
Lower Columbia Salmon Recovery Plan Partner Program Implementation Review

East Fork Lewis River Habitat Pilot Study



Prepared for Lower Columbia Fish Recovery Board

by PC Trask & Associates, Inc.

September | 2020

Table of Contents

Acronyms and Abbreviations.....	iii
Executive Summary.....	1
Project Description, Approach, and Context	1
Recovery Partner Program Implementation Review Findings.....	2
Threat Status and Quality of Supporting Data	3
Take-home Messages and Implications Beyond the EFLR	4
Chapter 1. Background and Introduction	5
Lower Columbia Fish Recovery Board (LCFRB) and the Recovery Plan	5
Evaluating Recovery Plan Implementation	6
EFLR – Study Area and Recovery Plan Importance	6
EFLR – Recovery Expectations and Progress	10
EFLR – Population Growth and Landcover Change	12
EFLR – A River of Expectations	16
Chapter 2. EFLR Partner Program Implementation Review	17
Recovery Plan Administration	22
LCFRB Recovery Plan Implementation	24
Recovery Partner Program Outreach	25
Lead Entity Administration Habitat Acquisition, Restoration, and Stewardship	28
Habitat Grant Funding Administration	29
Land Acquisition, Stewardship, and Management.....	31
Habitat Restoration and Enhancement	37
Technical Assistance and Outreach.....	42
Best Management Practices	43
Land Use and Development Regulation.....	46
Growth Management Act (GMA) Comprehensive Planning	47
Shoreline Management Act (SMA)	60
Clean Water Act (CWA)	64
Instream Protections	73
Endangered Species Act (ESA) and Magnuson-Stevens Fishery Conservation and Management Act	81
Forest Practices Regulation.....	85

Gifford Pinchot National Forest (GPNF) Land and Resource Management Plan	87
State Trust Lands Habitat Conservation Plan (HCP)	91
Forest Practices Habitat Conservation Plan (HCP)	95
Aggregate Mining and Mineral Prospecting Regulation	99
Clark County Mineral Resource Lands	103
Ecology Sand and Gravel Permit.....	105
DNR Surface Mining Reclamation.....	106
Storedahl Habitat Conservation Plan	107
Mineral Prospecting HPA.....	109
Chapter 3. EFLR Threat Observations and Monitoring	112
Urban and Rural Development.....	112
Forest Practices	115
Mining and Mineral Prospecting	119
Agriculture and Grazing.....	123
Channel Streambank and Floodplain Alterations.....	128
Program Implementation and Threats: Is It Enough?.....	130
Chapter 4. Data Sufficiency, Recovery Plan Expectations, and Implications Beyond the EFLR .	132
Data Sufficiency.....	132
Recovery Plan Implementation and Expectations	134
EFLR and Beyond: Flowing Through the I-5 Corridor	136
References	138

Acronyms and Abbreviations

AEMR	Action Effectiveness Monitoring and Research
AMP	Adaptive Management Program
BMP	Best Management Practices
BPA	Bonneville Power Administration
CAO	Critical Areas Ordinance
CEERP	Columbia Estuary Ecosystem Restoration Program
cfs	cubic feet per second
CLT	Columbia Land Trust
CMER	Cooperative Monitoring, Evaluation, and Research
CMZ	Channel Migration Zone
CPU	Clark Public Utilities
CARA	Critical Aquifer Recharge Area
CUP	Conditional Use Permit
CWA	Clean Water Act
DOC	Washington Department of Commerce
DNR	Washington Department of Natural Resources
Ecology	Washington Department Ecology
EDT	Ecosystem Diagnosis and Treatment
EFLR	East Fork Lewis River
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FFFP	Family Forest Fish Passage Program
FPARS	Forest Practices Application Review System
FOIA	Freedom of Information Act
FPR	Forest Practice Rules
FREP	Forestry Riparian Easement Program

GIS	Geographic Information System
GMA	Growth Management Act
GPNF	Gifford Pinchot National Forest
HCO	Habitat Conservation Ordinance
HCP	Habitat Conservation Plan
HPA	Hydraulic Project Approval
LCEP	Lower Columbia Estuary Partnership
LCFRB	Lower Columbia Fish Recovery Board
LCFEG	Lower Columbia Fish Enhancement Group
LRMP	Land and Resource Management Plan
LWD	Large Woody Debris
MMPA	Marine Mammal Protection Act
NFWF CSF	National Fish and Wildlife Foundation Community Salmon Fund
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northwest Power and Conservation Council
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
OFM	Office of Financial Management
OSS O&M	On-site Septic System Operation and Maintenance Program
PARIS	Permitting and Reporting Information System
PCSRF	Pacific Coastal Salmon Recovery Fund
PC Trask	PC Trask and Associates, Inc.
PGG	Pacific Groundwater Group
PHS	Priority Habitat and Species
PRISM	Project Information System
RCO	Recreation and Conservation Office
RCW	Revised Codes of Washington
RHA	Rivers and Harbors Act

RM	River Mile
RMAP	Road Maintenance and Abandonment Plan
ROSP	Riparian Open Space Program
ROW	Right of Way
SAM	Stormwater Action Monitoring
SEPA	State Environmental Protection Act
SMA	Shoreline Management Act
SMP	Shoreline Master Program
SNAP	Stormwater Needs Assessment Program
SRFB	Salmon Recovery Funding Board
TMDL	Total Maximum Daily Load
UGA	Urban Growth Area
USACE	United States Army Corps of Engineers
USACE ORM	USACE Operations and Maintenance Business Information Link (OMBIL) Regulatory Module
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
LRMP	Land and Resource Management Plan
VBLM	Vacant and Buildable Lands Model
WAC	Washington Administrative Code
WDFW	Washington Department of Fish & Wildlife
WRATS	Water Right Application Tracking System
WRIA	Water Resource Inventory Area
WSU	Washington State University

Executive Summary

Project Description, Approach, and Context

The purposes of this report are to (1) assess how well programs are addressing the expectations of the *Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (Recovery Plan) regarding threats to salmon and steelhead habitat in the East Fork Lewis River (EFLR) watershed, and (2) to provide a template that identifies data and potential metrics to guide future evaluations and adaptive management of the Recovery Plan.

The Lower Columbia Fish Recovery Board (LCFRB) engaged PC Trask and Associates, Inc. (PC Trask) to perform a pilot assessment of habitat-related implementation programs in the East Fork Lewis River (EFLR) watershed. The approach consisted of: 1) conducting interviews with key program staff, and 2) the identification, assessment, and synthesis of data sets for their potential contribution to characterizing program implementation within the context of threats to salmon and steelhead.

This evaluation represents one element of a comprehensive “All-H” (harvest, habitat, hatchery, and hydropower) review as part of the LCFRB’s adaptive management plan to assess progress after 15 years of implementation. Two related, but separate evaluations on hatcheries and harvest are underway by LCFRB to assess strengths and weaknesses of actions to reduce related threats.

Five populations of salmon and steelhead are listed as threatened under the Endangered Species Act in the EFLR: coho, chum, and Chinook salmon, and winter and summer steelhead. All five populations are identified in the Recovery Plan as “primary¹” contributors to recovery. The Recovery Plan identified their viability status as either very low (coho, chum, Chinook salmon, and summer steelhead) or medium (winter steelhead) and their viability objective as high or very high. Long-term monitoring of EFLR populations suggests that each population has their own distinct trajectory. Steelhead in the EFLR are currently doing well from a recovery abundance perspective. However, long-term recovery progress of fall Chinook and coho abundance peaked in 2013 and 2014 and have declined since. An estimate of chum abundance is not available at this time but it is thought to remain very low.

A fundamental assumption for the habitat portion of the Recovery Plan was that federal, state, and local regulatory and technical assistance programs would protect the environmental baseline from further degradation (Breckel 2020; Trask 2020). It was also assumed that conservation-based programs would be implemented to further protect key salmon and steelhead habitats and habitat-forming processes where regulatory mechanisms fell short. Finally, it was expected that restoration- and enhancement-based programs would return access to blocked habitats, improve the quality of existing degraded habitats, and help maintain/improve watershed processes (e.g., hydrology and geomorphology). Recovery planners also expected these partners would use the Recovery Plan to help set priorities, and conduct effectiveness monitoring to support adaptive management of their programs and the Recovery Plan.

Between August 1, 2018 and December 31, 2019, 65 (primarily in-person) interviews were conducted representing 29 partner programs in the EFLR watershed. Additional phone calls and email inquiries were made to investigate further and to clarify program information. Multiple field trips were

¹ Primary is the highest recovery priority designation in the Recovery Plan.

conducted to gather images and add perspective to the scope and intensity of threats (e.g., urban/rural development, agricultural practices, forest practices, and mining) that the Recovery Plan identified as the primary underlying causes of the habitat factors that limit salmon and steelhead viability in the EFLR.

Recovery Partner Program Implementation Review Findings

Results of the interviews and data collection highlight fundamental disconnects between the Recovery Plan and many of the programs envisioned to implement Recovery Plan actions. All programs appear to be implementing their programs according to their authorities, mission, policies, and funding. However, in only a few cases were programs aligned with and utilizing the Recovery Plan to help guide implementation. Where LCFRB has actively engaged in program reviews and updates, alignment to the Recovery Plan has increased. However, the historical and contemporary capacity of LCFRB results in limitations to these important program interactions.

LCFRB has been successful building and maintaining relationships with acquisition and restoration partners through its Lead Entity Salmon Recovery Funding Board (SRFB) program and other funding sources. Together with other programs (e.g., the Washington Wildlife and Recreation Program (WWRP), Bonneville Power Administration, and Clark County Conservation Futures) investments made by federal, state, local, and non-governmental entities to implement habitat acquisition and restoration projects in the EFLR watershed are impressive.

LCFRB's relationships with regulatory programs are weaker, and this study found few regulatory programs with direct alignment to the Recovery Plan. While there are some exceptions, like Ecology's Shoreline Master Program, regulatory programs follow their own authorities and policies with little incorporation of Recovery Plan guidance. Interview discussions indicated that weak regulatory relationships are a result of the voluntary nature of Recovery Plan implementation, the lack of resources for LCFRB to effectively engage in policy development and oversight processes, and the absence of more formalized relationships and implementation agreements with LCFRB that structurally connect regulatory programs to the Recovery Plan.

Recovery Plan expectations, in the form of actions, measures, and submeasures, are challenging to evaluate given their qualitative nature and the absence of program data to draw upon to evaluate program effectiveness. The question of whether specific program implementation was meeting the "expectations" of the Recovery Plan was particularly challenging because of a lack of clarity in the Recovery Plan itself. For example, Recovery Plan expectations were often generalized to direct a program to "...implement the terms of a habitat conservation plan" or "...increase the level of land use protections." In these cases, it could be argued that all programs are meeting the expectation of the Recovery Plan. Finally, the interview and data collection processes underpinning this report suggest limited compliance monitoring and enforcement of regulatory program requirements, across all partners.

Interviews and available data suggest that both contemporary threats (e.g., timber harvest and urban/rural development) and legacy threats (e.g., Ridgefield Pits avulsions) will continue to negatively impact salmon and steelhead habitat into the future. In balance, programs responsible for managing these threats continue to emphasize best management practices and implement mitigation and restoration activities. While acquisition and restoration program accomplishments are notable, especially in the EFLR Greenway, the degree to which their positive effects will counteract the intensity

of on-going threats in the EFLR watershed remains unclear. The following are summary conclusions about Recovery Plan implementation:

1. Recovery Plan expectations of partner programs are general and lack sufficient detail to support evaluation of effectiveness and adequacy in relation to threat reduction targets;
2. Local, state and federal implementation programs are generally designed to address and meet legislative or legal mandates, and clear and direct connections to Recovery Plan priorities, with few exceptions, are lacking;
3. Habitat Conservation Plans and other ESA-related programs, which the Recovery Plan assumed to be sufficient, provide legal protections for the proponent (e.g., avoid lawsuits or jeopardy). While they establish habitat protection and restoration elements, it is unclear to what level implementation of these elements fully mitigate impacts resulting from their own actions, or positively contribute to restoration or enhancement of habitat function and capacity;
4. LCFRB as a regional recovery organization lacks capacity to proactively engage with all partners to improve integration of Recovery Plan priorities into their various programs. This evaluation revealed that where LCFRB engagement has occurred, some success was achieved. A notable example is incorporation of Recovery Plan reach priorities into Clark County's previous (pre-2015) Shoreline Master Program update;
5. The overarching assumption that existing implementation under partner program authorities will achieve ESA threat reduction targets of the Recovery Plan may be an underlying weakness of the Recovery Plan (e.g., does existing program implementation add up to reduced threats to the point that salmon and steelhead recover?);
6. The assumption that partners would fully consider salmon and steelhead recovery needs in updates to land use programs, and rely upon the Recovery Plan for guidance in decision making, is not broadly supported or evident. However, many programs provide direct benefits and protections to ESA-listed species as a result of underlying statutory requirements that at least partially overlap with recovery needs.

Threat Status and Quality of Supporting Data

The delisting of ESA-listed populations of salmon and steelhead by NOAA Fisheries requires, among other elements, evidence that threats are eliminated or minimized to the degree that populations can achieve and maintain viability levels identified in the Recovery Plan. Interviews and program data were assessed for suitability to characterize the status of threats in the EFLR watershed. Whenever possible, spatial data were acquired and processed to portray effects on the landscape as they relate to program implementation between 2004 and 2019 to help demonstrate landscape changes since adoption of the Recovery Plan. Metrics were also identified that could help recovery planners assess threats at the watershed-scale. The following points provide a high-level summary of what was learned about monitoring efforts, data acquisition, and data synthesis, associated with partner programs:

1. Salmon recovery reporting on habitat acquisition and restoration focuses nearly exclusively on number of acres/miles acquired or restored. Comprehensive reporting on watershed health is absent, as are metrics to evaluate the trajectory of threats. The Governor's Salmon Recovery Office's (GSRO) *State of the Salmon Report* comprehensively describes restoration and acquisition actions, but provides few watershed-scale metrics to evaluate threat reduction status over time;

2. Regulatory Programs that gauge effectiveness at achieving the purpose and intent of the program (e.g., protection of shorelines, critical areas, watershed processes, etc.) are lacking, and where present, reporting and data dissemination are absent;
3. Key information about regulated activities in critical areas and shoreline protections (e.g., variances and conditional use permits) is not available for analysis;
4. Programs track elements of implementation, such as numbers and types of permits, and general location of authorized activities; however, databases are designed to manage permit or grant processes, and not to assess cumulative impacts on watershed processes and habitat conditions;
5. Human activities that pose threats to fish habitat (i.e., development, resource extraction, and forestry) can overlap both spatially and temporally and trigger cumulative impacts. However, these activities are tracked independently, and often insufficiently, by individual programs. With the exception of stormwater NPDES permits, implementation of a habitat status and trends monitoring program has not occurred, primarily due to budget constraints, and yet is critically important for independently evaluating the cumulative effect of programs (positive and negative) on watershed processes and habitat conditions;
6. For many programs, existing data at the project scale could be digitized into GIS polygons with informative attributes to provide useful information for estimating threat trajectories and cumulative impacts; however, converting data would be labor intensive and may not be useful because of inconsistent data recording. An underlying issue, aside from geospatial database architecture, is sufficient staff time and training to accurately capture data; and
7. Several of the recovery plan partners required public disclosure or FOIA requests to acquire data sets at no-charge, while others required a substantial cost reimbursement. While this is a common and accepted practice in general, it is yet another sign that relationships between partners for purposes of implementing the Recovery Plan are immature or absent.

Take-home Messages and Implications Beyond the EFLR

The EFLR's story is not unique among the lower Columbia watersheds. The Washington Office of Financial Management's (OFM) Forecasting and Research Division estimates that human population in the EFLR watershed grew by 47 percent between 2000 and 2018 (OFM 2019). OFM predicts that Washington State's population will increase by 25 percent by the year 2040, with most growth occurring in counties straddling I-5 (OFM 2019). In the lower Columbia, threats resulting from population growth (e.g., urban and rural development, forest practices, mining, and channel manipulation) will exert pressures on habitat-forming processes and habitat conditions in systems such as the NF Lewis, Kalama, and Cowlitz watersheds. Statewide, watersheds intersected by the I-5 corridor should expect habitat and habitat-forming processes to be further impacted by urban and rural development among other threats. Given the implications of rapid population growth and commensurate threats, clear direction in the Recovery Plan and alignment with implementation partners is imperative for listed fish species recovery.

Chapter 1. Background and Introduction

Lower Columbia Fish Recovery Board (LCFRB) and the Recovery Plan

The Lower Columbia Fish Recovery Board (LCFRB) was created by legislative action under Revised Code of Washington (RCW) Chapter 77.85.200 in March of 1998 as a result of Southwest Washington counties' desire to proactively address Endangered Species Act (ESA) issues related to five listed salmon and steelhead populations found in local watersheds. The LCFRB subsequently led and integrated three major planning initiatives: subbasin planning for the Northwest Power and Planning Council (NPPC); watershed planning for the Department of Ecology (Ecology) under RCW Chapter 90.82; and ESA recovery planning for National Oceanic and Atmospheric Administration Fisheries (NOAA), and under HB 2496, the state's Salmon Recovery Act. These interrelated planning efforts were incorporated into the *Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (Recovery Plan), which was first approved in 2004 and later revised and adopted by NOAA in 2010. In 2013, it was adopted as part of the domain plan for the lower Columbia, which also includes recovery modules for Oregon and the shared Columbia River estuary.

The Recovery Plan identifies factors limiting survival of salmon and steelhead and the underlying causes of these limiting factors. These underlying causes, or threats, represent the problems to address to achieve recovery. The Recovery Plan includes a comprehensive suite of strategies, measures, and actions that are intended to address threats to listed species. These threats are related to hatcheries, harvest, hydroelectric facilities and operations, ecological interactions, habitat, and ocean and climate conditions. To address uncertainties, the Recovery Plan also includes an adaptive management framework that guides implementation based on the results of monitoring, refinements in management approaches, and changes in biological and habitat conditions. Implementation of these strategies, measures, and actions are intended to recover salmon and steelhead populations to healthy and harvestable levels.

The Recovery Plan identifies partners with the authority, jurisdiction, or resources needed to implement the plan's 364 actions and supporting strategies and measures. The actions identified for each partner are based on the partner's mission, capabilities, responsibilities, authority, and agreement. The Recovery Plan specifically identifies key programs that are necessary to address threat reduction targets. It is expected that partners will fully implement existing programs to address assigned actions.

Most programs identified in the Recovery Plan pre-date the plan, and each is grounded within its own authority, mission, and policies that guide implementation. Although they precede the Recovery Plan, many of these programs fell under the purview of agencies represented by the LCFRB's Board, and the WRIA 27/28 (Salmon-Washougal and Lewis) Watershed Planning Unit. Others were intimately connected to the Recovery Plan development process, including the Governor's Salmon Recovery Office and NOAA. The Recovery Plan focuses on outcomes, and allows implementing agencies and entities the flexibility to craft innovative, scientific approaches that best fit local conditions and values. The plan recognizes that success can only be achieved if local, state, and federal partners take ownership and are involved in implementation and adaptive management. Volume II, Chapter L of the Recovery Plan provides brief summaries of local, state, federal and non-governmental programs pertinent to recovery in the EFLR basin (Section L.4.1), discusses gaps relating to implementation of key measures (Table L-14), and identifies future actions and responsible parties for addressing gaps (Table L-15).

Evaluating Recovery Plan Implementation

LCFRB is currently performing an “All-H” review as part of their adaptive management plan to assess program implementation 15 years after initial adoption of the recovery plan in 2004. Two related, but separate evaluations (on hatcheries and harvest) are underway to assess partner implementation of programs identified in the Recovery Plan, and more specifically strengths and weaknesses related to the reduction of salmon and steelhead threats. This report focuses on habitat by evaluating partner program implementation of actions that affect stream habitat relative to Recovery Plan expectations.

A fundamental assumption for the habitat portion of the Recovery Plan was that federal, state, and local regulatory and technical assistance programs would help protect the environmental baseline from further degradation (Breckel 2020; Trask 2020). It was also assumed that conservation-based programs would be implemented to further protect key salmon and steelhead habitats and their supporting processes. Finally, it was expected that restoration- and enhancement-based programs would return access to blocked habitats and improve the quality of existing degraded habitats. Recovery planners also expected these partners to use elements of the Recovery Plan to help set priorities and conduct program effectiveness monitoring to support adaptive management of their programs and recovery efforts.

The LCFRB contracted with PC Trask and Associates, Inc. (PC Trask) to evaluate program implementation of the stream habitat and land use portions of the Recovery Plan. This comprised two central questions: 1) are partner programs meeting the expectations of the Recovery Plan; and, 2) what data sources are available to inform the status of habitat threats to salmon and steelhead? The report is structured as a pilot study and limited to a specific geographic area – the East Fork Lewis River² (EFLR). PC Trask evaluated federal, state, local, and non-governmental programs that were identified in the Recovery Plan³ to implement habitat-related actions in the EFLR watershed.⁴

EFLR – Study Area and Recovery Plan Importance

The EFLR flows from east to west from its headwaters in the Gifford Pinchot National Forest (GPNF). The watershed is approximately 150,635 acres, located in northern Clark and western Skamania Counties, Washington. As with most lower Columbia River tributaries, the headwaters are forested while lower reaches are more urban, and agricultural and residential activities are found in the valley bottom areas. Interstate 5 crosses the EFLR near its confluence with the NF Lewis River. Figure 1 shows pertinent features of the EFLR watershed.

² The East Fork Lewis River watershed includes Gee Creek which drains independently into the Lower Columbia River.

³ Some partners/programs evaluated in this report were not originally identified in the Recovery Plan, but were deemed directly applicable to the implementation of Recovery Plan actions and objectives.

⁴ This program evaluation focuses on 18 actions that are identified in the Recovery Plan’s *Chapter L East Fork Lewis Subbasin*, Table L-15 ‘Habitat actions for the East Fork Lewis Basin’ and 24 implementation actions specifically for the LCFRB. However, 243 habitat, monitoring, and implementation actions are listed in *Chapter 10 Implementation* of the Recovery Plan, which may also be applicable to the programs evaluated in this report.

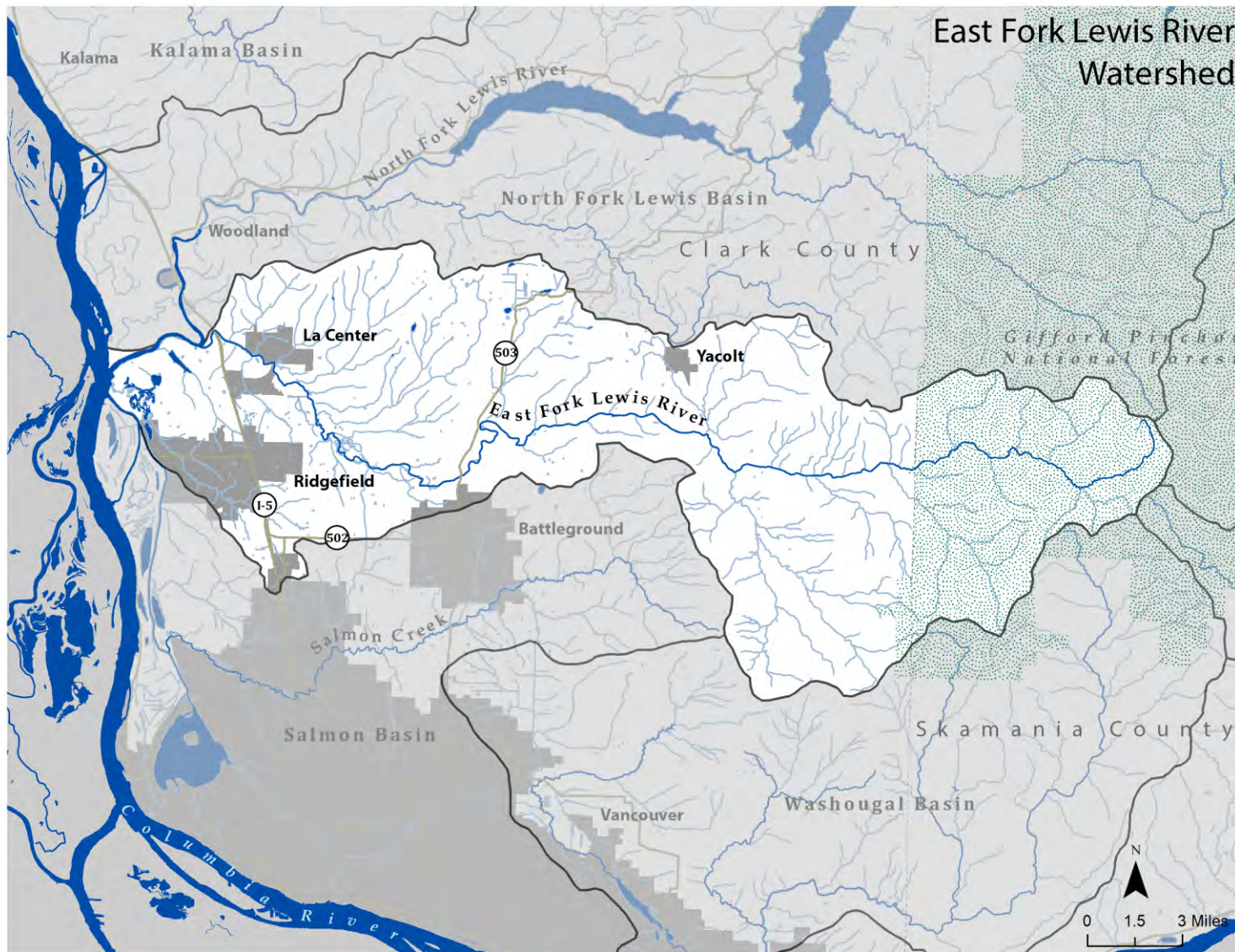


Figure 1. Map of the East Fork Lewis River watershed, including city urban growth areas (dark grey), National Forest (spotted green), state and interstate highways (yellow), NHD streams (light blue), rivers and lakes (dark blue)

The EFLR is considered one of the most important watersheds for the recovery of ESA-listed salmon and steelhead populations in the lower Columbia River. This is partly because five populations inhabit the system. Further, the EFLR has no mainstem dams and there are no in-basin hatcheries supplementing harvest.⁵ Table 1 shows the recovery priority, viability status, and objectives of salmon and steelhead populations in the EFLR. The Recovery Plan indicated that, at the time of listing (1998-1999), the viability status for four of the five populations was very low and the Recovery Plan viability objectives for all populations are high or very high. As a result, the EFLR plays a key role in the regional recovery of these species and must be recovered to a high or very high viability to achieve delisting targets.

Table 1			
EFLR Salmon and Steelhead Populations – Status Objectives			
Population	Recovery Priority¹	Viability	
		Status²	Objective²
Fall Chinook	Primary	Very Low	Very High
Chum	Primary	Very Low	High
Winter Steelhead	Primary	Medium	High
Summer Steelhead	Primary	Very Low	High
Coho	Primary	Very Low	High

¹Primary is the highest recovery priority designation

²100-year persistence probabilities

The Recovery Plan categorized the EFLR and its tributaries into tiers to prioritize where recovery efforts would yield the greatest benefits to achieve biological objectives, and are derived from Ecosystem Diagnosis and Treatment (EDT) outputs (LCFRB 2010). Tributary reaches are classified into tiers (1 through 4, with 1 being the highest priority) for primary, contributing, and stabilizing populations.⁶ Subwatersheds within the EFLR are grouped A through D based on the tiered tributary reaches within each subwatershed⁷. Figure 2 illustrates EFLR tiered tributary reaches and the corresponding subwatershed groups.

⁵ The EFLR has historically received steelhead summer-run hatchery plants of 15,000 and 60,000 winter-run smolts. Hatchery practices ended in 2014 when the EFLR was identified as a Wild Steelhead Gene Bank.

⁶ Tier 1 is comprised of all high priority reaches for one or more primary populations; Tier 2 is comprised of medium priority reaches for one or more primary populations and/or high priority reaches for one or more contributing populations; Tier 3 is comprised of medium priority reaches for contributing populations and/or high priority reaches for stabilizing populations; Tier 4 is comprised of medium priority reaches for stabilizing populations and/or low priority reaches for all populations.

⁷ Group A includes one or more Tier 1 reaches; Group B includes one or more Tier 2 reaches; Group C includes one or more Tier 3 reaches; Group D includes only Tier 4 reaches.

East Fork Lewis River Tiered Reaches and Subwatershed Groups

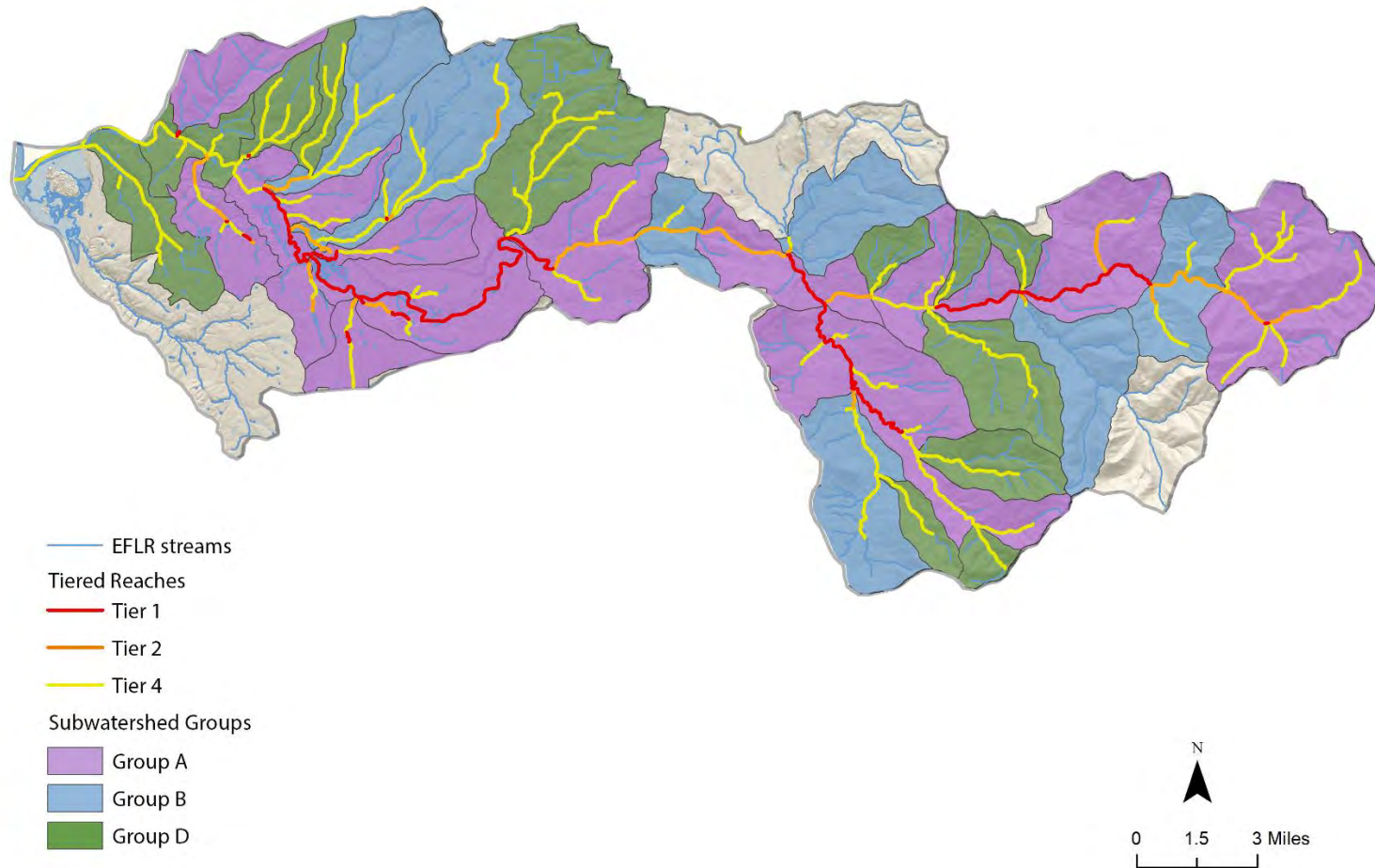


Figure 2. EFLR tiered reaches and subwatershed groups. There are no Tier 3 reaches in the EFLR watershed, and therefore no Group C subwatersheds. Data provided by LCFRB.

EFLR – Recovery Expectations and Progress

The Recovery Plan establishes a clear expectation that the EFLR will play a key role in the regional recovery of salmon and steelhead. To achieve recovery goals, the Recovery Plan indicates that a 25 percent to >500 percent increase in population productivity, depending on species, must be achieved in the EFLR watershed. It is important to note, however, that the status of ESA-listed populations is the result of the interaction of multiple threats across the entire fish life cycle, and that the relative magnitude of threats can change over time and space. As one threat is reduced or addressed, another may become more important. Monitoring and adaptive management are therefore critical elements of recovery.

With regard to expectations for achieving natural origin abundance targets, data is available for four of the five populations that occupy the EFLR - fall Chinook (Lewis), coho, winter steelhead, and summer steelhead (EF Lewis) (see Table 2 and Figure 3). Chum abundance is not estimated at this point because returns remain very low. Fall Chinook (which include fish in the North Fork Lewis River), winter steelhead and summer steelhead abundances are all surpassing delisting abundance targets, reflected by recent, four-year medians (2014 – 2017 for fall Chinook and coho, 2015 – 2018 for winter and summer steelhead). In contrast, coho have achieved about one third of their delisting abundance targets according to the recent four-year median abundance.

Monitoring data for steelhead are available for the last twelve years, and 12-year median abundances for these populations are also surpassing delisting targets. This long-term status suggests that steelhead are doing well from a recovery abundance perspective. More data is necessary in order to assess the long-term recovery progress of fall Chinook and coho, especially because abundance estimates peaked in 2013 and 2014 for these populations, respectively. Although greater than delisting targets, fall Chinook had lower returns in 2016 and 2017 than for the years 2013 – 2015, and annual coho returns were lower than delisting targets in 2015 – 2017. While abundance trends of some species are positive, it is uncertain whether land use and regulatory programs evaluated in Chapter 2 are sufficient to reduce threats in a manner that will achieve and sustain recovery objectives in the long-term.

Population	Watershed	Recovery Designation	Delisting Abundance Target	4-Year Median	12-Year Median	4-Yr % of Target	12-Yr % of Target
Fall Chinook	Lewis	Primary	1,500	2,536	--	169%	--
Chum	Lewis	Primary	1,300	--	--	--	--
Coho	EF Lewis	Primary	2,000	674	--	34%	--
Winter Steelhead	EF Lewis	Primary	500	712	513	142%	103%
Summer Steelhead	EF Lewis	Primary	500	782	770	156%	154%

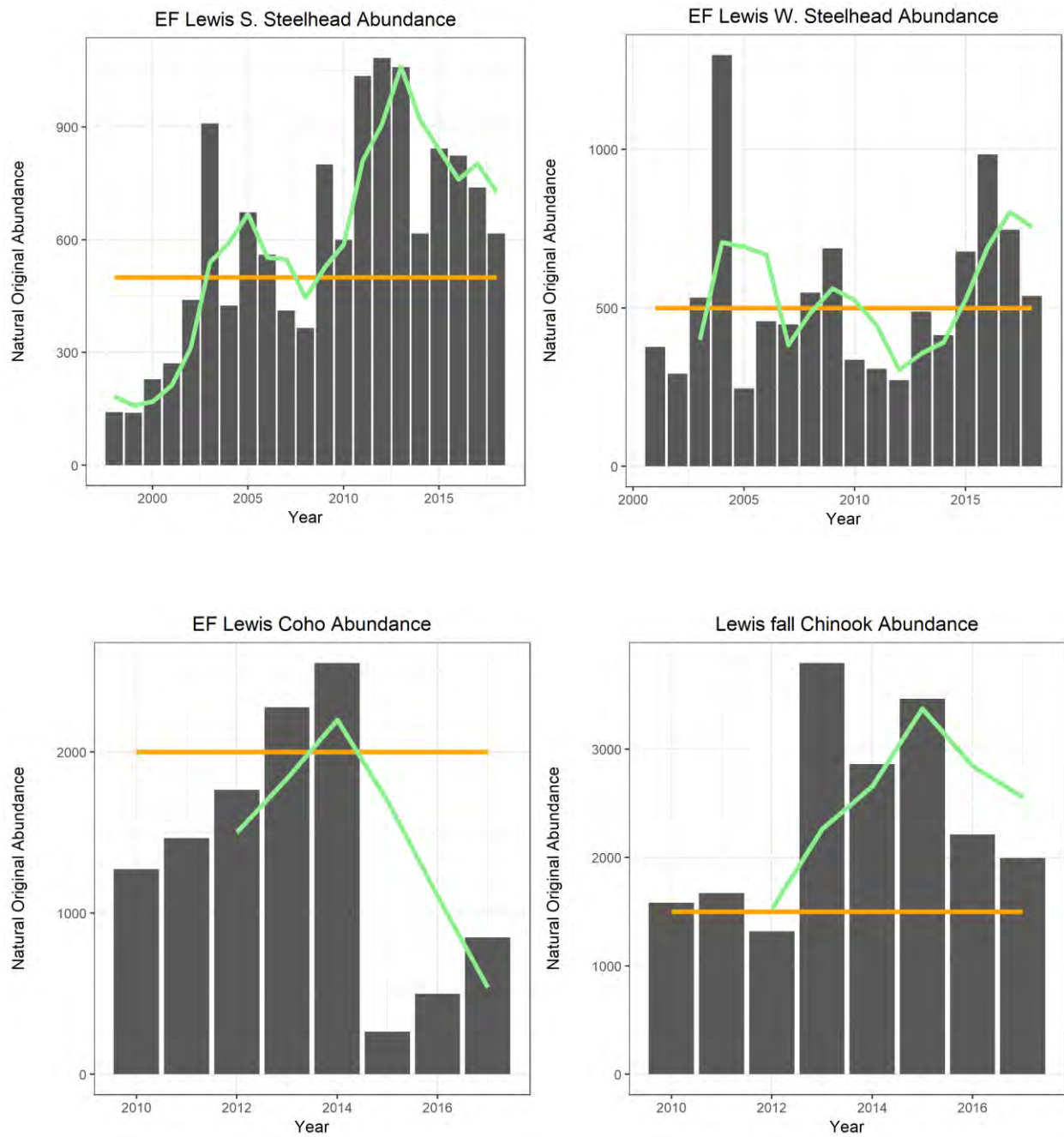


Figure 3. Graphs showing recent abundance data for EFLR summer steelhead (top left) winter steelhead (top right), coho (bottom left), and Lewis fall chinook (bottom right), their respective abundance targets (orange line) and three-year moving average (green line). Graphs provided by LCFRB.

Establishing cause and effect relationships between habitat threats and fish population status is challenging and beyond the scope of this project. However, understanding the current status of each population is critically important in guiding further analysis of programs relative to expectations, especially given the fact that different species use different parts of the watershed for spawning, rearing, and migration. See LCFRB 5 Year Status Review Comments for Pacific Salmon and Steelhead submitted to NOAA (LCFRB 2020) for companion efforts to characterize salmon recovery progress in the region.

EFLR – Population Growth and Landcover Change

The transition from native and vegetated landscapes to built environments increases the impervious coverage of roads, parking areas, sidewalks, rooftops, and landscaping. This alters the natural hydrological regime of watersheds, which can significantly degrade stream habitat. Typical hydrological responses include, but are not limited to, increased magnitude and frequency of high flows, reduced low flows, channel instability and erosion, and water quality degradation. The net result of these impacts is loss of biological integrity, and a reduction in the ability of a watershed to support and maintain healthy salmon and steelhead populations. Studies suggest the cumulative impact of hydrologic alteration can result in degraded biotic integrity at low, or typically rural, levels of watershed development.

Human population within the EFLR watershed has grown substantially since the first ESA listings of salmon and steelhead populations in 1998.⁸ According to population estimates from the Office of Financial Management (OFM), human population in the EFLR watershed has increased by approximately 47 percent (from 24,159 to 35,593) between 2000 and 2018. Five incorporated cities’ urban growth boundaries are either entirely within or partially intersect the EFLR watershed (Vancouver, Ridgefield, La Center, Battle Ground and Yacolt). All five cities have expanded their urban growth boundaries since the introduction of the Recovery Plan and are experiencing rapid population growth, with Ridgefield being the fastest growing city in Washington State. Table 3 highlights OFM’s census, intercensal, and postcensal population estimates for the five cities and unincorporated Clark County between 2000 and 2018. However, the rate of population growth in this region began to increase long before the Recovery Plan was introduced, beginning as early as the 1940s, as seen in Figure 4.

Table 3 Census Counts and Intercensal and Postcensal Population Estimates					
Cities/Town	2000 Census Count	2004 Intercensal Estimate	2010 Census Count	2018 Postcensal Estimate	% Change from 2000 to 2018
Vancouver	143,560	152,074	161,791	183,500	28% increase
Ridgefield	2,147	2,280	4,763	7,705	259% increase

⁸ Coho were listed under ESA in 2005.

Cities/Town	2000 Census Count	2004 Intercensal Estimate	2010 Census Count	2018 Postcensal Estimate	% Change from 2000 to 2018
La Center	1,654	2,046	2,800	3,320	101% increase
Battle Ground	9,322	14,028	17,571	20,890	124% increase
Yacolt	1,055	1,144	1,566	1,780	69% increase
Unincorporated Clark County	166,279	186,887	203,339	222,420	34% increase

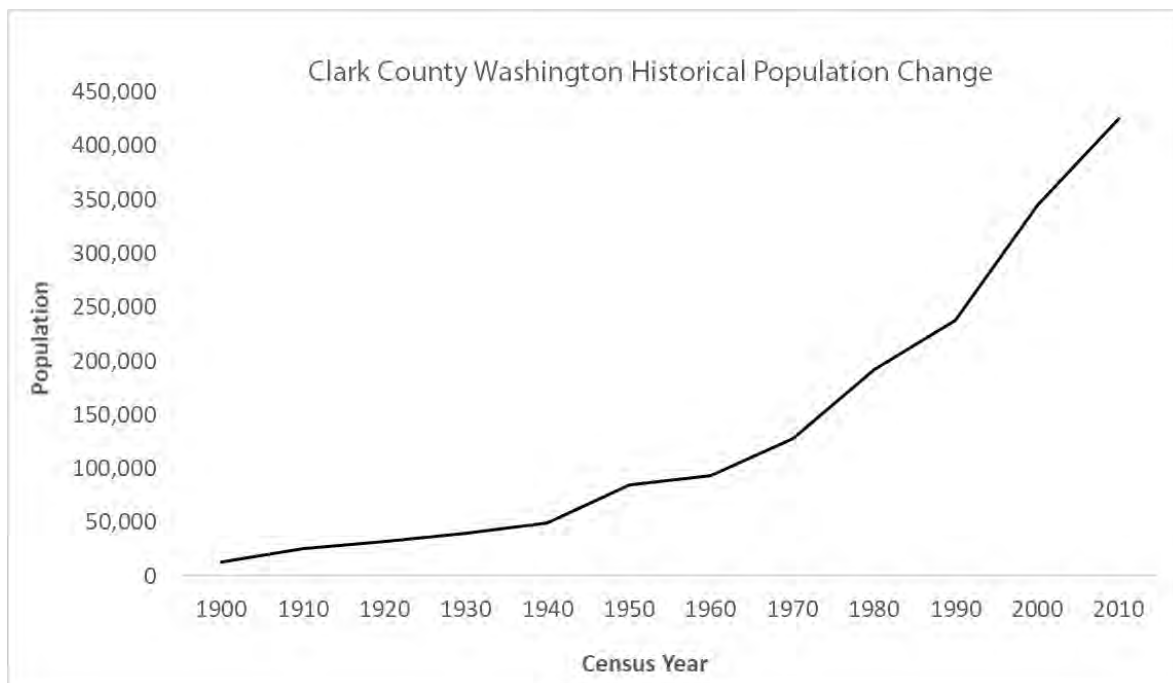


Figure 4. Graph depicting Clark County, Washington census estimates from 1990 to 2010. Population data are from OFM historical estimates of April 1 population.

The EFLR landscape has undergone major land cover changes between 2000 and 2018 primarily as a result of residential and commercial development, related infrastructure, and forest practices. The National Land Cover Database (NLCD) provides 30-meter resolution land cover classification, and offers a platform to evaluate broad scale landscape changes that have occurred in the EFLR watershed between 2001 and 2016. Figures 5 and 6 depict the trends in land cover and impervious surface between 2001 and 2016.

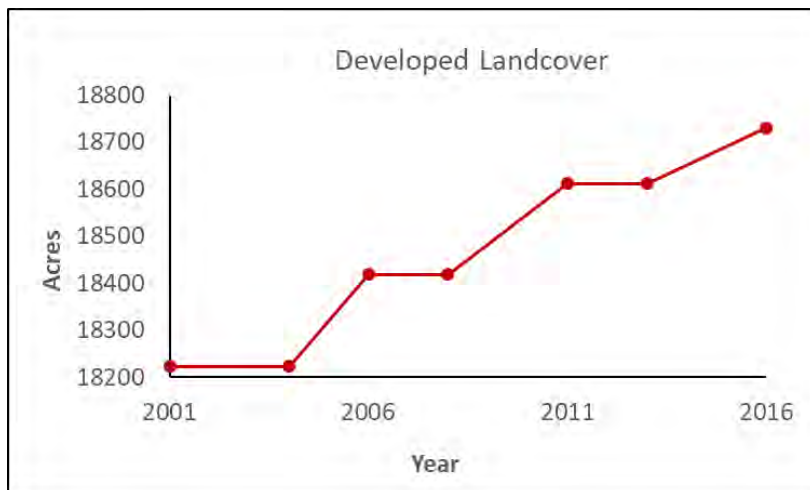
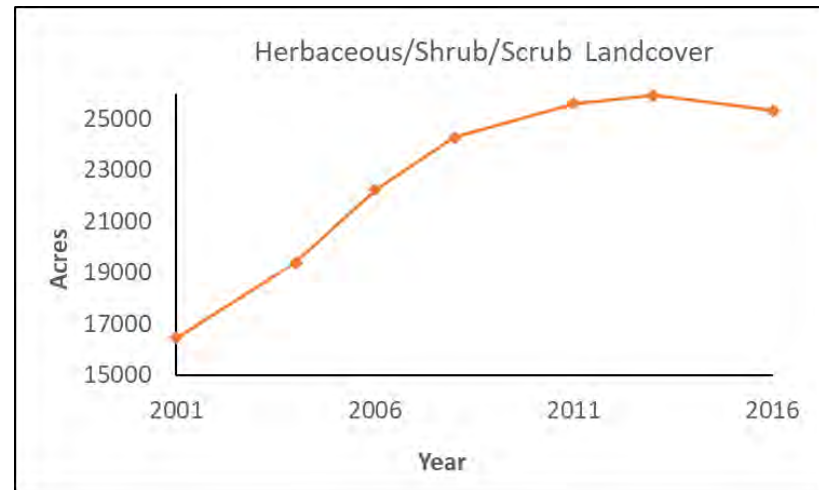
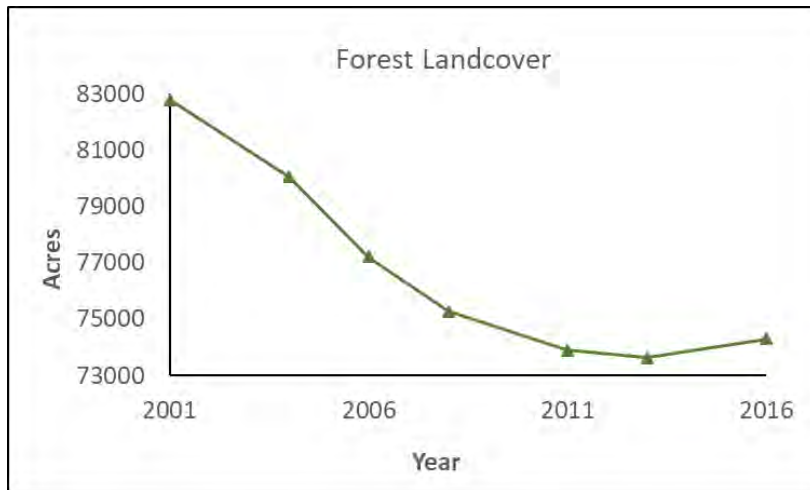


Figure 5. Graphs depicting changes in the acreage of three land cover classification groupings within the EFLR watershed between 2001 and 2016. For context, the EFLR watershed is approximately 151,100 acres. Data used for analysis are from the NLCD 2016 edition, which includes 30m resolution land cover products for 2001, 2004, 2006, 2008, 2011, 2013, and 2016. The "Forest" grouping includes deciduous, evergreen, and mixed forest classifications. The "Developed" grouping includes open space developed, and low-, medium-, and high-intensity developed classifications. The "Herbaceous/Shrub/Scrub" grouping includes herbaceous and shrub/scrub classifications.

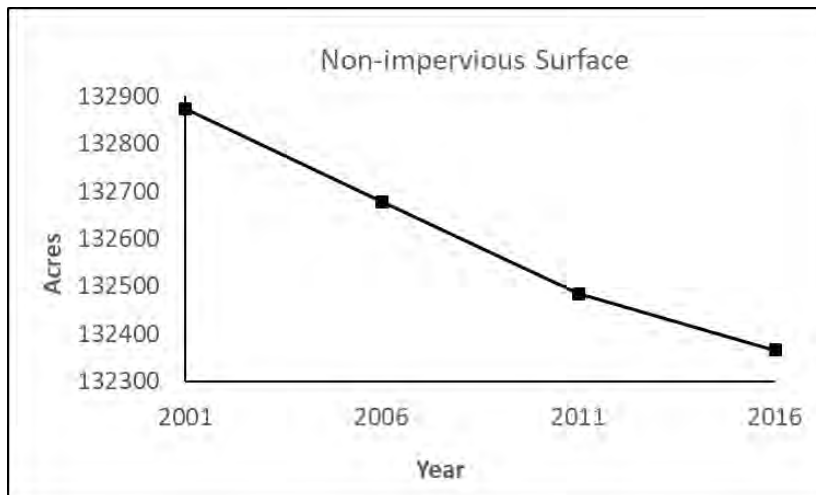
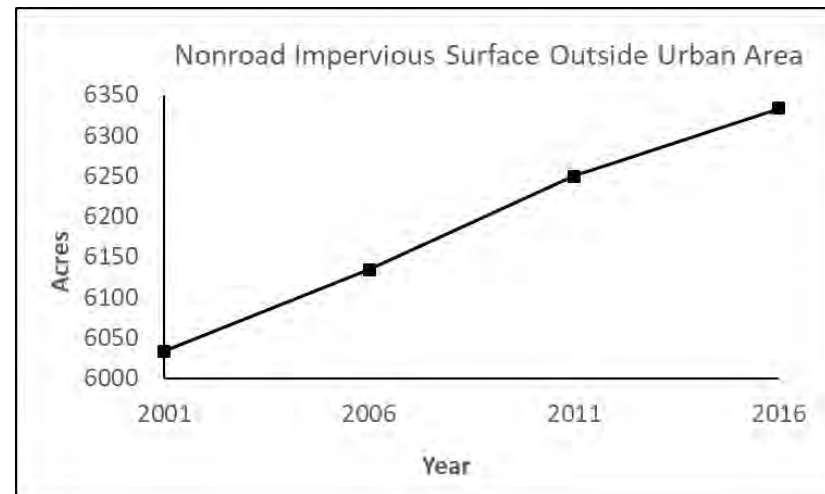
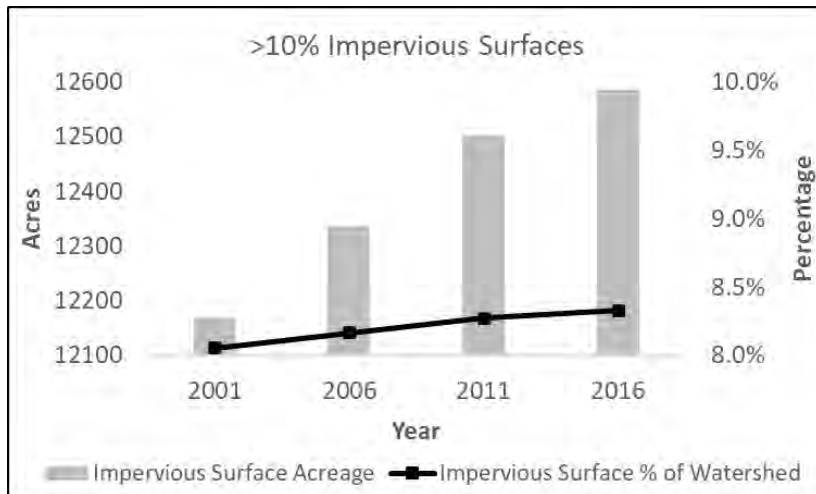


Figure 6. Graphs depicting changes in impervious surface area in the EFLR watershed between 2001 and 2016. Data used for this analysis are from the NLCD 2016 edition Percent Developed Imperviousness and Percent Developed Imperviousness Descriptor, which includes 30m resolution products for 2001, 2006, 2011, and 2016. The top left graph, >10% Impervious, shows changes in the acreage of land and % within the EFLR watershed classified as having >10% imperviousness. The bottom and top-right graphs show changes in 'non-impervious' and 'non-road impervious outside of urban areas' acreages between 2001-2016.

A 2002 study on forest cover and impervious surface area in the King County region suggests that approximately 10 percent impervious area within a watershed results in “demonstrable degradation,” and that a minimum 65 percent forest cover is a common threshold for maintaining watershed health (Booth et. al. 2002). According to the 2016 NLCD data, the EFLR watershed is approaching or has surpassed these thresholds, with approximately 8 percent of the EFLR watershed classified as impervious,⁹ and approximately 49 percent classified as forest cover (evergreen, deciduous, or mixed forests).¹⁰

EFLR – A River of Expectations

The EFLR has a reputation well beyond Southwest Washington as the place that produced a Washington State record steelhead that weighed in at 32.75 pounds on April 14, 1980. That record has since been broken, but the taxidermy replica remains displayed at Washington Department of Fish and Wildlife’s Region 5 office in Ridgefield, Washington. However, due to dwindling numbers, steelhead and salmon in the EFLR were part of NOAA’s threatened listing determinations under the ESA beginning in 1998. Habitat threats to listed populations in the EFLR were determined to be associated with human activities, including forestry, agriculture, mining, urban and rural development, and channel manipulations. The Recovery Plan indicates that loss of subbasin habitat quality and quantity for spawning and rearing accounts for the largest relative impact across all species in the watershed, except for historical harvest impacts for fall Chinook, which has since been substantively reduced. Recovery planners anticipated continued growth and resource extraction in the EFLR watershed, but envisioned program approaches to these activities that would ensure the protection and restoration of key resources. Planners also recognized the need for sufficient resources to fund restoration activities and to engage partner programs for coordination and alignment to Recovery Plan priorities.

⁹Pixels from the NLCD with greater than 10% imperviousness were considered impervious for the purposes of this calculation. The NLCD is 30-meter resolution, and therefore does not capture all impervious surfaces in the watershed.

¹⁰ Land recently harvested for timber will not be classified as “forest” in the NLCD products (instead it will be bare, herbaceous, or other early-succession classifications), even though the land use may technically still be forestry.

Chapter 2. EFLR Partner Program Implementation Review

This chapter is a synthesis of information collected and compiled on Recovery Plan program implementation in the EFLR. It is not an exhaustive evaluation of each program because of the deep history, evolving nature, and intricate detail in each program's operations. Twenty-nine federal, tribal, state, local, and non-government recovery partners¹¹ were queried to gauge their programs' effectiveness in meeting Recovery Plan expectations to restore and protect salmon and steelhead habitats in the EFLR watershed. Sixty-five interviews with program staff took place between August 2018 and December 2019. Table 4 identifies the individuals that were consulted in support of this report. Most interviews were held in-person and lasted approximately one hour. Interview questionnaires were developed and tailored to key programs and, in some cases, forwarded to the interviewee in advance. Interview topics ranged widely depending on the nature of programs, and addressed such topics as program purpose/intent, procedures, data management, reporting, and program effectiveness.

Table 4 Partner Program Interviewees		
Agency	Department	Interviewee
Clark County	Comprehensive & Shoreline Planning	Oliver Orjiako, Director
Clark County	Community Development	Mitch Nickolds, Director Brent Davis, Program Manager
Clark County	Health Department (well permits)	Chuck Harmon, Environmental Supervisor
Clark County	Public Works	Jeff Schnabel, Stormwater Lead Dean Boening, Environmental Director
Clark County	Public Works	Jennifer Taylor, Environmental Services
Clark County	Public Works	Pat Lee, Legacy Lands Manager
Clark County	Public Works	Rod Swanson, Monitoring Lead
Clark County	Parks & Trails	Bill Bjerke, Director (retired)
Clark County	Vegetation Management	Justin Collell, Interim Coordinator
Clark County	Parks Operations	Kevin Tyler, Lands Manager
City of Battle Ground	Community Development	Sam Crummett, Planning Supervisor
City of Battle Ground	Public Works	Kelly Uhacz, Stormwater Engineer
City of Vancouver	Operations	Brian Potter, Operations Supervisor

¹¹ Some partners/programs evaluated in this report were not originally identified in the Recovery Plan, but were deemed directly applicable to the implementation of Recovery Plan actions and objectives.

Agency	Department	Interviewee
City of La Center	Public Works	Naomi Hansen, Associate Planner
City of Ridgefield	Community Development/Planning	Jeff Niten, Director
Clark Conservation District	Conservation	Zorah Oppenheimer, Director
Clark Conservation District	Conservation	Denise Smee (former) Director
Clark Public Utilities	Water Services Stream Restoration	Doug Quinn, Water Services Director Jeff Wittler, Restoration Manager
Washington Department of Natural Resources (DNR)	Aquatic Reserves	Tom Gorman, Assistant Division Manager
DNR	Aquatic Restoration	Allen Lebovitz, Restoration Manager
DNR	Forest Practice Rules	Taylor Mizar, Forest Practices Coordinator
DNR	Forest Practices	Eric Wisch, Project Effectiveness & Standards
DNR	Forest Practices	Russ Hovey, RMAP
DNR	Forest Practices	Steve Bernath, Deputy Supervisor
DNR	Surface Mining and Reclamation	John Bromley, Assistant State Geologist
DNR	Surface Mining and Reclamation	Tara Salzer, Technical Assistance
Ecology	Shorelands and Environmental Assistance	Rebecca Rothwell, Program Manager
Ecology	Sand and Gravel Permits	Jessica McConnell, Program Manager
Ecology	Water Resources	Mike Gallagher, Program Manager
Ecology	Shorelands and Environmental Assistance	Lori Kingsbury, CWA Section 401
Ecology	Water Quality – 303(d)	Devan Rostorfer, TMDL Lead
Ecology	Water Resources	Barbara Anderson, Program Development and Operations Support
Washington Department of Fish and Wildlife (WDFW)	Science Division	Dan Rawding, Scientist
WDFW	Office of the Director	Jeff Davis, Director of Conservation
WDFW	Habitat Program	Margen Carlson, Habitat Program Director

Agency	Department	Interviewee
WDFW	Southwest Washington Region 5	Dave Howe, Regional Habitat Program Manager
WDFW	Habitat Program	Pat Chapman, Data Specialist
Washington Department of Transportation (WSDOT)	RRMP Maintenance Program	Gregor Myhr, Water Quality Manager
Washington Department of Commerce	Growth Management Act	Mark McCaskill, Director
Washington Department of Commerce	Growth Management Act	Charlene Andrade, Watershed Planner
Washington Recreation and Conservation Office (RCO)	Family Forest Fish Passage Program (FFFP)	Dave Caudill, Program Manager
RCO	Project Information System (PRSIM) grant database	Scott Chapman, PRISM Database Manager
LCFRB	Salmon Recovery	Steve Manlow, Executive Director
LCFRB	Salmon Recovery	Jeff Breckel, (former) Executive Director
LCFRB	Salmon Recovery	Steve West, Salmon Recovery Specialist
Lower Columbia Estuary Partnership (LCEP)	Habitat Restoration Program	Paul Kolp, Principal Restoration Ecologist
Pacific Watershed Institute	Noncommercial Research Organization	Patricia Olson, Hydrologist Project Manager
Habitat Bank, Inc	Wetland Mitigation Banks	Victor Woodward, Owner
Fish First	Habitat Restoration Program	Dick Dyrland, Hydrologist (retired)
Columbia Land Trust (CLT)	Land Trust	Dan Roix, Conservation Director
Interfluve	Private Environmental Business	Gardner Johnston, Geomorphologist
Dygert Consulting	Private Consultant	Bill Dygert, (former LCFRB Chair, Clark County Consultant, Columbia Land Trust Consultant)
US Army Corps of Engineers (USACE)	Seattle District, Regulatory Program	Kristina Tong, Section Chief
Environmental Protection Agency (EPA)	Region 10	Yvonne Vallette, Aquatic Ecologist Mary Lou Soscia, Columbia River Coordinator

Agency	Department	Interviewee
Natural Resources Conservation Service (NRCS)	Clark Conservation District NRCS Resource Conservation	Denise Smee, (former) Director Anitra Gorhan, Resource Conservationist
US Forest Service (USFS)	Gifford Pinchot National Forest (GPNF)	Ruth Tracy, Soil and Water Program Manager
Cowlitz Indian Tribe	Restoration Division	Rudy Salakory, Habitat Restoration & Conservation Manager

In-addition, a myriad of data sets, including program implementation and land use data, were acquired and reviewed for suitability to characterize changes in the EFLR watershed landscape over time. The goal was to acquire and synthesize data to characterize habitat threat trajectories in the EFLR watershed. The five priority threats include agriculture/grazing, rural/suburban development, forest practices, channel manipulations, and mining. Data requests were discussed and refined in the interviews; however, in a few cases, public disclosure requests (PDRs; state-level) and Freedom of Information Act (FOIA; federal-level) requests were necessary. Finally, where possible, the data were subset to the years 2004 – 2018 to focus on changes since the initial draft of the Recovery Plan in 2004.¹²

The Recovery Plan’s inventory of programs followed a federal, tribal, state, local, and non-government hierarchy. However, this organization was not conducive for the collective evaluation of program implementation across a watershed. Partly, this was because implementation of the Clean Water Act is spread across federal, state, and local government agencies. Some Washington State regulations (e.g., Shoreline Management Act) also divide responsibilities between the state and local entities. Therefore, this chapter organizes programs by function. This organization was intended to present the pertinent programs in a structure that provides context on how the programs relate to each other and to EFLR watershed habitat.

Throughout this chapter, each function category is introduced with a blue table that outlines the relevant habitat-related threats highlighted by the Recovery Plan,¹³ as well as the partners, programs, and actions identified in the Recovery Plan to address those threats. After each blue table, the mechanisms through which programs implement Recovery Plan actions are described and the corresponding programs are evaluated. Evaluations are found in orange tables throughout this chapter and consist of four questions answered on a qualitative basis as either “low,” “moderate,” or “high”:

¹² Earlier spatial data (e.g., 1999) exists for some data sets and could be useful within the context of ESA listing of the five salmon and steelhead populations.

¹³ Threats used for the blue tables in this chapter are from Table L-11 in the *East Fork Lewis Basin* chapter of the Recovery Plan.

1. To what degree do programs use the Recovery Plan to help guide their program's development and implementation?

- **Low:** Program is intended to be in compliance with ESA, but has no direct ties to the Recovery Plan. Program staff have little knowledge of the Recovery Plan beyond its existence.
- **Moderate:** Program is intended to be in compliance with ESA, and program documentation references the Recovery Plan. Some program staff may utilize the Recovery Plan for permit/project-level decisions.
- **High:** Program is intended to be in compliance with ESA, and program policies are directly influenced by the Recovery Plan/LCFRB to help meet Recovery Plan expectations. Program staff are familiar with the Recovery Plan and maintain current relationships with LCFRB staff, and permit/project-level decisions are informed by Recovery Plan priorities.

2. To what degree do the programs meet Recovery Plan expectations¹⁴ to address EFLR threats?

- **Low:** Program is not implementing all applicable actions, or not implementing them to the degree expected by the Recovery Plan to reduce threats. Program compliance monitoring and enforcement are minimal.
- **Moderate:** Program is implementing actions, and partially meeting the expectations of the Recovery Plan to reduce threats. Program has compliance monitoring and enforcement protocols, which are implemented at a regional level.
- **High:** Program is implementing actions to the degree expected by the Recovery Plan to reduce threats. Program compliance monitoring and enforcement are well-funded and thorough.
- **Unknown:** Program is implementing the applicable actions, but expectations in the Recovery Plan¹⁵ and/or program data are insufficient to evaluate how well the program is reducing threats.

3. To what degree do programs maintain data that help demonstrate the trajectory of threats?

- **Low:** Program data to demonstrate program implementation at the EFLR watershed scale are non-existent, only available via hard copy, or were not readily available for review for this analysis.
- **Moderate:** Program maintains a database to demonstrate collective program implementation on an EFLR watershed scale, but data quality, consistency, and content are not directly applicable for informing Recovery Plan expectations. The only way to attain applicable information would be on an individual permit or project basis. Geodatabase includes point

¹⁴ Recovery Plan expectations for each program are outlined in more detail in the Recovery Plan actions and measures in Tables L-14 and L-15 of Chapter L *East Fork Lewis Basin*, as well as in a comprehensive list of actions in Chapter 10 *Implementation*.

¹⁵ Recovery Plan expectations were envisioned to be clarified in Program-specific 6-Year Plans to support implementation.

features to depict permit/project locations, but no polygon (i.e., project footprint) information.

- **High:** Program maintains a publicly available database to demonstrate collective program implementation on an EFLR watershed scale where data quality and content are directly applicable for informing Recovery Plan expectations. Geodatabase includes polygon features to depict permit/project footprints.

4. To what degree do programs perform effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

- **Low:** Program performs minimal to no effectiveness monitoring to determine if program actions/policies/regulations result in outcomes intended by internal mandates.
- **Moderate:** Program performs some level of effectiveness monitoring to determine if program actions/policies/regulations result in outcomes intended by internal mandates.
- **High:** Program performs systematic effectiveness monitoring to determine if program actions/policies/regulations result in outcomes applicable to both internal mandates and Recovery Plan expectations.

Qualitative ratings were assigned by the authors based on evaluation of interview responses, information, data on program implementation, and understanding of the program in relation to Recovery Plan expectations. Each qualitative answer is followed by an explanation. A question is answered as “unknown” or “NA” if the authors had insufficient information to answer a question or if a question is not applicable to a program, respectively.

Recovery Plan Administration

The LCFRB is responsible for facilitating and overseeing implementation of the Recovery Plan. It is composed of officials from Wahkiakum, Lewis, Cowlitz, Clark, and Skamania Counties, tribal members, private property interests, environmental interests, hydro-electric partners, local citizens, and ex-official members representing key state and federal agencies. After the LCFRB was established in 1998, the business of establishing the various committees that would guide recovery, subbasin, and watershed planning was a top priority. Board and committee members represented many of the Recovery Plan implementation partners that would later implement Recovery Plan actions to achieve delisting. However, certain implementation responsibilities were also assigned directly to the LCFRB to be completed at specified intervals after the plan was adopted. They include 24 implementation actions identified in Recovery Plan *Chapter 10 – Implementation* as well as regular outreach to partners to maintain relationships and Recovery Plan relevance. Table 5 outlines these LCFRB-specific actions.

Table 5		
Recovery Plan Administration		
Threats: Agriculture/grazing, Rural/suburban Development, Forest Practices, Channel Manipulations, Mining		
Partners	Programs/Functions	Program #
LCFRB	LCFRB Recovery Plan Implementation	1
	Recovery Partner Program Outreach	2
Actions		Applicable Programs
Establish implementation oversight group and an implementation facilitation and coordination function to be carried out by the LCFRB		1,2
Regularly review and revise plan in a collaborative process		1
Refine draft benchmarks for assessing implementation progress		1,2
Develop and implement cost and economic analysis methods		1
Develop ESA threats criteria and prioritization for incorporation into the lower Columbia and domain Recovery Plans		1,2
Conduct qualitative evaluation of program sufficiency		1
Coordinate the development of a regional monitoring, research, and evaluation program		1,2
Coordinate the development of a regional public education and outreach program		1,2
Develop and periodically update 6-year implementation work schedules		1,2
Evaluate whether recovery strategies, measures, and actions are being implemented as planned		1,2
Refine and reprioritize plan implementation at the programmatic level		1
Prepare written plan implementation progress reports to participating agencies, stakeholders, and the public at 2-year intervals		1,2
Evaluate whether specific strategies, measures, and actions are producing the desired effects		1,2
Refine and reprioritize existing recovery strategies, measures, and actions		1

Prepare written plan implementation progress reports to participating agencies, stakeholders, and the public at 6-year intervals	1,2
Periodically evaluate biological status relative to populations and ESU objectives	1
Periodically evaluate habitat status relative to baseline conditions and benchmarks	1
Refine and reprioritize existing recovery strategies, measures, and actions based on results of biological and habitat status evaluations	1
Prepare written plan implementation progress reports to participating agencies, stakeholders, and the public at 12-year intervals	1,2
Use results of critical uncertainty research to identify new, or refine and reprioritize existing, recovery strategies, measures, and actions	1
Refine analytical tools and methods to better support adaptive management process	1
Refine biological objectives consistent with recovery as new information becomes available	1
Periodically evaluate strengths and weaknesses of the available monitoring and research to determine adequacy for assessing progress	1
Identify appropriate alternative approaches and revise priorities for monitoring and research based on results of evaluations	1

LCFRB Recovery Plan Implementation

Implementation actions specifically for the LCFRB, identified in Table 6, fall into five broad categories: coordination, implementation, action effectiveness, fish and habitat response, and adaptive management. Collectively, the 24 actions establish a roadmap to enable Southwest Washington to request NOAA to delist local salmon and steelhead, and to achieve LCFRB's goal of healthy and harvestable salmon and steelhead populations. While these 24 actions are directed to the LCFRB, the scope and nature of the actions involve all Recovery Plan partners and have bearing on Recovery Plans throughout the Pacific Northwest. As with many major natural resource planning efforts, funding is often available for the upfront planning, but resources to test assumptions scientifically and comprehensively and adaptively manage implementation after plan adoption has been largely lacking.

Table 6
Recovery Plan Administration
LCFRB RECOVERY PLAN IMPLEMENTATION PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: High. The LCFRB staff utilize the Recovery Plan to guide all aspects of their program.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Low. Chapter 10.8 of the Recovery Plan lists expectations for LCFRB to implement 24 actions to adaptively manage the implementation of the Recovery Plan. These expectations have not been met due to lack of resources to comprehensively track and monitor implementation, actively facilitate adaptive management, report on progress, and maintain interest and support through outreach and education. The LCFRB Board itself is partially composed of partner implementing entities that, in some cases, lack consistent and proactive efforts to comprehensively integrate Recovery Plan priorities into the programs they oversee, absent a legal impetus to do so. Delisting of the four ESA-listed salmon and steelhead species in Southwest Washington are partly dependent upon information generated from these implementation actions. Adaptive management adjustments to implementation are also dependent upon this information.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. LCFRB actions identified in Recovery Plan chapter 10.8 are intended to produce data and information to track and demonstrate EFLR habitat threat reduction. The Recovery Plan does a good job characterizing threat reduction targets; however, it does not translate threat reduction targets into meaningful metrics at the program-scale. As a result, demonstrating the trajectory of threats is generally qualitative and lacks scientific rigor.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. Effectiveness monitoring is implicit in each of the Recovery Plan chapter 10.8 actions, most of which are not being fully implemented.

Recovery Partner Program Outreach

Recovery Plan partner interaction is necessary to keep implementation efforts and the Recovery Plan aligned. Program partners helped develop the Recovery Plan and upon plan adoption, it was expected that they would help implement the plan using their own programs, authorities, and jurisdictions. Maintaining connections between the adopted Recovery Plan and implementation programs is an on-going effort intended to keep the Recovery Plan and programs aligned to the extent feasible. Program outreach is a substantial LCFRB role that lacks sufficient resources. Partly, this is because the task of

coordination is compounded by the diversity of habitat, harvest, hatcheries, ecological interaction, and hydroelectric programs. At an average of five employees, program outreach is an overwhelming responsibility given the geographical scope of the region, number of partners, and the complexity of programs that affect recovery.

Program outreach translates into attending county board meetings and city council meetings; reviewing and interacting with jurisdictions conducting comprehensive plan, critical areas ordinance, shoreline master program, and other land use program updates; and engaging in program processes to keep Recovery Plan priorities and actions integrated with program objectives. LCFRB's engagement with Ecology and Clark County in the 2010-12 Shoreline Master Program update process is a good example of linking the Recovery Plan to a key implementation partner. Continuing this engagement has become more critical as time passes because of staff turn-over, as program staff who were present during the initial development of the Recovery Plan and are familiar with its relationship to their programs retire or move to different jobs. During the interview process, it became evident that connections between the Recovery Plan and regulatory programs were diminishing or lost over time.

Table 7
LCFRB Recovery Plan Administration
RECOVERY PARTNER PROGRAM OUTREACH EVALUATION
Q: To what degree does the LCFRB engage Recovery Plan partners to help guide programs? * A: Low. Since initial adoption of the Recovery Plan in 2004, there have been few noteworthy interactions between LCFRB and partner programs that resulted in permanent changes to improved alignment between the Recovery Plan and implementing programs. This is especially true for regulatory programs. The best example where this did occur was between LCFRB, Ecology, and Clark County in revisions to their Shoreline Master Program in 2010-12.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Low. There was an implicit expectation that LCFRB would have the staff resources to adequately engage with partner programs to keep recovery efforts focused on threat reduction to the degree feasible. Partner program interviews consistently demonstrated a lack of connection to the Recovery Plan. For many partner program staff interviewed, the extent of their knowledge about the Recovery Plan ends at its existence, and does not include specific Recovery Plan expectations for their program.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. LCFRB's SalmonPORT inventory of recovery partner programs is not complete and presents inconsistencies in its organizational structure. Furthermore, while SalmonPORT identifies actions relating to Recovery Plan implementation, it does not track regulatory program data (e.g., project site, type, or mitigation requirements). If data management efforts only include restoration project data, then half of the ledger for determining net habitat losses or gains and Recovery Plan progress is missing (i.e., determining status of environmental baseline).
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. LCFRB has worked to develop comprehensive research, monitoring and evaluation programs (RM&E). However, funding for implementation is lacking. Efforts are underway by LCFRB and WDFW to monitor and assess effectiveness of hatchery and harvest reform actions region-wide through implementation of the Conservation and Sustainable Fisheries Plan program. Assessment of program implementation is part of LCFRB's emerging habitat effectiveness monitoring program. Efforts are also underway to seek funding to initiate implementation of a long-term habitat status and trends monitoring program, which in the future will support effectiveness monitoring efforts.
*Question was altered to apply to the LCFRB

Lead Entity Administration | Habitat Acquisition, Restoration, and Stewardship

The EFLR watershed has benefitted from targeted funding for acquisition, restoration, and stewardship by a diverse set of partners. Programs under this heading have the potential to improve the trajectory of the environmental baseline, provided adequate protection programs are also in place. Acquisition of key habitat types is often necessary to extend protections beyond what regulatory programs are capable of and to provide a land base where restoration and enhancement activities can occur. Restoration and enhancement activities are intended to improve habitat access, productivity, and capacity. Land stewardship activities are not explicitly identified in the Recovery Plan; however, stewardship activities are necessary to protect investments designed to improve the habitat baseline of the EFLR. Table 8 outlines the threats addressed by lead entity administration, habitat acquisition, restoration, and stewardship, and the corresponding partners, programs, and actions.

Table 8		
Lead Entity Administration Habitat Acquisition, Restoration, and Stewardship Programs		
Threats: Agriculture/grazing, Rural/suburban Development, Forest Practices, Channel Manipulations, Mining		
Partners	Programs/Functions	Program #
LCFRB	Habitat Grant Funding Administration	1
County/CLT/BPA	Land Acquisition, Stewardship, and Management	2
Sponsors ¹⁶ /BPA	Habitat Restoration and Enhancement	3
Actions		Applicable Programs
Protect and restore native plant communities from the effects of invasive species		1,2,3
Assess the impact of fish passage barriers and restore access to potentially productive habitats		1,3
Conduct floodplain restoration where feasible along the mainstem and in major tributaries that have experienced channel confinement. Build partnerships with landowners and agencies and provide financial incentives		1,2,3
Develop partnerships and increase funding available to purchase easements or property in sensitive areas to protect watershed function where existing regulatory programs are inadequate		1,2

¹⁶ Sponsors include the government and non-profit organizations that currently implement restoration actions in the EFLR watershed. They are listed in Table 11.

Within authorities, create and/or restore lost side-channel/off-channel habitat for chum spawning and coho overwintering	1,2,3
Increase implementation of voluntary habitat enhancement projects in high priority reaches and subwatersheds. This includes building partnerships with landowners and agencies and increasing funding	1,3

Habitat Grant Funding Administration

LCFRB administers grant programs within the region in support of habitat restoration and acquisition within its legislatively established role as a Washington State Lead Entity. LCFRB receives an annual allocation to distribute to implementing partners via the Salmon Recovery Funding Board (SRFB) to improve habitat function and habitat-forming processes as well as to help acquire and protect key habitats. SRFB funding consists primarily of state bonds and the NOAA Pacific Coastal Salmon Recovery Fund (PCSRF). Historically, the LCFRB also supported review of Ecology Centennial Grants to help implement the WRIA 27/28 Lewis Washougal Watershed Management Plan. The largest and most utilized program in the EFLR watershed is SRFB, which is administered by the Recreation and Conservation Office and the LCFRB through its Lead Entity process. The LCFRB conducts the solicitation, scoring and evaluation of projects, and submits a recommended project list to the SRFB for funding. The Cowlitz Indian Tribe also receives direct PCSRF funds, but has not utilized them in the EFLR watershed to-date. Local project sponsors provide significant match contributions to expand the beneficial results of implementation. The LCFRB has developed and maintains a “habitat strategy” that serves as the basis for project prioritization and ensures alignment with Recovery Plan priorities. The LCFRB also initiates watershed-based habitat evaluation studies to help identify restoration and protection opportunities and refine Recovery Plan priorities. Other funding sources used in the basin include, but are not limited to, the National Fish and Wildlife Foundation Community Salmon Fund (NFWF), Clark County Clean Water Grant Program (administered by the LCFRB), Family Forest Fish Passage Program (FFFPP), Centennial Clean Water Grant Program, Bonneville Power Administration’s (BPA) Columbia Estuary Ecosystem Restoration Program (CEERP), and Natural Resources Conservation Service (NRCS). SalmonPORT identified thirty-three projects as either completed or in progress in the EFLR. PCSRF grants through the SRFB program are the primary funding source, funding 30 of the 33 projects with a total grant request of \$27,435,963.

Table 9
Lead Entity Administration Habitat Acquisition, Restoration, and Stewardship
HABITAT GRANT FUNDING ADMINISTRATION PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: High. LCFRB’s grant administration of SRFB funding is directly based upon, and supports implementation of, the Recovery Plan. Scoring criteria build directly from Recovery Plan goals and objectives for habitat to guide work toward high priority species and reaches from a recovery perspective. Other funding sources and grants administered by LCFRB follow the Recovery Plan as modified by specific funding requirements and/or geography.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: High. The Recovery Plan expectations for LCFRB’s habitat grant administration and habitat assessment are to effectively distribute funding for habitat restoration and acquisition projects that target the highest priority species and reaches of the EFLR, and to monitor the status of EFLR habitat through time to draw connections between program action implementation and threat reduction. LCFRB has effectively administered the funds they receive from SRFB and other sources to implement the highest priority projects in the EFLR watershed. The Recovery Plan also expected that regulatory and protection programs would hold the ecological baseline over time while restoration projects would improve conditions above baseline conditions. A significant investment of \$28,060,185 with \$17,608,411 in matching fund contributions has been made by the SRFB, other restoration programs, and implementing partners. However, it is unclear if these efforts are helping to address regulatory protection deficiencies or functionally building upon the habitat baseline to address the “habitat” portion of recovery, given the lack of habitat status and trends monitoring data and information.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Moderate. LCFRB’s SalmonPORT website provides an interactive map that displays grant project locations as points within the landscape of tiered reaches. Drilling down to individual grant projects provides project descriptions and status. Displaying project locations on a map using point coverage is not as informative as using polygons and line segments that would provide a better landscape perspective of collective restoration and protection efforts. Restoration and protection project metrics tracked on SalmonPORT aren’t available for all projects and represent proposed conditions, which may not match actual implemented conditions.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. The Recovery Plan calls for evaluation of project effectiveness. To help evaluate effectiveness of funded projects and changes in project conditions over time, the LCFRB has developed the

Lower Columbia Project Implementation & Long-Term Functional Performance Monitoring Protocol (2015). However, funding for implementation is lacking. In addition, the SRFB project effectiveness monitoring has not yielded information to support evaluation of project investments in the region. Results of the Lower Columbia Intensively Monitored Watershed (IMW) project, which may provide insights into program effectiveness, are pending.

Land Acquisition, Stewardship, and Management

The EFLR watershed is a priority acquisition area for Clark County and Columbia Land Trust (CLT). Much of the acquisition began for Clark County through a Conservation Futures program enacted by the Clark County Board of Commissioners in 1985. Local funds were matched by various funding sources, notably RCO's Washington Wildlife and Recreation Program (WWRP). As a result, they have restrictive covenants that constrain land use generally to recreation and fish and wildlife protection. EFLR watershed conservation areas are currently comprised of County, State, CLT, and private lands totaling approximately 2,993 acres, shown in Figure 7.¹⁷ They include the EFLR Bottomlands from Paradise Point State Park to Lewisville Park and further upstream from Pomeroy Farm to Moulton Falls Park. Approximately 86 percent¹⁸ of the conservation lands are designated as critical areas in Clark County's Habitat Conservation Ordinance. Much of these lands represent the broad tidal and fluvial floodplains of the river.

Columbia Land Trust has partnered with the County in some of their acquisitions and is the single land-owning entity for others (e.g., adjacent to Daybreak Park and below Sunset Falls). A recent acquisition in 2015 by CLT along Rock Creek represents a new anchor property in a priority subwatershed. CLT also acquired a large parcel of land at the confluence of Allen Creek and Lake Rosannah in the Gee Creek watershed.

In the lowest reaches of the EFLR, at the confluence of the North Fork Lewis River, is Washington State Parks and Recreation's 88-acre Paradise Point State Park that includes 6,180 feet of EFLR shoreline. Other state-owned lands include DNR's Granted Trust Lands and State Forest Trust Lands; these lands are managed under habitat conservation plans that help protect the most sensitive areas (e.g., riparian buffers, wetlands, and unstable slopes) while implementing forest practices to economically benefit public schools, universities, and local services. Figure 8 identifies all public land ownership in the EFLR watershed.

Stewardship activities are actively implemented by Clark County and CLT. Clark County Park's Vegetation Management¹⁹ Program is responsible for stewardship of the regional parks and EFLR Greenway. The Conservation Futures tax levy (6.25 cents per thousand dollars of assessed value) allows up to 15

¹⁷ Includes some private lands with conservation aspects (e.g., Ridgefield Pits).

¹⁸ Clark County conservation land information and critical areas designation data were acquired from Clark County.

¹⁹ Clark County Vegetation Management operates as a noxious weed board under the state noxious weed law – Chapter 17.10 Revised Codes of Washington. Noxious Weeds – Control Boards.

percent of the prior year's levy collection to be used for operations, maintenance, and stewardship of the lands (Clark County 2014). For conservation lands not associated with the regional parks, approximately \$200,000 is spent per year on stewardship activities (Tyler 2019). Regional parks are funded through Clark County's general fund. For lands under CLT's ownership, an annuity exists to help fund stewardship activities.

The EFLR is heavily utilized for recreation during the summer months for swimming and snorkeling due to the deep pools and easy access via the regional parks (e.g., Moulton Falls) and Sunset Falls Campground in the Gifford Pinchot National Forest (GPNF). Whitewater rafting and kayaking is also popular during the winter months. However, the same deep pools that attract recreational users also function as important cold water refugia for both juvenile and adult salmon and steelhead (Knight 2009). A planned trail system of approximately 25 miles to connect the EFLR regional parks with the existing Clark County trail system is identified in Clark County's *Parks and Recreation Plan*. Currently about four miles of the trail system is complete.

Three important management policies have been implemented to help reduce recreation pressure on the EFLR. Shortly after the 1990-1995 acquisitions of Lucia Falls, Clark County Parks and Recreation Department closed the area below the falls to water contact activities to protect salmon and steelhead from disturbance. This unpopular department policy has been challenged over the years but remains in place and enforced, to protect important fish rearing and holding habitat (Bjerke). Also, in 2014, WDFW identified the EFLR as a wild steelhead gene bank which prompted the end of hatchery releases of steelhead in the EFLR. WDFW has also closed all recreational fishing directly above and below Lucia, Moulton, and Horseshoe Falls.

East Fork Lewis River Conservation Lands

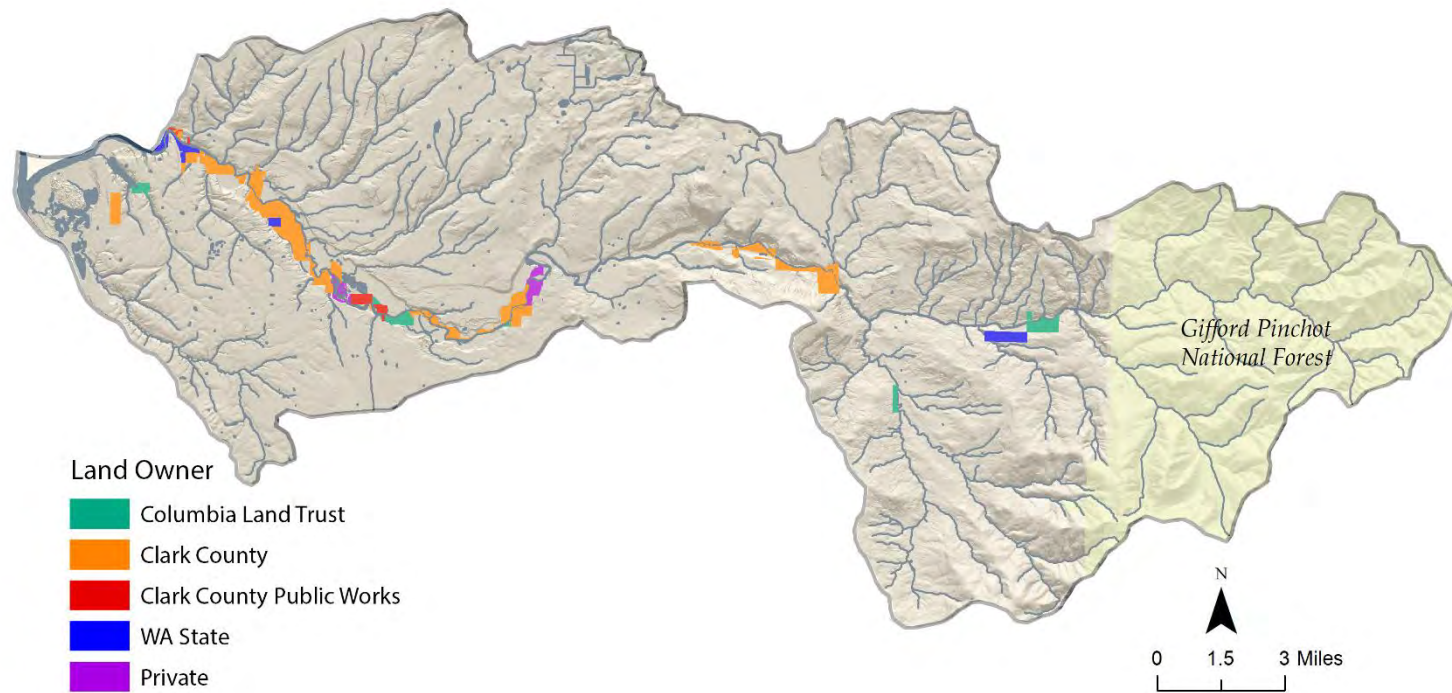


Figure 7. Lands included in a conservation vision for the EFLR watershed for the lower mainstem and eventually the upper watershed. Landowners include CLT, Clark County, Washington State, and private organizations. Clark County taxlot GIS layers were used to delineate property boundaries.

East Fork Lewis River Public Land Ownership

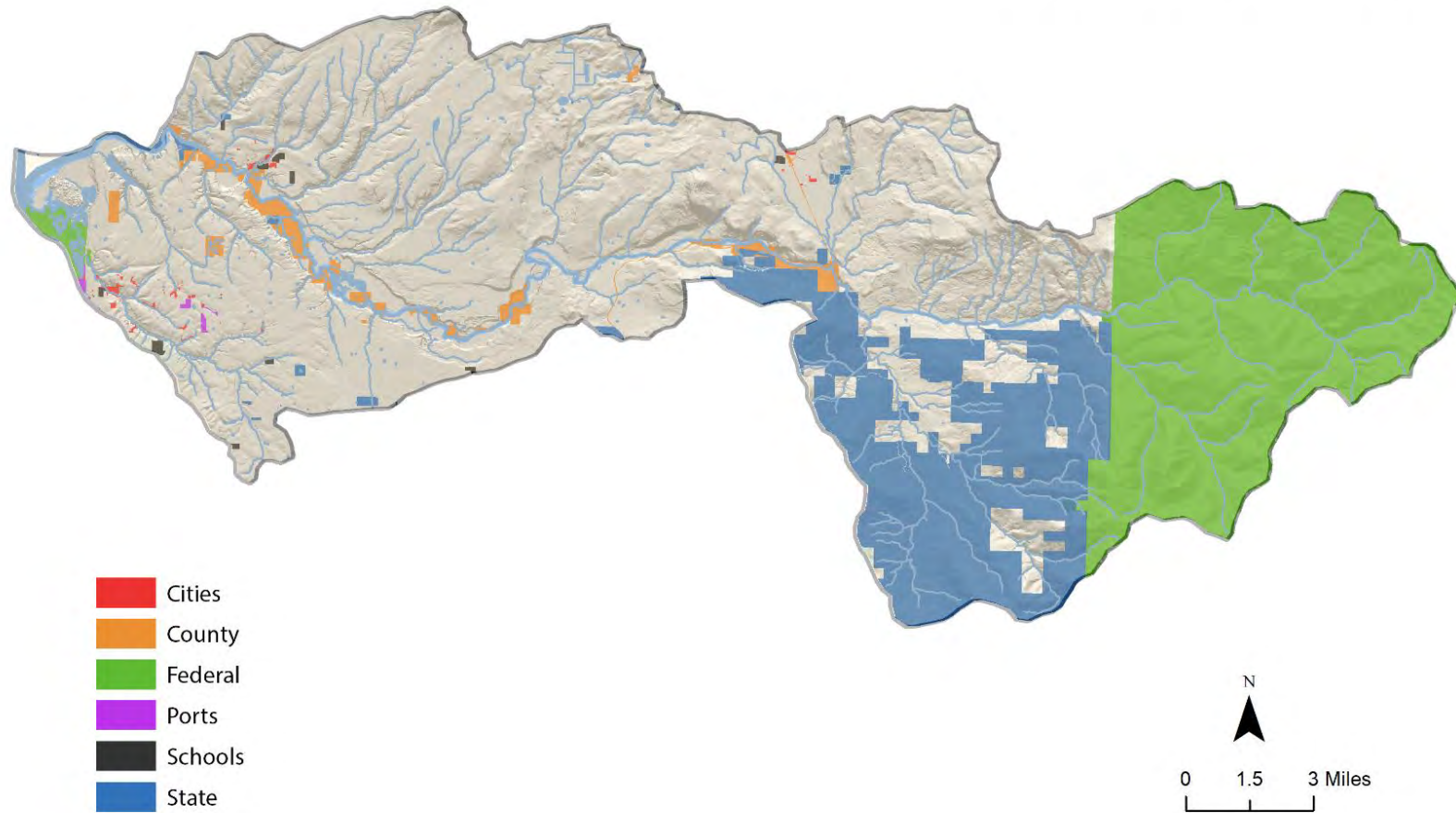


Figure 8. Public land ownership in the EFLR watershed symbolized by owner. Data from Clark County public land GIS layer.



Figure 8. Moulton Falls on August 4, 2019.

Table 10
Lead Entity Administration Habitat Acquisition, Restoration, and Stewardship
LAND ACQUISITION, STEWARDSHIP, AND MANAGEMENT PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: High. Clark County and Columbia Land Trust utilize the Recovery Plan as a basis for prioritizing acquisitions, especially when applying for grants to fund acquisitions. Both programs were functional prior to the formation of the Recovery Plan and both have their own priorities and target areas for acquisition.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: High. The Recovery Plan expectations for acquisition programs are to purchase property in sensitive areas to protect watershed functions where existing programs are inadequate. Clark County and CLT have acquired approximately one-half of the Clark County portion of the EFLR mainstem-adjacent lands. The total conservation land base for the EFLR watershed (including CLT and County-acquired lands, state lands, and some private land) covers approximately 2,993 acres of floodplain and upland habitat, including riparian habitat along approximately 26 miles of Tier 1, 2, and 4 mainstem or tributaries. Given the level of development and resource extraction pressure exerted on the EFLR watershed, this is a tremendous accomplishment. CLT is responding to growing development pressure in the upper Rock Creek subwatershed and is proactively securing resources to prevent forest conversions in the industrial forest lands of the EFLR watershed (Roix 2019).
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Moderate. Clark County and CLT both maintain acquisition data that is useful for characterizing their respective land bases in the EFLR watershed. Tabular data characterizing acquisitions is available and easily accessible; however, a map of parcels included in Clark County’s conservation land base was only available as a hard copy. PC Trask developed geospatial data for this report representing acquisitions as part of the County’s conservation vision and shared it with the County. Data to support evaluation of threat trajectories under the Recovery Plan (e.g., habitat condition of critical areas within acquired conservation lands) is not readily available.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Moderate. CLT performs basic annual monitoring for project success (e.g., planting survival) as well as overall ecological integrity using the Ecological Integrity Assessment (EIA) methodology developed with the Washington Natural Heritage Program. EIA measures key attributes that impart integrity to specific ecological systems. In the EFLR, EIA has been applied to CLT-owned parcels in Rock Creek and Daybreak.

Habitat Restoration and Enhancement

A large number of restoration projects have been implemented in the EFLR tributaries and mainstem floodplain to benefit salmon and steelhead. Several restoration programs operate in the EFLR watershed to implement projects.²⁰ Table 11 identifies the primary sponsors and the type of restoration they perform.²¹

Table 11 Current Restoration Sponsors Implementing Projects in the EFLR Watershed	
Program	Function
Clark County Parks Department	Partners with BPA, LCEP, CLT, and others to restore projects on their EFLR Bottomlands properties
Clark County Public Works	Partners with private land owners and recovery partners to restore fish passage at road crossings, restore floodplain connectivity, and improve instream habitat
Lower Columbia Estuary Partnership (LCEP)	Partners with BPA, LCFEG, SRFB, and others to study and implement salmon and steelhead access and habitat capacity projects on Clark County, private and CLT floodplain lands
Lower Columbia Fish Enhancement Group (LCFEG)	Partners with LCFRB and SRFB to implement riparian and large-wood projects on private and public properties
Clark Public Utilities (CPU)	Partners with LCFRB, SRFB, and Ecology to implement riparian and large-wood projects on private and public properties
Clark County Vegetation Management	Performs Japanese Knotweed controls throughout the EFLR watershed; the program performs other invasive plant control and provides technical assistance to private landowners
Fish First Friends of the EFLR	Partners with LCFRB, SRFB, private property owners, and USFS to plan and implement instream, side-channel, and riparian actions; this includes placement of LWD and other hydraulic-related structures
Clark Conservation District	Partners with NRCS, LCFRB, SRFB, Ecology, and private landowners to implement best management practices on farms through the Wetlands Reserve Program and the Conservation Reserve Enhancement Programs in the EFLR watershed; the District also implements fish barrier removal, LWD, and riparian plantings/invasive controls
US Forest Service	Performs culvert and road upgrades and other restoration activities in the Gifford Pinchot NF

²⁰ Restoration efforts in the Gifford Pinchot National Forest (GPNF) and by DNR on state-owned trust lands and on private forest lands to remove barriers to fish passage in tributaries, as well as road decommissioning and stormwater improvements, are addressed later in this chapter under Forest Practices.

²¹ Table does not include mitigation actions.

The number of restoration efforts in the EFLR watershed since first adoption of the Recovery Plan in 2004²² is considerable. Figure 9 provides an overview perspective of the number and distribution of projects throughout the watershed.²³ Mainstem restoration activities tend to be clustered from Lockwood Creek to Daybreak Park, along high priority Tier 1 and Tier 2 reaches. LCEP, in partnership with BPA and LCFRB,²⁴ have breached historical levees within the tidal reaches (La Center Bottoms) of the EFLR to improve hydrology and fish access to approximately 450 acres of floodplain (see Figure 10). Restoration actions also include restoring native plant communities, restoring fish passage, placing large wood, constructing spawning channels, and opening historical meanders at the upper extent of tidal influence, as shown in Figure 10. Lower reaches of EFLR tributaries have also received attention, especially Lockwood Creek, Dean Creek, and Mason Creek. In the upper tributaries, fish barriers (e.g., culverts) have been removed, large wood has been added, and riparian treatments have targeted Japanese Knotweed and other invasive plants. Metrics available in PRISM²⁵ indicate 309 miles of stream and/or shoreline treated or protected, 195 miles of stream made accessible, 533 acres of estuarine acres treated, and 2,184 structures placed in channels in the EFLR watershed.

²² Restoration by LCFRB and partners in support of salmon recovery preceded the Recovery Plan, beginning in 1999.

²³ This map does not include forest practices RMAP (Road Maintenance and Abandonment Plan) or FFFPP (Family Forest Fish Passage Program) improvements, or restoration actions in the GPNF. They are shown later in this chapter under Forest Practices.

²⁴ Primarily using Salmon Recovery Funding Board grant resources.

²⁵ RCO's project database

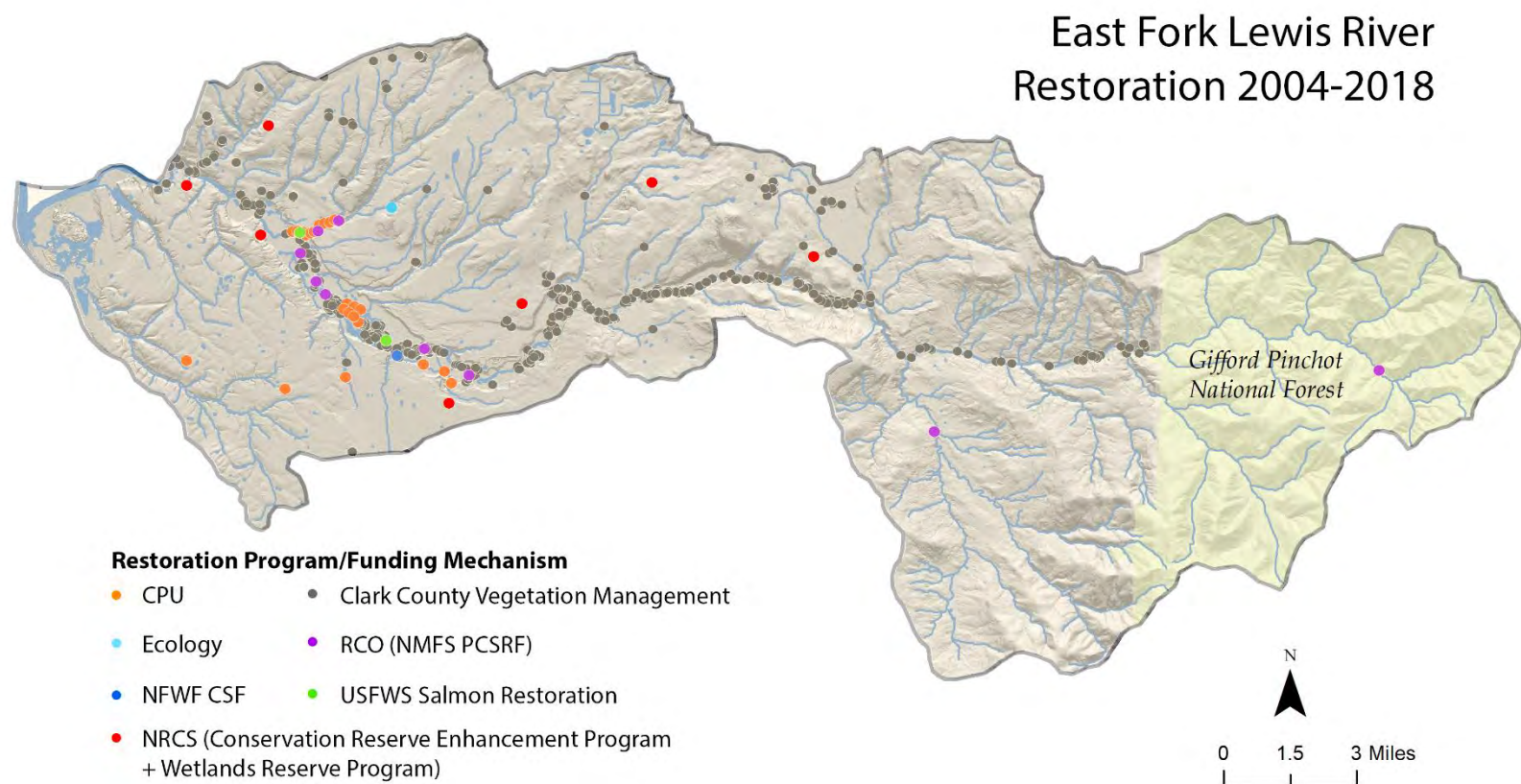


Figure 9. Restoration actions that have occurred in the EFLR watershed, excluding those implemented in the GPNF or through DNR HCP programs (those restoration actions will be addressed in the forest practices section of this chapter). Each point represents the implementation of one or more restoration actions (barrier upgrade, floodplain reconnection, instream habitat treatment, invasive vegetation removal, riparian planting, etc.) Points representing projects implemented through NRCS and Clark Public Utilities are not limited to 2004-2018 due to acquired data constraints. The remaining projects are subset to 2004-2018 to align with the introduction of the Recovery Plan. Data sources include the PRISM database, SalmonPORT database, Clark County Noxious Weed Board, and Clark Public Utilities. NRCS points are approximated by LCFRB.

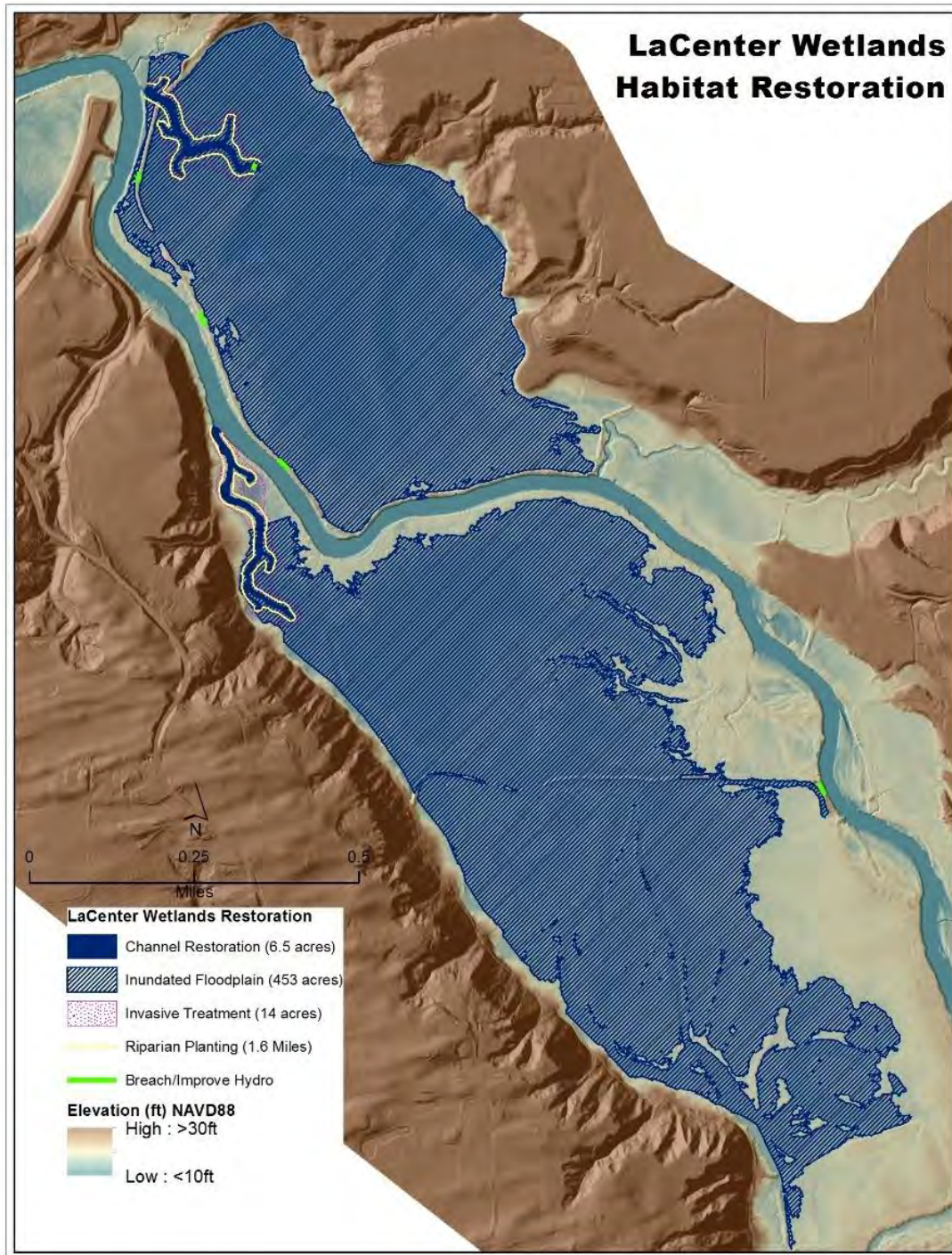


Figure 10. Map of La Center wetlands habitat restoration project implemented by LCEP in 2015. Symbology includes channel area and floodplain area improved through restoration actions, as well as breach locations, invasive plant treatment areas, and riparian planting locations. Data from PC Trask & Associates' BPA action geodatabase.

Table 12 Lead Entity Administration Habitat Acquisition, Restoration, and Stewardship Programs
HABITAT RESTORATION AND ENHANCEMENT PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: High. Restoration implementation partners seeking grant funding utilize the Recovery Plan as a basis for prioritizing restoration opportunities. This is reinforced as the LCFRB conducts competitive grant applications that are weighted toward primary populations and high priority Reach Tiers in the Recovery Plan. Other fund sources are also utilized, including BPA's Columbia Estuary and Ecosystem Restoration Program (CEERP) and, more recently, Ecology's Floodplains by Design program. In addition, recovery partners rely heavily on the Recovery Plan to guide their independent investments.
Q: To what degree do restoration programs meet Recovery Plan expectations to address EFLR threats? A: Moderate. The Recovery Plan expectations for restoration programs include floodplain restoration along the mainstem, in major tributaries that have experienced channel confinement, and in high priority reaches and subwatersheds; as well as protection and restoration of native plant communities; and creation or restoration of side-channel/off-channel habitat. Restoration partner (see Table 11) achievements in the EFLR watershed under LCFRB's Lead Entity Program include 309 miles of stream and/or shoreline treated or protected, 195 miles of stream made accessible, 533 acres of estuarine acres treated, and 2,184 structures placed in channels.²⁶ This constitutes work in approximately 27 percent of stream miles within the Clark County portion of the watershed A: The Recovery Plan also identifies the need to establish strategies to help restore floodplain function, channel migration, hillslope processes, and riparian conditions in the EFLR watershed. This need was partially addressed by LCFRB in 2009 with the development of the <i>Lower East Fork Lewis River – Habitat Restoration Plan</i>. This document provided guidance to restoration partners about the type of and location for priority actions. However, the study was limited to lower reaches between RM 0.0 and RM 15.0.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. LCFRB's SalmonPORT and RCO's PRISM databases are primarily grant-tracking programs that capture project information at the site-scale, and are the only sources that include collective restoration project information across programs and across the watershed. Metrics to summarize broad-scale restoration achievements have been developed by LCFRB and RCO, but are limited to coarse data, such as miles of riparian plantings, pieces of large wood, or acres of restoration. Data are often linked to limiting factors addressed by the project, or abstractly to threats; however, in

²⁶ Metrics are from RCO's PRISM database

almost all cases, data are presented without enough context to demonstrate threat trajectory. This is particularly difficult in the EFLR watershed due to the high levels of development and resource extraction pressure on the ecological baseline. Program databases are limited to point data rather than line features and polygons that could form the basis for landscape analysis and relationships to threats. To demonstrate threat reduction, the databases should be as comprehensive as feasible.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Moderate. The Lead Entity Program supports on-the-ground projects, and the Recovery Plan calls for evaluation of project effectiveness. To help evaluate effectiveness of funded projects and changes in project conditions over time, the LCFRB has developed the Lower Columbia Project Implementation & Long-Term Functional Performance Monitoring Protocol (2015). However, funding for implementation is lacking. In addition, the SRFB project effectiveness monitoring has not yielded information to support evaluation of project investments in the region. Results of the Lower Columbia Intensively Monitored Watershed (IMW) project are pending. Some level of effectiveness monitoring is conducted by project sponsors. For example, LCEP conducts Level 2 Action Effectiveness Monitoring and Research (AEMR) on the floodplain reconnection project they implemented on the EFLR near La Center in 2015. This level of monitoring includes before/after reference impact sampling design, and collection of metrics on vegetation composition and cover, salmonid prey, channel cross sections, and fish status.

Technical Assistance and Outreach

Technical assistance and outreach are often the first line of contact between programs and landowners. Effective outreach and technical assistance efforts can resolve questions before they become issues in permitting or other land use situations. Outreach and education help to instill a land ethic that is often more effective than land protection or restoration, teaching people the importance of their actions' impacts on ecosystems and salmon and steelhead habitats. Table 13 outlines the threats addressed by technical assistance and outreach, and the corresponding partners, programs, and actions in the EFLR watershed.

Table 13 Technical Assistance and Outreach		
Threats: Agriculture/grazing, Rural/suburban Development, Forest Practices, Channel Manipulations, Mining		
Partners	Programs/Functions	Program #
Clark Conservation District/County/Cities/	Best Management Practices	1

NRCS/WDFW/DNR/ WSU/USACE/Ecology/ LCFRB		
Actions		Applicable Programs
Increase technical assistance to landowners and increase landowner participation in conservation programs that protect and restore habitat and habitat-forming processes. Includes increasing the incentives (financial or otherwise) and increasing program marketing and outreach		1

Best Management Practices

Several agencies and non-profits provide technical assistance to individuals and entities seeking to implement new and on-going land use activities within the EFLR watershed. These include agriculture-related activities as well as land use development, forestry, and mining. Table 14 highlights programs that have dedicated technical assistance programs in the EFLR watershed.

Table 14 Example Technical Assistance Partners Providing Services in the EFLR Watershed	
Program	Function
Clark Conservation District	Provides technical services related to water quality, farm operations, and best management practices
Clark County Cities of Vancouver, Battle Ground, La Center, Ridgefield, and Yacolt	Provide technical services related to land use development, stormwater, and parks
Natural Resource Conservation Service	Provides conservation technical assistance to groups or individuals interested in conserving natural resources and sustaining agriculture
Washington Dept of Fish & Wildlife – Habitat Recovery and Protection Guidelines	Provide technical services by relaying fish and wildlife information from regional experts to local governments and landowners and developing best management practices
Dept of Natural Resources (Small Landowners Assistance)	Provides technical services to small forest landowners through their Forest Stewardship program and other forest practices-related topics

WSU – Agriculture Extension	Provides technical services through their Residential Low Impact Development, Riparian Grazing and Water Quality, and Stormwater Management Programs
USACE Seattle District	Provides technical assistance for individuals or entities seeking Rivers and Harbors Act or CWA Section 404 permits
Ecology	Provides technical assistance for individuals seeking water rights, CWA Section 401 permits, and CWA Section 303(d) funds, and other authorizations; facilitates the EFLR Partnership
LCFRB	Provides technical assistance through their lead entity role and interfaces with non-project Recovery Plan roles (e.g., assistance to Ecology and Clark County in Shoreline Master Programs)

Program websites are useful for initial access to basic requirements and direct users to contact information. Program contacts (e.g., permit writers, grant managers, and restoration practitioners) work with citizens to explain requirements and develop relationships. These learning opportunities have great value and yet there are few ways to effectively track and account for interactions that deter prohibited activities, minimize impacts, and proactively improve conditions.

Underlying the person-to-person contact side of technical assistance and education are seminal products that establish best management practices and guidelines that are the basis for permit provisions and “how to” approaches for various activities. On some level, each program identified in this report has technical products that help guide program implementation. A notable example is WDFW’s Priority Habitats and Species (PHS) program. Its four major elements include 1) PHS’ List of priority species and habitat; 2) cartographic products showing the location of these species and habitats; 3) PHS management recommendations; and 4) adaptive management. Other examples include WDFW guidance documents for constructing stream crossings and conducting habitat restoration work.

Table 15
Technical Assistance and Outreach
BEST MANAGEMENT PRACTICES PROGRAM(S) EVALUATION
Q: To what degree does the program utilize Recovery Plan to help guide their program? A: Moderate. Technical assistance and outreach programs focus on their topical areas and geography. There are some programs that are informed by the Recovery Plan (e.g., County Shoreline Management and LCFRB's lead entity program); however, most function independently from the Recovery Plan.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Moderate. The expectation of the Recovery Plan is for partner programs to perform technical assistance and outreach to inform landowners and engage them in stewarding the land. Interview discussions suggest that technical assistance is being implemented by regulatory programs and is one of the more effective tools available to address development and other land use decisions in the EFLR watershed. Technical assistance was not explicitly identified in the Recovery Plan as an action assigned to a specific program. However, interview discussions repeatedly highlighted the need for additional resources to engage landowners, partners, and interest groups.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. The interview process revealed that little or no data is produced to gauge how guidance on best management practices contributes to a reduction of habitat threats. This is not surprising given the nature of education and technical assistance, which functions by helping individuals and entities avoid or reduce activities that would otherwise negatively impact salmon and steelhead habitats.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. The only findings of program effectiveness monitoring for best management practices were Ecology's Stormwater Action Monitoring (SAM) Effectiveness Studies, which include public education/behavior change studies

Land Use and Development Regulation

Population growth is exerting pressure on the EFLR's ecosystem, natural processes, and habitat conditions. A myriad of regulatory programs and planning activities are in place to avoid, minimize, or mitigate for impacts resulting from home and infrastructure construction, septic systems, domestic and municipal wells, and stormwater. The Recovery Plan calls upon forward-thinking planning and regulatory programs to implement avoidance, minimization, and compensation measures to hold EFLR baseline conditions and avoid further impacts to ESA-listed populations. Table 16 outlines the threats addressed by land use and development regulation, and the corresponding partners, programs, and actions.

Table 16		
Land Use and Development Regulation		
Threats:		
Rural/suburban Development • Clearing of vegetation • Floodplain filling • Increased impervious surfaces • Increased drainage network • Roads – riparian/floodplain impacts • Leaking septic systems		Channel Manipulations • Bank hardening • Channel straightening • Artificial confinement • Clearing and snagging (historical)
Partners	Programs	Program #
Cities/County	Local GMA Comprehensive Planning	1
	Critical Areas Designation and Protection	2
Cities/County/Ecology	Shoreline Master Program	3
Cities/County	Stormwater Planning	4
EPA/USACE	Section 404 (Dredge and Fill)	5
EPA/Ecology	Section 401 Water Quality Certifications	6
	Section 303(d) Impaired Waterbody List and Total Maximum Daily Load (TMDL)	7
DNR	State-owned Aquatic Lands	8
WDFW	Hydraulic Project Approval	9
USACE	Rivers and Harbors Act- Section 10	10
Ecology	Ecology Water Resources; Shoreline Master Program	11

NOAA/USFWS	ESA: Section 7 and Section 10	12
NOAA	ESA: Limit No. 10 of the 4(d) Rule: Regional Road Maintenance	13
Actions		Applicable Programs
Within authorities, prevent floodplain impacts from new development through land use controls and Best Management Practices		1-4,12,13
Address water quality issues through the development and implementation of water quality clean-up plans (TMDLs)		6,7
Manage existing and future water supplies consistent with WRIA 27/28 Watershed Management Plan recommendations; initiate the development and implementation of a regional water source for Clark County, including Ridgefield and Battleground		1,11
Ensure standards in land use and environmental programs and plans afford adequate protection of ecologically important areas (e.g., stream channels, riparian zones, floodplains, CMZs, wetlands, unstable geology)		1-13
Review and adjust operations to ensure compliance with the Endangered Species Act		1-13
Using available planning tools (e.g., GMA, comprehensive planning, zoning, best management practices, etc.), manage future growth and development patterns to ensure the protection of watershed processes; this includes limiting the effects of conversion of agriculture and timber lands to developed uses		1

Growth Management Act (GMA) Comprehensive Planning

GMA is a series of Washington State statutes, first adopted in 1990, that requires fast-growing cities and counties to develop comprehensive plans to manage population growth. RCW 36.70A.020 established 13 goals that form the basis for comprehensive plans. GMA goals focus on issues such as urban growth, transportation, housing and economic development, as well as natural resource lands preservation and environmental protection. The environmental planning goals specifically address critical areas, including wetlands, critical aquifer recharge areas, fish and wildlife conservation areas, frequently flooded areas, and geologically hazardous areas. Under GMA, cities and counties must demonstrate how they will accommodate growth while protecting critical areas as well as lands that support agriculture and forestry uses. GMA requires counties and cities to adopt development regulations reflective of the best available science that preclude land uses or development deemed incompatible with critical areas (RCW 36.70A.172) (Sale 2005). The Washington State Department of Commerce (DOC) supports the Growth Management Hearings Board in their interpretation and implementation of GMA. Their Local

Governments Division provides technical assistance to counties and cities on GMA topics, such as rural and urban development, environmental protection, critical areas, and buildable lands.

Clark County is one of 18 counties in Washington State required to “plan fully” under GMA, which includes the requirement to develop comprehensive plans to manage their growth. Comprehensive planning is a series of tools used by the state, counties, and cities to manage land use patterns for population growth and commerce, while protecting natural systems and activities such as agriculture, forestry, and mining. GMA does not limit population growth, but directs counties and cities to react to and accommodate population projections from Washington State’s Office of Financial Management (OFM). Additionally, counties and cities must demonstrate how they will support growing demands on basic infrastructure (e.g., water supply, sewer, roads, etc.).

Local GMA Comprehensive Planning

Clark County and the cities of Ridgefield, La Center, Yacolt, Battle Ground and Vancouver use comprehensive planning to establish land use and zoning patterns in the EFLR watershed.²⁷ This structure provides the coarse parameters to direct the type, location, and intensity of human activities to occur, such as home construction, commercial development, and resource extraction. Development ordinances, including land use (zoning), subdivision, and environmental regulations must be in compliance and consistent with the Comprehensive Planning document. Example ordinances include zoning, critical areas, shoreline, roads, parks, and weed control. Collectively, these programs are regulatory in nature and are intended to protect natural resources by directing development activities and mitigating unavoidable impacts. Figure 11 identifies current zoning and urban growth areas (UGAs) for the EFLR watershed. The Recovery Plan characterized urban and rural development as a significant threat for salmon and steelhead species, especially in the expanding metropolitan areas in Clark County (LCFRB 2010).

Comprehensive land use planning in the EFLR watershed is challenging given the high rate of population growth modeled for the county and cities. The OFM provides low, medium, and high population projections for each county in Washington; projections for Clark County, completed in 2017, indicate a 57 percent, 86 percent, and 121 percent increase in population between 2000 and 2040, respectively. These estimates are important because they help guide the county and cities to accommodate the projected growth while protecting resource lands and critical areas.

²⁷ Excluding Gifford Pinchot NF lands falling within Skamania County. Skamania County opted-out of GMA but is still required to plan for critical areas and natural resource lands. Skamania County does not apply GMA to the Gifford Pinchot NF portion of their county.

To accommodate population growth, the county uses the Vacant and Buildable Lands Model (VBLM)²⁸ to assess each city's capacity for growth and determine if expansion of their UGA is warranted given population projections. Each of the four cities located in the EFLR watershed have expanded their UGAs since the Recovery Plan was adopted (Figure 12), with a fifth city's (Vancouver) UGA expanding into the EFLR watershed in 2005. Considering the substantial level of population growth projected for the future, these boundaries will likely continue to change. Pressures to expand are balanced within the county and cities' comprehensive plans, which limit where zoning conversions and UGA expansion can occur. This contradiction between growth and existing land use has resulted in on-going lawsuits over the expansion of UGAs, affecting agriculture lands in particular.

²⁸ Vacant Buildable Land Model is a planning tool developed by Clark County to analyze growth patterns in residential, commercial, and industrial lands within urban growth boundaries. The tool allows analysis of potential residential and employment capacity based on vacant and underutilized land classifications. This information is used to determine the amount of urban land needed to accommodate projected population and job growth for the next 20 years.

East Fork Lewis River 2018 Zoning and Urban Growth Boundaries

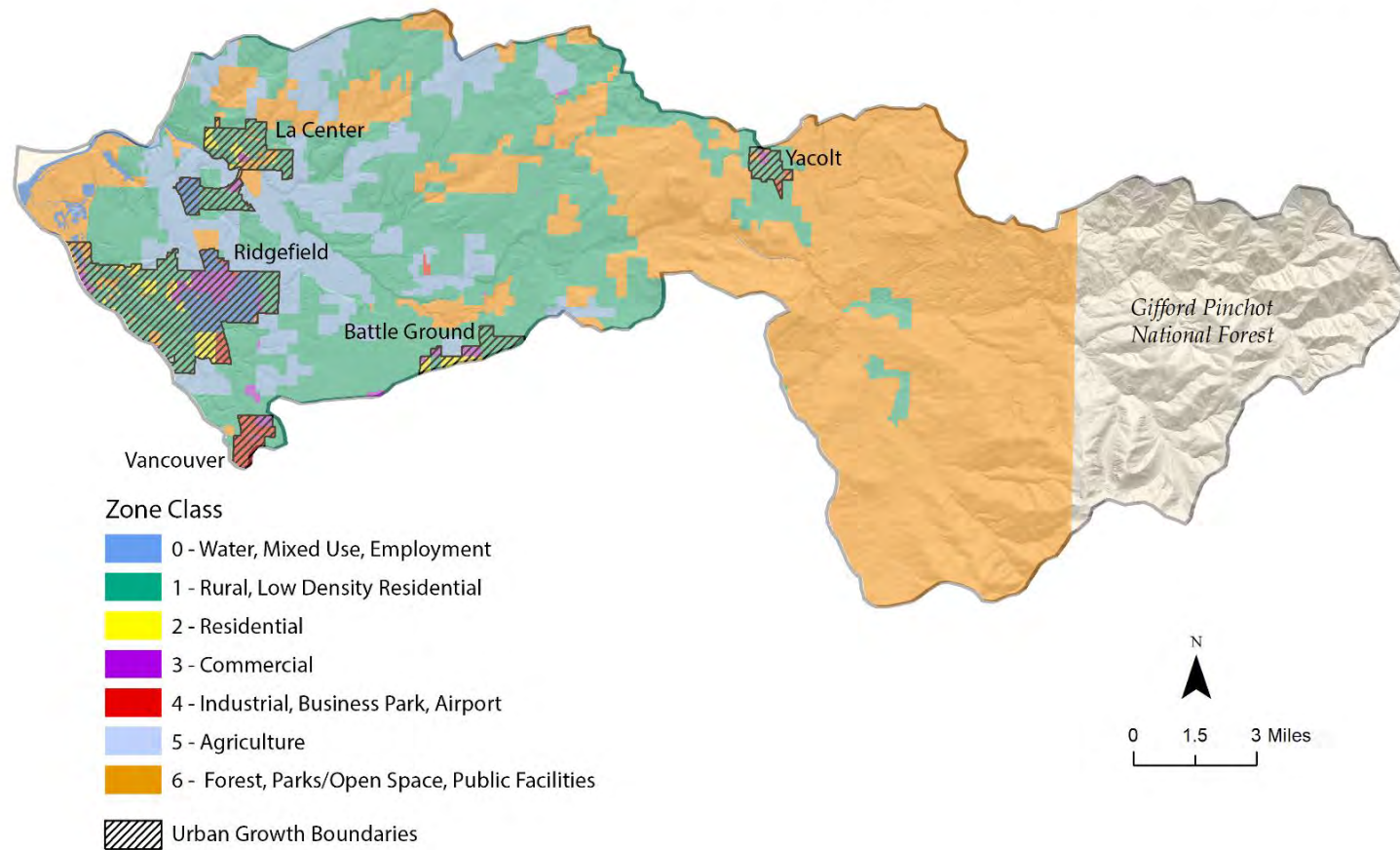


Figure 11. Map of Clark County 2018 zoning designations symbolized by zone class, and urban growth boundaries. Data from Clark County urban growth boundary and zoning GIS layers.

East Fork Lewis River Urban Growth Boundary Expansion

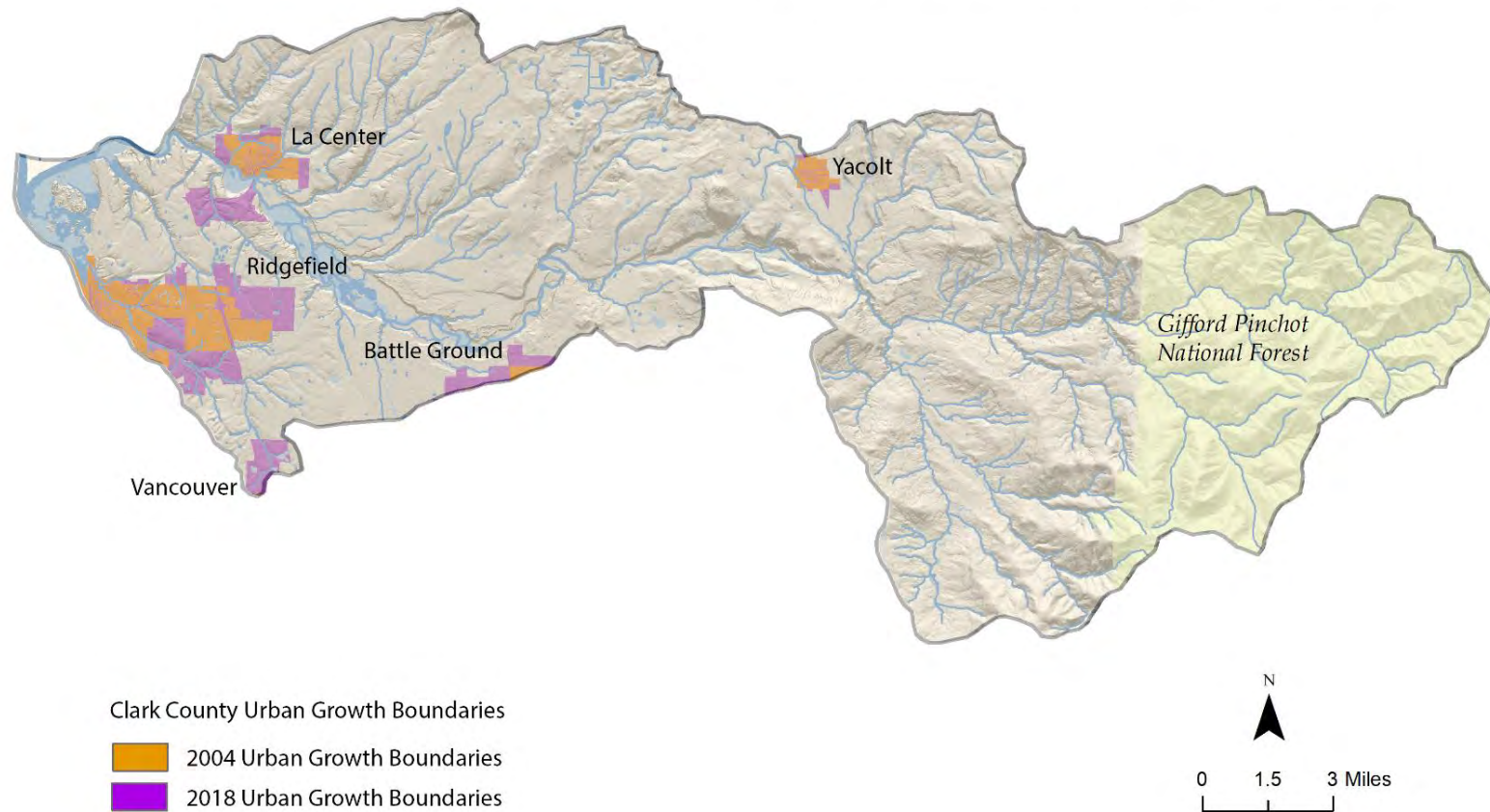


Figure 12. Map of Clark County urban growth boundary expansion within the EFLR watershed from 2004 to 2018. Data from Clark County Vacant Buildable Land Model GIS layer

In addition to UGA expansion, zoning changes have occurred in the EFLR watershed since the adoption of the Recovery Plan, resulting in an approximate 181 percent increase in residential zones (class 2), 73 percent increase in commercial zones (class 3), and 9 percent reduction in agriculture zones (class 5).²⁹ Table 17 lists the zone classes and associated acreage change and percent change between 2004 and 2018. Table 18 outlines the acreage of agriculture-zoned land reduction and the zone class it changed to.

Table 17					
EFLR Zone Class Acreage Changes Between 2004 and 2018³⁰					
Zone Class	Zone Class Description		2004 Acreage	2018 Acreage	% Change
	2004	2018			
0	Water, Unknown	Water, Mixed Use, Employment	795	2,201	+177%
1	Single Family	Single Family	41,353	40,563	-2%
2	Multi Family	Multi Family	272	764	+181%
3	Commercial	Commercial	621	1,075	+73%
4	Industrial	Industrial	814	735	-10%
5	Agriculture	Agriculture	16,339	14,827	-9%
6	Forest, Parks/Wildlife refuge/Open Space, Public Facilities, etc.	Forest, Parks/Wildlife refuge/Open Space, Public Facilities, etc.	61,448	61,501	+0.1%

²⁹ The 2004 zoning layer is included in the Clark County volume 2 dataset and is described as “zoning prior to the adoption of the 2004 comprehensive plan.” Zone changes are characterized by zone class, and zoning included in zone classes may have changed between 2004 and 2018.

³⁰ Total EFLR watershed acreage in 2018 is 24 acres greater than in 2004 due to data spatial reference differences.

Table 18 Agriculture Zone Change (2004-2018)	
Acres Changed	2018 Zone Class
430	Water/mixed used/employment
1,042	Single-family
99	Commercial
13	Industrial

The conversion of forest land to residential land uses is less apparent through zoning change analyses, but is still a concern in the EFLR watershed. For example, within the Upper Rock Creek subwatershed (a historically heavily forested watershed comprised of Forest-40/80, and some rural-20 zoning³¹) zoning has remained unchanged; but while there were approximately 20 records of septic systems when the Recovery Plan was first introduced, in 2018 there were approximately 93 records of septic systems, which all correspond to building footprints. Furthermore, analysis of the National Land Cover Database (NLCD) in the EFLR watershed reveals broad-scale land cover changes³² including forest reduction. Table 19 lists the acreages of land that changed from forest classification to another classification between 2001 and 2016. Changes to barren, shrub scrub, and grassland may also be a function of regeneration from recent timber harvest activities. Most changes from forest land cover to developed land captured in the NLCD products occurred in the lower watershed near Ridgefield, Battle Ground, and La Center.

Table 19 NLCD Forest Land Cover (Evergreen, Deciduous and Mixed) Classification Change (2001-2016)	
Acres Changed	2016 Land Cover
3	Water
27	Developed (open space, low-high intensity)
3	Barren Land
8,135	Shrub/Scrub
6,576	Grassland/Herbaceous
12	Pasture/Hay

³¹ These zoning categories limit development to one home and some additional structures per 40, 80, and 20 acres respectively (Clark County Code 40.210).

³² The NLCD datasets are 30-m resolution products (i.e., they are not high enough resolution to distinguish between individual homes in a rural setting).

Table 20**Land Use and Development Regulation****LOCAL GMA COMPREHENSIVE PLANNING PROGRAM(S) EVALUATION**

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Low. Clark County and the Cities of Vancouver, Battle Ground, Ridgefield, and La Center were involved at some level in the development of the Recovery Plan. As a result, it is assumed that some connection between the Recovery Plan and their comprehensive plans occurred since 2004. Yacolt did not participate in Recovery Planning. Clark County's Comprehensive Plan references the Recovery Plan several times. Ordinances that protect critical areas were adopted (see below), and as required by the GMA provide protection to habitat that supports ESA-listed salmon and steelhead, including streams and rivers. However, no direct evidence was found that Recovery Plan priorities were used to directly establish added protections for priority stream reaches; similarly, no evidence was found that Recovery Plan priorities were used to designate locations, types or densities of land uses under the Comprehensive Plan. Land use programs and associated designations were largely developed to address statutory GMA requirements, rather than recovery priorities.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. Local comprehensive plans are intended to strike a balance between accommodating human development and protecting sensitive habitats. **The Recovery Plan expectation was that salmon recovery needs would be considered upfront in comprehensive plans, along with other social, infrastructure, and service needs, and that high levels of protection would be afforded to streams and watershed processes. The Recovery Plan also anticipated that comprehensive plans would reduce development impacts in the EFLR's floodplain to minimize negative effects on habitat and habitat-forming processes.** Agriculture conversion is occurring in the EFLR watershed primarily within city UGAs (e.g., Ridgefield, La Center, and Battle Ground), with agriculture-zoned land reduced by 1,512 acres since the introduction of the Recovery Plan. Trends in decreasing forest land cover in the EFLR watershed have not been a function of forest zoning changes; however, interviewees expressed concerns about a growing risk of forest land conversion. County building data also indicate that approximately 787 building footprints (totaling 26 acres) are located within floodplains of the EFLR, according to the county shoreline designation boundaries (totaling approximately 0.4 percent of shorelines). These trends raise questions regarding long-term protection of watershed processes.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Moderate. Clark County produces a diversity of GIS data layers that can be synthesized to illustrate on-the-ground activities that can inform land use impact assessment. For example, the County has data showing land use and zoning changes over time, as well as septic tank and building footprints to show development patterns and intensity over time. Synthesis of this data is foundational to gaining an understanding of threat trajectories. A missing element from the county's database,

which would be additive to the characterization of threats, is a more detailed geodatabase of permits, including the location of Conditional Use Permits (CUPs) and variance approvals. City-specific datasets related to the EFLR were not digitally available.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. No evidence was found of effectiveness monitoring to ensure that local GMA comprehensive planning programs are helping to meet Recovery Plan objectives was found, especially with regard to floodplain, stream, and riparian corridor functions, and watershed processes that support and maintain productive fish habitat.

Critical Area Designations

Local governments (cities and counties) are responsible for the designation and protection of critical areas in the EFLR through their respective habitat conservation ordinances. Clark County and the cities of Ridgefield, La Center, and Yacolt each designate critical areas within the EFLR watershed. Critical areas are defined as wetlands; aquifer recharge areas; fish and wildlife habitat conservation areas; frequently flooded areas; geologically hazardous areas; ponds and lakes; and streams, creeks, and rivers. Geologic hazard areas include lands classified as landslide hazard areas, erosion hazard areas, seismic hazard areas, mine hazard areas, and volcanic hazard areas. Critical Aquifer Recharge Areas (CARAs) are highly susceptible to contamination because of high soil permeability and high water tables. Roughly half (48 percent) of the EFLR watershed is designated as critical area, as shown in Figure 13.

The goal of Clark County's Habitat Conservation Ordinance (HCO) is no net loss of habitat functions while allowing for use of private property (CC 40.440.010). The HCO strikes this balance through restrictions relating to development, forestry, and agriculture. Critical Area Ordinances (CAOs) identify restrictions to land use activities that occur within sensitive (or critical) areas, including fish and wildlife conservation areas. Development within critical areas is managed and permitted by the County's Community Development Department in unincorporated areas, and by cities within their respective city limits. Approximately 9,956 building footprints in the EFLR watershed, comprising 364 acres,³³ are located in lands designated as critical areas, as shown in Figure 14.

Exceptions to city and county critical area ordinances are permissible through exemptions, variances, and compensatory mitigation. *Exemptions* include emergency actions, new agricultural practices (since 2006), maintenance/repair of existing structures, and non-developmental activities (e.g., recreation). *Variances* can be granted if special conditions exist that deny a person of their property rights or will not create significant impacts to critical areas and resource lands (Clark County 2019). *Compensatory mitigation* can be required in situations where impacts to regulated critical areas or their buffers cannot

³³ The 364 acres metric does not include the tax lot that the building footprint is located within; it is strictly the area underneath the footprint of each building according to Clark County GIS data. Therefore, it does not include other land cover changes associated with buildings (driveways, land clearing, etc.)

be avoided. Mitigation Bank credits can also be acquired as compensatory mitigation in some circumstances. There are two active and approved mitigation banks operating in the EFLR system: the East Fork Lewis Mitigation Bank located at Fargher Lake and the Battle Ground Remy Farm Wetland Mitigation Project. Approximately 35 permittees have acquired credits from the East Fork Lewis Mitigation Bank to mitigate for disturbances to Class II, III and IV wetlands in the EFLR (Woodward 2019). The Remy Farm Consolidated Wetland Mitigation Site provides similar services relating to offsetting impacts to waters of the U.S.; however, Remy's service area is primarily for the City of Battle Ground, the Salmon Creek drainage, and the portion of the Upper Mill Creek basin that drains to the East Fork Lewis River. The Wapato Valley Mitigation and Conservation Bank, which is situated at the confluence of the North Fork Lewis and Columbia Rivers and incorporates lower Gee Creek, is also being developed. If approved, that bank would provide mitigation credits for impacts to critical areas in the EFLR watershed as well. In addition to use of mitigation banks, regulatory agencies often use onsite or offsite permittee responsible mitigation to mitigate impacts to critical areas.

East Fork Lewis River Critical Areas



Figure 13. Map of lands designated as critical areas lands in the EFLR watershed. Data from Clark County's critical areas GIS layer.

East Fork Lewis River Building Footprints that Intersect with Critical Areas

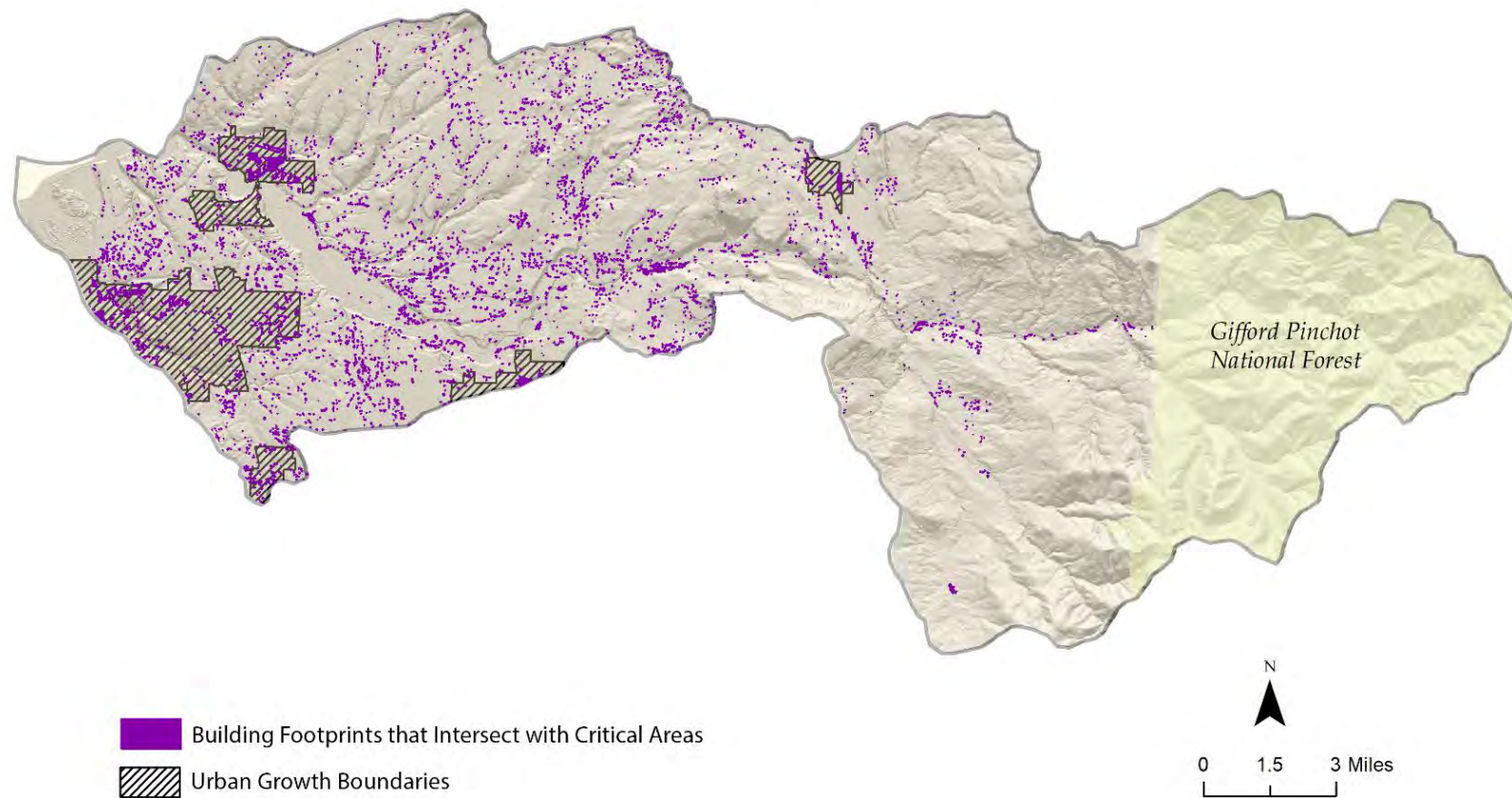


Figure 14. Map of building footprints that intersect with lands designated as critical areas in the EFLR watershed. Urban growth boundaries are also shown. Data is from Clark County building footprint, urban growth boundary, and critical areas GIS layers. Building footprint data may include buildings constructed prior to 2004.

Table 21**Land Use and Development Regulation****CRITICAL AREA DESIGNATION PROGRAM(S) EVALUATION**

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Moderate. Clark County and the Cities of Ridgefield and La Center (with city limits in the EFLR watershed) were involved at some level in the development of the Recovery Plan, so it is assumed that some connections between their critical area designations and the Recovery Plan exists. Clark County’s Habitat Conservation Ordinance (including critical areas) contains references to the Recovery Plan. Note that, by nature of the GMA, these programs provide some level of protection and minimize impacts to streams, riparian corridors, and floodplains, especially when these areas support ESA-listed salmon and steelhead. However, program interviews indicated a poor connection between the county and cities’ critical area ordinances and the Recovery Plan priorities. No direct evidence was found that Recovery Plan priorities were used to establish added protections for high priority stream reaches (e.g., Tier 1 or 2 reaches), or key watershed functions identified as important to recovery, or to direct mitigation opportunities. Ordinance requirements were largely developed to address statutory GMA requirements, rather than recovery priorities.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. Recovery Plan expectations of critical area ordinances are to reduce habitat and habitat-forming process impacts resulting from new development to a “no loss of function” condition. It is unclear how well critical area ordinances are protecting EFLR habitat because data indicate significant development within the floodplain and adjacent to smaller tributaries (see Figure 14). Available data do not indicate when the development occurred in lands designated as critical areas (i.e., pre- or post-Recovery Plan). Exempt uses within critical areas (e.g., single family homes, agriculture activities, etc.) offset instances where regulations prevent activities in critical areas. Clark County and the cities’ available databases do not capture variances, CUPs, or mitigation activities in a manner that supports evaluation. Interviews suggested that little compliance monitoring and enforcement occurs for critical area permits. Collectively, these limitations preclude evaluation of threat reduction benefits from program implementation.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. Clark County maintains a comprehensive GIS database that includes location of critical areas, building footprints, and septic tanks. The county does not differentiate between the various categories of critical areas (e.g., hillslopes, floodplain, etc.) which makes synthesis and analysis difficult. The available County data does not include variances, CUPs, or mitigation requirements which constrains analysis. Ridgefield, La Center, and Yacolt do not maintain this information in GIS

form for public use. In both County and city programs, specific development permit details are only available on a permit by permit basis.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. An internal Clark County Development study in 2008 to review permit compliance and effectiveness was initiated but never published. PC Trask could not acquire the draft report. Program information that allows evaluation of habitat losses relative to gains is lacking.

Shoreline Management Act (SMA)

The Shoreline Management Act (SMA) requires all counties and most towns and cities with shorelines to develop and implement Shoreline Master Programs. The act applies to the EFLR mainstem and fourteen tributaries with seasonal flows over 20 cubic feet per second (cfs) mean annual flow³⁴ (Clark County SMP 2012 and Skamania County SMP 2017). The SMA was adopted in 1972 with the goal of “preventing the inherent harm in an uncoordinated and piecemeal development of the state’s shoreline” (Ecology 2019).

Shoreline Master Program

Clark and Skamania counties and the cities of Ridgefield and La Center each have Shoreline Master Programs to guide shoreline development. Vancouver and Battle Ground also have Shoreline Master Programs; however, because both cities have not annexed lands within their UGAs at this time, authority rests with Clark County shoreline regulations.

A Clark County Shoreline Substantial Development Permit (Shoreline Permit) is required for substantial development that occurs within 200 feet of the shoreline or stream having flows over 20 cfs, and within associated wetlands. Figure 15 identifies the seven shoreline categories within the county’s jurisdiction. Table 22 outlines the mileage of Tier 1 through 4 streams within each shoreline designation in Clark County.

³⁴ Stream segments in Copper, King, Upper Rock, Coyote, Cedar, Big Tree, Yacolt, Lower Rock, Mason, Lockwood Creeks, Copper Creek, McKinley Creek, Little Creek, and the Green Fork.

Table 22 Clark County EFLR Shoreline Designation by Recovery Plan Tiers			
Clark County Shoreline Designations³⁵	Mileage by Recovery Plan EFLR Reach Tiers		% of total Tier mileage in EFLR watershed
Aquatic	Tier 1	16.2 miles	56%
	Tier 2	7.0 miles	69%
	Tier 4	8.2 miles	15%
Natural³⁶	Tier 2	0.5 miles	2.1%
	Tier 4	0.6 miles	0.6%
Rural Conservancy Residential	Tier 1	1.3 miles	4.5%
	Tier 2	0.9 miles	3.7%
	Tier 4	6.6 miles	6.1%
Rural Conservancy Resource land	Tier 1	6.9 miles	23.8%
	Tier 2	4.8 miles	20.3%
	Tier 4	12.8 miles	11.9%
Urban Conservancy	Tier 4	0.1 miles	0.1%

Substantial development is defined by state law (RCW 90.58.030) and generally includes any development that is valued at more than \$5,000 or development that materially interferes with the normal public use of the surface waters (Regional Planning Council of Clark County). Some types of developments are exempt from securing a substantial development permit. The most common exemption is for development of a single-family home and normal appurtenances; however, activities must be consistent with local regulations (e.g., critical area ordinances). Exemptions also exist for agricultural activities, certain forest practices, fish enhancement projects, stormwater treatment, existing bulkheads, and transportation-related maintenance. Ecology establishes guidelines and reviews variance and conditional use permits. County building data indicate that approximately 787 building footprints (totaling 26 acres) are located within shoreline designation boundaries, as shown in Figure 16.

³⁵ Shoreline designations not listed in table do not cover areas with Tier-rated streams.

³⁶ According to WAC 173-26-211: "The purpose of the "natural" environment is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes."

East Fork Lewis River Shoreline Master Program Designations

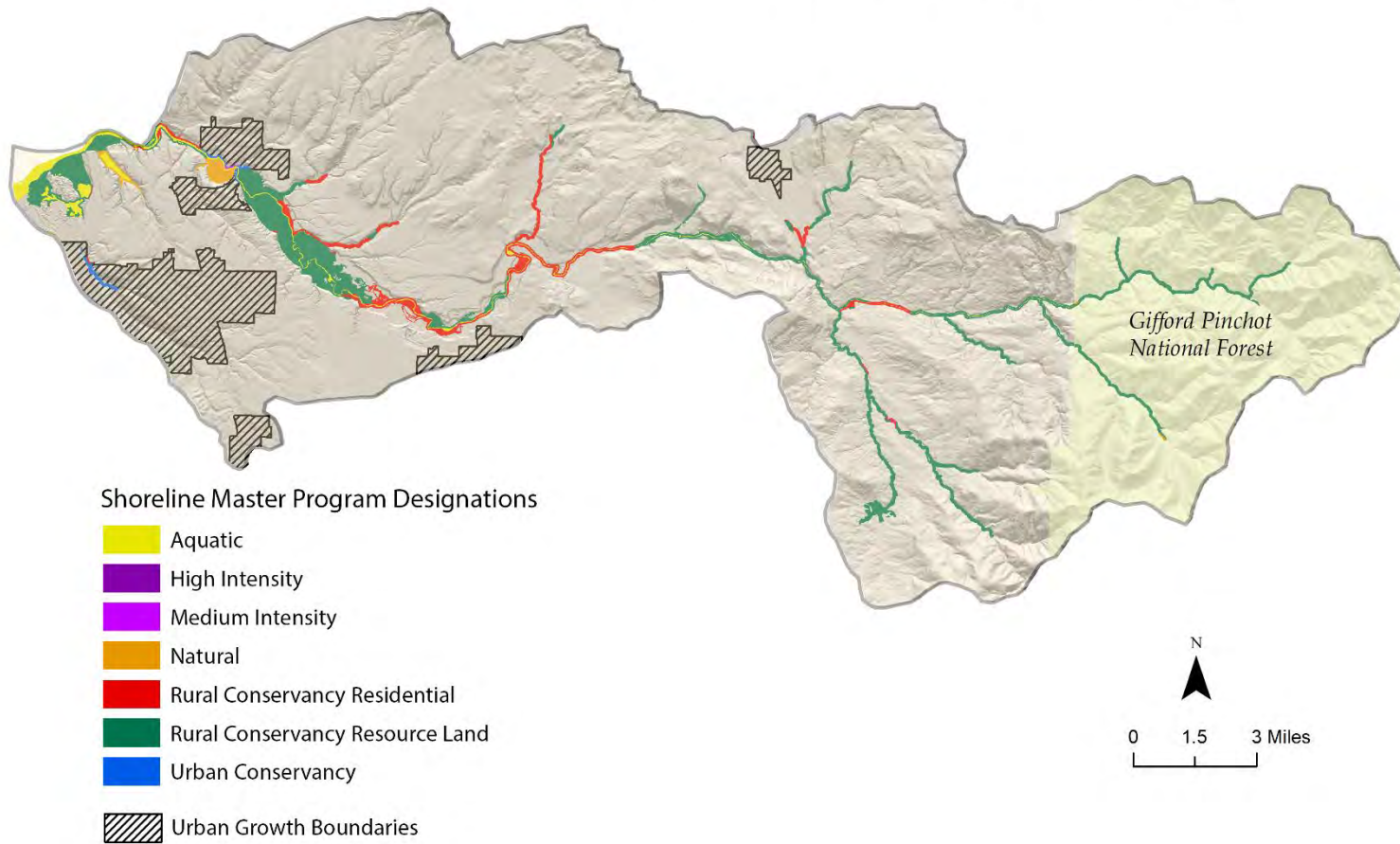


Figure 15. Map of EFLR Shoreline Master Program designations. Data from Clark County shorelines GIS layer.

East Fork Lewis River Building Footprints that Intersect with Shorelines

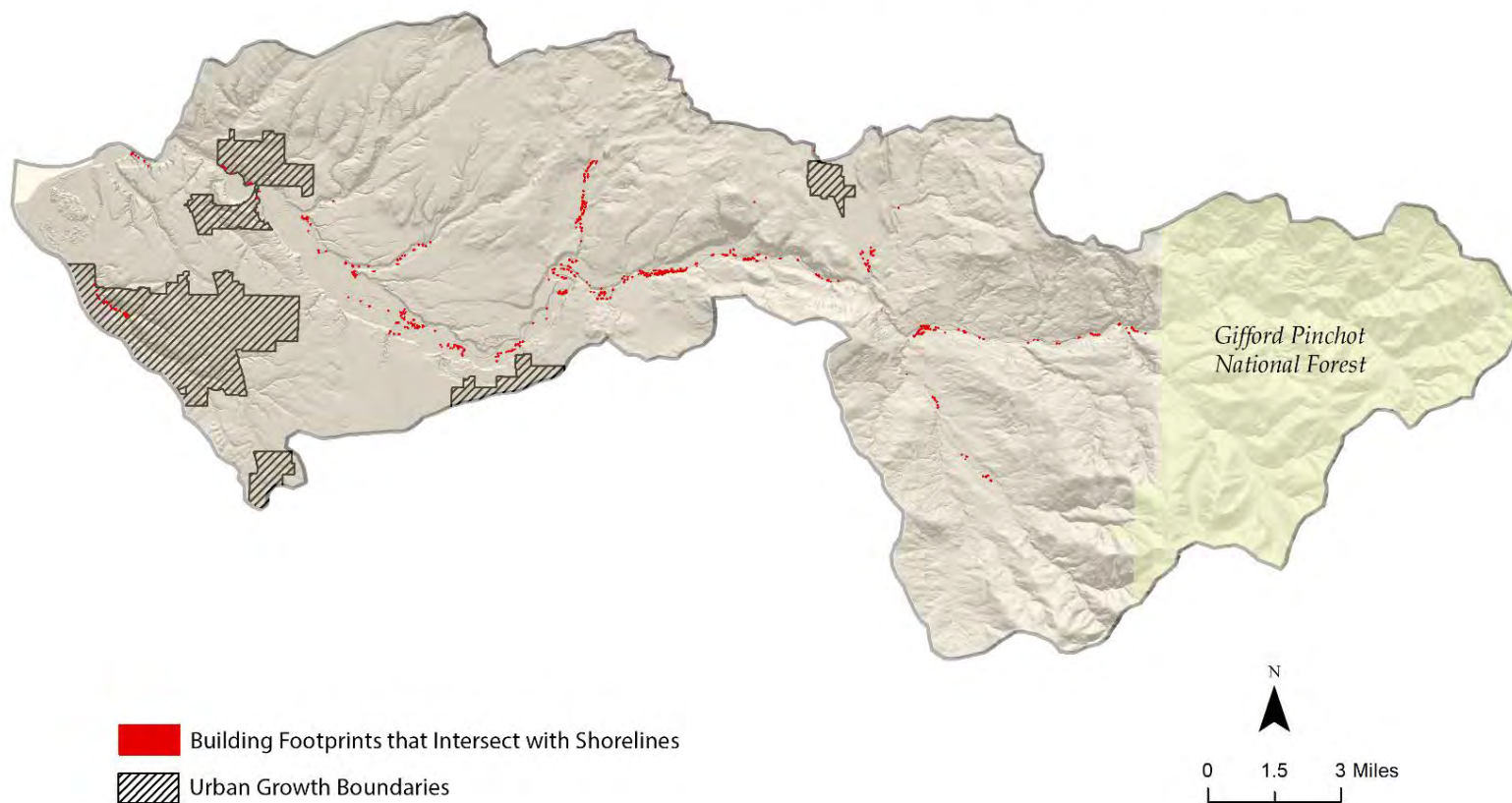


Figure 16. Map of building footprints that intersect with shorelines in the EFLR watershed. Urban growth boundaries are also shown. Data is from Clark County building footprint, urban growth boundary, and shorelines GIS layers. Building footprint data may include buildings constructed prior to 2004.

Table 23 Land Use and Development Regulation
SHORELINE MASTER PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: High. LCFRB worked with Clark County and Ecology to create the shoreline designations that classify shoreline areas into discrete categories with corresponding regulations; these designations were partially based on Recovery Plan priorities. SMA regulations were also integrated into Clark County's Habitat Conservation Ordinance.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Unknown. The Recovery Plan expectation is that shoreline master programs would help protect stream corridor structure and function, protect adjacent hillslope processes, and protect riparian conditions. Clark County's GIS database shows development activities within Shoreline designations (approximately 787 building footprints, totaling 26 acres) are located within shoreline designation boundaries; however, their effects on habitat are unclear. Available data managed by the county or Ecology does not identify activities that have received variances or CUPs (e.g. agriculture or single-family homes).
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. Clark County GIS data is useful in identifying shoreline designations under the SMA jurisdiction in the EFLR watershed. Other county GIS layers show structure footprints and septic systems. No currently available data effectively tracks exempt uses, variances, conditional use permits, mitigation, violations, or compliance.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. Interviews with Ecology, Clark County, Ridgefield, and La Center did not reveal efforts to assess program effectiveness and the cumulative effects of shoreline development.

Clean Water Act (CWA)

The federal Clean Water Act (CWA) regulates activities that affect water quality in the EFLR through several key partner programs. The CWA establishes the basic structure for regulating discharges of pollution and dredged and fill material into waters of the United States. The NPDES permit program regulates point sources that discharge pollutants into the waters of United States. In Washington State, the NPDES program is administered by Ecology on a permit basis that covers discharge into surface waters. Permits include discharge limits for specific pollutants, monitoring and reporting requirements, and operation and maintenance requirements.

The EPA is authorized to assist states in listing waters as impaired under section 303(d) of the CWA and developing Total Maximum Daily Loads (TMDLs) for impaired water bodies. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as a planning tool for restoring water quality. Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill material into the waters of the United States. Implementation of Section 404 is the responsibility of the USACE, with some oversight and authority by the EPA. Section 401 of the CWA provides for state certification of water quality. Implementation in Washington State is shared with Ecology.

Section 404 (Dredge and Fill)

Section 404 of the Clean Water Act, subsection 301, prohibits the discharge of dredged or fill material into waters of the U.S. without a permit from the USACE. Typical activities requiring Section 404 permits are the depositing of fill, dredged, or excavated material into waters of the U.S. and/or adjacent wetlands, grading or mechanized land clearing of wetlands, and placement of spoils from ditch excavation activities in wetlands. Federally designated navigable waters are also subject to Section 404 requirements.

The USACE's permit decision is considered a federal action that must comply with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and Section 7 of the Endangered Species Act (ESA), if applicable. MSA consultation with NOAA is required if proposed work may affect Essential Fish Habitat (EFH); if work may affect threatened or endangered species or their critical habitats, ESA consultation with NOAA or USFWS is needed. A programmatic consultation is a process whereby the USACE requests Section 7 consultation on certain types of work activities to streamline permitting. In the EFLR, examples include certain types of habitat or fish passage restoration.

In 2008, EPA and USACE, through joint rulemaking, expanded the CWA Section 404 implementing guidelines to include more comprehensive standards for compensatory mitigation. The purpose of mitigation is to offset unavoidable adverse impacts resulting from the permitted activity (CWA 2020). In Washington, Ecology and USACE developed their Joint Mitigation Guidelines to inform Section 404 (and Section 401) compensatory mitigation in Washington State. The guidance defines mitigation and also establishes priorities and guidelines for mitigation banks, watershed-based mitigation, and permittee responsible mitigation. There are two active wetland mitigation banks with service areas within the EFLR watershed.

The 113-acre East Fork Lewis Mitigation Bank at Fargher Lake was authorized by oversight regulatory agencies, including the USACE, EPA, Ecology, and Clark County, to sell 91 wetland mitigation credits. Current costs are \$150,000 per credit. To date, approximately 10 of the 91 credits have been sold in the EFLR watershed, including mitigation for Class II, III, and IV wetlands and wetland buffers (Woodward 2019). One additional mitigation program in the watershed includes the 60-acre Battle Ground Remy Farm Wetland Mitigation Project. About 35 acres have been committed to offset development impacts in the upper Mill Creek subwatershed, which drains both to Salmon Creek and the EFLR.

Approximately 194³⁷ Section 404 permits were issued in the EFLR watershed between 2004 and 2018; many of them appear to be associated with commercial or residential development, and associated transportation projects, in the vicinity of Ridgefield, Battle Ground, and La Center. Additionally, a subset of Section 404 permits was issued for mitigation or restoration projects along the mainstem EFLR. The EPA shares enforcement of Section 404 regulations with the USACE. Figure 18 identifies the location of Section 404 permits in the EFLR watershed.

Table 24
Land Use and Development Regulation
SECTION 404 DREDGE AND FILL PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: Low. Interview discussions highlighted the absence of any direct relationship between USACE’s Section 404 program and the Recovery Plan. If a relationship does exist, it may be in the form of staff using the Recovery Plan as context for fish and habitat information, and to sometimes guide mitigation decisions, especially when Section 7 under the ESA is triggered and consultation with NOAA is required.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Unknown. Recovery Plan expectations for Section 404 is to protect EFLR floodplain and wetlands from impacts resulting from urban and rural development. Implementation of Section 404 by USACE is on-going; however, program data does not currently provide a basis for determining if regulations are protecting the baseline through avoidance, minimization, or compensatory mitigation. The interview with the USACE’s Seattle District highlighted that limited compliance monitoring or enforcement has occurred in the EFLR watershed. While Seattle District’s internal performance tracking includes targets for compliance inspections, the target percentage is based on a multi-county, not watershed, scale.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. The Seattle District of USACE maintains the Operations and Maintenance Business Information Link (OMBIL) Regulatory Module, or “ORM” database, which supplies point locations for each permit record, and inconsistent permit attribute information (permit authority, project descriptions, area of impact, etc.). More information that may characterize EFLR habitat is found in individual permit files, but not included in the regional ORM database in a manner that can be exported for outside parties. The USACE did not identify any information or data to support the evaluation of program effectiveness. The quality of the collective database is insufficient to support

³⁷ The USACE permit database does not consistently distinguish between Section 404 and Section 10 permits. 195 permits were identified in the EFLR watershed between 2004 and 2018; of those, one record was definitively attributed Section 10 Authority. It is assumed that the remaining 194 are Section 404 Authority permits.

the characterization and evaluation of floodplain, stream, and wetlands impacts regulated by the USACE.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. USACE did not identify information or data to demonstrate program effectiveness monitoring during the interview with regard to Recovery Plan objectives. However, USACE-authorized mitigation banks and individual permit mitigation projects include annual reporting requirements relating to mitigation plan goals and objectives.

Section 401 Water Quality Certifications

CWA – Section 401 Water Quality Certifications enable Ecology to approve, condition, or deny any projects that may discharge material into US waters (i.e., require a CWA Section 404 permit). The Section 401 certification process ensures compliance with state water quality standards and thus benefits various aquatic resources. Section 401 covers both the construction and operations of a proposed project to ensure water quality and fish and wildlife standards are met. For projects that trigger State Environmental Policy Act (SEPA) review, SEPA must be completed before Section 401 certification decisions.

A search of Ecology's Water Quality Permitting and Reporting Information System (PARIS) identified ten water quality certifications in the EFLR. Three water quality certifications were issued for EFLR habitat restoration activities. The remaining certifications were associated with construction projects.

Table 25

Land use and Development Regulation

SECTION 401 WATER QUALITY CERTIFICATIONS PROGRAM(S) EVALUATION

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Low. Ecology's Section 401 Water Quality Certification Program is guided by the CWA and internal state water quality objectives rather than the Recovery Plan. Program interviews with Ecology indicated general awareness of the Recovery Plan, but did not identify direct consideration of recovery priorities in decision-making.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. The expectation of the Recovery Plan is for Section 401 Water Quality Certification to regulate urban and rural development sufficiently so that no net loss of water quality occurs as a result of development activities in the EFLR watershed. Datasets sufficient to evaluate whether the Section 401 Water Quality Certification Program is meeting these expectations were not available. Ecology does perform compliance monitoring and enforcement activities.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. Ecology's PARIS database provides permit-specific information including documented compliance visits, enforcement, and permittee reports. It is unclear how this information would be used by LCFRB to assess whether or not water quality is improving over time.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. No evidence was found of effectiveness monitoring to ensure that the Section 401 Certification program is helping to meet Recovery Plan objectives.

Section 303(d) Impaired Waterbody List and Total Maximum Daily Load (TMDL)

EPA delegates CWA Section 303(d) authority to Ecology to identify polluted water body segments and develop TMDL studies. The Total Maximum Daily Load (TMDL) Program establishes a new 303(d) list of polluted water body segments every two years and submits the list to the EPA. Ecology is responsible for setting priorities and preparing cleanup plans for the impaired water body segments. The EFLR and its tributaries are listed on the state's polluted waters list for high water temperatures and fecal coliform bacteria problems. Ecology developed an *EFLR Watershed Bacteria and Temperature Source Assessment* (Source Assessment) that analyzed water quality data, created a watershed inventory, identified issues of concern, and developed general implementation recommendations to address temperature and bacteria issues (Ecology 2018). The reaches of the EFLR that trigger the 303(d) listings for bacteria and temperature are shown in Figure 17.

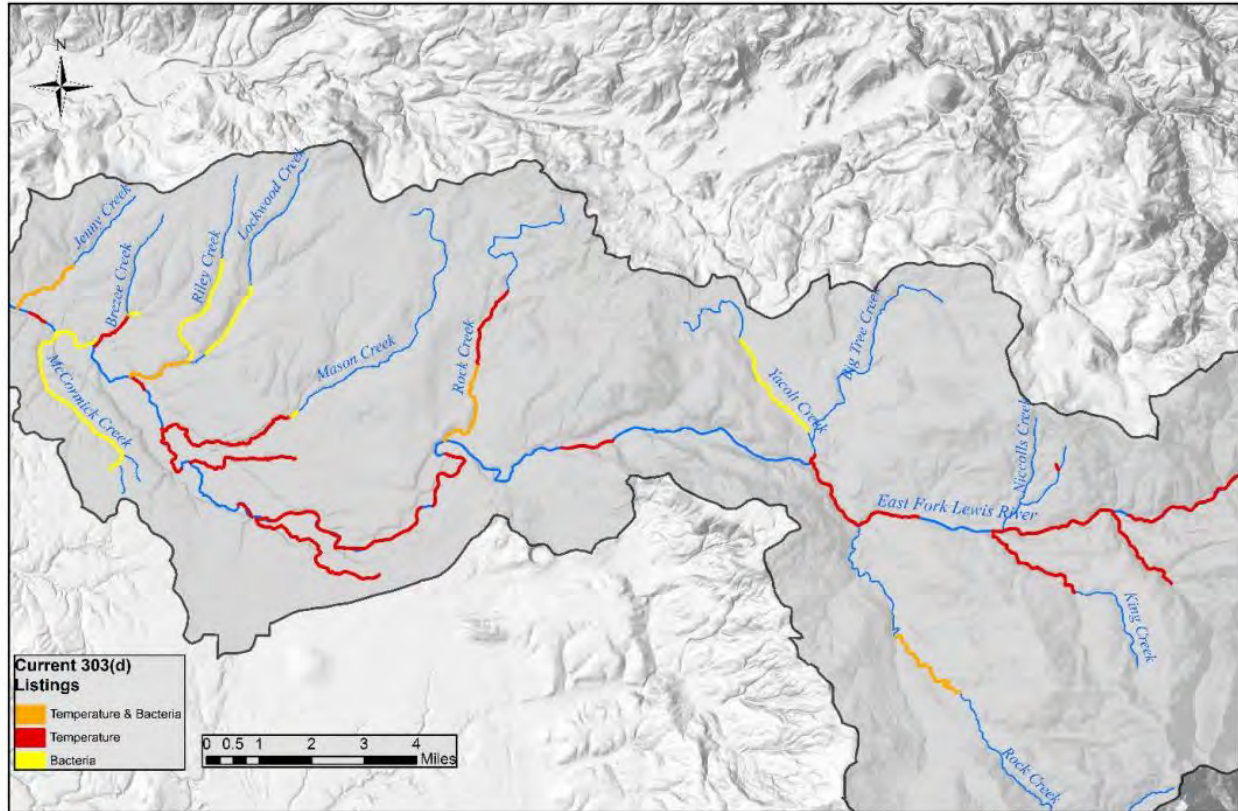


Figure 17. Figure excerpt from Ecology's East Fork Lewis River Watershed Bacteria and Temperature Source Assessment Report (2018). Map of EFLR watershed temperature and fecal coliform bacteria 303(d) listings.

The Source Assessment indicated that both temperature and bacteria levels are higher in the lower watershed compared to the upper watershed. It concluded that high coliform readings were found in agricultural areas, including Rock Creek North, Mason Creek, and McCormick Creek. Stormwater outfalls in Brezee Creek were believed to contribute to water quality issues (Ecology 2018). The Source Assessment identified river miles 9-13 as having the highest “shade deficit” in the EFLR (Ecology 2018). Ecology has issued various point source discharge permits in the EFLR. They include municipal wastewater NPDES for La Center, Paradise Point, and Larch Mountain Correction Center (Ecology 2018). Other discharge permits include sand/gravel, stormwater, and construction.

On-site septic systems in the EFLR watershed have increased, consistent with ongoing high levels of residential development. Clark County septic system GIS data indicate there were approximately 8,249 records of septic systems in the EFLR watershed in 2018. Clark County Public Health’s On-site Septic System Operation and Maintenance Program (OSS O&M) requires that landowners have regular inspections and provides financial help for repair or replacement of failing systems. Clark Conservation District, NRCS, and WSU Extension Office provide assistance to agricultural activities to reduce pollutants entering EFLR tributaries.

Ecology formed the EFLR Partnership in 2018 to work with partners to implement recommendations and develop and implement a water cleanup plan. Recent efforts between the LCFRB and Ecology to incorporate specific Recovery Plan actions into the developing water cleanup plan are important new linkages between programs.

Table 26
Land Use and Development Regulations
SECTION 303(d) IMPAIRED WATERBODY LIST AND TMDL PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: Moderate. Ecology’s TMDL process in the EFLR is independent from the Recovery Plan. However, recent developments between LCFRB and Ecology are leading to the incorporation of Recovery Plan actions into the yet-to-be completed EFLR water cleanup plan.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Unknown. The Recovery Plan expectation of Ecology’s TMDL process is for on-the-ground implementation of a water cleanup plan that reduces stream temperatures and fecal coliform to levels below the Section 303(d) thresholds. Formation of an EFLR Partnership and the completion and implementation of the cleanup plan are important milestones toward meeting Recovery Plan expectations. Implementation of Clark County Health’s OSS O&M program and agriculture water quality programs are helping to address fecal coliform threats; however, it is unclear how effective they are at this time. The OSS O&M program performs inspections and implements compliance monitoring and enforcement activities. However, according to Clark County Public Health, roughly 1,929 (or 32 percent of) septic systems in the EFLR watershed have not been inspected. The Source Assessment did not identify rapid population growth and land cover change in the EFLR as concerns related to elevated fecal coliform levels or temperature.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Moderate. Clark County’s Department of Environmental Services produced a Stream Health Report in 2010 that included the EFLR. The report includes a “stream health score card” that coarsely evaluates EFLR subwatersheds for water quality, biological health, and flow. The overall EFLR watershed rating is “fair” while the same assessment in Gee Creek is “poor.” A scorecard approach could be useful to demonstrate habitat threats reduction if rescored in the future. Ecology also produced the <i>East Fork Lewis River Watershed Bacteria and Temperature Source Assessment</i> report in 2018, which provides a comprehensive overview of EFLR watershed habitat status in the context of temperature (assessed through a shade analysis) and fecal coliform levels.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Moderate. The source assessment includes long-term monitoring for selected data sets. No other evidence was found of effectiveness monitoring to ensure that the program is helping to meet Recovery Plan objectives.

Stormwater Discharge

Stormwater in the EFLR watershed is managed by Clark County under a NPDES permit issued by Ecology in 1999. The permit specifies regulations for managing the quantity and quality of stormwater discharged from the county's stormwater system, including the EFLR watershed. The program follows Ecology's 2019 Stormwater Management Manual for Western Washington which describes design criteria for surface and stormwater discharge locations, analysis of off-site conditions, runoff control, infiltration basins, and water quality control. Other BMPs include runoff treatment, streambank erosion control, erosion and sedimentation control, and wetland quality control. Clark County's Stormwater Management Plan was first adopted in 2008 and was last updated in March 2019.

Primary responsibilities of the Clark County Stormwater Program include planning and constructing stormwater control facilities, watershed planning, water quality monitoring of stormwater and streams, public education and outreach, development and enforcement of water quality regulations, coordination with other municipalities, and maintenance of the county's stormwater system. According to the county, the rural areas of the EFLR watershed would benefit from an updated inventory to assess current conditions and improvement needs (Schnabel 2018). In 2008, Clark County Public Works Clean Water Program initiated a series of *Stormwater Needs Assessment Program* (SNAP) reports, including assessments for 17 subwatersheds in the EFLR watershed. Each of the SNAP reports include a water quality assessment, stormwater inventory, and various other environmental assessments. More recently in 2016, LCFRB produced their *Lower Columbia Region Habitat Status and Trends Monitoring (HSTM) Implementation Plan* report which included key monitoring questions targeted to stormwater and water quality status and trends. Monitoring results identified in the report will help guide Clark County's Stormwater Program and partially satisfy their NPDES permit requirements.

Battle Ground operates under a Phase II stormwater permit; however, Ridgefield, La Center, and Yacolt are currently under the population thresholds for stormwater planning requirements (10,000 residents for Phase II; 100,000 or 250,000 for Phase I).³⁸ Therefore, they are not currently regulated for stormwater planning under either phase. La Center is currently working with Ecology on a stormwater assessment and the identification of stormwater facilities within their city limits.

³⁸ The Phase I Municipal Stormwater Permit regulates systems owned or operated by incorporated cities with a population of over 100,000 people or unincorporated counties with populations of more than 250,000 people, based on the 1990 census.

Table 27**Land Use and Development Regulation****STORMWATER DISCHARGE PROGRAM(S) EVALUATION**

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: High. Clark County worked with LCFRB in 2008 to produce SNAP reports to guide their stormwater program, including subwatersheds of the EFLR. More recently, a LCFRB grant from Ecology was designed to satisfy NPDES monitoring requirements for stormwater, while developing metrics for a SW Washington habitat status and trends monitoring program. These efforts build upon elements of the Recovery Plan to guide stormwater management in the EFLR watershed. Ridgefield, La Center, and Yacolt are currently exempt from stormwater planning requirements.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. Recovery Plan expectations for stormwater management include effective management of concentrated stormwater flow in storm drains and road ditches that enter the EFLR. Clark County's stormwater facility inventory in the EFLR watershed is dated and improvements to the inventory generally follow increasing development. Data identified in the various SNAP reports are useful to describe the water quality baseline. New information resulting from habitat status and trends monitoring will help inform how well EFLR urban and rural development threats are being addressed.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Moderate. EFLR SNAP reports contain data that could be used to inform threat reduction relating to urban and rural development. It is unclear how much additional data has been produced since 2008 to inform habitat trends. Clark County maintains GIS stormwater point and line feature layers; however, interview discussions indicated inventory deficiencies in the rural areas of the EFLR watershed.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Moderate. Ecology performs effectiveness monitoring at a regional scale (e.g., Western Washington). Stormwater Action Monitoring (SAM) Effectiveness Studies include topics such as low-impact development, retrofits, source control, operations and maintenance, and public education/behavior change. Additionally, new requirements in the County's 2019 NPDES Stormwater permit align with the Lower Columbia HSTM Program (2016), and will add new focus to the EFLR stormwater monitoring and provide data and information that will help evaluate effectiveness.

Instream Protections

Habitat diversity and key habitat quantity are already low in the EFLR (LCFRB 2010), and such conditions are affected by multiple land use programs. Instream protection programs are a mix of authorities that include state aquatic lands ownership, USACE's Rivers and Harbors Act – Section 10, WDFW's Hydraulic Code, and Ecology's Water Resources Program. Collectively, these programs protect EFLR streamflow and geomorphic processes resulting from urban and rural development.

State-Owned Aquatic Lands

DNR is steward to approximately 2.4 million acres of state-owned aquatic lands in Washington State. These include tidelands, shorelands, harbor areas, and beds of navigable waters (RCW 79.105.060). The extent of navigability in the EFLR is defined by DNR as head of tide which is approximately river mile 6 (as defined by the Landscape Planning Framework, University of Washington and PC Trask). Permission in the form of a land use lease is required by DNR prior to development or restoration activities on state aquatic lands. DNR has negotiated a number of authorizations that can be characterized as utility crossings (e.g., oil/gas pipelines, power/telephone, and water lines); bridges (e.g., La Center Bridge); overwater structures downstream in the mainstem Lewis River; and stormwater outfalls in the vicinity of La Center (Wilhelm 2019).

DNR also administers an Aquatic Reserve Program to preserve, restore, and enhance state-owned aquatic lands of distinct environmental, educational, or scientific value. Aquatic Reserves could be established to conserve particular areas of state-owned aquatic lands within the lower Columbia region that are considered particularly important to salmon recovery. No Aquatic Reserves are identified in the EFLR watershed (Gorman 2018).

Table 28
Land Use and Development Regulation
STATE-OWNED AQUATIC LANDS PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program?
A: Low. Interviews with DNR staff indicate there is no apparent linkage between State-owned Aquatic Lands and the Recovery Plan. However, DNR staff do participate in LCFRB's Technical Advisory Committee, which enhances opportunities for integration of program priorities on State-owned Aquatic Lands.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?
A: Unknown. The Recovery Plan expectation for the State-owned Aquatic Lands in the EFLR is on-going protection from development on aquatic lands . This expectation is focused on protecting the environmental baseline against degradation. DNR agreements identify minimal impacts to

navigable waters in the EFLR. The Aquatic Reserve Program was not identified in the Recovery Plan, but may have a critical role in achieving Recovery Plan expectations in the future.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. State-owned Aquatic Lands program staff track and characterize leases under their jurisdiction. Point coverage is available upon request that identifies authorizations within the public lands. This data helps portray the types of activities occurring in the watershed but doesn't inform threat reduction. Aquatic Lands program staff perform compliance monitoring at the expiration of a lease authorization.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. No evidence was found of effectiveness monitoring to ensure that the State-owned Aquatic Lands program is helping to meet Recovery Plan objectives.

Hydraulic Project Approval (HPA)

The Washington State Hydraulic Code (RCW 77.55.021) applies to any construction activity that will use, divert, obstruct, or change the bed or flow of natural waters of the state. HPA jurisdiction extends beyond Ordinary High Water Line to those activities that may impact natural waters of the state. WDFW administers the Code through their Hydraulic Project Approval permit process. Typical permitted activities include streambank protection; construction of overwater structures; pile driving; channel change or realignment; dredging; gravel removal; pond construction; placement of outfall structures; log, log jam, or debris removal; installation or maintenance of water diversions; and habitat enhancement. WDFW's *Gold and Fish Pamphlet HPA* addresses mineral prospecting; however, the assessment of mineral prospecting is covered later in this chapter under the heading "Aggregate Mining and Mineral Prospecting Regulation." Prior to 2014, WDFW issued HPA permits in support of forest practices applications; in 2014 this regulatory authority was transferred to DNR as part of their Forest Practices HCP permitting authorities. However, WDFW is still required to provide concurrence on certain projects on fish bearing waters. Between 2004 and 2018, approximately 519 HPA permits were issued³⁹ in the EFLR watershed.

WDFW conducted a study of HPA permit program compliance, implementation, and effectiveness (Quinn et al 2006). The study highlights several issues related to implementation consistency and compliance. Authors of the report speculate that the goal of "no net loss of habitat function and values"

³⁹ Permit count caveats: Pre-2014 permits lack precise location attributes, preventing a reliable determination of exact project location. Instead, where available, permit township, range, and sections were used to estimate the number of permits within the EFLR watershed. Additionally, permit count may include permit renewals and/or separate activities covered under a single permit.

is not being achieved in most permitted circumstances and there is little understanding or focus on the cumulative effects of many permitted actions.

Table 29 Land Use and Development Regulation
HYDRAULIC PROJECT APPROVAL ⁴⁰ (HPA) PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: Low. Interviewees were aware of the Recovery Plan; however, RCWs and WACs do not refer to the LCFRB or other plans. There was some indication that permit writers may consult the plan for technical information relating to the proposed activities and mitigation.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Low. The Recovery Plan expectation for the HPA program is to help maintain the environmental baseline in the EFLR for regulated activities. Interviewees acknowledged workload issues and a lack of support for strictly enforcing the Hydraulic Code. Compliance monitoring and enforcement activities appear to be rare partly due to a lack of local support for prosecution. WDFW completed an assessment on compliance and effectiveness in 2006, which highlighted the underperformance in follow-up compliance monitoring, and difficulty in meeting no net loss standards (Quinn et al. 2006). There is no formal standard at WDFW to perform compliance inspections of permitted projects. If compliance monitoring does occur, it typically results from 3rd party complaints as workload issues were also cited as reducing enforcement effort.
Q: To what degree does the HPA program produce data to effectively demonstrate EFL habitat threats reduction? A: Low. WDFW HPA program data present inconsistencies, making a holistic assessment of HPA activity between 2004 and 2018 difficult. Pre-2014, permit locations were tracked using section, township, and range (which often included errors), rather than discrete points, and include sparse project details for each permit. It would be difficult to determine the scale of a permitted project or its impacts on fish habitat. The post-2014 database provides discrete point locations and more detailed project descriptions for each permit. Individual permit data are available on a permit by permit basis. While the post-2014 database is closer to providing the level of detail necessary to draw connections between permitted projects and fish habitat, assessment of program contribution toward threat reduction targets would require individual evaluation of each issued permit.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

⁴⁰ RCW Chapter 77.55 is commonly referred to as the Hydraulic Project Approval Program. However, the formal name is Construction Projects in State Waters.

A: Low. WDFW conducted a one-time compliance and effectiveness analysis in 2006 which highlighted program deficiencies. Aside from this effort, there is no ongoing effectiveness monitoring that would inform contribution toward meeting Recovery Plan objectives, or the program’s own goal of achieving “no-net-loss” of fish habitat.

Rivers and Harbors Act of 1899 – Section 10 (RHA)

The USACE regulates the protection and utilization of water resources in the lower EFLR watershed under Section 10 of the RHA. Section 10 applies to the lower three miles of the EFLR, from approximately La Center downstream. Section 10 prohibits the obstruction or alteration of navigable waters of the United States without a permit from USACE, thereby regulating activities such as placement/removal of structures, dredging, dredge material placement, filling, excavation, or other soil/sediment disturbance of work below Ordinary High Water. Often, Section 10 authorizations are also triggered for CWA Section 404 regulated activities. USACE’s database definitively identifies only one Section 10 permit in the EFLR watershed; however, several permit records indicate they could be either Section 10 or Section 404.⁴¹ Historically, the EFLR below La Center was dredged to accommodate sternwheeler traffic to support the timber industry and other commerce. Authorization for dredging in the EFLR to La Center was granted by the Sixtieth Congress in 1909 (US Congress 1909). Dredging continues by the Port of Woodland in the lowest reaches of the Lewis River under this authorization. Figure 18 identifies all Section 10 and Section 404 permits issued between 2004 and 2018 in the Seattle District Regulatory Program database.

⁴¹ The USACE database provided to PC Trask did not consistently identify the unique authority of each permit, so this number could be inaccurate.

East Fork Lewis River - USACE Section 404 and Section 10 Permits and Mitigation

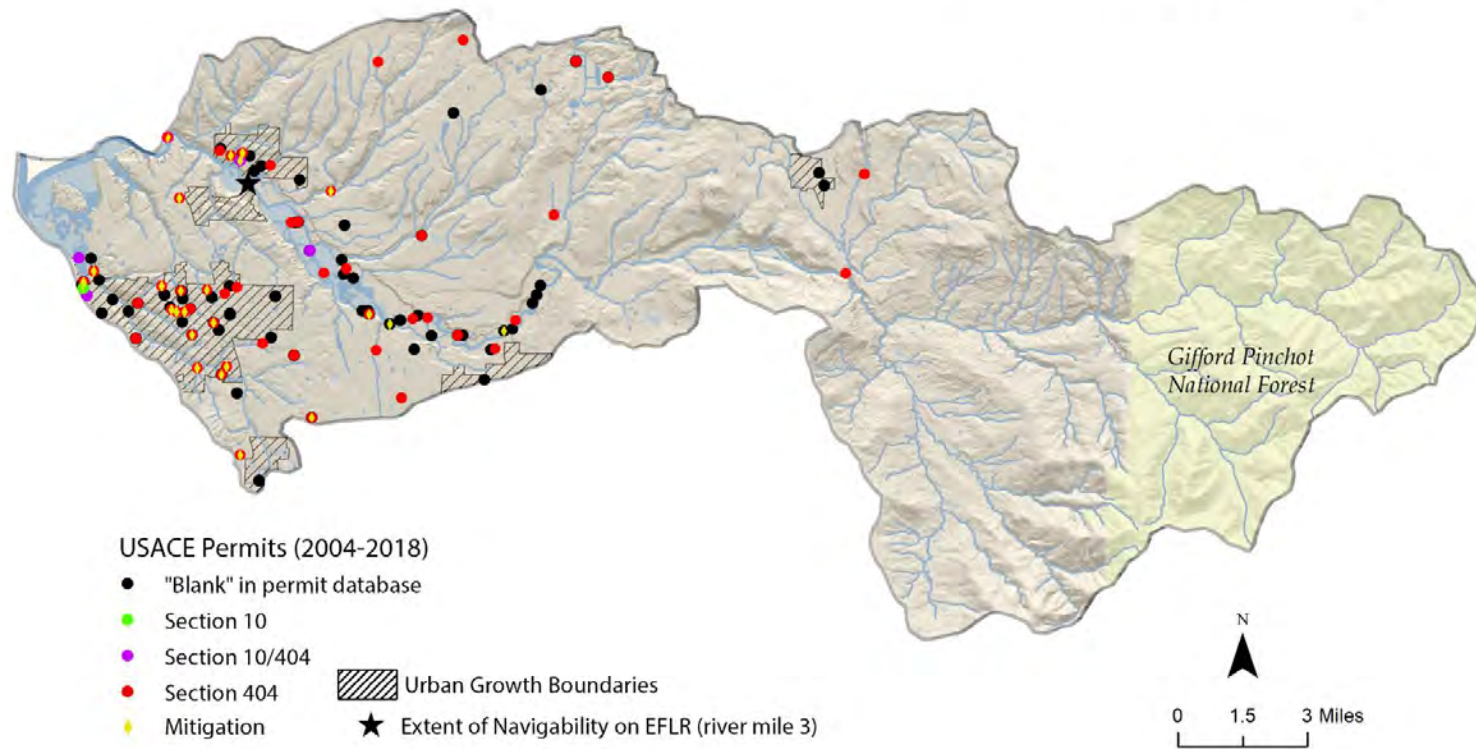


Figure 18. Map of USACE Section 404 permits, Section 10 permits, and mitigation locations that were effective between 2004 and 2018. Permits noted as withdrawn, exempt, or unregulated were removed. The "blank" permits had the permit-type attribute left blank in the database. All mitigation permits (yellow diamond) overlap with a Section 10/404 project location. Data from the USACE ORM database.

Table 30**Land Use and Development Regulation****RIVERS AND HARBORS ACT – SECTION 10 PROGRAM(S) EVALUATION**

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Low. The Rivers and Harbors Act was enacted in 1899, long before the Recovery Plan was adopted, and is focused on navigation. At the staff level, it is likely that some USACE staff are familiar with the Recovery Plan and use it to help their decision-making. Additionally, with the issuance of a Section 10 permit, USACE must consult with NOAA under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and Section 7 of the ESA regarding impacts on both essential fish habitat (EFH) and listed salmon and steelhead. Section 10 permit conditions may include recommendations from NOAA, which could be based on the Recovery Plan.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. The Recovery Plan expectation for the USACE's implementation of the Rivers and Harbors Act – Section 10 program is that the navigable waters (lower three miles of the river) will be protected from mainstem channel manipulation impacts to maintain EFLR environmental baseline conditions. Implementation of Section 10 by USACE is on-going; however, program data does not currently provide a basis for determining if mainstem channel manipulation under RHA regulations are protecting the baseline through avoidance, minimization, or compensatory mitigation. The interview with the USACE Seattle District highlighted that limited compliance monitoring or enforcement has occurred in the EFLR watershed. While Seattle District's internal performance tracking includes targets for compliance inspections, the target percentage is based on a multi-county, not watershed, scale. There are few records of Section 10 permits in the EFLR watershed, the majority of which are associated with habitat restoration projects near La Center.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. The Seattle District of USACE maintains the ORM Jurisdictional Determinations and Permit Decisions database, which supplies point locations for each permit record, and inconsistent permit attribute information (permit authority, project descriptions, area of impact, etc.). More information that may be applicable to characterize EFLR habitat is found in individual permit files, but not included in the regional ORM database. The quality of the collective database is insufficient to support the characterization and evaluation of in-channel threats resulting from urban and rural development and its associated infrastructure needs (e.g., dredging, bridges, and utilities).

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. No evidence was found of effectiveness monitoring to ensure that the USACE Section 10 Program is helping to meet Recovery Plan objectives.

Ecology Water Resources

Ecology's Water Resources program manages water resources in the EFLR watershed to meet the current and future needs of the natural environment and Washington's communities. The program is guided in part by Chapter 90 of the Revised Code of Washington (RCW). Major activities of the Water Resources program include administering water rights adjudication and compliance monitoring, restoring and maintaining stream flows, conservation and re-use of agricultural and municipal water supplies, well construction regulation, dam safety, and drought response. It also tracks ambient monitoring of flow, water quality, lake stations, and study results. Three important aspects of the Water Resources program directly relate to the EFLR: Watershed Planning, well construction regulation, and the administration of water rights. The EFLR was part of the WRIA 27/28 Watershed Planning Unit (Planning Unit) convened by the LCFRB and Ecology. The plan was adopted by Clark, Skamania, and Cowlitz County Commissioners in 2006. The Watershed Plan indicated that average January stream flows in the EFLR are 1,419 cfs and average August flows are 83 cfs (LCFRB 2006). The lowest EFLR flow was 29 cfs on November 3, 1935;⁴² however, it is common to have August – September flows around 50 cfs at the Heisson gage (at river mile 20.2).

A review of Ecology-granted water rights in the EFLR was conducted by the Planning Unit by querying Ecology's WRATS database in August of 2000. The exercise identified 150 water rights in the form of certificates and permits equaling 14,405 gallons/minute of ground water or approximately 32.09 cfs (LCFRB 2006). The three largest holders of these water rights include domestic use (~43 percent), irrigation (~30 percent), and municipal (~19 percent). Groundwater pumping impacts to baseflow are complex due to a variety of physical characteristics associated with the permeability, porosity, and gradient of specific aquifers. In a modeling effort in 2004, Pacific Groundwater Group (PGG) estimated the potential impacts to the EFLR resulting from municipal wells (Battle Ground and CPU's Pioneer Wellfield) at approximately 3.2 cfs (PGG 2003). The planning effort also identified 272 surface water permits and/or certificates in the EFLR totaling 55 gallons/minute or about 0.2 cfs (LCFRB 2006). Of the 272 water rights, approximately 60 percent were attributed to irrigation.

In their rule-making authority, Ecology adopted elements of the plan into Washington Administrative Code. A major part of the rule-making was to close the EFLR to future water withdrawals except for a reservation of water for public water suppliers⁴³ (e.g., Clark Public Utilities, Battle Ground, and Ridgefield) and domestic wells and small systems.⁴⁴ Ecology is responsible for tracking the usage of these reservations based upon Clark County Health Department's reporting of new housing starts in the EFLR watershed. The Heisson gage is currently the only flow monitoring gage on the EFLR.

Since closure of the EFLR to further withdrawals in 2009, Ecology has approved an additional 117 gallons/minute of groundwater rights or about 0.26 cfs (Ecology 2018). A significant portion of those rights were to the City of Ridgefield (112 gallons/minute), located relatively low in the EFLR watershed

⁴² A similar discharge was observed again on September 27th and 28th in 1967.

⁴³ EF Lewis reservation for Clark Public Utilities, Battle Ground, and Ridgefield is 2.20 cfs (LCFRB 2006)

⁴⁴ EF Lewis reservation for domestic wells and small systems is 0.66 cfs (LCFRB 2006).

where baseflow impacts are more likely to be realized in the Lake River system.⁴⁵ Baseflow conditions for tributaries of the EFLR were modeled by PGG in 2004. PGG's conclusion was that the contribution of EFLR tributaries to the EFLR mainstem baseflow was approximately one-quarter of deep aquifer withdrawals (e.g., Sand and Gravel Aquifer) (PGG 2003). As one of the highest priority stream flow and watershed actions, the watershed plan called for the development of a regional water supply to pump more plentiful tidally-influenced water near the confluence of the Columbia River estuary to upland cities such as Ridgefield, La Center, and Battle Ground to avoid further withdrawals that impact EFLR baseflows. Clark Public Utilities (CPU) began development of their Paradise Point regional water supply shortly after the plan was adopted. Ecology has provided some financial assistance (~\$4 million) to this project, which totals approximately \$40 million. Full implementation of Paradise Point will allow CPU to meet water supply needs through 2050 and beyond.⁴⁶ An estimated 3.1 cfs will also be returned to EFLR baseflows as a result of limiting CPU's Pioneer Wellfield to peaking and redundancy system needs.

Table 31
Land Use and Development Regulation
ECOLOGY WATER RESOURCES PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: High. Watershed Planning actions identified in WRIA 27 (including the EFLR) were integrated into the Recovery Plan, and Ecology uses the document to directly guide their decision-making. The watershed plan included specific guidance to Ecology and planning partners, including closing the EFLR to additional water rights except those specifically identified in the plan. The closure of the EFLR watershed to further water withdrawals is an important cornerstone of the Recovery Plan.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: High. The primary threat addressed by the Water Resources Program is water withdrawals in the EFLR. Recovery Plan expectations included the closing of the EFLR to further water withdrawals and the development of three regional water supplies in areas within the tidally-influenced reaches of the Columbia River. At present, one regional supply is complete and a second is nearing completion. These projects were high priority actions identified in the integrated WRIA and Recovery Plan. Summer flows in the EFLR are still impacted by water withdrawals; however, the Paradise Point Regional Supply has the potential to not only protect existing instream flows, but also restore flows by reducing CPU's Pioneer Well Field to peaking and redundancy once the system is fully functional.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

⁴⁵ PGG reported that groundwater withdrawals in the Sand and Gravel aquifer in the lower reaches of the EFLR would have effects on both the EFLR and the Lake River system.

⁴⁶ Paradise Point and other CPU sources will meet demand through 2050.

A: High. Ecology monitors the use of EFLR water reservation consumption through data provided by Clark County Health Department. Ecology accounting of Clark County Health Department data (WRIA 27-28 Reservation Accounting Instream Flow Rules) was last updated in December 2016. Through 2016, the public supplier reservation was 0 percent used and domestic wells and small systems were 13 percent used. After completion of CPU's Paradise Point Regional Supply, Ecology will monitor CPU's operation of the Pioneer Well Field to ensure compliance with the WRIA 27/28 Watershed Plan.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. Ecology installed two additional flow gages in the EFLR in 2005 to complement the long-period data set collected at Heisson. The two gages were removed by Ecology two years after deployment. Therefore, effectiveness monitoring data is only collected at the Heisson gage, which is 20.2 miles up from the river mouth.

Endangered Species Act (ESA) and Magnuson-Stevens Fishery Conservation and Management Act

The purpose of the ESA is to conserve and recover endangered and threatened species and the ecosystems upon which they depend (USFWS 2019). The ESA provides several regulatory and planning tools to assist with this, including Sections 7 and 10, as well as Section 4(d). NOAA and USFWS implement the provisions of ESA. ESA-listed species under NOAA's jurisdiction within the range of the LCFRB Recovery Plan include four salmon and steelhead species. Section 4(c)(2) of the ESA directs NOAA to review the listing classification of threatened and endangered species at least once every five years (NOAA 2016). The last 5-Year Review was completed in 2016 and determined that all four listed species in the lower Columbia should remain listed as threatened (NOAA 2016).

NOAA also administers the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Under this authority, NOAA performs consultations on Essential Fish Habitat (EFH) pursuant to section 305(b). NOAA is required to provide EFH conservation recommendations to federal agency actions that may adversely affect EFH. The federal agency is required to carry out these recommendations or provide NOAA with a justification for not accepting any of the given recommendations. NOAA's Office for Law Enforcement is dedicated to the enforcement of laws that protect and conserve the nation's living marine resources and their natural habitat. These laws include the ESA, MSA, and the Marine Mammal Protection Act (MMPA). The Office of Law Enforcement investigates violations of these acts and promotes voluntary compliance through constituent communication and public awareness. NOAA interviewees indicated that no NOAA enforcement actions have been taken in the EFLR watershed under the ESA, MSA, or MMPA.

Section 7 and Section 10 (NOAA and USFWS)

Section 7 of the ESA requires any federal agency that is authorizing, funding, or carrying out a project that may affect ESA-listed species or their critical habitat to consult with NOAA and/or USFWS. For example, for activities regulated under the CWA – Section 404 that impact ESA-listed species or their critical habitat, the USACE must consult with NOAA and/or USFWS. At the end of formal Section 7 consultation for listed salmon or steelhead, NOAA issues a biological opinion. Opinions ensure that approved activities are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitat. The biological opinion includes recommended measures to avoid, reduce, or mitigate effects on habitats and/or species, and may include required terms and conditions. The ESA also provides the opportunity for programmatic consultations for certain types of activities, most commonly restoration work. Three key EFLR programmatic consultations are: 1) the 2008 Fish Passage and Restoration Programmatic (programmatic consultation), 2) the SRFB 4(d) Rule, Limit No. 8 programmatic (programmatic consultation), and 3) the BPA-funded Habitat Improvement Projects opinion (HIP), all of which facilitate and expedite implementation of on the ground restoration work.

Section 10 permits under the ESA are also issued by NOAA and USFWS. In the EFLR watershed, three Habitat Conservation Plans (HCPs) have been permitted under Section 10. They include a State Trust Lands HCP and a Forest Practices HCP for private lands. A third HCP was issued to J.L. Storedahl and Sons for expansion of their Daybreak Pits surface mining operations. The majority of requirements under Section 10 permits are contained within the HCPs, which are discussed separately later in this chapter.

Table 32 Land Use and Development Regulation	
SECTION 7 AND SECTION 10 MAGNUSON-STEVENS FISHERIES CONSERVATION ACT PROGRAM(S) EVALUATION	
Q: To what degree does the program utilize the Recovery Plan to help guide their program?	A: Moderate. Section 7 consultations are for the purpose of ensuring proposed actions do not jeopardize the existence/potential recovery of a species (or adversely modify its critical habitat). NOAA utilizes recovery plans as guidance in developing terms and conditions and conservation recommendations in their Section 7 consultations, but the plan plays a small role in assessing the extent of impacts. Similarly, terms and conditions in Section 10 permits and conservation recommendations in EFH consultations would be recovery plan based.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?	A: Unknown. Recovery Plan expectations for ESA – Section 7 and Section 10 are to protect threatened or endangered species and their critical habitats. Biological opinions are issued to ensure an action doesn't jeopardize the ability of a species to recover, which is not a high standard for promoting recovery. Opinions include recommended (and sometimes required) measures to avoid, reduce, or mitigate effects on habitats and/or species. These measures are typically linked to the Recovery Plan and are often implemented together with other regulatory programs (e.g., CWA

– Section 404 and RHA – Section 10) providing several layers of protection from urban and rural development and other threats. No compliance monitoring or enforcement activities could be identified for the three habitat conservation plans or any consultations on federally permitted projects.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. NOAA’s Public Consultation Tracking System provides access to a database of consultations, searchable by County at the smallest geographic unit. The database can be queried using consultation attributes like ‘category of activity,’ ‘species name,’ or ‘final determination.’ More detailed summary information is available by clicking on each individual consultation, but the proposed activity location is inconsistently provided. Therefore, narrowing the database to activities proposed specifically in the EFLR watershed and collectively assessing their effects is difficult. The interview and data collection processes could not uncover any documents required by NOAA as part of their three approved HCPs in the EFLR. Although annual reports are publicly available for the State Trust Lands HCP and a Forest Practices HCP, information and data is provided at the statewide, not watershed, scale.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. Little evidence was found to suggest effectiveness monitoring as part of an adaptive management process is occurring to determine if program regulations/policies are producing desired effects consistent with the expectations of the Recovery Plan. NOAA’s 5-Year Review of lower Columbia listings as it relates to its Five-Factor Analysis⁴⁷ (Listing Factors A and D) did not appear to be based upon data but rather on qualitative and generalized judgements. A status review update initiated by the Northwest Fisheries Science Center in 2015 provided limited discussion on air temperature, precipitation, and streamflow patterns to help inform trends and status in abundance, productivity, spatial structure, and diversity of listed Columbia River populations (NWFSC 2015).

⁴⁷ A species must be listed if it is threatened or endangered because of any of the following 5 factors: A. present or threatened destruction, modification, or curtailment of its habitat or range; B. over-utilization of the species for commercial, recreational, scientific, or educational purposes; C. disease or predation; D. inadequacy of existing regulatory mechanisms; and E. other natural or manmade factors affecting its continued existence.

Section 4(d): Regional Road Maintenance

Section 4(d) of the ESA requires NOAA to issue protective regulations for species listed as threatened. There can be limits to (i.e., exceptions from) the prohibitions on take under Section 4(d) if the take occurs as the result of implementation of actions or programs that are described within a 4(d) rule. Limit No. 10 of the rule covers routine road maintenance if plans are submitted and approved by NOAA.

The Washington Department of Transportation (WSDOT) developed a Regional Road Maintenance Program (RRMP) that was approved by NOAA in 2003. Primary elements of the roadside maintenance program go well beyond vegetation management, litter control, and maintenance of safety rest areas to include the following: “cleaning and repair of roadway surfaces, base and shoulders; maintenance and repair of drainage structures (e.g., ditches, culverts, catch basins, stormwater detention and treatment facilities, etc.); bridge cleaning, maintenance and repair (including cleaning and maintenance of fishways and ladders); snow and ice control; and, slide repair and abatement” (WSDOT 2019).

Clark County developed a road operations program under the RRMP in compliance with Limit No. 10 of the 4(d) rule. The program follows a Best Management Practice Manual that was developed in conjunction with Puget Sound jurisdictions (Tri-County Response Effort) and NOAA. The Road Operations Program ensures that Best Management Practices are followed for road construction and maintenance, employee training, research, monitoring and reporting. Approximately 163 miles of county and state roads are covered under the 4(d) rule in the EFLR watershed.⁴⁸

Table 33
Land Use and Development Regulation
SECTION 4(D) REGIONAL ROAD MAINTENANCE PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program?
A: Moderate. WSDOT worked with NOAA and local governments to develop the Regional Road Maintenance program that Clark County adopted. This effort culminated in 2003 with NOAA approving the Program under the 4(d) rule. This was during the same period that the Recovery Plan was being developed, a process for which Clark County was a major stakeholder. NOAA participated in both the Recovery Plan and the ESA 4(d) rule.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?
A: Unknown. The Recovery Plan expectation for the Regional Road Maintenance program is the protection of baseline conditions for salmon and steelhead from transportation-related threats (e.g., stormwater, herbicides, etc.). The program is ongoing, but it is unclear if the Regional Road Maintenance Program is meeting this expectation. Element 4 of the Regional Road Maintenance Program specifies compliance monitoring at the local, state, and federal levels.

⁴⁸ This estimate was calculated by summing the mileage of public roads (excluding federal and forest roads) within the EFLR watershed from the Clark County Roads GIS layer.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Moderate. WSDOT maintains GIS data representing a myriad of transportation features (e.g., bridge locations, roads, maintenance data, etc.) as well as environmental features (e.g., fish passage inventory, aquatic sensitive areas, habitat connectivity investment priorities, climate impact vulnerability assessment data, etc.). However, there are no data on the Regional Road Maintenance Program's impacts (positive or negative) to the EFLR watershed (runoff, impervious surfaces, etc.).

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. Elements 5, 6, and 8 of the Regional Road Maintenance Program specify scientific research, adaptive management, and biological data collection requirements. Scientific research components include literature search and case studies to verify the effectiveness of their best management practices. Adaptive management components include compliance monitoring, effectiveness monitoring, and changes to the Regional Program. Biological data collection components include the identification of aquatic habitat resources within ROW, ROW aquatic habitat location to make best management practices decisions, and training and alerting staff where to apply guidelines. Although the Regional Road Maintenance Program's effectiveness monitoring requirements appear relatively robust, it is unclear how targeted they are to inform Recovery Plan objectives versus compliance with Section 4(d) of the ESA.

Forest Practices Regulation

Forest practices in the EFLR watershed are regulated by the GPNF, DNR, and Clark County, with regulatory review support from interested tribes and WDFW. This includes regulating alterations to stream corridor function and watershed processes on private and public lands. Federal lands under the management of the GPNF are regulated through the GPNF Land and Resource Management Plan, which adheres to the Northwest Forest Plan. DNR manages forest practices on state and private forest land in the EFLR watershed through two distinct habitat conservation plans (HCPs) approved by NOAA and USFWS. A Forest Practices HCP regulates private industrial lands including small forest landowner (SFLO) forest practices, and a State Trust HCP regulates DNR's management of state trust lands. Clark County also regulates aspects of forest practices that fall within Shoreline Master Program and Critical Areas designations, as well as through their Forest Conversion Ordinance requirements. The Recovery Plan recognized that these programs were new, and called for careful monitoring of their effects with respect to restoration and protection of hillslope and watershed processes, including hydrology and sediment delivery. Excluding the GPNF, approximately 23 percent of the EFLR watershed was subject to a forest

practices (FPA) permit⁴⁹ between 2004 and 2018. Table 34 identifies the top three Clark County zone classes that received FPA permits.

Table 34			
Clark County EFLR Forest Practice Permits (2004-2018) by Zoning Class			
Zone Class	Approximate Acreage Permitted between 2004-2018	Total Acres in Zone Class	% of Acres in Zone Class Under Permit between 2004-2018
1 - Rural and low density residential	3,257	40,563	8%
5 - Agriculture	494	14,827	3.3%
6 - Forest	23,508	58,893	40%

Table 35 outlines the threats addressed by forest practices regulation, and the corresponding partners, programs, and actions.

Table 35		
Forest Practices Regulation		
Threats:		
Forest Practices • Timber harvests – sediment supply impacts • Timber harvests – impacts to runoff • Riparian harvests (historical) • Forest roads – impacts to sediment supply	Forest Practices (Continued) • Forest roads – impacts to runoff • Forest roads – riparian/floodplain impacts • Catastrophic wildfire (historical) • Splash-dam logging (historical)	
Partners	Programs	Program #
USFS	GPNF Land and Resource Management Plan	1
DNR/NOAA/USFWS/County	State Trust Lands HCP	2
	Forest Practices HCP	3

⁴⁹ Forest Practice Permits are issued for a range of forest practices, from salvage of down wood to harvest.

Actions	Applicable Programs
Manage federal forest lands to protect and restore watershed processes and habitat conditions while allowing for diverse forest uses	1
Conduct forest practices in accordance with the state Habitat Conservation Plan in order to afford protections to riparian areas, sediment processes, runoff processes, water quality, and access to habitats	2
Fully implement and enforce the Forest Practices Rules (FPRs) on private timber lands in order to afford protections to riparian areas, sediment processes, runoff processes, water quality, and access to habitats	3
Increase technical support and funding to small forest landowners faced with implementation of Forest Practices Rules to ensure full and timely compliance with regulations.	3

Gifford Pinchot National Forest (GPNF) Land and Resource Management Plan

The upper EFLR is publicly owned and managed by the US Forest Service's GPNF. It covers approximately 29,885 acres and ranges in elevation from 1,000 feet⁵⁰ in the western downstream part of the GPNF to about 4,442 feet at the summit of Green Mountain (GPNF 2002). The upper watershed includes the EFLR mainstem, Green Fork, Little Creek, Slide Creek, Poison Creek, McKinley Creek, and most of Copper Creek. A series of wildfires beginning in 1902 (referred to as the Yacolt Burn) covered over 370 square miles, consuming approximately 12 billion board feet of timber (GPNF 2002). Subsequent fires, including the Rock Creek Fire in 1927 and the Dole Fire in 1929 burned and reburned sections of the upper EFLR. Forest impacts resulting from the fires included soil sterilization and loss of nutrients (PWI 1998). Fire history has altered forest stand structure, composition, and age class distribution, contributing to a prevalence of early successional structure stages (GPNF 1995). For example, according to the USFS 2002 EFLR watershed analysis, three percent of riparian reserves are in late successional structure stages but are lacking in the large down wood component, 27 percent are in hardwoods, and 70 percent are in early to mid-successional structure stages (GPNF 2002). Little harvest activity has occurred in the EFLR GPNF in the last 80 years. Since 1939, three percent of the GPNF in the EFLR watershed has been clear cut, two percent has been commercially thinned, and less than one percent has been salvage logged (USFS 2002). Approximately 21 percent of the GPNF in the EFLR watershed is categorized as "administratively withdrawn" (e.g., Late Successional Reserve), which is not managed for timber outputs. The remaining 79 percent is "matrix," where harvest activities follow requirements that vary depending on more specific land allocations within matrix areas (Figure 19). Activities on any land

⁵⁰ The 1,000 ft elevations relate to the geographic extent of the watershed analysis.

allocation that may result in “take” of ESA-listed species would require consultation with NOAA and/or USFWS.

The Northwest Forest Plan designated the upper EFLR watershed as a Tier 1 Key Watershed.⁵¹ On Federal lands, Tier 1 Key Watersheds are to be managed as refugia with the objective of maintaining and recovering habitat for at-risk stocks of anadromous salmon and steelhead, and resident fish species (USFS 1995). Three objectives were identified in the Upper EFLR Restoration Plan: 1) enhance shade along the EFLR; 2) decommission unnecessary roads; and, 3) restore stream channel and habitat for at-risk stocks of anadromous salmon and steelhead, as well as resident fish (USFS 2002).

The GPNF has also implemented restoration actions identified in the Recovery Plan. This includes improving stream structure through many Recovery Plan Tier 1 and Tier 2 reaches of the EFLR mainstem, and several road decommissioning and improvement projects. Figure 19 locates these actions and the LRMP areas and designations.

⁵¹ According to the Northwest Forest Plan: “Tier 1 Key Watersheds contribute directly to conservation of at-risk anadromous salmonids, bull trout, and resident fish species. They also have a high potential of being restored as part of a watershed restoration program. Long-term management within Key Watersheds requires watershed analysis prior to further resource management activity.” And: “Timber harvests, including salvage, cannot occur in Key Watersheds without a watershed analysis.” (Northwest Forest Plan Standards and Guidelines, pg. B-18)

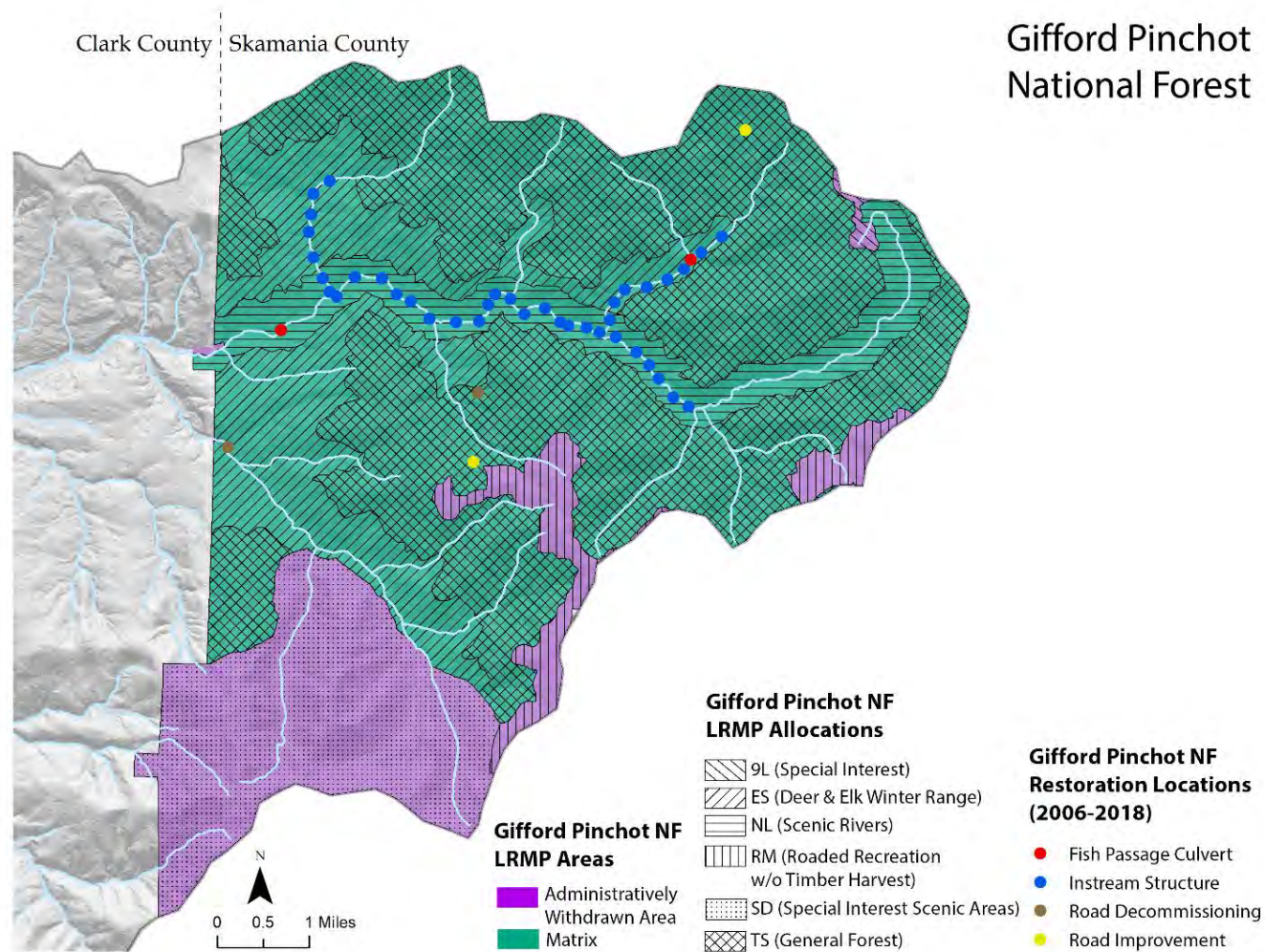


Figure 19. Map of the GPNF Land and Resource Management Plan (LRMP) designations (Administratively Withdrawn and Matrix) and allocations within the designations. Colored dots represent approximate locations of restoration work that the USFS completed from 2006-2019. LRMP data are publicly available from the GPNF website. Restoration locations approximated from USFS Upper EFLR Restoration Plan appendix.

Table 36**Forest Practices Regulation****GPNF LAND AND RESOURCE MANAGEMENT PLAN PROGRAM(S) EVALUATION**

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: High. The upper EFLR watershed is designated as a Tier 1 Key Watershed for at-risk salmon and steelhead, and for resident fish species in the GPNF Land and Resource Management Plan and the NW Forest Plan. GPNF's restoration plan for the EFLR watershed was developed in part based on the Recovery Plan's prioritized measures. Tier 1 watersheds are part of a system of large refugia crucial to at-risk fish species, and are intended to contribute to anadromous salmon conservation. GPNF staff actively participated in the WRIA 27/28 Watershed Planning Unit, Recovery Plan development meetings, and development of the LCFRB's Research Monitoring and Evaluation (RME) program.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: High. The Recovery Plan expectation for the GPNF Land and Resource Management Plan is to **conduct forest practices in a manner that protects against historical forest practices threats to watershed health (e.g., road runoff and erosion).** Since 1939, limited forest practices have occurred within the GPNF due partly to the early successional stage structures after the Yacolt Burn. However, forest practices are scheduled in the EFLR GPNF within the next five years (GPNF 2014). Without knowledge of the extent of harvest plans, it is unclear how much of an impact it will have on salmon and steelhead habitat. However, any harvest activity will abide by the Northwest Forest Plan's riparian conservation strategy, which includes "no timber harvest" riparian buffer management (widths defined as two site-potential tree heights on fish-bearing streams and one site-potential tree height on non-fish-bearing streams), and further protections for key watersheds, which includes the EFLR. Harvest activity will also abide by land allocations, like administratively withdrawn areas and scenic rivers allocations in the EFLR. Until harvest plans for the next five years are defined, the level of future change in the upper watershed is unclear. However, Tier 1 watersheds are given the highest priority for watershed restoration, which aligns very well with Recovery Plan priorities for the EFLR.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. GPNF's *Upper East Fork Lewis River Watershed Analysis* report is dated (2002) but contains a wealth of information about the upper watershed. Land management designations are available to download as a GIS layer. Restoration action locations were made available via a paper copy of the GPNF Restoration Plan, from which a GIS point layer was estimated for this report. Maintenance of a publicly available GIS database portraying restoration and forest practices activities would be a significant improvement.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Moderate. The Aquatic and Riparian Effectiveness Monitoring Program (AREMP) evaluates whether the Northwest Forest Plan aquatic conservation strategy is reaching its goal of maintaining and restoring watershed conditions (Reeves et. al. 2004). 20-year monitoring reports are available at <https://www.fs.fed.us/r6/reo/monitoring/>. Stream sampling data and upslope/riparian, GIS, and remote-sensing data were used to evaluate conditions for sixth-field watersheds in each aquatic province. Stream conditions were evaluated on sampling data collected between 2002 and 2013 as part of an 8-year repeating sample design. Small but improving status trends in physical habitat, aquatic macroinvertebrates, scores, and water temperature were predicted (Miller et. al. 2017).

State Trust Lands Habitat Conservation Plan (HCP)

DNR manages approximately 26,300 acres of land within the EFLR watershed.⁵² State lands⁵³ are located primarily to the south of the mainstem EFLR between the Skamania County border and Lucia Falls, and are designated as Forest-80 zoning.⁵⁴ State lands are managed for multiple purposes. Revenues generated from the forests benefit public schools and universities, as well as fund county services.

DNR manages forest practices on state lands by conditions identified in their *State Trust Lands Habitat Conservation Plan*. The Habitat Conservation Plan has ESA Section 10 permits from NOAA and USFWS. Upland and riparian strategies are identified in the HCP. The riparian strategy protects riparian habitat function, including large-wood recruitment, sediment filtration, streambank stability, shade, litterfall and nutrients (NMFS | USFWS 2006). DNR implements this strategy by managing harvest along riparian areas dependent upon water type. Water typing is a DNR classification system that identifies if a stream is within a shoreline of the state (S), used by fish (F or N) and whether the stream is perennial (P) or seasonal flow (S). Riparian buffers range from one site-potential tree height (or 100 ft, whichever is greater) on Type S and F streams, to “protected when necessary” on Type N streams. Buffers consist of three management zones which allow between 0 percent to 25 percent harvest by volume. Perennial initiation points, which are often sources of hydrology for headwater streams, are also buffered and protected from direct harvest. Water typing is also used to determine the location and construction of stream crossing structures. The Forest Practices Board has been in the process of developing a permanent water typing rule since 2014; the permanent rule will replace those adopted in 2001. DNR established a Water Typing System Rule Committee in 2019 to guide this effort.

The upland conservation strategy of the HCP is intended to prevent, avoid, minimize, or mitigate changes in erosion, hydrologic processes, and associated effects on public resources; implementation consists of protection measures related to unstable slopes and wetlands (DNR 2005). Further, the HCP

⁵² Metric calculated from DNR’s “WA DNR Managed Land Parcels” GIS dataset

⁵³ State lands include State Trust Lands and State Forest Lands

⁵⁴ One home per 80 acres

calls for best management practices related to the location, design, construction, maintenance, and abandonment of forest roads. Many fish passage barriers have been opened on DNR State Trust lands and are tracked through their Road Maintenance and Abandonment Planning (RMAP) program.

A large percentage of the DNR-managed lands are located south of the mainstem EFLR and along the Rock and King Creek tributaries. Much of Rock Creek in this area consist of Tier 1 reaches with high Species Reach Potential ratings for Winter Steelhead.⁵⁵ Upper Rock Creek is the EFLR's largest and most important steelhead spawning and rearing tributary (Rawding 2019). Approximately 40 percent of the Upper Rock Creek subwatershed was harvested between 2004 and 2018.⁵⁶ Figure 20 illustrates areas harvested or permitted to be harvested in the Upper Rock Creek subwatershed since 2004. Aerial imagery of the harvest areas in the Upper Rock Creek subwatershed revealed that private harvests maintain riparian buffers around streams, but State Trust harvests maintain more robust buffers and mosaics of "leave tree" areas within harvest boundaries. Approximately 22 percent of the area harvested in the Upper Rock Creek subwatershed had slopes between 25-40 percent, and another 10 percent of harvest area had slopes greater than 40 percent.⁵⁷ Soils in upper portions of this watershed are thin and not very productive due to the numerous fires that occurred in the drainage during the early 1900s (GPNF 2002).

⁵⁵ Tiers and Species Reach Potential ratings are a product of EDT analysis

⁵⁶ The majority of harvested land in the Rock Creek subwatershed was State Trust land. However, this percentage includes harvests on both State Trust and private lands.

⁵⁷ Slope data derived from Clark County's slope dataset, categorized into slope percentage classes (0-5%, 5-10%, 10-15%, 15-25%, 25-40%, >40%)

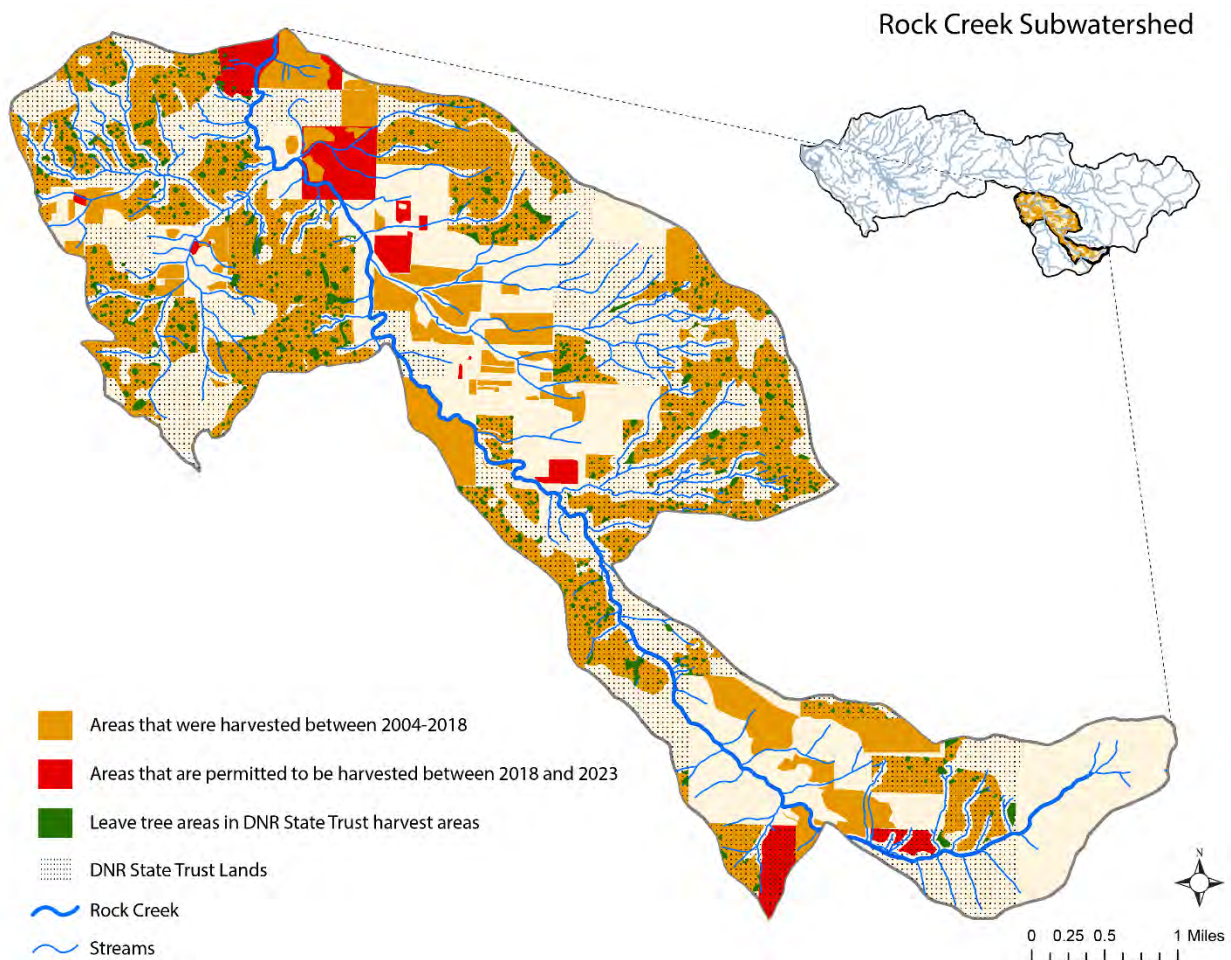


Figure 20. Map of the Upper Rock Creek Group A subwatershed displaying DNR permitted harvests. Orange polygons represent both State Trust HCP harvests on public lands and Forest Practice HCP harvests on private lands that occurred between 2004 and 2018. Dotted areas distinguish the State Trust lands from private lands. Green polygons represent “leave tree” areas within harvests on State Trust lands. Red polygons represent areas with effective harvest permits that have not yet occurred, but will by 2023. Many harvests occurred just before 2004 and are not shown here.

Table 37

Forest Practices Regulation

STATE TRUST LANDS HABITAT CONSERVATION PLAN PROGRAM(S) EVALUATION

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Low. The State Trust Lands HCP was initiated by DNR and approved and permitted by NOAA under ESA – Section 10 in 1999, five years before the LCFRB posted their initial draft of the Recovery Plan. As a result, there are no direct connections to the Recovery Plan. DNR staff may consult the Recovery Plan for specific information; however, this connection is undocumented. While

management under the HCP is intended to protect and improve aquatic habitat conditions relative to past practices, and is expected to help achieve Recovery Plan goals, it is based on prescriptions in the HCP and does not reflect watershed or population specific priorities outlined in the Recovery Plan.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A1: High. The Recovery Plan expectation for roads and fish passage within DNR-managed state lands includes implementation of best management practices for new road construction and maintenance activities to avoid hillslope failure and release of sediments. The fish passage restoration expectation is to return EFLR tributary habitats to historical access. DNR actions under RMAP are impressive with regard to road standards and fish passage. DNR's RMAP database indicates that 100 percent of fish passage barriers on large forest lands in the EFLR watershed have been removed or fixed, equating to approximately 22 miles of stream opened for fish habitat.

A2: Moderate. The Recovery Plan expectation for forest practices includes protections to riparian buffers, protection of unstable slopes, and the protection of watershed-scale processes (e.g., functioning hydrology and sediment processes). DNR follows the terms of the HCP through the protection of riparian buffers and unstable slopes and utilizes best management practices, such as maintaining leave-tree stands in harvest areas. However, it is unclear if these HCP measures are sufficient to protect EFLR watershed-scale processes due to the magnitude of harvest that has occurred within a 15-year time-span. DNR's sustainable harvest calculations to determine the allowable magnitude of timber harvest within Clark County considers environmental impacts, but it is unclear if those considerations align with the priorities of the Recovery Plan.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Moderate. DNR maintains detailed GIS data for each State Trust harvest, including harvest unit boundaries, riparian buffers, and leave tree areas. State Trust GIS products are currently available through public disclosure and require a fee. Some State Trust harvest boundaries are in the free Forest Practices Application GIS data, but not all. DNR also maintains the RMAP geodatabase which includes barrier locations and improvement status. Additionally, DNR tracks mileage of proposed road creation/decommissioning, although GIS layers of these activities would provide a more comprehensive understanding of DNR's location and extent of potential habitat impacts in the EFLR watershed.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Moderate. Through their Adaptive Management Program, DNR runs the Cooperative Monitoring, Evaluation, and Research (CMER) program. The CMER program aims to test whether the recommendations of the Forests and Fish Report are being effectively implemented. Monthly meetings are held to plan and review research and monitoring projects; example topics of projects discussed during 2019 CMER meetings include: buffer integrity shade-effectiveness, type-F QAQC surveys, riparian status and trends monitoring of stream temperature, mass wasting landscape-scale effectiveness, etc. Projects are targeted to geographic regions in Washington state. According to DNR's Adaptive Management Program Research and Monitoring Documents webpage, approximately 12 published studies are applicable to Western Washington. These studies evaluate topics such as water temperature in hardwood conversion sites, effectiveness of regulations for roads, validation of desired future condition performance targets, effectiveness of riparian buffers on non-fish-bearing streams, Type N experimental buffer studies, mass wasting effectiveness monitoring, forested wetlands regeneration studies, etc.

The CMER program is an important source of data and information for adaptive management and evaluating program implementation and effectiveness. Given some degree of overlap between HCP and CMER program and Recovery Plan goals and objectives, the CMER program yields pertinent data and information for evaluating effectiveness relative to Recovery Plan expectations at the regional scale. However, additional analysis would be needed to evaluate whether the CMER program is sufficient to address Recovery Plan effectiveness monitoring needs at the watershed scale. This is especially the case in the EFLR given its unique fire and land use history, and the high level of harvest that has occurred during the evaluation period.

Forest Practices Habitat Conservation Plan (HCP)

DNR regulates forest practices on private lands through their Forest Practices HCP. This includes all forest practices within the EFLR watershed, except on federal, state, or tribal lands. A large block of privately-held industrial forest lands is located north of the mainstem EFLR between Lucia Falls and Skamania County. These lands are zoned Forest-80 (tier I), Forest-40 (tier II), and Rural-20. The Forest-80 and Forest-40 zones are managed for long-term production of commercially significant forest products and are primarily applied to larger parcels and major industrial landowners. The Rural-20 zoning is intended to provide lands for residential living in rural areas. This zone allows for one single-family dwelling and guest house per lot plus rural accessory dwelling units and other business-related structures, abiding by the zone density restrictions (Clark County Code 40.210). Similar zoning extends downstream along the middle reaches of the mainstem and upper tributaries of the system. Additionally, small forest landowners have holdings throughout the EFLR watershed.

The HCP's upland strategy is similar to that in the State Trust HCP: to prevent, avoid, minimize, or mitigate forest practices-related changes in erosion, hydrologic processes, and associated effects on public resources. This consists of protection measures implemented in upslope areas related to unstable

slopes and landforms, including the location, design, construction, maintenance, and abandonment of forest roads. (NMFS | USFWS 2006).

The HCP's riparian strategy protects riparian habitat function, including large-wood recruitment, sediment filtration, streambank stability, shade, litterfall, and nutrients (DNR 2005). DNR implements this strategy by managing harvests along riparian areas dependent upon water type. As described in the section on the State Trust Lands HCP, water typing is a DNR classification system of streams and other water bodies that identifies whether streams/water bodies are used by fish, and whether streams experience perennial or seasonal flow. Water types are used by the Forest Practices program to determine the amount and pattern of riparian buffer protection required during forest practices activities, as well as size and type of water crossing structure (bridge, culvert, etc.) if proposed. DNR Forest Practices Division maintains and updates the DNR Water Type Maps. These maps are provided as a starting point to help landowners identify and type streams, lakes, and ponds on their property.

HCP requirements for small forest landowners are partially offset by programs such as the Family Forest Fish Passage Program (FFFP), which shares the financial burden of road and culvert improvement requirements. The *Forestry Riparian Easement Program (FREP)* provides long-term protection for aquatic resources by acquiring easements from small forest landowners in riparian and ecologically important areas (e.g., channel migration zones, riparian management zones and wetland management zones) (DNR 2005). The *Riparian Open Space Program (ROSP)* ensures the long-term conservation of aquatic resources by acquiring a fee interest or easement on lands within a specific type of Channel Migration Zone (CMZ) known as an "unconfined avulsing CMZ⁵⁸" (DNR 2005).

Forest practices on private lands occur throughout the EFLR watershed. Figure 21 shows all lands (state-owned and private) that received an FPA permit from DNR between 2004 and 2018. A working assumption is that areas around Ridgefield/Gee Creek and other lower tributaries were previously harvested and converted to agriculture and rural residential zones. Remaining timber in the lower third of the watershed appear primarily along the EFLR tributaries. Lands further upstream in the watershed have been more intensively harvested between 2004 and 2018, mainly because of their remaining larger-sized trees. Figure 21 also highlights locations where road barrier improvements (e.g., culvert/bridge upgrades) on state and private lands have occurred through the RMAP and FFFPP programs.

⁵⁸ Unconfined avulsing CMZs are areas where abrupt shifts in stream or river location occur that typically have high value as spawning or rearing habitat for salmonids or other fish (DNR 2005).

East Fork Lewis River DNR Forest Practices and State Trust HCP Harvests and RMAP and FFFPP

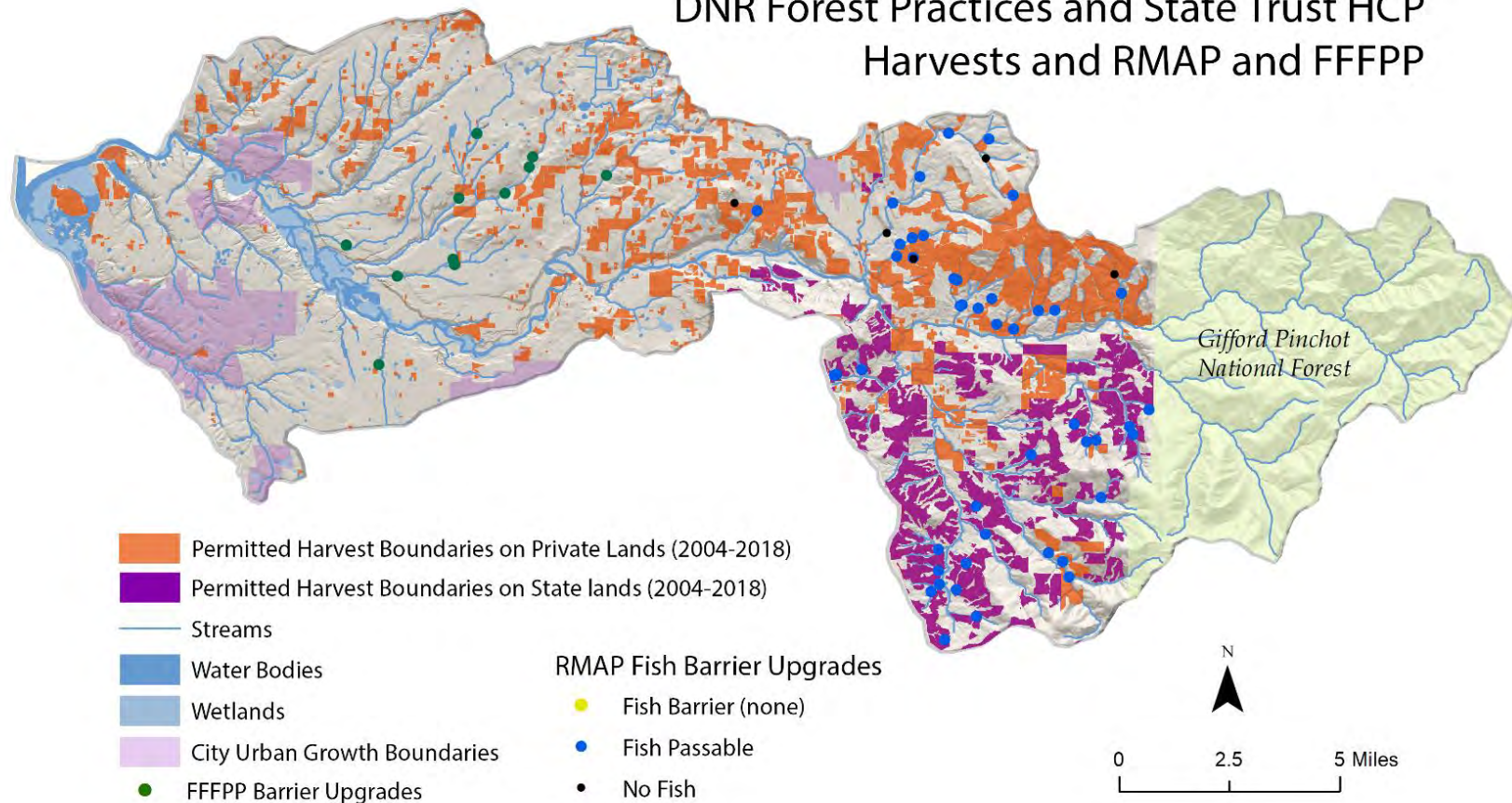


Figure 21. Map of all DNR permits for forest practices within the EFLR watershed effective between 2004 and 2018, including both State Trust HCP (dark purple polygons) and Forest Practice HCP (orange polygons) harvests. Blue dots show all stream barriers that have been upgraded under the DNR RMAP program. Green dots show all stream barriers that have been upgraded through the FFFPP program since 2004. Light purple polygons are City urban growth boundaries for reference. DNR harvest permit data are from two sources: (1) the publicly available Forest Practices Application GIS dataset on the DNR website, and the DNR proprietary harvest database acquired through public disclosure and a fee. FPA permits effective prior to 2004 were excluded from this figure.

Table 38**Forest Practices Regulation****FOREST PRACTICES HABITAT CONSERVATION PLAN PROGRAM(S) EVALUATION**

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Low. The Forest Practices HCP was initiated by DNR and approved and permitted by NOAA under ESA – Section 10 in 1999, five years before the LCFRB posted their initial draft of the Recovery Plan. As a result, there are no direct connections to the Recovery Plan. DNR staff may consult the Recovery Plan for specific information; however, this connection is undocumented. While management under the HCP is intended to protect and improve aquatic habitat conditions in contrast with past practices and is expected to help achieve Recovery Plan goals, it is based on prescriptions in the HCP and does not reflect watershed or population specific priorities outlined in the Recovery Plan.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A1: High. The Recovery Plan expectation for roads and fish passage within private forest lands includes implementation of best management practices for new road construction and maintenance activities to avoid hillslope failure and release of sediments. The fish passage restoration expectation is to return EFLR tributary habitats to historical access. Actions implemented under RMAP for private industrial lands are impressive with regard to road standards and fish passage under the Forest Practices HCP. DNR's RMAP database indicates that 100 percent of fish passage barriers on large forest landowner lands in the EFLR watershed have been removed or fixed, equating to approximately 22 miles of stream opened for fish habitat.

A2: Moderate to Low. The Recovery Plan expectation for forest practices includes protections to riparian buffers, protection of unstable slopes, and the protection of watershed-scale processes (e.g., functioning hydrology and sediment processes). DNR administers the terms of the HCP through a permitting system intended to protect riparian buffers and unstable slopes and utilizes best management practices. Permit compliance and enforcement activities performed by DNR were not readily available for review. It is unclear if these HCP measures are sufficient to protect EFLR watershed-scale processes due to the magnitude of harvest that has occurred within a 15-year time-span. DNR's sustainable harvest calculations to determine the allowable magnitude of timber harvest within Clark County considers environmental impacts, but it is unclear if those considerations align with the priorities of the Recovery Plan.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Moderate. DNR maintains the Forest Practices Application Review System (FPARS) database, a GIS layer of harvest permit polygons, including permit effective and expiration dates. The FPARS database is less detailed than the State Trust proprietary GIS database, which includes detailed harvest boundary units, riparian buffers, leave tree areas, etc. DNR also maintains the RMAP

geodatabase which includes barrier locations and improvement status. And although DNR tracks mileage of proposed road creation/decommissioning, GIS layers of these activities would provide a more comprehensive understanding of the location and extent of potential habitat impacts in the EFLR watershed.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Moderate. Through their Adaptive Management Program, DNR runs the Cooperative Monitoring, Evaluation, and Research (CMER) program. The CMER program aims to test whether the recommendations of the Forests and Fish Report are being effectively implemented. Monthly meetings are held to plan and review research and monitoring projects; example topics of projects discussed during 2019 CMER meetings include: buffer integrity shade-effectiveness, type-F QAQC surveys, riparian status and trends monitoring of stream temperature, mass wasting landscape-scale effectiveness, etc. Projects are targeted to geographic regions in Washington state. According to DNR's Adaptive Management Program Research and Monitoring Documents webpage, approximately 12 published studies are applicable to Western Washington. These studies evaluate topics such as water temperature in hardwood conversion sites, effectiveness of regulations for roads, validation of desired future condition performance targets, effectiveness of riparian buffers on non-fish-bearing streams, Type N experimental buffer studies, mass wasting effectiveness monitoring, forested wetland regeneration studies, etc.

The CMER program is an important source of data and information for adaptive management and evaluating program implementation and effectiveness. Given some degree of overlap between HCP and CMER program and Recovery Plan goals and objectives, the CMER program yields pertinent data and information for evaluating effectiveness relative to Recovery Plan expectations at the regional scale. However, additional analysis would be needed to evaluate whether the CMER program is sufficient to address Recovery Plan effectiveness monitoring needs at the watershed-scale. This is especially the case in the EFLR given its unique fire and land use history, and the high level of harvest that has occurred during the evaluation period.

Aggregate Mining and Mineral Prospecting Regulation

Mining activities have a long and important history in the EFLR watershed. Commercial floodplain gravel mining in the EFLR likely began in the 1940s as it did in many other Washington streams (Collins 1997). Mines were often developed in abandoned channels in the historical floodplain and within the active river channel during summer low-flows (Storedahl 2003). Two consecutive 100-year flood events resulted in an avulsion into a relic pit at river mile 9 in 1995 and into six pits two river miles downstream in 1996 (Norman 1998). Together, the two avulsion events resulted in the loss of approximately 5000 ft of channel and spawning habitat and a headcut of about 10 feet (Norman 1998). These pits are commonly referred to as the Ridgefield Pits and are shown in Figure 22. Because mining activities at Ridgefield Pits predate contemporary regulatory programs, only minor studies and restoration have been targeted at the avulsion impacts to river hydraulics, sediment, and geomorphology. No

information could be identified under Ecology’s Sand and Gravel permit program or DNR’s Mining Reclamation Permit Program to indicate any landowner requirements after the avulsions. Recent planning efforts led by LCEP and partners suggest that it will take at least 50 years for the river to return to pre-avulsion conditions (Johnston 2020). These same planning efforts are evaluating restoration alternatives for the Ridgefield Pits 25 years after the historical floods of 1995 and 1996.

Today, there are four aggregate mines in the EFLR that hold Sand and Gravel permits from Ecology. Clark County’s GIS data identify 19 additional county gravel pits. Figure 23 depicts surface mining overlays in Clark County’s zoning designations, the Clark County inventory of gravel pits, and the DNR inventory of areas potentially suitable for aggregate mining. Several gravel pits and surface mining overlays are located along the floodplain of the lower EFLR, a Recovery Plan Tier 1 reach. Aggregate mining continues to be an important economic driver in Washington State. DNR estimates that state-wide aggregate mining contributes about \$363 million annually to Washington State’s economy. According to DNR, each Washington resident uses about 13.5 tons of aggregate per year and the cost of aggregate doubles every 25 miles traveled by truck to the mine source (DNR 2019) making the location of mining activities critical to economies and watershed health.



Figure 22. Figure from *Flood Plains, Salmon Habitat, and Sand and Gravel Mining* (Norman et al. 1998). The photo was taken in 1997 and shows the pathways of the 1995-1996 EFLR avulsions. Labels A, B, C, D, E, and F indicate locations where the river avulsed into the gravel pits, abandoned the historical channel, or re-entered its channel.

Mineral prospecting also has a long history in the EFLR. Copper and gold were discovered near the EFLR headwaters, resulting in several hundred mining claims (USFS 1995). While those activities ceased with the depression in the 1930s, hundreds of claims still exist (USFS 2002). Some mineral prospecting activities (e.g., gold mining) occur in the EFLR watershed, especially in Copper Creek and the EFLR mainstem within the GPNF.

East Fork Lewis River Gravel Pits, Surface Mining Overlay Districts, and Aggregate Mining Potential

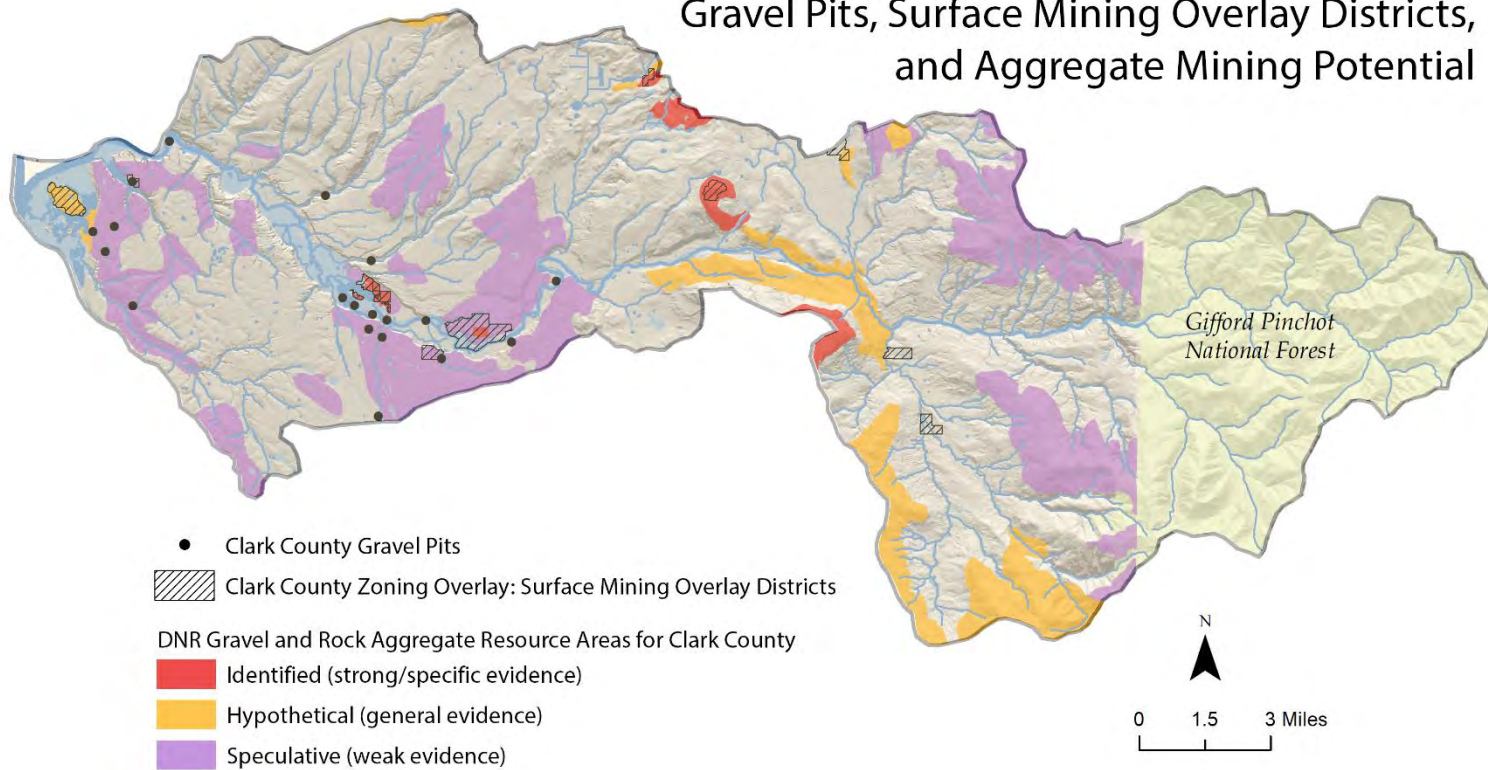


Figure 23. Map of aggregate mining activity and general aggregate resource potential in the EFLR watershed. DNR's "identified" polygons represent gravel or bedrock aggregate that can be confidently characterized from strong field evidence; "hypothetical" polygons represent aggregate resources postulated to exist on the basis of general geologic information; "speculative" polygons represent aggregate resources with sparse evidence and rock types have not been evaluated for aggregate potential. These polygons provide context about where future aggregate mining could potentially occur in the EFLR watershed. The black points represent current gravel pits, and hashed areas are designated as surface mining overlays in Clark County zoning. DNR aggregate resource data acquired from DNR Geology Department. Gravel pit locations are from Clark County gravel pit GIS layer. Surface mining overlays are from the Clark County 2018 zoning overlay GIS layer.

Table 39 outlines the threats addressed by mining regulation, and the corresponding partners, programs, and actions.

Table 39 Mining Regulation		
Threats:		
Mining • Clearing of vegetation • Channel and/or floodplain substrate removal • Floodplain filling • Water quality degradation		Mining (continued) • Increased water surface area • Disrupted hyporheic flow • Increased sedimentation • Interruption of channel migration processes • Loss of long-term gravel sources
Partners	Programs	Program #
County	Clark County Mineral Resource Lands	1
Ecology	Sand and Gravel Permit	2
DNR	DNR Surface Mining Reclamation	3
Storedahl/NOAA/USFWS	Storedahl HCP	4
Actions⁵⁹		Applicable Programs
Monitor, evaluate, and enforce the Storedahl Habitat Conservation Plan		4

Clark County Mineral Resource Lands

Clark County’s comprehensive plan designation and zoning map guides their regulation of surface mining, through Surface Mining Overlay Districts and individual Conditional Use Permits (CUPs). Clark County Code 40.250.22 establishes surface mining permitted uses, standards, approval processes, and monitoring and enforcement. Clark County’s goal for Mineral Resource Lands is to “protect and ensure appropriate use of gravel and mineral resources of the county, and minimize conflicts between surface mining and surrounding land uses.” Clark County’s Surface Mining Overlay identifies zoning within the County where surface mining may be allowed. Proponents seeking changes to the Surface Mining Overlay map must demonstrate consistency with the Growth Management Act, city and county comprehensive plans, capital facilities plan, and official population growth forecasts (Clark County

⁵⁹ One action identified in Chapter L of the Recovery Plan pertains to one mining regulation program, but others are evaluated in this report because of their relevance to addressing the overall mining threat in the EFLR watershed.

2019). CUPs are included in Clark County’s comprehensive plan in Section 40.520.030 to provide a review process for uses with unusual characteristics, or uses that are in areas with special characteristics. Such uses can be approved with appropriate conditions to ensure that the uses are properly located and restricted in size and/or intensity to comply with CUPs. CUPs generally fall into a Type II-A County review (usually for commercial/industrial development with unusual characteristics or impacts). Type II-A reviews are generally implemented by staff unless the County Hearings Examiner requires a public hearing. There are ten distinct surface mining overlay areas in the EFLR watershed (see Figure 23).

Table 40 Mining Regulation
CLARK COUNTY MINERAL RESOURCE LANDS PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: Low. Clark County’s Comprehensive Plan references the Recovery Plan; however, no connection could be identified in Title 40 Surface Mining text. Clark County staff may consult the Recovery Plan on a case-by-case basis but there is no documented process or requirement.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Unknown. The Recovery Plan expectation for regulatory entities governing mining is to protect stream, river, floodplain and watershed processes and functions, restore channel and floodplain areas damaged by previous mining, and reduce risks of future impairment. These threats have occurred in the EFLR floodplain at the Ridgefield Pits site (before completion of the Recovery Plan). Between 2004 and 2018, Portions of Clark County Surface Mining Overlay Districts in the Upper Rock Creek subwatershed have been removed while new districts have been formed within the forest-zoned lands north of the mainstem in the upper EFLR watershed, as well as in the lower watershed between La Center and Ridgefield. Without further information it is unclear if the Clark County Mineral Resource Lands Program permit and zone change policies meet the expectations of the Recovery Plan.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. Clark County maintains the publicly available Surface Mining Overlay District GIS layer; however, the County’s CUPs review and permit requirements were only available on a case-by-case request. Compliance monitoring and enforcement activities data were not readily available.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. There is no evidence of county effectiveness monitoring of active mines that could ensure EFLR mining regulations are achieving “no net loss” of salmon and steelhead habitat function.

Ecology Sand and Gravel Permit

Ecology regulates discharges of process water, stormwater, and mine dewatering into the waters of the state. The regulatory mechanism is a Sand and Gravel permit; however, Ecology also requires small scale mining and prospecting to acquire a National Pollution Discharge Elimination System (NPDES) permit. A State Waste Discharge Permit is required if discharge is targeted directly to groundwater. Authority for these permits is delegated to Ecology under Section 401 of the CWA and the State of Washington Water Pollution Control Law. Four aggregate mines in the EFLR watershed are currently regulated under active NPDES permits; they include Cadman Lewisville Pit, Daybreak Mine, Mountain Top Quarry, and Tebo Pit (Ecology 2019).

Table 41 Mining Regulation
ECOLOGY SAND AND GRAVEL PERMIT PROGRAM(S) EVALUATION
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: Low. CWA Section 401 and the Washington Water Pollution Control Laws provide regulatory guidance for issuance of Sand and Gravel permits. It is possible that some Ecology permit writers consult the Recovery Plan; however, there is no evidence to show a connection. The county's largest floodplain mining operation, the Storedahl Daybreak Mine, is located immediately adjacent to a Tier 1 reach, and within the historical channel migration zone.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Unknown. The Recovery Plan expectation for regulatory entities governing mining is to protect stream, river, floodplain and watershed processes and functions, restore channel and floodplain areas damaged by previous mining, and reduce risks of future impairment. While Ecology's Sand and Gravel permits were not explicitly identified in the Recovery Plan, this program directly relates to the expectation that the water quality baseline in the EFLR will not deteriorate. The extent to which the Sand and Gravel permitting process meets these expectations is unclear with the available data. Ecology performs compliance inspections on an annual basis and executes enforcement actions as required. Permit enforcement typically includes monitoring and reporting violations with isolated water quality issues that involve penalties.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. Ecology's PARIS database tracks site-scale monitoring results, compliance visits, and enforcement actions; however, geospatial data to depict impacts of permitted activities on habitat in the EFLR were not available.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. Ecology's Sand and Gravel permit program does not explicitly conduct effectiveness monitoring. It is unclear whether any entity among those regulating mining operations in the EFLR watershed synthesizes data or performs effectiveness monitoring.

DNR Surface Mining Reclamation

DNR regulates the reclamation of areas subject to surface mining activities through their Surface Mining and Reclamation Program (SMRP) which implements the Surface Mining Act. Surface mining reclamation restores vegetation, soil stability, and proper water conditions after mining operations are completed at a site. As new mining sites are proposed to Clark County (and other regulators), DNR requires a Surface Mining Reclamation Permit for mining activities that result in more than three acres of disturbed ground, or activities that result in a highwall that is both higher than 30 feet and steeper than 45 degrees (RCW 78.44). A high-quality reclamation plan is required for each mine and is subject to periodic review and modification. DNR encourages reclamation activities to be initiated as mining activities cease in areas within the mining site. DNR performs site visits on an annual basis to ensure reclamation plans are followed.

Table 42

Mining Regulation

DNR SURFACE MINING RECLAMATION PROGRAM(S) EVALUATION

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Low. The Surface Mining Reclamation program is narrowly focused on reclamation plans for surface mining sites. There are no references to the Recovery Plan in state surface mining RCWs or WACs. It is possible that staff consult the Recovery Plan for specific mining reclamation plans, but no evidence of this kind of relationship was identified in this evaluation.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. The Recovery Plan expectation for regulatory entities governing mining is to protect stream, river, floodplain and watershed processes and functions, restore channel and floodplain areas damaged by previous mining, and reduce risks of future impairment. The Recovery Plan does not identify mining reclamation as a partner program, but does call for restoring areas damaged by previous mining and reducing future risks. It is unclear if reclaimed mining sites are re-purposed for human activities (e.g., single-family houses) or returned to natural and dynamic habitats for salmon and steelhead. DNR performs annual compliance inspections for all permitted sites and pursues enforcement when required. Interview discussions identified a loop-hole to site reclamation in the use of an inactive site for gravel staging activities thereby avoiding timely reclamation.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. DNR tracks permit data in an internal database that is not readily available to the public. Through DNR staff assistance, reclamation data was identified for Daybreak Pit and the Lewisville Pit. No permit or permit information was identified by DNR staff for the Ridgefield Pits.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. Based on information available, it is unclear if effectiveness monitoring is conducted for the Surface Mining Reclamation program.

Storedahl Habitat Conservation Plan

JL Storedahl and Sons developed an HCP for expansion and operations of their 300-acre Daybreak Mine located in a flat alluvial valley adjacent to RM 8, at the confluence of Dean Creek and the EFLR. ESA Section 10 HCP permits were issued by NOAA and USFWS in 2004. Impacts were identified in the HCP, which included elevated water temperatures, sediment regime alterations, and the creation of habitats for nuisance fish species. In 2003, Storedahl negotiated the HCP with NOAA and USFWS to expand operations at their Daybreak Mine Expansion and Habitat Enhancement Project. The HCP calls for water quality, water quantity, channel avulsion, species, and habitat monitoring and evaluation measures. Extensive monitoring and reporting measures are identified in Chapter 5 of the HCP. Periodic (5-year, annual, and quarterly) reports are specified for NOAA, USFWS, Ecology, WDFW, and the County. The HCP includes a contingency that if Ecology approves changing the water rights from the current type as agriculture to one of industrial use, Storedahl will donate 237 acre-feet of water per year to the State Water Trust to be held in perpetuity. A conservation and habitat enhancement endowment of up to \$1,000,000 is created which will transfer to a non-profit entity at the end of the 25-year term of the HCP. LCFRB receives \$25,000 per year for habitat restoration activities related to impacts resulting from mining operations.

Table 43

Mining Regulation

STOREDAHL HCP PROGRAM(S) EVALUATION

Q: To what degree does the program utilize the Recovery Plan to help guide their program?

A: Moderate. This HCP, as most, is not driven by species recovery although mitigation for project impacts does utilize the Recovery Plan. The LCFRB is referenced in the Storedahl HCP, and LCFRB receives annual funding of \$25,000 to implement restoration efforts in the vicinity of Daybreak Mine and Dean Creek.

Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats?

A: Unknown. The Recovery Plan expectation of the Stordahl HCP was to avoid future avulsions at Daybreak Mine and protect and restore water quality, riparian function, stream channel structure (e.g., LWD), erosion, mass wasting, bank stability and sediment supply processes.

Stordahl's HCP to operate the Daybreak Mine includes a suite of conservation measures that address limiting factors; however, until they are fully implemented and until effectiveness monitoring is conducted, HCP implementation effectiveness to meet Recovery Plan expectations is unknown. Conservation measures of the HCP include: donation of water rights, a water management plan, a conservation and habitat enhancement endowment, forest revegetation, floodplain reestablishment, mining and reclamation designs to reduce the risk of avulsions or impacts from flooding, contingency plans for potential avulsions, study of the Ridgefield pits and EFLR, off-site floodplain enhancement, conservation easements, riparian management zones, in-channel habitat enhancement, shallow water and wetland habitat creation, non-native fish control, Oregon spotted frog habitat creation, and controlled public access. However, without data demonstrating the effectiveness of HCP implementation actions, it is unclear the extent to which the implemented conservation measures meet the expectations of the Recovery Plan.

Conservation and monitoring measures from the 2018 Annual Report provide measure-by-measure accounting of implementation progress and monitoring results.

Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats?

A: Low. Stordahl mining operations are regulated by the terms of the HCP permits by NOAA and USFWS. The HCPs specify monitoring activities and reporting requirements. When asked for the 5-year reports, NOAA was unable to demonstrate they had received the reports or what progress had been made on HCP requirements. Other programs such as Ecology's Sand and Gravel permit, DNR's Surface Mining Reclamation permit, or Clark County's Mineral Resource Lands' permit also have reporting requirements; however, it is unclear if these data sources are adequate or have been synthesized into usable information to characterize threat reductions.

Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives?

A: Low. It is unclear the degree to which the monitoring data or reports are targeted to demonstrate effectiveness in helping to meet Recovery Plan expectations. A review of Daybreak Conservation Measures Annual Report for 2018 provides measure implementation progress and monitoring results. Some of this information could be synthesized to inform effectiveness monitoring.

Mineral Prospecting HPA

Mineral prospecting in the EFLR is a popular activity especially within the GPNF. Mineral prospecting has been regulated by WDFW's *Gold and Fish Rules for Mineral Prospecting and Placer Mining Pamphlet* (Pamphlet) since 1980 (WDFW 2019). Conformance with the Pamphlet represents an HPA that historically has no reporting requirements. If a prospector cannot conform to the Pamphlet requirements, then an individual HPA is required. Approximately 70 individual HPAs were issued in the Copper Creek tributary and approximately 40 on the EFLR mainstem between 2004 and 2014 (WDFW 2019). This does not account for mineral prospecting permitted under WDFW's Pamphlet HPA. The number of entities operating under the Pamphlet HPA is unknown.

According to WDFW, no other entities regulate mineral prospecting in Washington State (Howe 2019). Recent WDFW rule-making, effective November 1, 2019, will require suction dredging to apply for an individual HPA with new reporting requirements beginning in 2021 (WDFW 2019).

Table 44 Mining Regulation
MINERAL PROSPECTING HPA PROGRAM
Q: To what degree does the program utilize the Recovery Plan to help guide their program? A: Low. There is no indication that WDFW, as regulators responsible for the Gold and Fish Pamphlet HPA, utilize the Recovery Plan directly. Since prospectors are not required to report to WDFW, there is no indication that staff knowledge of the Recovery Plan is transferred to prospectors. Individual mineral prospecting HPAs may include staff consultation with Recovery Plan objectives, but that is not documented.
Q: To what degree does the program meet Recovery Plan expectations to address EFLR threats? A: Unknown. Mineral prospecting was not identified in the Recovery Plan as a threat. However, how individual prospectors address salmon and steelhead habitat is unknown.
Q: To what degree does the program produce data to effectively demonstrate the trajectory of EFLR threats? A: Low. The Gold and Fish Pamphlet HPA does not require reporting of prospecting activities. Individual HPAs (used when the prospector cannot conform to the Pamphlet) are tracked in WDFW's pre-2014 database. Data is limited to stream name and section, township, and range location information.
Q: To what degree does the program conduct effectiveness monitoring to ensure the program is helping to meet Recovery Plan objectives? A: Low. There is no monitoring of mineral prospecting in the EFLR unless a full HPA is required.

Summary

The *EFLR Program Implementation Review* is based on interviews and program data gathered between June 1, 2018 through July 31, 2019 to characterize and evaluate program implementation as it relates to the Recovery Plan. Chapter 2 is a synthesis of this information and is organized according to implementation functions: Recovery Plan administration; habitat acquisition, restoration, and stewardship; technical assistance; land use and development regulations; forest practices regulations; and, mining regulations. Data analysis to inform this project was challenging due to the absence or insufficiency of program data, and limited evidence of program intention to relate data to the Recovery Plan or to synthesize data for landscape-scale effects. Table 45 summarizes the four question responses by program.

With the exception of compliance monitoring and enforcement, program implementation is on-going and consistent with internal program missions, priorities, and underlying statutory requirements. In situations where the LCFRB had capacity to proactively engage in program development or updates, partners were willing to entertain or address recovery needs. Conversely, in most situations program implementation is poorly connected to the Recovery Plan, with only a few minor exceptions. Program updates and implementation decisions have been driven by underlying statutory obligations, rather than regional Recovery Plan priorities or needs. This is exacerbated by the fact that many of the referenced programs have their foundation in statewide or federal mandates, and there has been a lack of impetus and progress at the statewide level to update programs to reflect broader recovery needs. The program review was further constrained by the lack of Recovery Plan clarity regarding program implementation expectations. The consistent lack of alignment between Recovery Plan expectations, on-the-ground program implementation, and data yields little opportunity for adaptive management and quality decision-making. This is complicated by a lack of guidance in the Recovery Plan for evaluation of program sufficiency.

Table 45 Program Evaluations (Orange Box) Summary				
Program	Q1 Recovery Plan informs Program	Q2 Program meets Recovery Plan expectations	Q3 Program Data	Q4 Effectiveness monitoring
LCFRB Recovery Plan Implementation	High	Low	Low	Low
LCFRB Recovery Partner Program Outreach	Low	Low	Low	Low
Habitat Grant Funding Administration	High	High	Moderate	Low
Land Acquisition, Stewardship, and Management	High	High	Moderate	Moderate
Habitat Restoration and Enhancement	High	Moderate	Low	Moderate

Program	Q1 Recovery Plan informs Program	Q2 Program meets Recovery Plan expectations	Q3 Program Data	Q4 Effectiveness monitoring
Best Management Practices	Moderate	Moderate	Low	Low
Local GMA Comprehensive Planning	Low	Unknown	Moderate	Low
Critical Areas Designation	Moderate	Unknown	Low	Low
Shoreline Master Program	High	Unknown	Low	Low
Section 404 Dredge and Fill	Low	Unknown	Low	Low
Section 401 Water Quality	Low	Unknown	Low	Low
Section 303(D) Impaired Waterbody List and TMDL	Moderate	Unknown	Moderate	Moderate
Stormwater Discharge	High	Unknown	Moderate	Moderate
State-owned Aquatic Lands	Low	Unknown	Low	Low
Hydraulic Project Approval	Low	Low	Low	Low
Rivers and Harbors Act – Section 10	Low	Unknown	Low	Low
Ecology Water Resources	High	High	High	Low
Section 7 and Section 10 Magnuson-Stevens Fisheries Conservation Act	Moderate	Unknown	Low	Low
Section 4(D) Regional Road Maintenance	Moderate	Unknown	Moderate	Low
GPNF Land and Resource Management Plan	High	High	Low	Moderate
State Trust Lands HCP	Low	A1: High A2: Moderate	Moderate	Moderate
Forest Practices HCP	Low	A1: High A2: Moderate to Low	Moderate	Moderate
Clark County Mineral Resource Lands	Low	Unknown	Low	Low
Ecology Sand and Gravel Permit	Low	Unknown	Low	Low
DNR Surface Mining Reclamation	Low	Unknown	Low	Low
Storedahl HCP	Moderate	Unknown	Low	Low
Mineral Prospecting HPA	Low	Unknown	Low	Low

Chapter 3. EFLR Threat Observations and Monitoring

This section takes a qualitative look at five priority habitat-related threats (urban/rural development, forest practices, mining, agriculture/grazing, and channel manipulations), as identified in Chapter L (EFLR) of the Recovery Plan to provide perspective on how well they are being addressed by the programs evaluated in this pilot study. The following observations focus on the status of available data to assess threats to salmon and steelhead in the EFLR, including whether regulatory and acquisition programs are effectively protecting the habitat baseline, and whether restoration actions are improving habitat conditions. It is clear from interviews that recovery partners have been judiciously implementing their respective programs. It is less clear how well those programs have effectively produced data to characterize the threats that are believed to have contributed to declines in salmon and steelhead, articulated in the Recovery Plan, and NOAA's delisting criteria. For each of the five EFLR priority threats, example metrics are suggested that could be used to evaluate the status of those threats in the future.

Urban and Rural Development

Land use data suggest that urban and rural development between 2004 and 2018 in the EFLR watershed remains a long-term threat to salmon and steelhead despite an aggressive effort to protect and restore lower mainstem EFLR habitats. Rapid population growth is placing development pressure on the natural resources of the EFLR watershed. Much of that growth has occurred since the Recovery Plan was first adopted in 2004. The story of the EFLR is not unlike many other urban river systems around Western Washington, where conversion of forest and other natural habitats to residential, commercial, and industrial development and associated infrastructure have fundamentally, and in some cases irretrievably, altered salmon and steelhead habitats and watershed processes.

Regulatory programs at the federal, state, and local levels help ensure that individual development activities proceed in a manner that avoids or minimizes impacts to habitat and habitat-forming processes. Mitigation banks and other forms of mitigation programs (e.g., permittee responsible, consolidated mitigation sites, etc.) have been established to help offset impacts that are deemed unavoidable. However, their efficacy in ensuring impacts are fully mitigated has not been critically evaluated. Despite the intent of various land use programs, cumulative impacts from incremental losses (e.g., increased impervious surfaces, loss of floodplain and riparian habitats, etc.) over the long-term can produce significant impacts on salmon and steelhead habitats and habitat-forming processes.

At the same time, much of the lower- and middle-reaches of the mainstem EFLR have been acquired as part of the EFLR Greenway. Restoration activities in the EFLR watershed primarily address salmon and steelhead habitat access issues by adding large wood, reconnecting floodplains, and restoring riparian vegetation communities. Figure 24 provides an example of dense rural development found throughout the lower- to middle-reaches of the EFLR watershed as residential infilling progresses eastward up the watershed. Table 46 identifies possible metrics that could help LCFRB and partner programs characterize and manage urban and rural development in the future.

Table 46 Urban and Rural Development - Example Metrics to Inform Threat Status		
Activity	Example⁶⁰	Data Status
Monitor City Population	Between 2000 and 2018, OFM estimates the following city growth: • Battleground population has grown by 124% • La Center population has grown by 101% • Ridgefield population has grown by 259% • Yacolt population has grown by 69%	Available
Monitor UGA Expansion	Between 2004 and 2018, Clark County estimates the following UGA expansions: • Battle Ground: +84% • Ridgefield: +83% • La Center: +160% • Yacolt: +37%	Available
Monitor Taxlots with Septic Tanks	As of 2018: • 69% of unincorporated taxlots in the EFLR watershed have septic systems • 33% of septic systems have up-to-date inspections	Available
Monitor % Change in Impervious Surface	• Non-road impervious surfaces in the EFLR watershed increased by approximately 4.9% between 2001 and 2016 (from an estimated 7,450 acres to 7,816 acres)	Available
Monitor land cover and development in Critical Areas	• In critical areas of the EFLR watershed, developed land cover increased by approximately 2.6% and forest land cover decreased by approximately 14.6% between 2001 and 2016 (an estimated 203 acre increase in developed land cover, and a 5,686 acre decrease in forest land cover in critical areas)	Available
Monitor development within Shoreline Master Program lands	• As of 2018 Clark County data, within the Shoreline Master Program designated lands, there are an estimated 787 building footprints, totaling 26 acres (approximately 0.06% of the total Shoreline Master Program designated lands); this statistic does not account for parcel clearing, driveways, or lawns	Available
Monitor % Change in Agriculture	• Agriculture-zoned lands in the EFLR watershed decreased by 9% between 2004 and 2018 (a 1,512-acre reduction)	Available
Monitor % Change in Road Surface	• Between 2001 and 2016, the NLCD impervious surfaces datasets indicate that there was a 96 acre increase in road	Available

⁶⁰ Information derived from WA Office of Financial Management (OFM), Clark County GIS data, National Land Cover Database (NLCD), and DNR FPARS database

	surfaces outside of urban areas in the EFLR watershed (an approximate 0.1% increase in road surface)	
Monitor polygons/data showing Class IV land use conversions	• Number, percent, acreage, and location of FPARS Class IV conversions that show changes from forest to different land use categories	Available
	• Number, percent, acreage, and location of renewed Class IV conversion permits reclassified as another permit type	Not Readily Available
Monitor polygons/data showing CUPs and Variances	• Number, percent, acreage, and location of Conditional Use Permits and Variances as they relate to Tier 1 and 2 Recovery Plan reaches	Not Readily Available



Figure 24. Rural Development Intermixed within EFLR Resource Lands [GJ Image 5162, June 13, 2019]

Forest Practices

Interview discussions and data suggest that changes in land cover resulting from forest practices in the EFLR remain a threat to salmon and steelhead habitat and habitat-forming processes. Although forests are a renewable resource, the intensity of harvest in the EFLR in combination with development land use pressures in the lower- to mid-watershed can be expected to impact hydrology and other watershed processes. Considerable uncertainty exists about the severity of the threat and its impact on EFLR salmon and steelhead in the absence of a detailed functional watershed analysis and habitat status and trends data specific to the EFLR.

Evaluation of DNR's harvest permit database indicates that an estimated 9,439 acres (or 43 percent) of state managed forest in the EFLR watershed were permitted to be harvested between 2004 and 2018. According to a 2016 Draft Environmental Impact Statement for the establishment of a sustainable harvest level for Forested State Trust Lands in Western Washington, harvests on State Forest transfer unit lands in Clark County alone exceeded the 2005-2014 sustainable harvest level more so than any other county in Western Washington. Of the sixteen counties in western Washington, ten counties' state forest transfer unit lands exceeded the sustainable harvest level for 2005-2014, but Clark County saw by far the greatest exceedance, with between 50-100 MMBF (million board feet) over the sustainable harvest level (DNR 2016). The HCPs do not regulate timber harvest to align with Recovery Plan priorities (e.g., EFLR priority subwatersheds) or to balance harvest activities with other land uses (e.g., development) to ensure functioning watershed processes and habitat conditions over time. Based on the distribution of harvest patterns in high priority reaches, this is evident in the EFLR watershed. In balance, implementation of DNR's two HCPs offers protections for unstable slopes, wetlands, and riparian buffers depending upon their physical and biological characteristics. Implementation of the HCPs have improved road design to minimize erosion and the removal of fish passage barriers has led to improved accessibility of historical habitats. In the absence of effectiveness monitoring designed specifically to study impacts on the EFLR, the effects of harvesting significant portions of the watershed within a 15-year period remain unclear, especially when coupled with the rate of development occurring lower in the watershed. Additionally, while DNR assesses slope stability, the criteria and results of hillslope harvest eligibility in the EFLR watershed are unavailable. Neither interviews nor data could confirm that DNR utilizes the Recovery Plan to consider locations of harvest levels in priority watersheds like the EFLR.

Timber harvest in Upper Rock Creek, one of the most important tributaries for the EFLR's wild steelhead (Rawding 2019), occurred on 37 percent percent of the sub-watershed between 2004 and 2018, with an additional 7.7 percent permitted for harvest through 2023. The relationship between forest management activities and peak flows or shallow landslide risk is unclear in the EFLR watershed. Considering the cumulative effects of urban and rural development with forest practices, watershed-scale processes in the EFLR watershed, such as hydrology and sediment processes, remain a concern into the foreseeable future. This uncertainty warrants reevaluation of watershed process conditions. A DNR-initiated watershed analysis in the EFLR would address these types of data gaps and system-wide understanding.

In lieu of a formal watershed analysis, a hydrologic maturity assessment based on forest composition and canopy structure was conducted for the EFLR watershed. Using elements of the DNR Watershed Analysis Manual (DNR 2011), land cover and percent canopy remote sensing products (MRLC NLCD 2016) were used to map forest hydrologic maturity in the EFLR watershed.⁶¹ The analysis suggested that in 2016, the EFLR watershed consisted of approximately 33 percent hydrologically mature forest, 11 percent intermediate hydrologic maturity forest, and 11 percent hydrologically immature forest, with the remainder of the watershed non-forest.

The same analysis conducted for the rain-on-snow zone within the EFLR watershed⁶² suggested that in 2016 approximately 68 percent of this portion of the watershed consisted of hydrologically mature forest, 9 percent intermediate hydrologic maturity forest, and 6 percent hydrologically immature forest, with the remainder non-forest. Between 2004 and 2018, approximately 16 percent (4,440 acres) of the EFLR watershed's rain-on-snow zone was permitted to be harvested. The significance of the rain-on-snow zone within the EFLR watershed is aptly captured in the following quote from the DNR Watershed Analysis Manual: "The greatest likelihood for causing significant, long-term cumulative effects on public resources via alteration of forest hydrologic processes is through increases in peak flows attributable to the influence of timber harvest on winter snow accumulation and melt rates during rain-on-snow events." (DNR 2011).

Figure 25 shows a portion of Upper Rock Creek near its confluence with the mainstem EFLR; note rural development activities as well as road building and forest practices along slopes greater than 40 percent. Upper Rock Creek is the EFLR's largest and therefore the most important steelhead spawning and rearing tributary (Rawding 2019).

⁶¹ Hydrologically mature forests included evergreen or mixed forest land cover types that have greater than 70 percent canopy closure. Forests of intermediate hydrologic maturity included evergreen or mixed forest land cover types that have between 10-70 percent canopy closure. Hydrologically immature forests included hardwood or shrub land cover types and less than 10 percent canopy closure. Land cover classes with majority hardwoods or shrubs were assumed to be deciduous forest, grass/herbaceous, and shrub/scrub from the NLCD 2016.

⁶² The rain-on-snow zone dataset is a statewide coverage of rain-on-snow zones created by WA DNR.



Figure 25. Upper Rock Creek near the confluence with the EFLR mainstem. Image taken June 13, 2019.

Table 47 identifies possible metrics that could help LCFRB and partner programs characterize and manage threats resulting from forest practices in the future.

Table 47 Forest Practices - Example Metrics to Inform Threat Status		
Activity	Example	Data Status
Perform DNR EFLR Watershed Analysis	A DNR watershed analysis of the EFLR provides hydrological maturity and peak flow outputs to inform the periodic proxy data updates	Not available
Monitor % change of hydrological maturity	Acreage, percentage, and location of changes in DNR thresholds of hydrological maturity through time (use crown cover data, land cover, and aerial photography)	Available
Monitor % change in riparian zone buffers	Percent change in riparian buffers of Recovery Plan Tier 1 and 2 reaches over time, including evaluation of width (achieve by measuring and digitizing, periodic updates)	Not available

Implement periodic updates to Integrated Watershed Analysis (IWA)	Changes in riparian areas (percent cover, age class, width and extent), hydrology (land cover, road density), and sediment processes (erodibility, road density, etc.) in the EFLR watershed over time	Base period available. No updates
Monitor % over time Harvest in Forest-zoned lands	Between 2004-2018, approximately 40% of forest-zoned lands were permitted to be harvested in the EFLR watershed; periodic updates	Available using FOIA and cost reimbursement
Monitor % over time Harvest in Non-forest-zoned Lands	Percentage of non-forest-zoned lands that were permitted to be harvested between 2004-2018; periodic updates	Available
	Acreage of Class IV General Conversions from forest to development, including permit renewals. (periodic updates allow estimation of change over time)	Not readily available
Monitor % Harvest in Key Tributaries	- Approximately 40% of the upper Rock Creek subwatershed was permitted to be harvested between 2004 and 2018 - An estimated 780 additional acres of harvest (~7.7 percent of the subwatershed) are permitted to occur between 2018 and 2023	Available using FOIA and cost reimbursement
Monitor % Harvest on Steep and/or Unstable Slopes	Approximately 8% of all harvest between 2004-2018 in the EFLR occurred on slopes greater than 40%	Available
	Percent of harvest on lands in the EFLR greater than 60%⁶³ (requires new slope layer)	Not readily available
Review/comment on HCP 5-Year Reports	Information on actions either conducted or permitted under DNR's Forest Practices and State Trust Lands HCPs is included in DNR's annual reports to NOAA and USFWS	Available
	Metrics within reports for delisting criteria	Unknown; discuss with Services
Document Miles of Stream Opened to Fish Access	- Approximately 22 miles of stream have been opened for fish habitat in the EFLR watershed⁶⁴ - Location and number of miles opened to potential habitat for salmon and steelhead - Location and number of Recovery Plan Tier 1 and Tier 2 reaches opened	Available (not publicly)

⁶³ The Pacific Watershed Institute found most slope failures in the EFLR occurred on 60% slopes or greater in the upper watershed (PWI 1998).

⁶⁴ Data from DNR's RMAP database

Monitor % Forest Roads Improved	• Location, number, and type of road improvements completed (Digitize and enter data into SalmonPORT)	Not readily available
Monitor EFLR harvest on Geological Hazards and Unstable Slopes	• Acreage of harvest activities in Tier 1 and Tier 2 reaches that contain steep slopes, geological hazards, and unstable slopes	Not readily available

Mining and Mineral Prospecting

Interview discussions, an emerging LCEP study, and DNR’s reported aggregate availability suggest that threats resulting from mining activities continue to exist in the EFLR watershed. Mining threats range from ongoing impacts due to historical avulsions to potential habitat impacts resulting from existing and potential aggregate mining located within and adjacent to critical areas, shorelines, and high priority subwatersheds of the EFLR watershed. The Ridgefield Pits avulsions during the floods of 1995 and 1996 continue to influence watershed processes and habitat conditions below Daybreak Park in the middle reaches of the EFLR. This impacted the EFLR mainstem by interrupting sediment transport, creating vertical and lateral instability, increasing bank erosion, and reducing connectivity between the mainstem and its floodplain and tributaries. Located at River Mile 9, the Ridgefield Pits (seen in Figure 22) are situated within the EFLR Greenway, where much of the EFLR’s salmon and steelhead restoration activities are occurring (e.g., breaching floodplain levees, adding large wood, and restoring plant communities).

However, the river continues to fill abandoned mining pits and avulse into other historical mining features as it meanders across the floodplain. Steps taken to prevent avulsions by active mining operations (e.g., buried floodplain dikes) will create their own impacts to natural channel processes. It is unclear how these impaired physical processes affect salmon and steelhead restoration efforts or how long into the future it will take for the river to repair itself. An unpublished draft study by LCEP suggests Ridgefield Pits may take another 50 years to reach equilibrium (Johnston 2019).

Two additional aggregate mines are operating adjacent to the EFLR. They include Daybreak Pit (Figure 26), which is next to the Ridgefield Pits, and the Lewisville Pit (Figure 27). According to DNR’s Sand and Gravel Reclamation Permit reporting, 89.9 acres of the 292-acre Daybreak Pit are reclaimed (DNR 2019). DNR also reports that 3.2 acres of 122.4-acre Lewisville Pit have been reclaimed (DNR 2019). The Lewisville Pit is perched above the 100-year floodplain, but its ~10-acre tailing pond is within 0.2 miles from the mainstem. In May 2020, the Lewisville Pit ceased operations after Ecology determined its earthen dam securing the tailing pond to be unstable, lacking the required strength to prevent a collapse. If the retaining dike failed, the contents of the holding pond would flow into the East Fork Lewis River. Cadman, the mine operator, is working to resolve the issues to resume operations in the near future (Granneman, 2020).

In the long term, development of new mines to tap into significant aggregate resources may pose some level of threat to the EFLR. According to DNR estimates, there are significant aggregate reserves in the EFLR watershed (DNR 2019); approximately 370 and 3,086 acres of potential aggregate resources⁶⁵ are located within shorelines and high priority (group A) subwatersheds, respectively, primarily along the mainstem of the mid-upper watershed (see Figure 23). DNR's Surface Mining and Reclamation program requires reclamation of areas after mining activities. However, interviews suggested that mining operations often renew permits to stay active with the intent of delaying requirements for reclamation actions. Additionally, Clark County's Surface Mining Overlay District and Conditional Use Permits provide avenues for additional aggregate mining in the EFLR into the foreseeable future.



Figure 26. Ridgefield (left) and Daybreak Pits (right). Photo taken June 13, 2019 oriented North.

⁶⁵ Acreage of potential aggregate resources were quantified using DNR's aggregate GIS data, which identifies the locations of "identified," "hypothetical," and "speculative" aggregate resources based on varying levels of evidence. For the purposes of this analysis, potential aggregate resources include the "hypothetical" category only, as they have a greater degree of certainty than the "speculative" category.



Figure 27. Lewisville Pit perched directly above the EFLR floodplain. Photo taken June 13, 2019 looking South.

Impacts resulting from mineral prospecting in the EFLR are poorly understood, and little if any monitoring, compliance reviews, or enforcement activities are occurring. This threat is not specifically addressed in the Recovery Plan and the scope of the activity is not known. Information on the area of stream affected, magnitude of impact, or relationship to high priority stream reaches is lacking. Contemporary gold miners in the EFLR often use suction dredge equipment to excavate into active stream channels to find pockets where the heavier gold deposits occur. Dredged material (sediments) are released back into the waters, potentially impacting adult spawning habitats, juvenile rearing habitats, and food resources. Redistributing bed materials also fundamentally disrupts channel forming processes (e.g., pool riffle sequences).

Mineral prospecting is popular in EFLR lands managed by the GPNF. Most permitted activity is located within Copper Creek and the mainstem EFLR. Between 2004 and 2014, approximately 70 individual mineral prospecting-specific HPAs were permitted in Copper Creek, 41 in the EFLR mainstem, and 20 in the Green Fork.⁶⁶ Other popular mineral prospecting tributaries include Poison Gulch and Slide Creek.

⁶⁶ HPA data acquired from WDFW. Permit numbers are estimates; permit locations are not exact and permit records may correspond to renewals and/or multiple projects filed within a single record.

Mineral prospecting activities covered by the Gold and Fish Pamphlet are not tracked by WDFW (Howe 2019).

The EFLR is advertised nationally through mineral prospecting clubs and newspaper articles describing how prospecting works and typical places to find gold and other precious minerals. However, ESHB 1261 passed during the 2020 legislative session and became effective June 11, 2020. Beginning this date, motorized and gravity siphon aquatic mining is prohibited in waters of the state that are critical habitat under the Endangered Species Act (ESA) for salmon, steelhead, or bull trout, and all fresh waters of the state with designated uses of salmonid spawning, rearing, and migration. Non-motorized aquatic mining activities are not affected. If enacted, Washington State would join Oregon in the prohibition of this activity. Table 48 identifies possible information sources that could help LCFRB and partner programs characterize and manage threats resulting from mining and mineral prospecting in the future.

Table 48 Aggregate Mining and Mineral Prospecting – Example Information Sources to Assess Threat Status		
Activity	Example	Data Status
Review and comment on HCP reports	Information on activities conducted under the Storedahl (Daybreak Pit) HCP is included in the 5-year reports submitted to NOAA and USFWS	Available
Review Ecology's PARIS Database	PARIS database includes information on potential NPDES water quality violations for Lewisville and Daybreak Pits	Available
Review/Monitor DNR Reclamation Plan Progress	Number of acres reclaimed in the floodplain and category of scheduled reclamation on aggregate mining in the EFLR floodplain	Available
Review Gold & Fish Pamphlet HPA	- Number and location of activity and type of equipment permitted - Number of permittees and prospecting days (WDFW) - Number and location of permits granted in Tier 1 and Tier 2 reaches - Location and types of WDFW compliance and enforcement actions	Not available at this time
Monitor Individual Mineral Prospecting HPAs	- Number and location of activity and type of equipment permitted - Number of permittees and prospecting days (WDFW) - Number and location of permits granted in Tier 1 and Tier 2 reaches - Location and types of WDFW compliance and enforcement actions	Not available at this time
Identify % of priority subwatersheds with aggregate mining potential	Percentage of each Group A subwatershed, critical areas, and designated shorelines in the EFLR that intersects with identified, hypothetical, and speculative aggregate mining potential from DNR's dataset	Available

Agriculture and Grazing

Land use and land cover data suggest that agriculture lands are in general converting to more intensive land uses (e.g., residential and industrial). At the same time, a recent study by Ecology identifies some agriculture activities as a source of fecal coliform in tributaries of the EFLR. Long-term ambient monitoring data from an Ecology study show that fecal coliform bacteria concentrations have increased between 2005 and 2016 with the highest concentrations in McCormick and Brezee Creeks (Ecology 2018). A primary recommendation from the study identified the implementation of best management practices to reduce fecal coliform loading from agricultural lands at Rock Creek North, Mason Creek, and McCormick Creek (Ecology 2018). Figure 28 depicts Washington State Department of Agriculture (WSDA)-mapped crop lands in relation to McCormick, Brezee, Mason, and North Rock Creek.

Segments of the river with the highest shade deficit occur between RM 9-13. Within this stretch, agricultural lands abut the mainstem EFLR with minimal to no riparian buffer for approximately 3,230 cumulative feet (Figures 29 and 30). In balance, the trend in the EFLR watershed of permanent conversion of agricultural lands to residential, commercial, and industrial uses is continuing. In general, conversions from agriculture to these types of land use increases impervious surface, can increase winter high flows, decrease low summer flows, and may also influence riparian habitat quality and quantity. The conversion from agriculture to developed uses is most apparent in the urban growth areas of Ridgefield and La Center along the I-5 Corridor.

Urban growth area expansion and land conversions are partly a function of a city's capacity to accommodate projected population and job growth estimates. Clark County selects from the State's low, medium, or high population projections, and assesses the city's capacity accordingly. If the high population estimate is selected, there is greater flexibility for city expansion and up-zoning (Orjiako 2018).

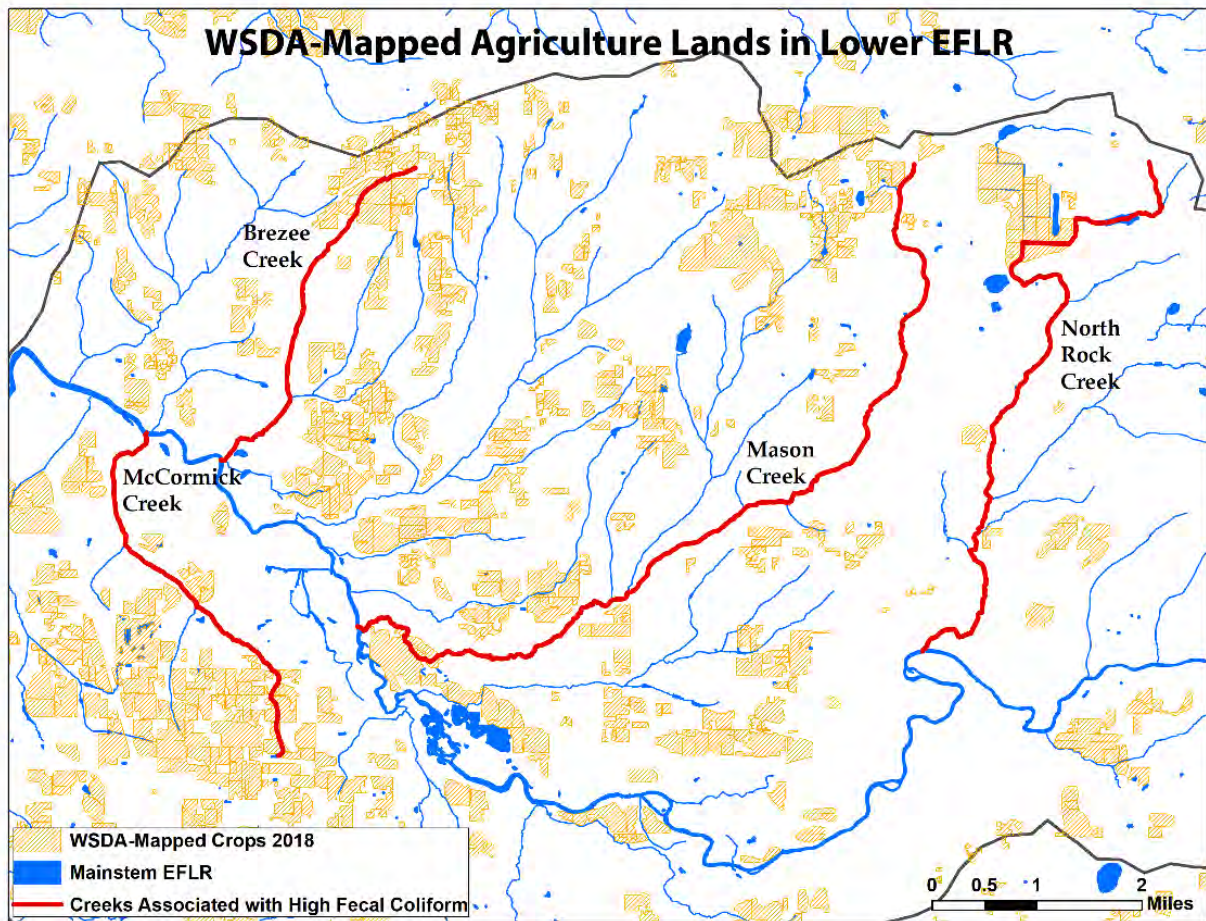


Figure 28. Washington State Department of Agriculture (WSDA)-mapped crop lands (hashed orange) in relation to McCormick, Brezee, Mason, and North Rock Creeks (shown in red) in the lower EFLR. Mainstem and tributaries of the EFLR are shown in blue.

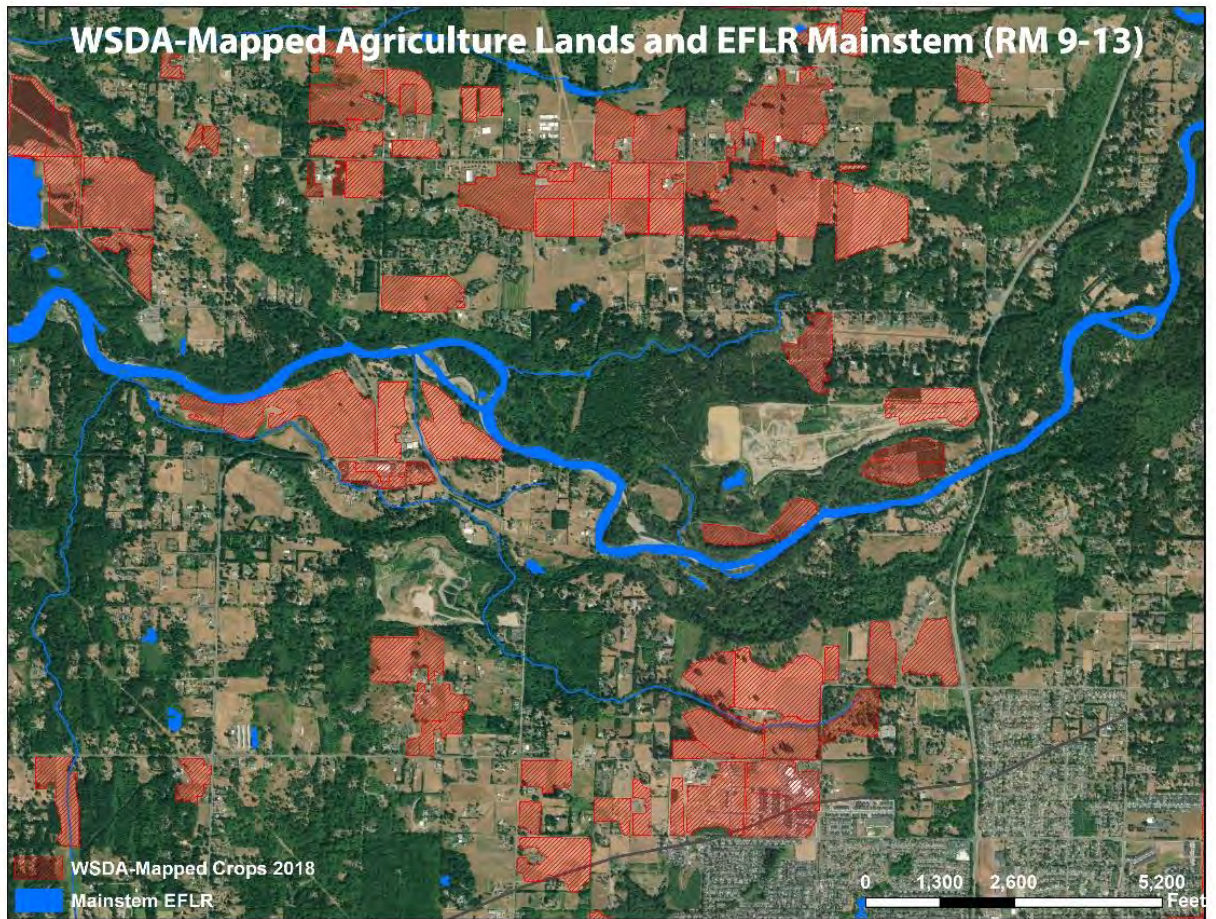


Figure 29. Aerial image of EFLR RM 9-13 with WSDA-mapped crop lands in hashed orange and mainstem and tributaries in blue.



Figure 30. Photo of agricultural land adjacent to EFLR mainstem. Image taken in 2019.

Table 49 identifies possible metrics that could help LCFRB and partner programs characterize and manage threats resulting from agriculture and grazing in the future.

Table 49 Agriculture and Grazing - Example Metrics to Inform Threat Status		
Activity	Example	Data Status
Monitor % Change in Agriculture zoning	There was a 9% reduction in agriculture-zoned lands between 2004 and 2018 in the EFLR watershed (1,512-acre reduction)	Available
Identify location of agriculture conversion to more intensive land uses	The majority of losses in agriculture-zoned lands occurred in La Center, Ridgefield, and Battleground urban growth areas	Available
Monitor intensity of agriculture activity	- Percent of the EFLR with agriculture activities (WSDA crops database) - Amount and location of agricultural overlap with critical areas and shorelines	Available

	• Number, location, and volume of transfers of historical agricultural water rights to other sectors	
Monitor # of water quality violations in Recovery Plan Tier 1 and Tier 2 reaches	• Number, location, and level of water quality violations under Section 401 CWA • Number, location, and level of violations of State water quality standards • Number, location, and level of violations of County water quality and stormwater ordinance standards	Not available
Identify TMDL actions	• Location, type, and number of water quality and quantity improvement projects • Assess TMDL data in relation with other program data (harvests, permitted activities, building footprints, etc.)	Available

Channel Streambank and Floodplain Alterations

Data and interviews indicate that the status of threats resulting from mainstem and tributary channel manipulations and restoration activities in the EFLR are difficult to assess because available datasets are point coverage,⁶⁷ lack consistent metrics, and are tailored to permit or grant tracking. Historical mainstem channel manipulations that still impact the EFLR include dredging from the City of La Center downstream to the Columbia River confluence to accommodate sternwheeler traffic as early as 1895 and bridges and associated road fills across the EFLR (especially La Center and Daybreak bridges). A few legacy overwater structures also exist under lease agreements with the DNR in the lower mainstem Lewis River.

Modifications to the La Center Bridge in the 1970s and in 2001 included floodplain infilling to redirect the approach road, stabilize the bridge and confine the EFLR flows to the channel (LCEP 2019). This action contributed to floodplain disconnection and is hypothesized to alter sediment dynamics in the broad tidally-influenced floodplain (LCEP 2019). A recent photo of the La Center bridge is shown in Figure 31. At least nine additional bridges bisect the EFLR mainstem, including I-5, Daybreak, Dole Valley, and SR 503.

Instream regulatory protection programs such as the ESA, Magnuson-Stevens Fishery Conservation and Management Act, USACE's Section 404 and the RHA Section 10 authorities, WDFW's HPA programs, Shoreline Master Programs, and local CAOs are called upon by the Recovery Plan to protect instream habitat in both mainstem channel areas and regulated tributaries. Tributary threats are generally not regulated by DNR aquatic leases or RHA Section 10 requirements, leaving WDFW's HPAs, Clark County CAO, Section 404, and Shoreline programs (in some cases), and any ESA Section 7 or Section 10 authorizations to manage these threats. DNR also regulates mainstem and tributary crossings on state and private forest lands through forest practices regulations.

WDFW HPA descriptions (using post-2014 data) include permits issued for habitat restoration, road and bridge improvements, bank protection, and utility crossings. HPA data prior to 2014 is less descriptive, but consist of water crossings, channel modifications (e.g., dredging and mineral prospecting), and shoreline hardening (WDFW 2018). According to WDFW, most HPAs in the EFLR consist of road and culvert improvements in the resource lands, residential culverts, and residential bank stabilization activities (Howe 2019).

Channel streambank and floodplain restoration has been occurring in the lower reaches of the EFLR, including downstream of Daybreak Park, by organizations such as Fish First, LCEP, Columbia Land Trust, Clark County, the Lower Columbia Regional Fisheries Enhancement Group, and Clark Public Utilities. These entities have been removing remnant levees to improve connectivity between the EFLR and its floodplain, adding large woody material, constructing spawning channels, correcting fish passage barriers, and re-establishing riparian habitats.

⁶⁷ HPA data prior to 2014 were represented only by township, section, and range.



Figure 31. Photograph of the La Center bridge crossing the East Fork Lewis River, oriented south. Image taken in 2019.

Table 50 identifies possible metrics that could help LCFRB and partner programs characterize and manage threats resulting from channel manipulations in the future.

Table 50 Channel Manipulation - Example Metrics and Information Sources to Assess Threat Status		
Activity	Example	Data Status
Monitor and document CWA Section 404 and RHA Section 10 permits	• Data describing project and mitigation type, location (GIS polygons), and acres impacted.	Not readily available
Monitor and document WDFW HPA	• Data describing project and mitigation type, location (GIS polygons), and acres impacted.	Not readily available
Monitor DNR Agreements	• Data describing project and mitigation type and location (GIS polygons).	Not readily available

Monitor and document NOAA ESA Consultations and Actions	• ESA consultation and permit requirements, recommendations, terms and conditions, compliance reports, and enforcement actions. • Data describing project and mitigation, location (GIS polygons), and acres impacted.	Available
Monitor status of EFH recommendations	• EFH consultation recommendations, requirements to justify if not carrying out recommendations, compliance reports, and enforcement actions.	Available

Program Implementation and Threats: Is It Enough?

The relationships between LCFRB and acquisition and restoration partners have resulted in many successes for the EFLR. The preservation of lands along the mainstem between Lewisville Park and La Center is impressive, as well as the lands between Moulton Falls and the Pomeroy Farm. This land base provides additional long-term protection from urban and rural development, forest practices, mining, and channel manipulation threats. It also provides an available land base for greater restoration and enhancement activities. Acquisition and restoration actions between the EFLR confluence with the NF Lewis and Lewisville Park at RM 13 are significant.

It should be noted that much of these protected lands are within the response reach of the EFLR with local conditions affected by upstream and tributary processes. For example, wide-scale urban encroachment fueled by population growth throughout the lower and middle watershed and intensive forest practices in the mid- to upper-watershed can be expected to impact these protected lands. Additionally, the Ridgefield Pits avulsion at approximately RM 7 is expected to impact sediment processes in these protected lands for decades (Johnston 2019). Acquisition programs have targeted the mainstem EFLR, but little habitat has been protected in tributaries. This leaves much of the responsibility for maintaining habitat capacity and productivity to regulatory programs in order to maintain the environmental baseline. Emerging efforts by CLT targeting acquisition and protection of lands that are facing likely conversion of existing forest habitats to other more intensive land uses may provide some offset to this economic pressure (Roix 2019).

Also, due to a lack of implementation of a comprehensive habitat status and trends monitoring program, it is unclear how much of a counterbalance these actions are providing to the threats in EFLR. That is, it is unclear whether the environmental baseline is improving as a result of these actions or if these efforts are only slowing the pace of an eroding baseline due to development, mining, forest practices, channel manipulations and other threats. It is also unclear how the location and type of restoration actions fit into a cohesive strategy to address these threats. Table 51 highlights the current status of metrics that are available to characterize acquisition and restoration activities in the EFLR.

Table 51 Acquisition and Restoration Example Metrics		
Activity	Example	Data Status
Collect restoration and conservation project metrics by focal area (upland, riparian, and stream channel habitat)	• 309 miles of stream and/or shoreline treated or protected, 195 miles of stream habitat made accessible, 533 acres of estuarine habitat, and 95 acres of riparian habitat treated for restoration benefits • Approximately 2,993 acres of habitat are conserved in the watershed	Available
Map restoration and conservation project areas	• Polygons of as-built designs for completed projects demonstrate overlap with restoration and conservation locations and relationship to other activities (e.g., development, salmon distribution, restoration site relationships to conservation areas, etc.)	Not Available
Calculate % of watershed treated and conserved	• Approximately 27% of stream miles were treated for restoration benefits. • Approximately 2% of the watershed acreage is treated for some type of restoration and conservation benefits	Available

A fundamental take-home message about threats to salmon and steelhead recovery resulting from this pilot study is that few data are targeted directly to understanding the status of threats and no established process exists to synthesize the trajectory of threat impacts, individually and collectively. At the most basic level, this pilot study demonstrates that some programs are functioning to minimize the underlying causes of threats while other programs are working to repair salmon and steelhead habitats from the impacts of legacy threats. Unfortunately, existing monitoring data and information for most programs is insufficient to determine whether threats are being adequately addressed in the context of Recovery Plan expectations for partner programs or in the context of NOAA delisting considerations.

Threats in the EFLR are not unique among the 11 subbasins comprising LCFRB's planning area, but the EFLR may currently be the most impacted subbasin from those threats. Chapter L of the Recovery Plan indicates five primary threats for the EFLR: urban and rural development, forest practices, mining activities, agriculture, and channel manipulation. Underlying each of these threats is human population growth that results in land development and conversion, and the need for raw materials (e.g., wood and gravel) to build homes, businesses, and other societal needs. Interviews and data suggest that regulatory programs are reducing habitat impacts by avoiding and minimizing threats through best management practices and mitigating threats when no other reasonable solution is available. However, the scale and magnitude of these threats across the EFLR watershed, and the absence of data to adequately assess the current status of EFLR threats, do not support an "improving" or even a "holding the line" trajectory for habitat-forming processes and habitat conditions. The remaining three threats (water withdrawals; dams, culverts, and other barriers; and recreation) will continue to be an issue, but generally appear to be under control through implementation of existing programs, several of which were specifically structured and updated to address ESA and recovery needs as described in Chapter 2.

Chapter 4. Data Sufficiency, Recovery Plan Expectations, and Implications Beyond the EFLR

The Recovery Plan identifies a suite of measures, actions, and strategies that were developed to reduce threats to salmon and steelhead, across all categories of impact. Together, these measures, actions, and strategies established a roadmap for Recovery Plan implementation. Evident in this road map are clear expectations that habitat-related policies and programs would be updated to better reflect salmon and steelhead recovery needs. However, there was still considerable uncertainty about the sufficiency of program implementation to reverse historical and contemporary threats to habitat. Confounding the issue of program-sufficiency during Recovery Plan development was the lack of data to illustrate program impacts at a watershed-scale (i.e. geospatial data illustrating permitted activity footprints and impacts to fish habitat). Given these uncertainties, it was recognized that a comprehensive monitoring effort and assessment were essential for evaluating recovery progress over time, gauging the sufficiency of programs, and supporting adaptive management.

Data Sufficiency

Twenty-four implementation and monitoring actions were identified in the Recovery Plan (*Chapter 10 – Implementation*) to help LCFRB adaptively manage implementation and measure functional improvements to both habitat and biological status and trends. The LCFRB's Research, Monitoring & Evaluation Program for Lower Columbia Salmon and Steelhead (LCFRB, 2010), details the full spectrum of data, information and approaches for monitoring recovery progress, within the context of the Recovery Plan's adaptive management process. Monitoring approaches include biological status and trends, habitat status and trends, implementation/compliance, action effectiveness, and uncertainty and validation research. Results of these monitoring activities would help clarify the trajectory of threats, demonstrate the effectiveness of programs at minimizing impacts of human activities, and show how salmon and steelhead are responding to protection and restoration activities in the EFLR and other watersheds. LCFRB is currently finalizing an evaluation of biological status relative to recovery abundance targets; however, they lack the funding for implementation of their comprehensive habitat status and trends monitoring framework. As a result, data to draw connections between human activities, the programs that regulate or oversee the activities, and impacts to fish habitat are largely lacking, or piecemeal. This is a common challenge across all recovery regions in the state. When key elements of a comprehensive monitoring program are missing, the foundation for adaptively managing a recovery plan is compromised.

In addition to a lack of habitat status and trends monitoring, most recovery partner programs are not generating data that inform the current status of threats and impacts to EFLR habitat. Regulatory programs are capturing permit information at the individual application scale with little effort to evaluate site effects and no effort to evaluate cumulative effects at the watershed scale. Similarly, restoration and acquisition programs capture information through grant application processes that typically report on metrics such as miles or acres restored. Both regulatory and restoration programs

almost exclusively utilize GIS point coverage to inventory projects, rather than GIS polygon layers that more adeptly convey the individual and cumulative impacts of projects on watershed processes. Notable exceptions include DNR State Forest HCP and Clark County Community Planning programs, which while missing some key data elements, both maintain valuable GIS polygon data sets.

Where good program GIS data exist, (e.g., project or mitigation footprints, or geographical extent of environmental protections), spatial analysis can help inform habitat threat trends. Underlying the GIS layers, comprehensive and consistent attribute tables are needed, with summary information explaining the project intent (regulatory or restoration) and impacts to fish habitat (e.g., a bank stabilization project could include a polygon delineating the action footprint, attributed with metrics such as project type, description, date, etc.). Most program databases examined in this report attempted to capture useful data, but were inconsistent in level of detail and/or completeness. Given the state of data observed in programs functioning in the EFLR watershed during this pilot study, there is little evidence to say that impacts resulting from threats are increasing or decreasing as they relate to salmon and steelhead.

The following points provide a high-level summary of what was learned about monitoring efforts, data acquisition, and data synthesis, associated with partner programs:

1. Salmon recovery reporting on habitat acquisition and restoration focuses nearly exclusively on number of acres/miles acquired or restored. Comprehensive reporting on watershed health is absent, as are metrics to evaluate the trajectory of threats. The Governor's Salmon Recovery Office's (GSRO) *State of the Salmon Report* comprehensively describes restoration and acquisition actions, but provides few watershed-scale metrics to evaluate threat reduction status over time;
2. Regulatory Programs that gauge effectiveness at achieving the purpose and intent of the program (e.g., protection of shorelines, critical areas, watershed processes, etc.) are lacking, and where present, reporting and data dissemination are absent;
3. Key information about regulated activities in critical areas and shoreline protections (e.g., variances and conditional use permits) is not available for analysis;
4. Programs track elements of implementation, such as numbers and types of permits, and general location of authorized activities; however, databases are designed to manage permit or grant processes, and not to assess cumulative impacts on watershed processes and habitat conditions;
5. Human activities that pose threats to fish habitat (i.e., development, resource extraction, and forestry) can overlap both spatially and temporally and trigger cumulative impacts. However, these activities are tracked independently, and often insufficiently, by individual programs. With the exception of stormwater NPDES permits, implementation of a habitat status and trends monitoring program has not occurred, primarily due to budget constraints, and yet is critically important for independently evaluating the cumulative effect of programs (positive and negative) on watershed processes and habitat conditions;

6. For many programs, existing data at the project scale could be digitized into GIS polygons with informative attributes to provide useful information for estimating threat trajectories and cumulative impacts; however, converting data would be labor intensive and may not be useful because of inconsistent data recording. An underlying issue, aside from geospatial database architecture, is sufficient staff time and training to accurately capture data; and
7. Several of the recovery plan partners required public disclosure or FOIA requests to acquire data sets at no-charge, while others required a substantial cost reimbursement. While this is a common and accepted practice in general, it is yet another sign that relationships between partners for purposes of implementing the Recovery Plan are immature or absent.

Recovery Plan Implementation and Expectations

At the time the Recovery Plan was developed, the expectation was that existing local, state, and federal programs would be relied upon and or updated to better reflect salmon and steelhead recovery needs, and that associated policies and implementation approaches would be strengthened as needed. Although the Recovery Plan identified key programs critical to recovery, implementation expectations for partner programs were poorly defined. During the development of the Recovery Plan, precedence was initially given to understanding the status of listed fish species, limiting factors, threats, and actions. Details regarding program implementation of actions came later in the planning process, and new programs such as DNR's Forest and Fish HCPs were emerging while the Recovery Plan was being developed. Since adoption of the Recovery Plan, the level to which key programs have been updated per expectations has not been critically evaluated.

The Recovery Plan included an Appendix (Volume 3, Appendix C) describing each program and outlining significance to recovery, and also included brief descriptions of program sufficiency and gaps in each subbasin chapter. However, at a fundamental level, the Recovery Plan lacks clear implementation expectations between actions and Recovery Plan implementation partners. The LCFRB intended to clarify Recovery Plan expectations after the Plan was completed by developing "Six-Year Implementation Work Schedules" detailing implementation and partner commitments and schedules. While LCFRB was successful in garnering local support to approve the Recovery Plan, it was less successful at generating support to secure commitments to specific actions and schedules or to meet specific benchmarks. This is partially due to a lack of LCFRB resources to engage in partner programs, and the challenge of motivating partners to extend beyond their statutory mandates. This is not surprising nor is it uncommon – it is relatively easy to support salmon and steelhead recovery conceptually (e.g., Recovery Plan) but much harder to commit to specific actions that may be more stringent than a program's mission. Of the 82 implementation partners identified in the Recovery Plan, only 14 have developed "6-Year Implementation Work Schedules" (Manlow 2020).

Despite this finding, interviews and program data revealed examples where the Recovery Plan was actively being used to help guide land use program implementation. These include local and state habitat restoration and conservation programs (e.g., National Estuary Program, Family Forest Fish Passage Program, Clark County's Lower East Fork Lewis Greenway, and Salmon Recovery Funding Board

(SRFB) Program, etc.), as well as a few regulatory programs (e.g., Clark County Shoreline Management Master Program). These examples highlight the importance of recovery plan outreach and education, and proactive efforts to work individually with implementation partners to better address and incorporate recovery priorities into the programs they administer. Interviews with LCFRB staff as part of this effort reveal that the capacity to do this across the region is currently, and has historically been, lacking.

This study also identified several programs where there is significant overlap between the underlying program mission, statutory responsibility, and Recovery Plan priorities. For example, DNR's HCPs, based on the Forests and Fish law, substantively increased protections for riparian habitat and water quality compared to past practices, and called for removal of fish passage barriers. Endangered Species Act Section 7 consultations also often result in terms and conditions for projects that reduce impacts to salmon and steelhead. However, evidence that partners actively use the Recovery Plan to guide day to day decisions under these programs is generally lacking.

The following points represent findings about Recovery Plan implementation:

1. Recovery Plan expectations of partner programs are general and lack sufficient detail to support evaluation of effectiveness and adequacy in relation to threat reduction targets;
2. Local, state, and federal implementation programs are generally designed to address and meet legislative or legal mandates, and clear and direct connections to Recovery Plan priorities, with few exceptions, are lacking;
3. Habitat Conservation Plans and other ESA-related programs, which the Recovery Plan assumed to be sufficient, provide legal protections for the proponent (e.g., avoid lawsuits or jeopardy). While they establish habitat protection and restoration elements, it is unclear to what level implementation of these elements fully mitigate impacts resulting from their own actions, or positively contribute to restoration or enhancement of habitat function and capacity;
4. LCFRB as a regional recovery organization lacks capacity to proactively engage with partners to improve integration of Recovery Plan priorities into their various programs. This evaluation revealed that where LCFRB engagement has occurred, some success was achieved. A notable example is incorporation of Recovery Plan reach priorities into Clark County's previous (pre-2015) Shoreline Master Program update;
5. The overarching assumption that existing implementation under partner program authorities will achieve ESA threat reduction targets of the Recovery Plan may be an underlying weakness of the Recovery Plan (e.g., does existing program implementation add up to reduced threats to the point that salmon and steelhead recover?); and
6. The assumption that partners would fully consider salmon and steelhead recovery needs in updates to land use programs, and rely upon the Recovery Plan for guidance in decision making, is not broadly supported or evident. However, many programs provide direct benefits and protections to ESA-listed species as a result of underlying statutory requirements that at least partially overlap with recovery needs.

EFLR and Beyond: Flowing Through the I-5 Corridor

This study is a step forward in clarifying and reconciling Recovery Plan expectations with on-the-ground program implementation. In general, LCFRB has been successful building and maintaining relationships with acquisition and restoration partners. Investments made by federal, state, and local entities as well as non-government organizations to implement habitat acquisition and restoration projects in the EFLR are impressive. LCFRB's relationships with other partner programs are weaker, and this study found few regulatory programs with direct alignment to the Recovery Plan. Recovery Plan expectations, in the form of actions, measures, and submeasures, are challenging to evaluate given their qualitative nature and the absence of synthesized program data to draw upon, especially for regulatory programs. Interview discussions indicated that weak relationships with regulatory programs are a result of the voluntary nature of Recovery Plan implementation, as well as a lack of resources for LCFRB to effectively engage in policy development and oversight processes. Finally, the interview and data collection processes underpinning this report suggest a near absence of compliance and enforcement of regulatory program requirements across all partners.

The EFLR is an ideal test case for assessing program implementation because of the high rate of development, resource extraction, and forestry activities occurring. These three interrelated factors represent major stressors to the watershed. At the same time, Recovery Plan expectations are very high in terms of the level of improvement needed to recover the five ESA-listed salmonid populations (e.g., >500 percent productivity improvement needed for Summer Steelhead and Coho). The "habitat" bottom line for EFLR threatened salmon and steelhead populations boils down to the following questions:

- How well are regulatory programs able to keep the baseline from eroding under development growth and resource extraction pressures?
- To what degree can restoration and acquisition programs reverse the impacts of historical threats while addressing impacts of threats that regulatory programs cannot fully protect against? and
- How well can Recovery Plan expectations be articulated and integrated with program implementation using meaningful data sets to inform new strategies and priorities?

The EFLR's story is not unique among the lower Columbia watersheds. The Office of Financial Management's Forecasting and Research Division (OFM 2019) estimates that the human population in the EFLR watershed grew from an estimated 24,159 residents in 2000 to 35,593 residents in 2018, representing a growth of approximately 47 percent. OFM predicts that Washington State's population will increase from its current level at approximately 7.5 million to approximately 9.4 million by 2040, or by 25 percent. Most of the expected growth over the next 20 years would come from counties straddling I-5⁶⁸ (OFM 2019). Over the past three decades, the percent of Washington's population

⁶⁸ 78 percent of the population growth in Washington State between 2000 and 2010 came from counties straddling I-5.

growth occurring along I-5 counties⁶⁹ increased from 70 percent in the 1990s to 78 percent in the last decade (OFM 2019). In the lower Columbia, threats resulting from population growth (e.g., urban and rural development, forest practices, mining, and channel manipulation) will exert similar pressures on habitat-forming processes and habitat conditions in systems such as the NF Lewis, Kalama, and Cowlitz watersheds. Statewide, watersheds intersected by the I-5 corridor should expect habitat and habitat-forming processes to be further impacted by urban and rural development among other threats. Given the implications of rapid population growth and its commensurate threats, a clear alignment between the Recovery Plan and implementation partners is imperative if listed salmon and steelhead are to be recovered.

⁶⁹ Clark, Cowlitz, Thurston, Pierce, King, Snohomish, Skagit, and Whatcom Counties.

References

- Anderson, B. 2018. Washington Department of Ecology. Phone conversation. December 11, 2018.
- Andrade, C. 2018. Washington Department of Commerce. In-person interview. December 4, 2018.
- Bernath, S. 2018. Washington Department of Natural Resources Forest Practices Review Board. In-person interview. November 4, 2018.
- Bjerke, B. 2019. Parks Manager, Clark County (former). Phone conversation. July 9, 2019.
- Boening, D. 2018. Clark County Environmental Department. In-person interview. October 10, 2018.
- Booth, D., Hartley, D., Jackson, R. 2002. *Forest Cover, Impervious-surface Area, and the Mitigation of Stormwater Impacts*. Journal of the American Water Resources Association. 38:835–845.
- Breckel, J. 2018. Lower Columbia Fish Recovery Board (retired). In-person interview. October 26, 2018.
- Breckel, J. 2020. Email conversation about Recovery Plan program assumptions. January 2, 2020.
- Bromley, J. 2019. Assistant State Geologist. Phone conversation on January 7, 2019.
- Caudill, D. 2018. Outdoor Grants Manager. Washington Recreation and Conservation Office. Phone conversation. October 5, 2018.
- Carlson, M. 2018. Washington Department of Fish and Wildlife Habitat Division. In-person interview. September 4, 2018.
- Chapman, P. 2018. Washington Department of Fish and Wildlife Habitat Division. Phone conversation. September 8, 2018.
- Chapman, S. 2018. Washington Recreation and Conservation Office. Phone conversation. November 14, 2018.
- Clark County. 2014. *Conservation Areas Acquisition Plan*. Legacy Lands Program. March 2014.
- Clark County. 2019. *Habitat Conservation Ordinance (CC 40.440.010)*. Clark County website accessed February 10, 2019.
- Clark County. 2019. *Shoreline Master Plan Program*. CC 40.460. Website accessed on August 12, 2019.
- Clark County. 2019. *Variance Land Use Review*. Accessed via internet on August 13, 2019.
<https://www.clark.wa.gov/sites/default/files/dept/files/community-development/land-use/variance.pdf>
- Clark County Public Works 2019. *Surface Mining Overlay District, Clark County Code Chapter 40.250.022*. Web site accessed on January 5, 2019. <https://www.clark.wa.gov/public-works/quarries-and-mines>
- Chase, N. 2019. Office of Financial Management. Telephone conversation. August 8, 2019.

- Collell, J. 2018. Clark County Noxious Weed Board. Phone conversation. November 16, 2018.
- Collins, B. 1997. *Application of Geomorphology to Planning and Assessment of riverine gravel removal in Washington*. In: *Geology and Geomorphology of Stream Channels – course manual*, University of Washington, Seattle, p IX-1-IX-46.
- Crummett, S. City of Battle Ground Community Development Department. In-person interview. November 7, 2018.
- Davis, B. 2018. Clark County Community Development Department. In-person interview. November 8, 2018.
- Davis, J. 2018. Washington Department of Fish and Wildlife Habitat Division. In-person interview. December 21, 2018.
- Dygert, Bill. 2020. Phone conversation. August 17, 2020.
- Dyrland, R. 2018. Fish First. In-person interview. November 2, 2018.
- East Fork Lewis River Partnership for Clean Water*. Web site accessed on December 28, 2018.
https://www.ezview.wa.gov/site/alias_1962/view_our_committees_east_fork_lewis_river_partnership/37305/east_fork_lewis_river_partnership.aspx
- Ecology. 2019. *Permitting and Reporting Information System*. Website accessed multiple times January 1, 2019 – July 31, 2019. Publication No. 18-03-019. May 2018.
- Ecology. 2018. *Reservation Accounting for WRIAs 27-28 Instream Flow Rules*. Phone conversation, emails, and spreadsheet. December 11, 2018 through January 17, 2019.
- Ecology. 2018. *EFLR Watershed Bacteria and Temperature Source Assessment Report*.
- Ecology. 2019. Email correspondence on May 30, 2019 with Jessica McConnell.
- Environmental Protection Agency. 2005. *Protecting Water Quality from Agricultural Runoff*. EPA 841-F-05-001. March 2005.
- Environmental Protection Agency. 2008. Website access on January 14, 2020.
<https://www.epa.gov/cwa-404/background-about-compensatory-mitigation-requirements-under-cwa-section-404>
- Gallagher, M. 2018. Washington Department of Ecology Water Resources Division. In-person interview. November 28, 2018.
- Gifford Pinchot National Forest. 1995. *Upper East Fork Lewis River Watershed Analysis*. P. 1.
- Gifford Pinchot National Forest. 2002. *Upper East Fork Lewis River Watershed Analysis*. p. 12
- Gifford Pinchot National Forest. 2014. *Proposed Project Areas 2014-2027*.

Gorhan, A. 2018. Natural Resources Conservation Service. Phone conversation. October 15, 2018.

Gorman, T. 2018. Department of Natural Resources Aquatic Lands Division. Phone conversation. November 14, 2018.

Granneman, Jacob. 2020. Clark County Today. *Federal Mine Safety and Health Administration felt earthen dam was a potential hazard*. May, 19 2020.

Hansen, N. 2018. City of La Center Public Works Department. In-person interview. October 22, 2018.

Harmon, C. 2018. Clark County Environmental Department. In-person interview. November 16, 2018.

Hecht, S. 2018. National Marine Fisheries Service Columbia River Regulatory. December 4, 2018.

Hovey, R. 2018. Washington Department of Natural Resources RMAP. In-person interview. September 8, 2018.

Howe, D. 2019. Washington Department of Fish & Wildlife. Phone conversation on August 14, 2019.

Johnston, G. 2018. Interfluve. Phone conversation. November 27, 2018

Johnston, G. 2019. PowerPoint Presentation on June 27, 2019. *East Fork Lewis River – Ridgefield Pits Geomorphology*. 2019.

Johnston, G. 2020. Interfluve. Phone conversation. August 14, 2020.

Kingsbury, L. 2018. Washington Department of Ecology Section 401. In-person interview. September 9, 2018.

Knight, K. 2009. *Land Use Planning for Salmon and Trout*. Washington Department of Fish & Wildlife. Olympia, Washington. 2009.

Kolp, P. 2018. Lower Columbia Estuary Partnership. In-person interview. November 9, 2018.

Kratz, K. 2018. National Marine Fisheries Service Portland. Phone interview. December 4, 2018.

Lebovitz, A. 2018. Washington Department of Natural Resources Aquatic Lands Division. Phone interview. October 15, 2018.

Lee, P. 2018. Clark County Parks Department. In-person interview. August 17, 2018.

Lower Columbia Estuary Partnership. 2019. *La Center Wetlands, Phase II Restoration Project*. Expert Regional Technical Group. 2019.

Lower Columbia Fish Recovery Board. 2010. *Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan*. May 28, 2010.

Lower Columbia Fish Recovery Board. 2006. *Salmon-Washougal and Lewis Watershed Management Plan. Appendix F. Target Flow Examples*. P F3.

Lower Columbia Fish Recovery Board. 2020. *NOAA-NMFS-2019-0097, Lower Columbia Fish Recovery Board Comments on the 5-Year Status Review for Pacific Salmon and Steelhead*. May 2020.

Manlow, S. 2018. Lower Columbia Fish Recovery Board. In-person interview. November 13, 2018.

Manlow, S. 2020. Lower Columbia Fish Recovery Board. Email correspondence. August 10, 2020.

Markle, R. 2018. National Marine Fisheries Service, In-person interview. November 21, 2018.

McCaskill, M. 2018. Washington Department of Commerce. In-person interview. December 4, 2018.

McConnell, J. 2019. Program Manager. Department of Ecology Sand and Gravel Permit Program. Phone conversation on May 30, 2019.

McConnell, J. 2019. Program Manager. Department of Ecology Sand and Gravel Permit Program. Email correspondence May 30, 2019.

Miller, S. A., Gordon, S. N., Eldred, P., Beloin, R. M., Wilcox, S., Raggon, M., Andersen, H., Muldoon, A. 2017. *Northwest Forest Plan—the first 20 years (1994–2013): watershed condition status and trends*. Gen. Tech. Rep. PNW-GTR-932. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 74 p.

Mizar, T. 2018. Washington Department of Natural Resources Forest Practices. In-person interview. October 24, 2018.

Myhr, G. 2018. Washington Department of Transportation Regional Roads. Phone conversation. October 16, 2018.

Multi-Resolution Land Characteristics Consortium. National Land Cover Database 2016. 2019. <https://www.mrlc.gov/data>

National Marine Fisheries Service, US Fish & Wildlife Service 2006. *Endangered Species Act Section 7 Consultation Biological Opinion and Section 10 Statement of Findings and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation: Washington State Forest Practices Habitat Conservation Plan*. June 5, 2006. p. 291. NOAA 2016. *5-Year Review: Lower Columbia River chinook Salmon, Columbia River Chum Salmon, Lower Columbia River Coho Salmon, Lower Columbia River Steelhead*. National Marine Fisheries Service, West Coast Region, Portland, OR. 2016.

Nickolds, M. 2018. Clark County Development Department. In-person interview. November 8, 2018.

Niten, J. 2018. City of Ridgefield Community Development/Planning. In-person interview. November 1, 2018.

Norman, D. K., Cederholm, J. C., Lingley, W. S. *Department of Natural Resources. 1998. Flood Plains, Salmon Habitat, and Sand and Gravel Mining*. September 1998.

NW Fisheries Science Center, NOAA Fisheries. *Lewis River case Study Final Report*. May 2007.

NW Fisheries Science Center, NOAA Fisheries. *Status Review Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Pacific Northwest*. December 21, 2015.

Office of Financial Management. 2019. Population and Demographics. <https://ofm.wa.gov/washington-data-research/population-demographics>

Olson, P. 2019. Phone conversation and email exchange. August 23, 2019.

Oppenheimer, 2020. Phone conversation. Clark County Conservation District. August 25, 2020.

Oregon Department of Fish & Wildlife. 2006. Fish Habitat Assessment in the Oregon Department of Forestry Astoria North Study Area. July 2006.

Orjiako, O. 2018. Clark County Community Planning Department. In-person interview. October 17, 2018.

Pacific Groundwater Group. 2003. *Technical Memorandum 10 (Task 8A), WRIA 27/28 Watershed Plan, East Fork Lewis River Watershed, Groundwater/Surface-Water Relationships*. December 2003.

Pacific Groundwater Group. 2004. *Technical Memorandum No. 12 (Task 6), Hydrologic Modeling of Effects of Land Use Changes, WRIA 27/28, East Fork of the Lewis River and Washougal River*. August 2004.

Pacific Groundwater Group. 2011. *Appendix A Technical Memorandum, Changes in Streamflow Capture Associated with Reduced Pumping from the Pioneer Wellfield – Results of Predictive Model Simulations*. December 8, 2011.

Pacific Watershed Institute. 1998. *Rehabilitation Assessment for the Upper East Fork Lewis River Watershed*. February 9, 1998.

Potter, B. 2019. Parks Superintendent (former). Phone conversation on July 9, 2019.

Quan, J. 2018. National Marine Fisheries Service Regulatory Branch. In-person interview. December 4, 2018.

Quinn, T., Kalinowski, S., Bicknell, R., Olds, C., Schirato, M., Price, D., Byrnes, C., Kloempkin, D., Barnard, R. 2006. *A 2006 Pilot Study of Hydraulic Permit Compliance, Implementation, and Effectiveness in Region 6*. 2006.

Quinn, D. 2018. Clark Public Utilities Water Services Department. In-person interview. October 22, 2018.

Rawding, D. 2019. Washington Department of Fish & Wildlife. In-person discussion on July 31, 2019 and phone discussion on August 9, 2019.

Regional Planning Council of Clark County. 1974. *Shoreline Management Master Program*. August 1974.

Reeves, G. H., Hohler, D. B., Larsen, D. P., Busch, D. E., Kratz, K., Reynolds, K., Stein, K. F., Atzet, T., Hays, P., Tehan, M. 2004. *Effectiveness monitoring for the aquatic and riparian component of the Northwest*

Forest Plan: conceptual framework and options. Gen. Tech. Rep. PNW-GTR-577. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 71 p.

Roix, D. 2018. Columbia Land Trust. In-person interview. October 6, 2018.

Roix, D. 2018. Columbia Land Trust. Email correspondence on December 19, 2019.

Rostorfer, D. 2018. Washington Department of Ecology Water Quality. In-person interview on September 4, 2018.

Rothwell, R. 2018. Washington Department of Ecology Shoreline and Environmental. In-person interview. September 4, 2018.

Salakory, R. 2019. Cowlitz Indian Tribe. Phone conversation. January 7, 2019.

Sale, D, S. Davis and S Wright. 2005. *“Technical Guidance Document for Clearing and Grading in Western Washington.”* Washington State Department of Community, Trade and Economic Development. 2005. Page 2.

Salzer, Tara. 2020. Email exchange regarding DNR Surface Mine Reclamation permitted sites in the EFLR. January 15, 2020.

Schnabel, J. 2018. Clark County Public Works. In-person interview. August 17, 2018.

Sinks, Ian. 2019. Email conversation about monitoring on Columbia Land Trust acquired lands in the EFLR. December 23, 2019.

Skamania County. 2017. *Draft Shoreline Master Program Update*.

Smee, D. 2018. (former) Clark County Conservation District. Phone conversation. August 2, 2018.

Soscia, M. 2018. Environmental Protection Agency. Phone conversation. November 7, 2018.

Storedahl, J.L. *Daybreak Mine Expansion and Habitat Enhancement Project Habitat Conservation Plan*. November, 2003. p. 3-98.

Storedahl, K. 2019. *Daybreak Habitat Conservation Plan (HCP) Annual Report*. November 25, 2019.

Swanson, R. 2018. Clark County Public Works. In-person conversations. July 31, 2018 and October 11, 2018. Email conversations on December 16, 2019.

Sweet, Randy. 2020. Email conversation about Daybreak HCP. January 6, 2020.

Taylor, J. 2018. Clark County Public Works. Phone conversation. September 5, 2018. Email conversation about Regional Road Maintenance Program monitoring requirements. December 23, 2019.

Thom, B. 2018. National Marine Fisheries Service. In-person interview. November 21, 2018.

Tong, K. 2018. US Army Corp of Engineers, Seattle Regulatory Branch. In-person interview. October 24, 2018.

Tracy, R. 2018. US Forest Service Gifford Pinchot National Forest. In-person interview. August 13, 2018.

Trask, Phil. 2020. Email exchange with Jeff Breckel regarding recovery plan assumptions. January 2, 2020.

Tyler, K. 2019. Clark County Weed Manager. Phone conversation. July 17, 2019.

Uhacz, K. 2018. City of Battle Ground Public Works Department. In-person interview. November 7, 2018.

US Congress. 1909. Sixtieth Congress. Session II. Chapter 264. *An Act to Provide for the Repair, Maintenance, and Preservation of Public Works on Rivers and Harbors, and for other Purposes*. March 3, 1909.

US Fish & Wildlife Service. Endangered Species Act | Overview. Accessed website on December 16, 2019. <https://www.fws.gov/endangered/laws-policies/>

US Geological Survey. *National Water Information System: Web Interface*. Web site accessed on January 9, 2019. https://waterdata.usgs.gov/wa/nwis/wys_rpt/?site_no=14222500

Vallette, Y. 2018. Environmental Protection Agency Clean Water Act Enforcement. Phone conversation. November 8, 2018.

Washington Department of Fish & Wildlife. 2019. *Gold and Fish Rules for Mineral Prospecting and Placer Mining Pamphlet*. June 2018.

Washington Department of Fish & Wildlife. 2013. *Recommendations for Wild Steelhead Gene Banks in the Lower Columbia River*. November 25, 2013.

Washington Department of Fish & Wildlife. 2019. Website accessed on August 16, 2019. https://wdfw.wa.gov/sites/default/files/2019-05/08_ots-9992.3_for_fwc_web.pdf

Washington Department of Fish & Wildlife. 2018. HPAs Issued in WRIA 27 2004-2014. Dataset provided in email correspondence with Pat Chapman on October 15, 2018.

Washington Department of Fish & Wildlife. 2018. HPAs Issued in WRIA 27 2014-2018. https://www.govonlineaas.com/WA/WDFW/Public/Client/WA_WDFW/Public/Pages/SubReviewList.aspx

Washington Department of Natural Resources. 2011. *Methodology for Conducting Watershed Analysis Board Manual*. May 2011.

Washington Department of Natural Resources, Forest Practices Program, Forest Practices Division. 2019. *Forest Practices Habitat Conservation Plan Annual Report*. December 5, 2019.

Washington Department of Natural Resources. 2005. *Forest Practices Habitat Conservation Plan, Chapter 4b – Riparian Strategy*. December 2005. pp. 214 – 215.

Washington Department of Natural Resources. 2019. *Aggregate Resources*. Web site accessed on January 2, 2019. <https://www.dnr.wa.gov/programs-and-services/geology/energy-mining-and-minerals/aggregate-resources>.

Washington Department of Natural Resources. 2019. *Clark County Aggregate GIS data*. Email correspondence with Robert Berwick on January 7, 2019.

Washington Department of Transportation. *Regional Road Maintenance Program*. Web site accessed on January 3, 2019. <https://www.wsdot.wa.gov/Maintenance/Roadside/Esa.htm>

Washington Forest Practices Board. 2011. *Standard Methodology for Conducting Watershed Analysis*. Version 5.0. May 2011

Washington State Office of Financial Management. Growth Management Act county projections. 2017 projections. Website accessed on August 11, 2019. <https://ofm.wa.gov/washington-data-research/population-demographics/population-forecasts-and-projections/growth-management-act-county-projections>

West, S. 2018. Lower Columbia Fish Recovery Board. In-person interview. December 4, 2018.

Wilhelm, D. 2019. Department of Natural Resources. Phone conversation on July 23, 2019.

Wisch, E. 2018. Washington Department of Natural Resources Forest Practices. In-person interview. September 8, 2018.

Wittler, J. 2018. Clark Public Utilities Restoration Department. Phone conversation. November 28, 2018.

Woodward, V. 2019. Phone conversation on July 25, 2019.