City might also be considered in some locations.

Table 29. Winlock Stormwater Management.

Project Name	**Winlock Stormwater Management**
Location	**Winlock**

Management Area	Winlock
Reach ID	All reaches in Winlock
Project Sponsor	City of Winlock
Project Status	Conceptual
Target Habitat	King Creek and Olequa Creek
Current Ownership	Private, City of Winlock
Zoning	Transportation
Hydrogeomorphic Classification	Riparian and upland
Project Size	All shorelines within the City
Strategy	Stormwater management

Existing Conditions	Both King and Olequa Creeks are located within the City of Winlock, which provide habitat for priority fish species including Chinook, coho, steelhead, as well as rainbow and cutthroat trout. Land use in Winlock is dominated by high density residential; stormwater impacts from impervious surfaces associated with residential development can negatively impact receiving water bodies, including King and Olequa Creeks.
Project Description	Extensive regional and national research have demonstrated a link between development in a watershed and degradation of aquatic resources. Winlock should consider assessing its stormwater system and identify locations where low impact development (LID) features could be constructed. Winlock should also encourage new developments to incorporate LID features, such as, bioswales, rain gardens, and pervious pavement.
Future Threats	Increased development using traditional stormwater management techniques aggravating existing water quality deficiencies.
Project Rationale	LID uses vegetation and small-scale hydrologic controls to capture, treat, store, and infiltrate stormwater runoff. Using LID features helps maintain a watershed's natural hydrology, which would benefit King and Olequa Creeks.
Functions Restored	Natural hydrologic functioning, groundwater storage (via infiltration) and improved base flow volumes and improved water quality.

Habitat Benefits

Revegetation of the creek banks could provide habitat for insects and macroinvertebrates, which are food sources for juvenile salmonids; it could also help reduce localized summertime water temperatures in the creek. Revegetation, particularly in combination with stormwater improvements, would also improve water quality by reducing temperatures and contaminant loading from the developed areas around Olequa Creek.

Additional Restoration Strategies

Suggested programmatic strategies for increasing benefits gained and the number of public and private restoration activities are presented here.

Build upon Successful Existing Site-Specific Restoration Projects

There are a number of existing and ongoing restoration projects throughout the Coalition. Often these projects were funded and completed because they were in areas that would leverage large ecological benefits if restored. Some of the site-specific projects identified in this plan meet this goal (such as the Lower Cispus Side Channels project). Other projects could be funded and implemented that follow this model of being in areas that would leverage ecological functions, or are adjacent to existing restored areas and would improve habitat connectivity.

Vegetate Shoreline Road Rights-of-Way with Native Vegetation

Many miles of roads are adjacent to shorelines throughout Coalition. In many cases, there is a small buffer of land (often a public right-of-way) between the roadway and the active channel of streams and rivers or adjacent to lakes. These areas typically lack vegetation due to riprap and other bank hardening structures or are colonized by nonnative, invasive species.

Native vegetation is essential to health of riparian ecosystems. For locations in the Coalition where the roadway buffer is large enough and the ecological benefits of revegetation are significant enough, implement removal of nonnative invasive plant species and revegetation with native species. Doing so in public rights-of-way could create an opportunity to engage the community and thereby encourage people to remove invasive plants, and plant native vegetation on their properties.

Develop Educational Programs

Education is a key restoration plan strategy. As property owners become increasingly aware of the important roles of shoreline vegetation and natural geomorphic processes, it is expected that more property owners will initiate private restoration projects.

One of the largest stressors on the ecological health of the Coalition is the cumulative impact of private development that alters important shoreline ecological functions. Thus, homeowner education on activities that would improve shoreline conditions is viewed as an essential strategy for maintaining and improving ecological conditions along the shoreline. Reduction and removal of such impacts will be more common and effective with an educated shoreline populace.

Development has occurred on valuable shoreline habitats throughout the Coalition therefore landowner education on the implications of their land use activities is an essential strategy to

ensure no net loss of ecological functions. In addition, incentive based programs can be used to encourage landowner protection and improvement of shorelines.

Education for Small Stream Riparian Landowners

There are many small impaired streams throughout the Coalition that are tributary to jurisdictional waterbodies and a number of reaches on jurisdictional waterbodies are impaired. Human-caused activities that contribute to degraded riparian conditions throughout the Coalition include agricultural activities, residential and urban development, and silvicultural activities. Many tributaries are ecologically disconnected by culverts or other stormwater infrastructure. However, many have quality habitat located upstream and could be actively used by salmonids and other aquatic species. The riparian corridors along these streams in many locations are absent (i.e., lawns or paved areas extend to the streams). Invasive species (e.g., English ivy and Japanese knotweed) are also common. A program to educate local landowners who live along these streams about ways to care for and restore their riparian corridors and how to advocate for their streams would improve shoreline functions and processes.

Education for Incorporated Areas

Educational programs could be expanded to include stormwater education, which would help residents in incorporated areas become more aware that their storm drains contribute to the water used by aquatic species, similar to a program set up by the Puget Sound Partnership for Puget Sound (Puget Sound Starts Here 2014: <http://www.pugetsoundstartshere.org/>). Such education could also help minimize illicit discharges to the Coalition's important waterbodies.

Monitor Restoration Projects

One of the primary means to ensure no net loss of ecological functions is to monitor existing and future restoration projects to determine if they are performing as designed, and to evaluate the efficacy of different approaches. Whenever possible, monitoring of future restoration projects should include baseline monitoring prior to project construction, as that is critical to understanding and demonstrating the effects of restoration.

Determining a physical and ecological baseline is crucial for documenting the ecological lift of restoration projects. As such, it is recommended that all of the proposed and potential restoration projects be monitored both prior to and following their construction and that such monitoring be included as part of the project implementation and funding.

Restoration Programs and Resources

In addition to the management-area-specific recommended priorities and opportunities summarized in the previous sections, several broad-scale public and private programs are available to assist with Coalition restoration efforts. They are described below.

Family Forest Fish Passage Program

The Family Forest Fish Passage Program (FFFPP) was established by the Washington State legislature in 2003 as an incentive-based program that assists smaller private forestland owners in replacing regulatory fish barriers from their land (DNR 2013). Private forest landowners are eligible to use the FFFPP if less than 2 million board feet of timber is harvested each year from their land. Regulatory fish barriers that are eligible under the FFFPP include culverts, and other stream crossing structures that prevent salmonids and other fish species from reaching upstream habitat.

The FFFPP works with over 40 entities in Washington State, including salmon enhancement groups, conservation districts, local tribes, and the US Fish and Wildlife Service (DNR 2013). This program has assisted nearly 200 private landowners since its inception, resulting in the replacement of 244 barriers, and opening of more than 524 miles of stream habitat. The replacement of fish barriers has the added benefit of reducing maintenance concerns for smaller private forestland owners.

Chehalis Fisheries Restoration Program

The Chehalis Fisheries Restoration Program provides funding for habitat restoration in the Chehalis River and Grays Harbor Basins (USFWS 2013). Private landowners, nonprofit organizations, and local, tribal, state, or federal agencies are eligible to apply for funding through this program. The Chehalis Fisheries Restoration Program funds a variety of projects, including fish passage barrier corrections, removal of invasive species, native plant revegetation, riparian and off-channel fish habitat restoration, agricultural wetland restoration for fish use, and monitoring of fish use of these habitats.

National Fish Passage Program

The National Fish Passage Program provides funding to restore native fish and other aquatic species to self-sustaining levels by reconnecting habitat that has been fragmented by human-made barriers (USFWS 2013). Private landowners, nonprofit organizations, and local, tribal, state, or federal agencies are eligible to apply for funding through this program.

Washington Wildlife and Recreation Program

The Washington Wildlife and Recreation Program (WWRP) is a state grant program that provides a variety of different funding programs to protect habitat, restore habitat and species, and acquire properties with valuable natural resources. It is administered by the

state Recreation and Conservation Office and funded by the legislature in the state's capital construction budget (WWRP 2012).

- The Critical Habitat Category fund program provides funding to protect habitat for wildlife including habitat for endangered, threatened, or sensitive species. Project sites may include high-quality habitat or degraded habitat that once restored will support the target species.
- The Natural Areas Category fund provides funding to protect high quality, representative native ecosystems or unique plant or animal communities, endangered, threatened, or sensitive species, rare geological features, or similar features of scientific or educational value. Project sites must have, to a major degree, retained their natural character and be managed primarily for resource preservation, protection, and study.
- The Riparian Protection Category fund provides funding to protect riparian areas. Projects may include a wide variety of site conditions on either fresh or saltwater riparian areas. Projects must include property acquisition. Projects to extend riparian protection for a minimum of 25 years on lands enrolled in the federal Conservation Enhancement Reserve Program are allowed.
- The Salmon Recovery fund provides funding to improve important habitat conditions or watershed processes to benefit salmon and bull trout. Projects must go through selection by local lead entities and must address goals and actions defined in regional recovery plans or lead entity strategies.
- State Lands Restoration and Enhancement fund provides funding to two state agencies to repair damaged plant and animal habitat. Restoration projects must bring a site back to its original function through activities that will help the site be self-sustaining. Enhancement projects must improve the ecological functionality of a site.
- Urban Wildlife Habitat Category fund provides funding to conserve wildlife habitat in cities. Projects must be within 5 miles or inside a city or town (or its adopted urban growth area boundary) with a population of at least 5,000; or within 5 miles of an adopted Urban Growth Area in a county that has a population of at least 200 people per square mile.

Land Conservation Programs

Conservation of existing shoreline functions via property or easement acquisition is a process-based strategy to conserve and protect broader, self-sustaining, ecosystem processes that support valued nearshore habitat. For example, acquiring a property or easement that permanently protects a wetland area could prevent future flooding and degradation of shoreline functions downstream. Likewise, protection of a key strategic parcel may provide an important habitat connection that ecologically supports the functions of adjacent restored or enhanced parcels, thereby adding more restoration value than a single parcel. A restoration strategy that combines enhancement with an easement or fee ownership of an adjacent ecologically intact property can shorten the timeline for shoreline recovery.

Providing similar benefits, the Open Space Tax Deferral Program can provide a reduced property tax incentive for property owners willing keep their land in a natural state.

- **Property acquisition** – There are many properties throughout the Coalition that are either under developed or undeveloped. Acquiring such properties can provide habitat connectivity, and ensure that they continue to provide key ecological functions. Property acquisition can also serve as the first step toward completing restoration projects.
- **Easement acquisition** – Placement of conservation easements can be an effective tool to protect key ecological areas, such as riparian forests and salmonid spawning habitat. Placing conservation easements on strategically located properties can provide habitat continuity and ensure that those areas continue to provide key ecological functions that benefit the shoreline jurisdiction. Landowners who provide easements can also typically lower their property taxes.
- **Open Space Tax Deferral Program –** The Open Space Taxation Act, enacted in 1970, allows property owners to have land valued at its current use rather than its highest and best use. The Act states that it is in the best interest of the state to maintain, preserve, conserve, and otherwise continue in existence adequate open space lands to assure the use and enjoyment of natural resources and scenic beauty for the economic and social well-being of the state and its citizens. Lands suitable for this program are those where the current use conserves and enhances natural or scenic resources; protects streams or water supplies; promotes conservation of soils, wetlands, or beaches or preserves archaeological and historic sites. The Open Space Tax Deferral Program provides landowners with incentive to restore ecological functions on their land to lower their property taxes.

Partners and Funding for Restoration

The following organizations and agencies support and some fund the types of restoration projects described in this plan. There are local organizations described that could lead the work or serve as partners to accomplish restoration goals as well as organizations that will fund restoration projects that meet their mission.

In addition to the outside funding sources described below, the Coalition could identify some projects as part of its capital facilities planning or develop a specific restoration fund to ensure that shoreline restoration is considered during the budget process. It is expected that restoration funding will be derived from a variety of sources selected for their appropriateness to the project or program goals.

Lewis County Conservation District

The Lewis County Conservation District's (the CD) mission is to provide technical and financial assistance for the conservation, protection, and development of natural resources within Lewis County. The Lewis County Conservation District provides a number of programs to help landowners put conservation on the ground. Among them are:

- Conservation Reserve Enhancement Program (CREP) — CREP is a voluntary program created by the United States Department of Agriculture (USDA) Farm Service Agency (FSA), Commodity Credit Corporation (CCC), and Washington State to improve the water quality of streams providing habitat for salmonids listed under the ESA (LCCD 2013; USDA 2013). In order to be eligible, the land must be cropland that has been cropped 2 out of the past 5 years, and that is physically and legally capable of being cropped. Marginal pastureland is also eligible to be enrolled provided it is suitable for use as a riparian buffer planted with trees. Financial incentives covered by the program include land rental costs, and the cost of establishing conservation practices, annual maintenance, monitoring, and technical assistance.

- Coordinated Resource Management (CRM) — CRM offers a voluntary, collaborative, team approach that promotes active local participation in developing and implementing sound resource management programs.

- Livestock Program – This program provides Livestock Grants through the Washington State Conservation Commission to conservation districts to protect water quality (LCCD 2013, WSCC 2013). The grants assist owners and operators of animal feeding operations in obtaining nutrient management plans. Grants are also available to provide cost share funding for implementation of BMPs, including facility gutters, livestock exclusion fencing, and manure containment facilities (WSCC 2013). The CD also provides two sizes of manure spreaders for rent.

Culverts, if improperly installed or deteriorated over time, can prevent or limit the ability of adult and juvenile salmonids to access all habitats. Coho salmon, searun cutthroat trout, and

steelhead travel up into the smaller streams and are therefore more likely to be impacted by blocking culverts.

The CD completed a culvert survey for all of WRIA 23 located in Lewis County, and a portion of WRIA 23 located in Thurston and Grays Harbor Counties, Washington (2002a; 2002b; 2003a; 2003b; 2004a; 2004b; 2004c; 2004d; 2006; 2007b; 2008; 2009a; 2009b). The total area surveyed was 569,600 acres.

The CD utilized the WDFW Salmonid Screening, Habitat Enhancement, and Restoration (SSHEAR), a priority index method to rank the culverts that would benefit fish by being replaced. The Fish Passage Priority Index takes into account the habitat gain, the mobility, and health status of the fish stocks that would benefit from increased access to the habitat, and the projected cost of the project. The Coalition can use the CD's resources and investigative work to identify culvert projects within their jurisdictions that restore fish passage.

Lower Columbia Fish Recovery Board

The Lower Columbia Fish Recovery Board coordinates efforts aimed at recovering ESA-listed Chinook, coho, chum, steelhead and bull trout, and managing water resources in the Lower Columbia Region. They can serve as a valuable partner in supporting restoration projects that meet the needs of their recovery plan.

Local governments, primarily five counties (Clark, Cowlitz, Lewis, Skamania, and Wahkiakum), requested the formation of the Lower Columbia Fish Recovery Board, which resulted in the 1998 Legislature authorizing the board. The board charter is contained in Revised Code of Washington 77.85, which officially recognizes the board as a regional organization. The law authorizes the board to prepare recovery plans, and to implement the habitat portion of such plans for steelhead and other ESA-listed species at an Evolutionary Significant Unit scale.

The board serves as the Northwest Power and Conservation Council subbasin planning organization, lead entity for the state habitat protection and restoration program, and lead agency for state watershed planning in two planning units – WRIAs 25 and 26 and WRIAs 27 and 28. The board has particular responsibility for habitat portions of a recovery plan related to local government responsibilities, but its recovery plan addresses habitat, hatcheries, harvest, and hydropower. In February 2006, the National Marine Fisheries Service adopted the board's recovery plan as the Washington portion of the full Evolutionarily Significant Unit plan. The board now is coordinating with Oregon and the National Marine Fisheries Service in development of a full Evolutionarily Significant Unit-scale recovery plan (i.e., both Washington and Oregon portions).

Lower Columbia Fish Enhancement Group

The Lower Columbia Fish Enhancement Group (LCFEG) is a non-regulatory, non-partisan 501(c)(3) salmon recovery organization founded by the state legislature in 1990 (LCFEG 2013). Working within specific watersheds throughout Clark, Skamania, Lewis, Wahkiakum, and Cowlitz Counties, LCFEG leverages public funding through landowner partnerships and

collaborations with individuals, groups, corporations, tribes, foundations and agencies. LCFEG's mission is to lead the process of salmon recovery in a way that ensures community involvement in habitat restoration so that abundant, naturally self-sustaining salmon and steelhead runs occur throughout the Lower Columbia River region. LCFEG sponsors and may fund restoration projects and a variety of public education and outreach programs.

Salmon Recovery Funding Board

In 1999, the Washington State legislature created the Salmon Recovery Funding Board (SRFB), which is now administered by the Puget Sound Partnership. The board funds projects that protect existing, high quality habitats for salmon, and that restore degraded habitat to increase overall habitat health and biological productivity. The board also awards grants for feasibility assessments to determine future projects and for other salmon related activities.

Projects may include the actual habitat used by salmon and the land and water that support ecosystem functions and processes important to salmon. Applicants must submit their proposals to their local lead entity rather than directly to the Salmon Recovery Funding Board. The lead entity is responsible for assembling a ranked list of projects from its area and submitting them to the SRFB for consideration. Typical projects funded by SRFB include removing fish passage barriers, replanting stream banks, removing dikes and levees, installing large woody material to slow rivers and create habitat, and buying pristine habitat.

Aquatic Lands Enhancement Account

In 1984, the Washington State legislature created the Aquatic Lands Enhancement Account (ALEA) to ensure that money generated from aquatic lands was used to protect and enhance those lands. Aquatic lands are all tidelands, shore lands, harbor areas, and the beds of navigable waters. ALEA grants may be used for the acquisition, improvement, or protection of aquatic lands for public purposes. They also may be used to provide or improve public access to the waterfront. The ALEA program is targeted at re-establishing the natural, self-sustaining ecological functions of the waterfront, providing or restoring public access to the water, and increasing public awareness of aquatic lands as a finite natural resource and irreplaceable public heritage. It is administered by the Recreation and Conservation Office and is funded almost entirely by revenue generated by the DNR's management of state-owned aquatic lands (Washington State Recreation and Conservation Office 2012).

US Fish and Wildlife Service

The US Fish and Wildlife Service has a number of grant programs, depending on funding year, that fund restoration-oriented projects. The programs are often tailored to particular goals of the agency, and goals can vary from year to year. However, it is likely that, in any given year, there are programs that would apply to the restoration goals described herein, particularly projects that support protection of endangered species and critical habitats.

US Environmental Protection Agency: Region 10 Pacific Northwest

The US Environmental Protection Agency (USEPA) funds projects intended to safeguard the natural environment and protect human health. Potential opportunities specific to watershed protection and restoration are listed below.

- The Clean Water State Revolving Fund Program: Under this program, USEPA provides grants to capitalize state loan funds. The states, in turn, make loans to communities, individuals, and others for high-priority water-quality activities. Wetlands protection and restoration, estuary management efforts and development of riparian buffer zones are examples of the type of projects that can be funded by the low-interest loans.
- Wetland Protection, Restoration, and Stewardship Discretionary Funding: This program provides support for studies and activities related to implementation of Clean Water Act Section 404 for both wetlands and sediment management. Funded projects can be regulatory, planning, restoration or outreach based. Typical grant awards range from $5,000 to $20,000.
- Environmental Education Grants: This program funds a broad range of environmental education, training, and outreach activities. This grant program provides financial support for projects that design, demonstrate, or disseminate environmental education practices, methods, or techniques. Grant awards are provided to universities, state, local, and tribal education agencies, and nonprofit organizations.

Washington State Department of Ecology

Ecology has programs that provide funding for flood control assistance projects and for improving water quality.

- Flood Control Assistance Account Program (FCAAP) – This program provides for development of comprehensive flood hazard management plans, feasibility studies, match for federal projects, flood control maintenance projects, and emergency projects. This fund may be used for levee setbacks or floodplain reconnection where flood hazards are reduced. This is one of very few state programs in the country that provides grant funding to local governments for floodplain management planning and implementation actions. Counties, cities, towns, conservation districts, flood control zone districts, or any special district as defined in WAC 173-145 are eligible. There is a requirement for a 25 percent match in non-state funds for most awards. Grant awards are up to $500,000.
- Water Quality Grants – Ecology offers a number of grants related to improving water quality. One application can be submitted for funding under Centennial grants or loans, Section 319 grants or Clean Water Act State Revolving Fund (CWSRF) loans. Eligible projects include education and stewardship, water quality monitoring, lake water quality planning, riparian and wetlands habitat restoration and enhancement, stream restoration, and total maximum daily load (TMDL) plan development and implementation. A 25 percent match is required and projects may be funded up to $500,000 if matched with cash or $250,000 if matched in other ways.

Chehalis River Basin Land Trust

The Chehalis River Basin Land Trust (CRBLT) promotes the protection of lands that provide habitat for wildlife and fish in the Chehalis Basin (CRBLT 2013). Created in 1995, the CRBLT is a nonprofit sponsor organization of the Land Trust Alliance that focuses on permanent conservation easements, riparian and wetland restoration projects, and land acquisition.

Columbia Land Trust

The Columbia Land Trust (CLT) is a private, nonprofit organization that works exclusively with willing landowners in the Columbia River region, including portions of Washington and Oregon, to conserve vital habitat (CLT 2013). The CLT acquires land or development rights (easements) on land via direct donations and by purchasing land outright. The trust also identifies threatened lands that have significant scenic, environmental, or recreational value and targets these areas for easements or purchase.

Gifford Pinchot Task Force

The Gifford Pinchot Task Force supports the biological diversity and communities of the northwest through conservation and restoration of forests, rivers, fish, and wildlife. The Task Force focuses their work in three principal areas: conservation, restoration, and policy (Gifford Pinchot Task Force 2013). For conservation, their mission is to recover thriving fish and wildlife populations and to protect community water sources; the Task Force works to protect public lands from destructive mining, grazing, timber practices, and more. The Task Force's restoration programs are deeply rooted in the foundation of ecological restoration—assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. The Task Force work's to reconnect fragmented landscapes so fish and wildlife habitats can survive floods, fire and drought – all of which are predicted to increase in intensity and occurrence with climate change. They work with coalitions and rural community members to prioritize closure of roads, which can be turned into trails or other non-motorized recreational areas while restoring fish and wildlife habitat. In the policy realm, the Task Force works with other organizations and with coalitions to shape national legislation and Forest Service policies to protect and restore northwest public lands.

Ducks Unlimited

The Matching Aid to Restore States Habitat or MARSH program was founded in 1985 to develop and protect waterfowl habitat in the United States. It is a reimbursement program that provides matching funds for wetland acquisition and habitat restoration and enhancement in each state based on Ducks Unlimited's income within that state. Projects submitted for MARSH funding must significantly benefit waterfowl. All projects must be on land under the control of a public agency or private cooperator with whom Ducks Unlimited has an approved memorandum of understanding. Control must be through ownership, lease, easement, or management agreement. Control must be adequate for protection, maintenance, and use of the project throughout its projected life.

Western Native Trout Initiative

The mission of the Western Native Trout Initiative is to serve as a catalyst for the implementation of conservation or management actions, through partnerships and cooperative efforts that result in improved trout species status, improved aquatic habitats, and improved recreational opportunities (WNTI 2007). The Western Native Trout Initiative funds a variety of projects, including riparian restoration, invasive species removal, fish passage barrier correction, and wetland and estuary restoration. Private landowners, nonprofit organizations, and local, tribal, state, or federal agencies are eligible to apply for funding through this program (USFWS 2013).

Fisheries Restoration and Irrigation Management Act

Fisheries Restoration and Irrigation Management Act (FRIMA) was enacted by the US Congress in 2000 to establish a voluntary, non-regulatory program administered by the US Fish and Wildlife Service for irrigators and water users to provide safe passage for fish while continuing to meet irrigation needs (USFWS 2012). This program provides matching federal funding for design and construction of fish passage projects at water diversion structures in the Pacific drainage area of Oregon, Washington, Idaho, and western Montana. Projects must include fish screens, fish ladders, or related modifications to water diversion structures that are directly associated with passage improvements (USFWS 2013). State agencies, local groups, and private landowners are eligible to apply for FRIMA funding, but must include a local government or tribal sponsor or co-applicant. Project sponsors must identify at least 35 percent in matching funding for the design and construction of an eligible project.

Implementation and Monitoring

Effective implementation of restoration projects and programs may require both regulatory and non-regulatory approaches to be effective. In many cases, the restoration opportunities described herein require acquisition of or easements on private land, potential relocation of public infrastructure (predominantly roads), and extensive cooperation and coordination with citizens, private landowners, and other stakeholders. While technically feasible, many of the suggested restoration strategies are extremely challenging from a socio-political perspective and will require consensus on what needs to be accomplished and how.

Timelines and Benchmarks

Many aspects of restoration can be highly opportunistic, for example, where one finds a willing landowner; or where an event, such as a road failure due to flood-induced erosion that requires immediate repair, creates an opportunity for a more ecologically beneficial solution. Establishing timelines is further complicated by the fact that shoreline restoration may largely depend on grant funding, which is unpredictable at best. It may benefit the Coalition's restoration efforts to incorporate projects with restoration elements into their Capital Improvements Program. That said it is important to set specific timelines and benchmarks to ensure progress. A suggested timeline for initiating implementation of this plan is as follows:

Within 0 to 7 years of adoption of this plan:

- Identify at least three potential floodplain reconnection or levee setback projects that provide a high level of ecological function. Establish a schedule for obtaining and assigning staff, applying for funding, and initiating steps toward implementation.
- Identify at least four shoreline areas suitable for riparian enhancement (including invasive vegetation removal). Establish a schedule for obtaining and assigning staff, applying for funding, and initiating steps toward implementation.
- Identify and complete design work on at least three public agency sponsored fish barrier removal projects on a jurisdictional shoreline or tributary.
- For incorporated areas, identify and complete design work on at least two stormwater quality treatment projects such as a bioswale, rain garden or other water quality treatment option to improve stormwater quality.
- Develop and implement at least one restoration directed program using public outreach and education or incentives to engage private landowners in restoration activities.

Within 7 to 10 years of adoption of this plan (assuming funding is available):

- Complete at least three floodplain reconnection or levee setback projects.
- Complete at least four riparian enhancement/invasive vegetation removal projects.

- Complete at least three fish barrier removal projects on a jurisdictional shoreline or tributary.
- For incorporated areas, complete construction of at least two stormwater quality treatment projects that will improve water quality

Every 10 years thereafter:

- Identify and complete at least three new floodplain reconnection or levee setback projects that provide a high level of ecological function.
- Identify and complete at least three new riparian enhancement/invasive vegetation removal projects.
- Identify and complete at least three fish barrier removals on a jurisdictional shoreline or tributary.
- For incorporated areas, identify and complete at least two stormwater quality treatment projects that will improve water quality.
- Develop and implement at least one restoration directed program using public outreach and education or incentives to engage private landowners in restoration activities.

Over time, restoration efforts must be evaluated against a set of benchmarks to determine if adequate progress is being made. Progress can be tracked by reporting benchmarks such as the examples below:

- Acres of riparian enhancement
- Acres of reconnected floodplain
- Number of levee setbacks
- Acres of wetland restored in the shoreline jurisdiction
- Acres of noxious weed removal and native vegetation planted
- Number of fish barriers removed or number of stream miles open to fish passage
- Number of exceedances of water quality criteria as measured in the state water quality assessment
- Number of restoration actions implemented in conjunction with other project partners

Shoreline restoration planning is a long-term effort. The SMP guidelines include the general goal that local master programs "include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area" (WAC 173-26-201(c)).

The legislature has provided an overall timeframe for future amendments to the SMP. A jurisdiction is required to review its SMP once every 8 years, and amend if necessary, (RCW 90.58.080(4)). During this review period, the Coalition should document progress toward achieving shoreline restoration goals. The review could include:

- Re-evaluating adopted restoration goals, objectives, and policies
- Summarizing both planning efforts (including application for and securing grant funds) and on-the-ground actions undertaken in the interim to meet those goals
- Revising the SMP restoration plan to reflect changes in priorities or objectives

Monitoring Strategies

The Coalition is required to monitor the effectiveness of the SMP, including this restoration plan, over time to assess whether net loss of ecological functions and processes is occurring. This will require tracking shoreline development activities to ensure permit compliance, and periodically reassessing the ecological health and status of shoreline resources in addition to charting the timelines and benchmarks recommended in the previous section. The latter should include identifying which restoration activities have occurred compared to the stated goals, objectives, and priorities of this plan. Should restoration projects fall short of being implemented within the general periods recommended in this plan (see *Timelines and Benchmarks* section), the Coalition should take specific steps to remedy that situation in order to remain compliant with the SMP. An annual review of restoration efforts, including projects and programs, is recommended.

Data Gaps

Monitoring Results

One of the largest data gaps found during the preparation of this plan was the lack of information on the effectiveness of past and current restoration activities in the Coalition. Monitoring of sites has been limited. In particular, projects involving barrier culvert removal/replacement should be monitored. Such monitoring data should then be used to educate landowners, gauge cost effectiveness, and determine effectiveness of different approaches.

Shoreline Armoring

Shoreline armoring is the construction of erosion resistant structures in and along shorelines to protect banks from flowing water in streams, and to intercept wave energy or control the movement of sediment in lakes. There is currently no comprehensive database of the types and extents of shoreline armoring for the Coalition. Shoreline armoring can cause a number of physical changes to the shoreline and nearshore environment including:

- In lakes:
  - Loss of beach area from placement of structures
  - Impoundment of sediment behind structures, interrupting sediment transport and causing sediment starvation and beach instability
  - Modification of groundwater regimes
  - Redirection and intensification of wave energy
  - Alterations of substrate from fine sediment to coarse sediment and rock
- In streams:
  - Loss of stream bank vegetation
  - Reduced shoreline and stream-bed complexity
  - Reduction in local sediment inputs to the stream
  - Concentration of high flow velocities along the toe of armored banks
  - Localized channel scour or incision

These physical changes can affect biological processes, habitats, and species. Riparian vegetation displaced by armoring leads to decreases in shade, cover, detritus, and terrestrial prey upon which aquatic organisms depend.

Knowing where severe impairments due to shoreline armoring occur would help determine the highest priority sites for restoring natural geomorphic processes. With such information, the Coalition could develop technical guidance and implement alternatives to traditional shoreline armoring that maintain natural shoreline processes and functions.

Climate Change

There has been extensive research on expected weather-related precipitation and hydrologic changes in the Cascade Mountains and the Puget Lowland due to climate change. The most significant change for Lewis County is a temperature-driven shift in precipitation form, with less snowfall and more rainfall (Elsner et al. 2010; Dalton et al. 2013). This will mean lower base flow in streams in the summer and higher flood flows in the winter. This will be particularly pronounced for those basins that currently have a significant amount of snowmelt; in Lewis County this means those basins that originate along the Cascade Crest. The effects of lowered summertime streamflow will be exacerbated by the increase of summertime temperatures (Abatzoglou et al. 2014). The combination of lower streamflow with higher summertime temperatures will complicate restoration efforts, particularly those projects that spread out flow thus increasing risk of triggering ephemeral (seasonal) flow conditions (i.e., drying out streams).

In addition to the effects of warming and reduction of snowmelt, climate change is also expected to lead to an increase in precipitation intensity during the largest storms (Muschinski and Katz 2013). This increase occurs because of the increase in available moisture in the atmosphere when temperatures increase, and because storms in a warmer climate are likely to draw moisture from larger areas (Trenberth 2011). This intensification of the hydrologic cycle has already been documented to have occurred in areas including Lewis County (Muschinski and Katz 2013), and likely will continue into the future. Prediction of the magnitude of this effect has occurred by driving higher resolution regional-scale models with coarse-scale global circulation output (Dulière et al. 2011; Dominguez et al. 2012). Further, analysis of observed historical precipitation in the Pacific Northwest has shown increases in precipitation intensities for durations less than 24 hours in the Puget Sound area (Rosenberg et al. 2010) and for maximum 48-hour precipitation across much of Western Washington (Mass et al. 2011). Continued review of climate change research will be important to ensuring restoration projects are designed and sited appropriately to be sustainable given expected weather changes.

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