11 Lewis Subbasin - Lower North Fork Lewis

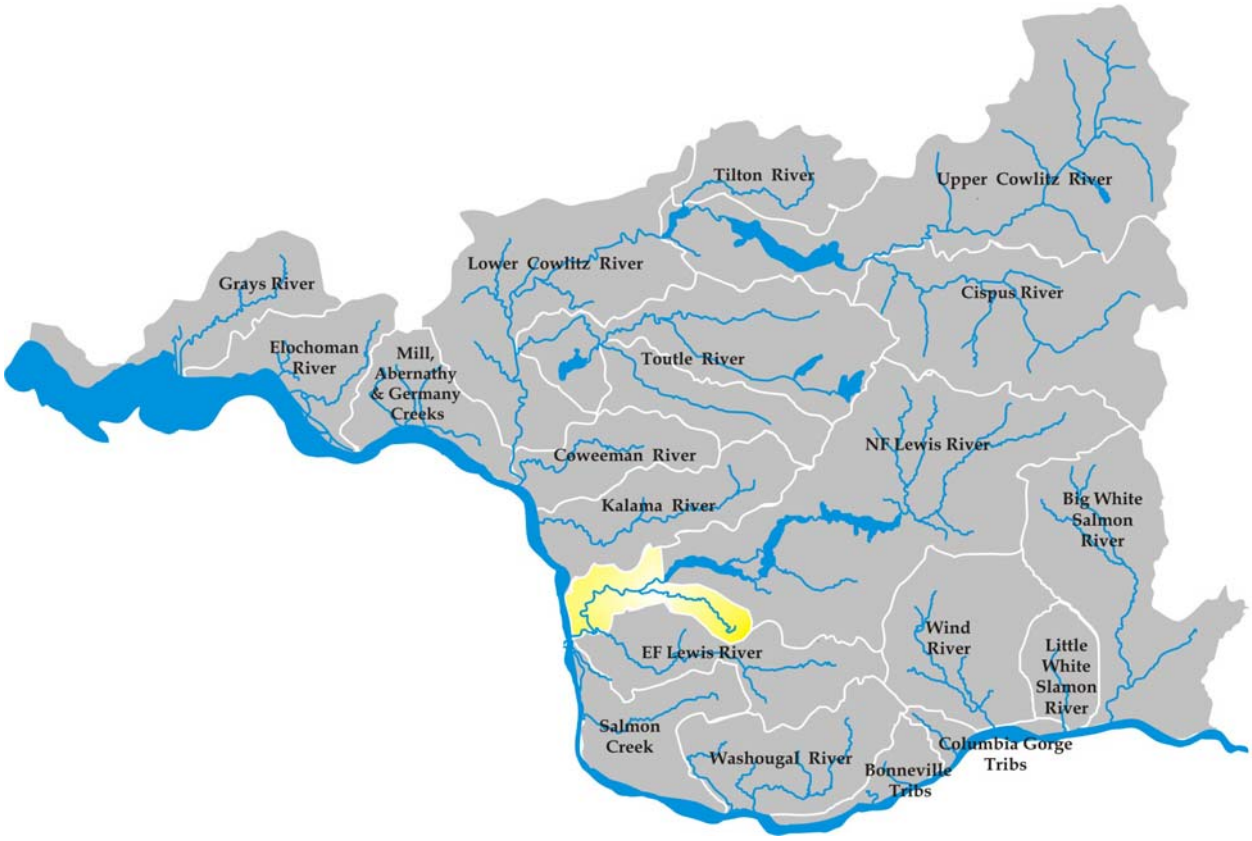


Figure 11-1. Location of the Lower North Fork Lewis River Basin within the Lower Columbia River Basin.

11.1 Basin Overview

The Lower North Fork Lewis Basin comprises approximately 100 square miles in Clark County. The river enters the Columbia at RM 87, between Ridgefield and Woodland, Washington. The principal tributary is Cedar Creek, and the upper end of the subbasin is marked by Merwin Dam. The basin is part of WRIA 27.

The Lower North Fork Lewis Basin will play a key role in the recovery of salmon and steelhead. The basin has historically supported populations of fall and spring Chinook, winter and summer steelhead, chum, and coho. Today, Chinook, steelhead and chum are listed as threatened under the ESA. Coho salmon are a candidate for listing. Other fish species of interest are Pacific Lamprey and coastal cutthroat trout – these species are also expected to benefit from salmon protection and restoration measures.

Lower North Fork Lewis salmon and steelhead are affected by a variety of in-basin and out-of basin factors including stream, Columbia River mainstem, estuary, and ocean habitat conditions; harvest; hatcheries; and ecological relationships with other species. Analysis has demonstrated that recovery cannot be achieved by addressing only one limiting factor. Recovery will require action to reduce or eliminate all manageable factors or threats. The deterioration of habitat conditions in the Columbia River mainstem, estuary, and plume affect all anadromous salmonids within the Columbia Basin. Direct harvest of listed salmon and steelhead is prohibited but sport and commercial fisheries focusing on hatchery fish and other healthy wild populations, primarily in the mainstem Columbia and ocean, incidentally affect ESA-listed lower North Fork Lewis fish. Lewis River, Speelyai, and Merwin hatcheries operate within the basin

with the potential to both adversely affect wild salmon and steelhead populations and to assist in recovery efforts. Key ecological interactions of concern include effects of non-native species; nutrient inputs from salmon carcasses; and predation by species affected by development including Caspian terns, northern pikeminnow, seals, and sea lions. Discussions of out-of-basin factors, strategies, and measures common to all subbasins may be found in Volume I, Chapters 4 and 7. This subbasin chapter focuses on habitat and other factors of concern specific to the Lower North Fork Lewis Subbasin.

The bulk of the land is forested and a large percentage is managed as commercial forest. Agriculture and residential activities are found in valley bottom areas. Recreation uses and residential development have increased in recent years. Stand replacement fires, which burned large portions of the basin between 1902 and 1952, have had lasting effects on basin hydrology, sediment transport, soil conditions, and riparian function. The largest of these was the Yacolt Burn in 1902. Subsequent fires followed in 1927 and 1929.

The Lower North Fork Lewis Basin has experienced intensive watershed development along the mainstem Lewis, Cedar Creek, and the lower reaches of many tributaries. Timber harvests and road building have been widespread in the middle and upper elevation areas, which mostly lie within private commercial timberland.

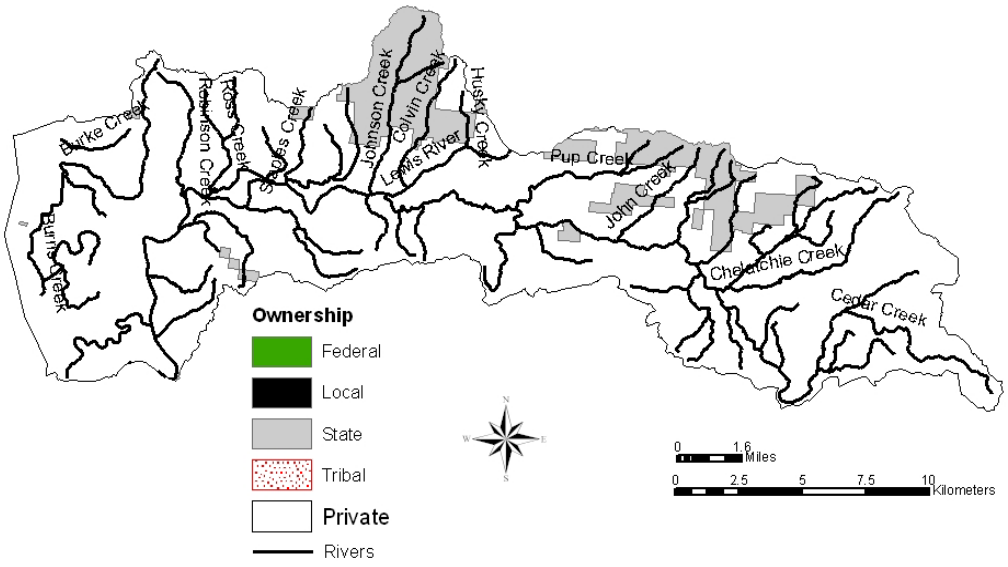
The most important aquatic habitat areas in the basin are upper Cedar Creek, lower Cedar Creek, and the mainstem Lewis between tidal influence and Cedar Creek. Upper Cedar Creek is very important for steelhead spawning and rearing, however, production is severely limited by habitat diversity, flow, and sediment issues that are related to the high degree of timber harvest and road building that occurred in the upper basin during the 1980s and 1990s. Lower Cedar Creek is also important for steelhead, in particular for parr rearing. These reaches are impacted by impaired sediment and flow processes stemming from upper basin logging/road building, but they also suffer from localized riparian impacts from agriculture and grazing.

The mainstem Lewis between tidal influence and the Cedar Creek confluence has lost a significant amount of habitat due to artificial confinement. An estimated 50% of the historical floodplain has been disconnected from the river. Habitat diversity is severely limited in this straightened and simplified channel. Riparian function is impaired due to development within riparian areas. Historical fall Chinook, chum, and coho production has been reduced as a result of habitat degradation in these reaches. Further degradation would pose great risks to the existing low levels of natural production.

The population of the basin is small. The 2000 population of the entire NF Lewis (including the Upper NF Lewis) was approximately 14,300 persons (LCFRB 2001). Small rural communities include Chelatchie and Amboy (Cedar Creek drainage). The largest population center is Woodland, which is situated on the lower mainstem. The population of Woodland is expected to grow by 233% between 2000 and 2020. Population growth will result in conversion of forestry and agricultural land uses to residential uses, with potential impacts to habitat conditions. It is important that growth management policy adequately protect sensitive habitats and the conditions that create and support them.

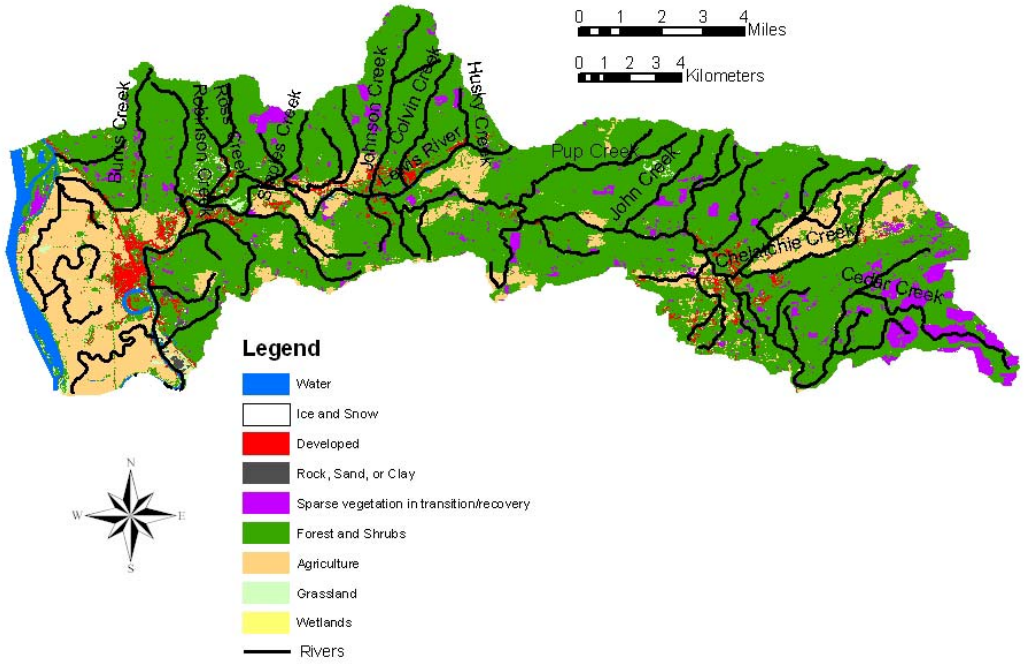
Land Ownership	
Private	84%
State	16%
Federal	0%
Other public	0%

Land Ownership



Vegetation Composition	
Late Seral	0%
Mid Seral	20%
Early Seral	2%
Other Forest	57%
Non Forest	21%

Land Use / Cover



11.2 Species of Interest

Focal salmonid species in the North Lewis River (including the upper Lewis basin) include fall Chinook, spring Chinook, chum (same as EF Lewis population), coho, winter steelhead, and summer steelhead. The current health or viability of the focal populations is very low for all, except low for winter steelhead and medium+ for fall Chinook. Focal populations need to improve to a targeted level that contributes to recovery of the species (see Volume I, Chapter 6). Recovery goals call for restoring Chinook and chum to a high or very high viability level. This level will provide for a 95% or better probability of population survival over 100 years. Winter steelhead and coho recovery goals call for restoring viability to a medium level which would provide for a 75-95% chance of survival over the next 100 years. Summer steelhead viability recovery goals are very low and provide for a less than 40% chance of persistence over the next 100 years.

Other species of interest in the North Fork Lewis include coastal cutthroat trout and Pacific lamprey. Regional objectives for these species are described in Volume I, Chapter 6. Recovery actions targeting focal salmonid species are also expected to provide significant benefits for these other species. Cutthroat will benefit from improvements in stream habitat conditions for salmonids. Lamprey are also expected to benefit from habitat improvements in the estuary, Columbia River mainstem, and lower North Fork Lewis subbasin although specific spawning and rearing habitat requirements of lamprey are not well known.

Table 11-1. Current viability status of lower North Fork Lewis populations and the biological objective status that is necessary to meet the recovery criteria for the Cascade strata and the lower Columbia ESU.

	ESA	Hatchery	Current		Objective	
Species	Status	Component	Viability	Numbers	Viability	Numbers
Fall Chinook	Threatened	No	Med+	3,200-18,000	High+	6,500-16,600
Spring Chinook	Threatened	Yes	Very low	200-1,000	High	NA
Chum	Threatened	No	Very low	<100	High	1,100-71,000
Winter Steelhead	Threatened	Yes	Low	Unknown	Medium	NA
Summer Steelhead	Threatened	Yes	Very low	Unknown	Very low	600-1,200
Coho	Candidate	Yes	Very low	Unknown	Medium	Unknown

Fall Chinook– The historical North Lewis River fall Chinook adult population is estimated from 18,000-20,000 fish. Current natural spawning returns range from 3,200-18,000. The North Lewis fall Chinook population exceeds WDFW's escapement goal in most years and was considered healthy in WDFW's 2002 stock assessment. There is no hatchery fall Chinook program in the North Lewis. Spawning is primarily concentrated in four miles of river immediately downstream of Merwin Dam. Natural spawning occurs later than most other lower Columbia fall Chinook populations, extending from late October through January and peaking in mid-November. Juvenile rearing occurs near and downstream of the spawning area, most notably in the Eagle Island area. Juveniles emerge in early spring and migrate to the Columbia in late spring and summer of their first year.

Spring Chinook– The historical North Lewis River adult population estimate is from 10,000-50,000 fish. Current natural spawning returns range from 200-1,000 and are almost entirely hatchery produced fish. Historical spawning was almost entirely in the upper Lewis Basin which was blocked by Merwin Dam in 1931. Spring Chinook are expected to be reintroduced above the hydrosystem in the near future. The majority of upper Lewis spawning

habitat is above Swift Reservoir in the main North Lewis, the Muddy River, Clearwater Creek, and Clear Creek. Spawning in the lower North Lewis occurs in the first 2 miles below Merwin Dam and in Cedar Creek. Spawning occurs in late August and September. Juveniles rear in the Lewis Basin for a full year before migrating to the Columbia in the spring.

Winter Steelhead– The historical North Lewis River adult population is estimated from 6,000-24,000 fish. Current natural spawning returns are presumed to be very low and are limited to habitat below Merwin Dam. Winter steelhead are expected be reintroduced to habitats upstream of the Lewis River hydrosystem in the near future, where the majority of winter steelhead habitat is available. The preferred stock for reintroduction is late-timed wild winter returning to the North Lewis and trapped at Merwin Dam. Spawning occurs in the lower North Lewis and tributaries below Merwin Dam, most notably in Cedar Creek. The majority of habitat in the upper Lewis is in the main North Lewis and tributaries upstream of Swift Dam. Spawning time is March to early June. Juvenile rearing occurs both downstream and upstream of the spawning areas. Juveniles rear for a full year or more before migrating from the Lewis basin.

Summer Steelhead– The historical North Lewis River adult population is estimated as high as 20,000 fish. Current natural spawning returns are presumed to be very low. Habitat assessments indicate that North Lewis summer steelhead were historically present upstream of Merwin Dam, but in small numbers in tributaries of Merwin Reservoir. Current spawning occurs in the lower North Lewis and tributaries below Merwin Dam, most notably in Cedar Creek. Skamania stock hatchery summer steelhead are released into the North Lewis basin for harvest opportunity. Wild summer steelhead Spawning time is March to early June. Juvenile rearing occurs both downstream and upstream of the spawning areas. Juveniles rear for a full year or more before migrating from the Lewis Basin.

Coho– The historical North Lewis River adult population is estimated from 7,500-85,000 fish. Both early and late stocks were present historically, with early stock primarily spawning in the upper Lewis. Current returns are unknown but assumed be low and limited to the habitat downstream of Merwin Dam. Early coho are expected to be reintroduced to the habitat upstream of the hydrosystem in the near future. Natural spawning currently occurs in tributaries below Merwin Dam including Ross, Johnson, Colvin, NF and SF Chelatchie, and Cedar creeks. A number of hatchery produced fish spawn naturally. Early stock coho spawn from late October into November and late stock spawn from late November to March. Juvenile rearing occurs upstream and downstream of spawning areas. Juveniles rear for a full year in the Lewis Basin before migrating as yearlings in the spring.

Chum– Historical adult populations produced from the Lewis Basin (including the mainstem, North, and East Lewis) are estimated from 120,000-300,000. Current natural spawning is estimated at less than 100 fish. Natural spawning occurs in the lower reaches of the mainstem, North Fork, East Fork, and in Cedar Creek. Adult spawning peaks in December. Chum in the Lewis Basin are all naturally-produced as no hatchery chum are released in the area. Juveniles rear in the lower reaches for a short period in the early spring and quickly migrate to the Columbia.

Bull Trout– There may have been both fluvial and resident bull trout populations in the North Lewis River historically. The current bull trout populations in Swift and Yale reservoirs are isolated because there is no upstream passage at the dams. Genetic samples show significant differences between these populations indicating there may have been biological separation prior to construction of Swift Dam in 1958. Current peak counts of spawners in Cougar Creek range from 0-40 fish, and Swift Reservoir spawning population estimates range from 100-900 fish.

Spawning occurs primarily in Cougar Creek (Yale population), and in Pine and Rush creeks (Swift population).

Coastal Cutthroat– Coastal cutthroat abundance in the North Lewis River has not been quantified but the population is considered depressed. Anadromous cutthroat trout are present in in the North Fork Lewis and tributaries upstream to Merwin Dam, resident forms are present throughout the basin, and adfluvial forms are present in the reservoirs. Anadromous cutthroat enter the North Lewis from July-December and spawn from December to June. Most juveniles rear 2-3 years before migrating from their natal stream.

Pacific lamprey– Information on lamprey abundance is limited. However, based on declining trends measured at Bonneville Dam and Willamette Falls it is assumed that Pacific lamprey have also declined in the Lewis Basin. The UFWS coducted lamprey studies in Cedar Creek in 2000 and 2001. Their data indicates notable lamprey presence, primarily Pacific lamprey, but also western brook lamprey in Cedar Creek. The adult lamprey return from the ocean to spawn in the spring and summer. Juveniles rear in freshwater up to 6 years before migrating to the ocean.

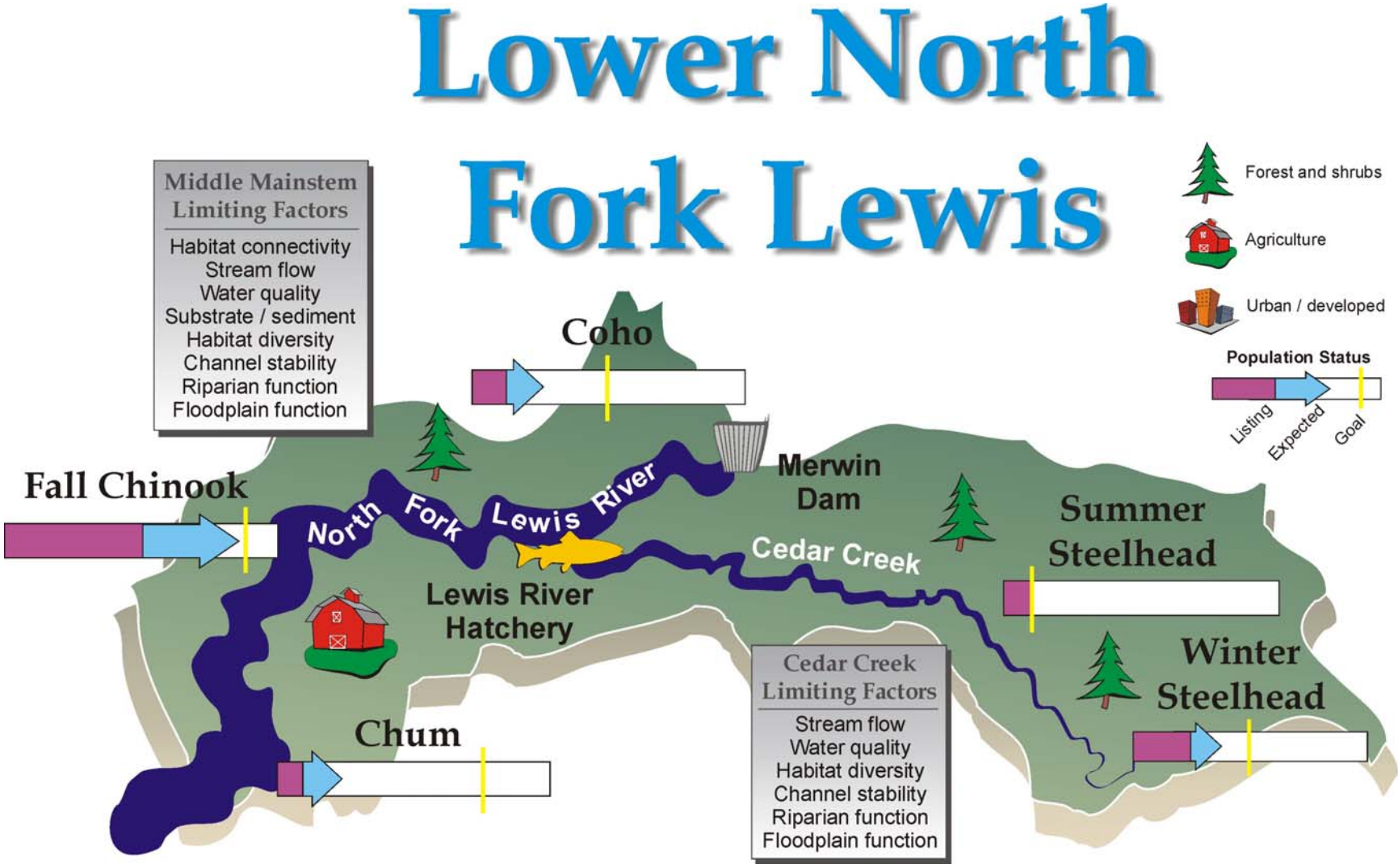


Figure 11-2. Summary of habitat limiting factors, population status, expected population improvement trend with existing programs, and biological objectives depicted for the Lower North Fork Lewis Basin.

11.3 Potentially Manageable Impacts

Stream habitat, estuary/mainstem habitat, harvest, hatchery and predation effects have all contributed to reduced salmonid productivity, numbers, and population viability in the North Fork Lewis Subbasin. The pie charts below represent the relative order of magnitude of quantifiable effects for each of these factors for each focal species. The preferred recovery scenario targets an equivalent reduction in each impact factor in proportion to the magnitude of the effect. Population-specific targets are discussed in further detail in Volume I, Chapter 6.

- Loss of tributary habitat quality and quantity is an important impact for all species, particularly for chum and steelhead. Loss of estuary habitat quality and quantity is also important, particularly for chum.
- Harvest has a large relative impact on fall Chinook and moderate impacts on coho and spring Chinook. Harvest effects on winter and summer steelhead and chum are minimal.
- Hatchery impacts include domestication of natural populations (most applicable to Chinook and coho) and ecological interactions which can impact all species to variable degrees.
- Predation impacts of northern pikeminnow, Caspian terns, and marine mammals in the mainstem and estuary are moderate for winter and summer steelhead, but appear to be less important for coho, chum, and fall Chinook.
- Hydrosystem access and passage impacts are significant for spring Chinook, winter steelhead, and coho.

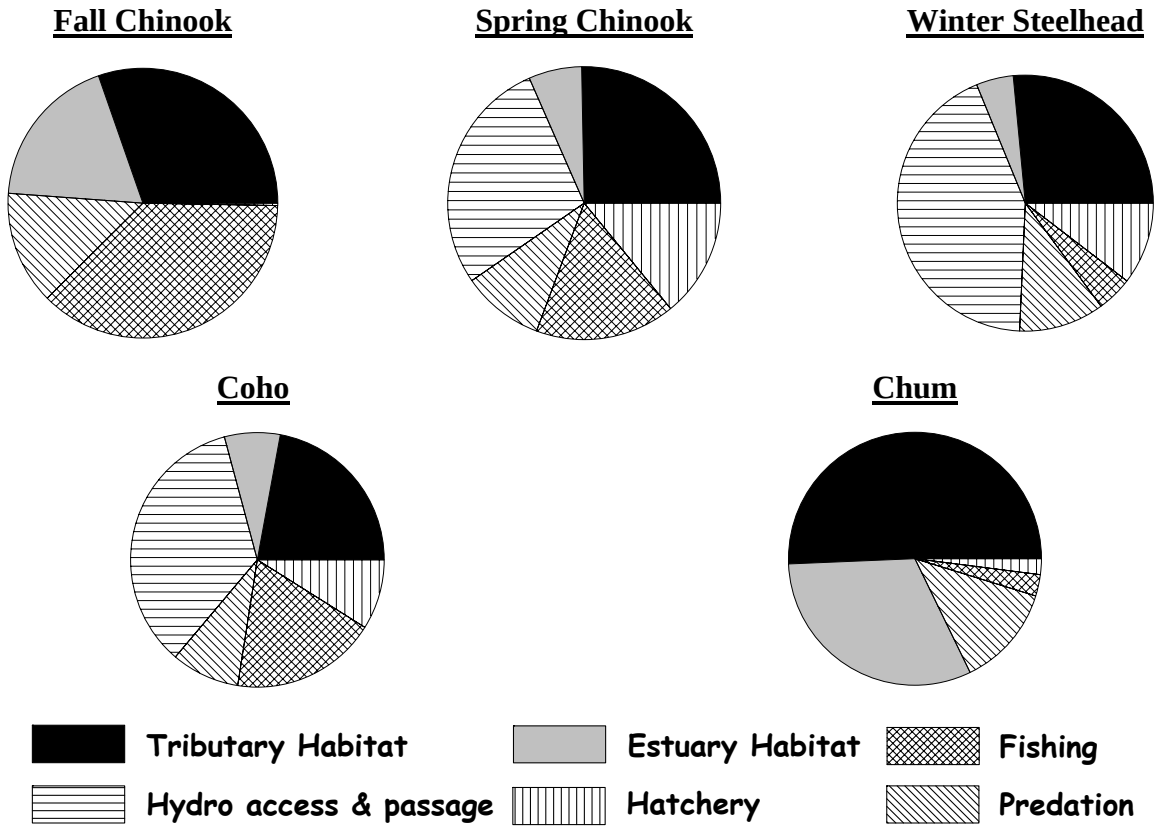


Figure 11-3. Relative contribution of potentially manageable impacts for lower North Fork Lewis populations.

11.4 Limiting Factors, Threats, and Measures

11.4.1 Hydropower Operation and Configuration

The three hydro-electric dams on the Lewis River are considered to be located in the upper Lewis basin. However, lower North Fork Lewis species, in particular fall Chinook, are affected by flow regimes from Lewis River hydro operations which effect spawning and rearing habitat in the lower Lewis. The quantity and quality of fall Chinook habitat in the lower Lewis can be addressed by; maintaining a flow regime, including minimum flow requirements, that enhance the spawning and rearing habitats for natural salmonid populations downstream of the North Lewis hydrosystem. In addition, mainstem Columbia hydro operations and flow regimes affect habitat utilized by lower Lewis species in migration corridors and in the estuary. Key regional strategies applying to the lower North Fork Lewis populations are displayed in the following table.

Table 11-2. Regional hydropower measure from Volume I, Chapter 7 with significant application to North Lewis Subbasin populations.

Measure	Description	Comments
D.M4	Operate the tributary hydrosystems to provide appropriate flows for salmon spawning and rearing habitat in the areas downstream of the hydrosystem.	The quantity and quality of spawning and rearing habitat for salmon, in particular fall Chinook in the North Fork Lewis a, is affected by the water flow discharged at Merwin Dam. The operational plans for the Lewis hydrosystem, in conjunction with fish management plans, should include flow regimes, including minimum flow and ramping rate requirements, which enhance the lower river habitat for fall Chinook.

11.4.2 Harvest

Most harvest of wild North Lewis salmon and steelhead occurs incidental to the harvest of hatchery fish and healthy wild stocks in the Columbia estuary, mainstem, and ocean. This mortality is very low for chum and steelhead, but is more significant for fall Chinook. North Lewis fall and spring Chinook are harvested in ocean and Columbia River commercial and sport fisheries as well as in-basin sport fisheries. Ocean and freshwater harvest of fall Chinook is controlled by a spawning escapement goal of 5,700 adults in the North Lewis River. Wild spring Chinook impacts are limited by Columbia River and Lewis River fishery management provisions to retain fin-marked hatchery fish and release unmarked wild fish. No harvest of chum occurs in ocean fisheries, there is no directed Columbia River or Lewis basin chum fisheries and retention of chum is prohibited in Columbia River and Lewis River sport fisheries. Some chum can be impacted incidental to fisheries directed at coho and winter steelhead. Harvest of North Lewis coho occurs in the ocean commercial and recreational fisheries off the Washington and Oregon coasts and Columbia River as well as recreational fisheries in the Lewis Basin. Wild coho impacts are limited by fishery management provisions to retain marked hatchery fish and release unmarked wild fish. Incidental mortality of steelhead occurs in freshwater commercial fisheries directed at Chinook and coho and freshwater sport fisheries directed at hatchery steelhead and salmon. All recreational fisheries are managed to selectively harvest fin-marked hatchery steelhead and commercial fisheries cannot retain hatchery or wild steelhead.

Measures to address harvest impacts are generally focused at a regional level to cover fishery impacts accrued to lower Columbia salmon as they migrate along the Pacific Coast and

through the mainstem Columbia River. The regional measures cover species from multiple watersheds which share the same migration routes and timing, resulting in similar fishery exposure. Regional strategies and measures for harvest are detailed in Volume I, Chapter 7. A number of regional strategies for harvest involve implementation of measures within specific subbasins. In-basin fishery management is applicable to steelhead and salmon while regional management is more applicable to salmon. Harvest measures that have significant application to the lower North Lewis subbasin are summarized in the following table:

Table 11-3. Regional harvest measures from Volume I, Chapter 7 with significant application to North Lewis Subbasin populations.

Measure	Description	Comments
F.M17	Monitor chum handle rate in winter steelhead and late coho tributary sport fisheries.	State agencies would include chum incidental handle assessments as part of their annual tributary sport fishery sampling plan.
F.M18	Monitor and evaluate commercial and sport impacts to naturally-spawning steelhead in salmon and hatchery steelhead target fisheries.	Includes monitoring of naturally-spawning steelhead encounter rates in fisheries and refinement of long-term catch and release handling mortality estimates. Would include assessment of the current monitoring programs and determine their adequacy in formulating naturally-spawning steelhead incidental mortality estimates.
F.M19	Continue to improve gear and regulations to minimize incidental impacts to naturally-spawning steelhead.	Regulatory agencies should continue to refine gear, handle and release methods, and seasonal options to minimize mortality of naturally-spawning steelhead in commercial and sport fisheries.
F.M24	Maintain selective sport fisheries in ocean, Columbia River, and tributaries and monitor naturally-spawning stock impacts.	Mass marking of lower Columbia River spring Chinook, coho and steelhead has enabled successful ocean and freshwater selective fisheries to be implemented since 1998. Marking programs should be continued and fisheries monitored to provide improved estimates of naturally-spawning salmon and steelhead release mortality.
F.M10	Manage ocean, Columbia River and tributary fisheries to meet the spawning escapement goal for lower Columbia bright fall Chinook.	Ocean and freshwater fisheries wuld continue to be managed to achieve the Lewis River wild fall Chinook escapement goal. The escapement goal would be assessed by WDFW and NOAA fisheries to assure consistency with biological objectives.
F.M30	Develop a harvest plan for wild spring Chinook as populations are reestablished.	Adaptively manage harvest to respond to biological objectives for reintroduced Lewis River spring Chinook as they become reestablished in the upper watershed.

11.4.3 Hatcheries

As noted in the regional strategies, hatcheries can adversely affect wild salmon and steelhead populations in several ways. These include domestication or the reduction in the fitness of wild fish due to interbreeding with hatchery fish, direct competition between wild and hatchery fish for habitat and nutrients, and the introduction of disease. Hatcheries can also assist in recovery efforts by providing fish needed to reestablish extirpated populations or to augment wild populations that have reached critically low levels.

There are three hatcheries operating in the North Lewis Basin. The Lewis River Hatchery (since 1932) produces spring Chinook and coho for harvest as well as a sorting facility for all species trapped at Merwin Dam. The Lewis River Hatchery provides late coho eggs for the

Klickitat coho program and in some years spring Chinook pre-smolts for the Deep River program. The Lewis River Hatchery also provides spring Chinook and coho for the Fish First organization's net pen program. Speelyai Hatchery (since 1958) is located in Merwin Reservoir and is used for incubation and early rearing of spring Chinook, coho, and steelhead. Speelyai Hatchery also produces kokanee and rainbow trout for reservoir recreational fisheries. Merwin Hatchery (since 1983) produces early-timed winter and summer steelhead and rainbow trout. Merwin Hatchery also provides summer steelhead for the Elochoman program. These hatchery facilities and programs will be used in the near future to facilitate the reintroduction of spring Chinook, coho, and winter steelhead to the habitats in the Upper Lewis Basin

The Lewis River Hatchery spring Chinook and late coho programs are primarily derived from Cowlitz stocks, and the early coho program from Toutle stock. The early winter steelhead produced at Merwin Hatchery is a composite Elochoman, Chambers Creek, and Cowlitz steelhead, and the summer steelhead are Skamania stock. The main threats from hatchery released salmon are domestication of wild fish and ecological interactions between hatchery smolts and wild fall Chinook, chum, and coho in the lower river. The main threats from hatchery steelhead are potential domestication of the naturally-produced steelhead as a result of adult interactions or ecological interactions between natural juvenile salmon and hatchery released juvenile steelhead.

Table 11-4. Lewis Basin hatchery production.

Hatchery	Release Location	Spring Chinook	Late Coho	Early Coho	Winter Steelhead	Summer Steelhead	Kokanee	Rainbow
Lewis R.	Lower Lewis	1,050,000	815,000	880,000				
Speelyai	Yale Res.						93,000	
	Swift Res.							400,000
Merwin	Lower Lewis				100,000	175,000		
	Elochoman					35,000		
	Swift Res.							400,000

Regional hatchery strategies and measures are focused on evaluating and reducing biological risks and reducing the risks to natural populations. Artificial production programs within the Lewis facilities will be evaluated in detail through the WDFW Benefit-Risk Assessment Procedure (BRAP) relative to risks to natural populations. The resulting program specific actions will be developed, evaluated, and documented through the Hatchery and Genetic Management Plan for public review and consideration by NOAA Fisheries (details in programs Volume I, Chapter 8). Regional hatchery measures identified in Volume I, Chapter 7 with potential applications at facilities within the Lewis subbasin are summarized in Table 11-5.

Table 11-5. Regional hatchery measures from Volume I, Chapter 7 with potential implementation actions in the Lewis Subbasin.

Measure	Description	Comments
H.M2,5,38	Integrated hatchery and wild program for reintroduced spring Chinook and early coho.	Assures fitness of the natural produced fish which will improve population productivity. Integrated programs would be developed specific to the Lewis populations in the BRAP procedure.
H.M30	Develop a late-timed winter steelhead broodstock to enhance the winter steelhead reintroduction program	Late-timed wild winter steelhead are the preferred stock to reintroduce above the Lewis River dams. The brood stock would be developed from wild winter steelhead entering the Merwin Trap.
H.M15, 22,32, 40	Juvenile release strategies to minimize interactions with naturally spawning fish.	Release strategies are aimed at reducing or avoiding interactions with wild steelhead, fall Chinook, coho, and chum by release timing and release location strategies.
H.M32,34,41	Mark hatchery steelhead, coho, and spring Chinook, with an adipose fin-clip for identification and selective harvest.	Marking hatchery fish allows for identification of hatchery fish in the natural spawning grounds and at collection facilities which enables accurate accounting of wild fish and sorting for the reintroduction program. Marking also enables selective fisheries to retain hatchery fish and release wild fish.
H.M24	Hatchery program utilized for supplementation and enhancement of lower Lewis chum populations.	The Lewis hatchery complex will be used for reintroduction of salmon and steelhead in the upper basin. Enhancement of chum in the lower North Lewis and East Fork Lewis could also be considered.
H.M8	Adaptively manage hatchery programs to further protect and enhance natural populations and improve operational efficiencies.	Appropriate research, monitoring, and evaluation programs along with guidance from regional hatchery evaluations will be utilized to improve the survival and contribution of hatchery fish, reduce impacts to natural fish, and increase benefits to natural fish.
H.M2,6	Evaluate the Lewis Salmon and Trout Hatcheries facility operations.	Both facilities would be evaluated in the BRAP process for potential hazards associated with barriers to fish passage and adequacy of screens.
H.M19, 29, 37	Hatcheries utilized for reintroduction of coho, spring Chinook, and winter steelhead into the upper Cowlitz basin.	Hatchery facilities and operations to accommodate the reintroduction effort; including rearing, collection, transport, marking, sorting, brood stock development, and M&E.

11.4.4 Ecological Interactions

Ecological interactions focus on how salmon and steelhead, other fish species, and wildlife interact with each other and the subbasin ecosystem. Lower North Fork Lewis salmon and steelhead are affected throughout their lifecycle by ecological interactions with non-native species, food web components, and predators. Interactions are similar for lower North Fork Lewis populations to those of most other subbasin salmonid populations. Ecological Interactions are addressed by regional strategies and measures identified in Volume 1.

11.4.5 Habitat – Estuary and Lower Columbia Mainstem

Conditions in the Columbia River mainstem, estuary, and plume affect all anadromous salmonid populations within the Columbia Basin. A variety of human activities in the mainstem

and estuary have decreased both the quantity and quality of habitat used by juvenile salmonids. These include floodplain development; loss of side channel habitat, wetlands and marshes; and alteration of flows due to upstream hydro operations and irrigation withdrawals. Effects are similar for lower North Fork Lewis populations to those of most other subbasin salmonid populations. Effects are likely to be greater for chum and fall Chinook than spring Chinook, steelhead, and coho. Estuary and mainstem effects on North Fork Lewis salmon populations are addressed by regional strategies and measures identified in Volume I and the Columbia Mainstem and Estuary Subbasin sections of Volume II.

11.4.6 Habitat – Subbasin Streams and Watersheds

Decades of human activity have significantly altered watershed processes and reduced both the quality and quantity of habitat needed to sustain viable populations of salmon and steelhead. Although the hydropower system has the greatest negative impact on some lower North Fork populations, stream habitat conditions play a significant role in the health and viability of all salmon and steelhead populations.

Subwatersheds, reaches, and habitat attributes have been prioritized for protection and/or restoration based on the plan's biological objectives, fish distribution, critical life history stages, current habitat conditions, and potential fish population performance. Priority areas for habitat preservation and restoration are identified in Figure 11-4. A summary of the primary habitat limiting factors and threats are presented in Table 11-7. Habitat measures and related information are presented in Table 11-8. Results of IWA watershed process modeling are depicted for subwatersheds in Figure 11-5. Reach- and subwatershed-scale limiting factors generated from the technical assessment are included in Table 11-6. Details on species-specific spatial priorities and limiting factors at the subbasin level may be found in Volume II of the Technical Foundation. A description of the methodology used to generate composite (multi-species) reach and subwatershed priorities can be found in the introduction to this volume of the recovery plan.

The areas with the greatest current or potential contribution to focal salmonid population health and productivity are listed below. Tier 1 and 2 reaches within these priority areas are included in the list. The habitat limiting factors, threats, and measures included in this chapter focus primarily on the priority areas and the Tier 1 and 2 reaches within them. Tier, 3, 4, and non-tiered reaches are considered secondary priority, but in many cases, these lower priority areas will also require restoration and preservation actions in order to achieve recovery objectives. Watershed process measures generally focus on the entire basin as opposed to being limited only to high priority areas because conditions in high priority areas are often influenced by cumulative watershed effects. High priority areas and reaches in the lower NF Lewis Basin include the following:

- Middle mainstem Lewis – Lewis 3-7
- Cedar Creek – Cedar 1a, 1b, 3, & 4.

The following paragraphs provide a brief overview of each of these priority areas, including species most affected, land-use threats, and the general type of measures that will be necessary for recovery. Additional detail can be found in the tables and figures that follow.

While reach level habitat conditions often result from local factors, they are also affected or shaped by systemic watershed processes. Limiting factors such as temperature, high and low

flows, sediment input and large woody debris recruitment are often affected by or result from upstream conditions and degraded watershed processes. Access to key reaches may also be affected by barriers that occur downstream of a reach. Accordingly, restoration of a priority reach may require action outside the targeted reach. The IWA analysis was used to identify potential upstream watershed areas that could influence reach level habitat attributes. EDT was used to allow a relative comparison of reaches and habitat attributes within a reach.

The most critical reaches in the middle mainstem Lewis lie between Ross Creek and Merwin Dam. These reaches are most important for chum, fall Chinook, and coho. Winter steelhead also utilize these reaches. The middle mainstem basin is largely in private land ownership with some areas of state forest land. Hydropower operations, agriculture, and rural development have the greatest impacts. The recovery emphasis is for preservation as well as restoration. Effective recovery measures in the middle mainstem will involve managing regulated flows from the hydropower system, addressing agricultural and rural/suburban development impacts to floodplains and riparian areas, and ensuring that land-use planning effectively protects habitat and watershed processes.

Cedar Creek reaches are most important for winter steelhead, though other species make limited use of these habitats. Lower Cedar Creek (mouth to Pup Creek) (Cedar Creek 1a) and the reach downstream of the Chelatchie Creek confluence (Cedar Creek 3) are the most critical. Forest practices on private commercial timber lands in the upper watershed have impacted sediment supply and hydrologic processes in Cedar Creek reaches. Agriculture and rural residential uses have impacted riparian areas and floodplains. Recovery measures will need to address agricultural impacts along stream corridors and forest practices in the upper basin.

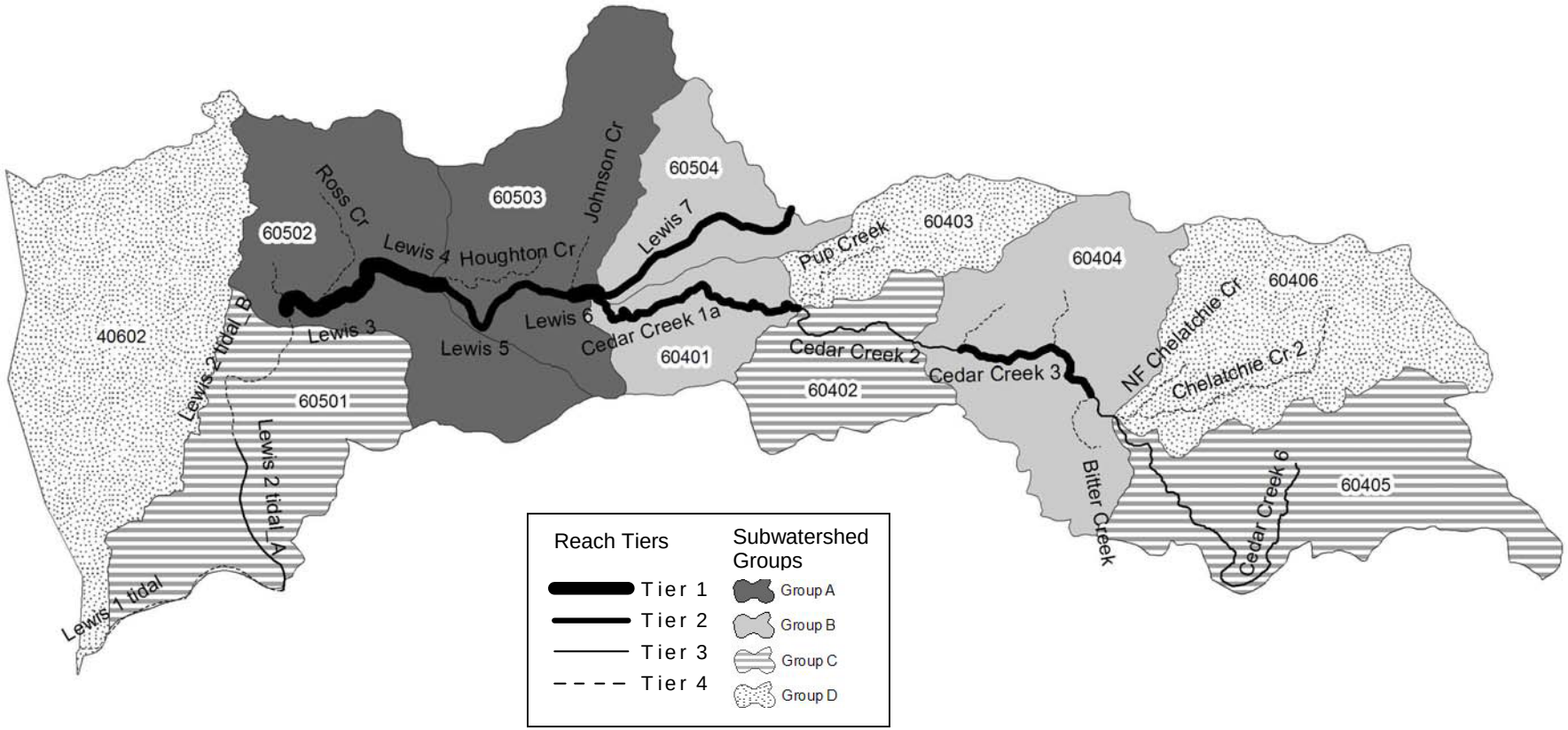


Figure 11-4. Reach tiers and subwatershed groups in the lower NF Lewis Basin. Tier 1 reaches and Group A subwatersheds represent the areas where recovery actions would yield the greatest benefits with respect to species recovery objectives. The subwatershed groups are based on Reach Tiers. Priorities at the reach scale are useful for identifying stream corridor recovery measures. Priorities at the subwatershed scale are useful for identifying watershed process recovery measures. Watershed process recovery measures for stream reaches will need to occur within the surrounding (local) subwatershed as well as in upstream contributing subwatersheds.

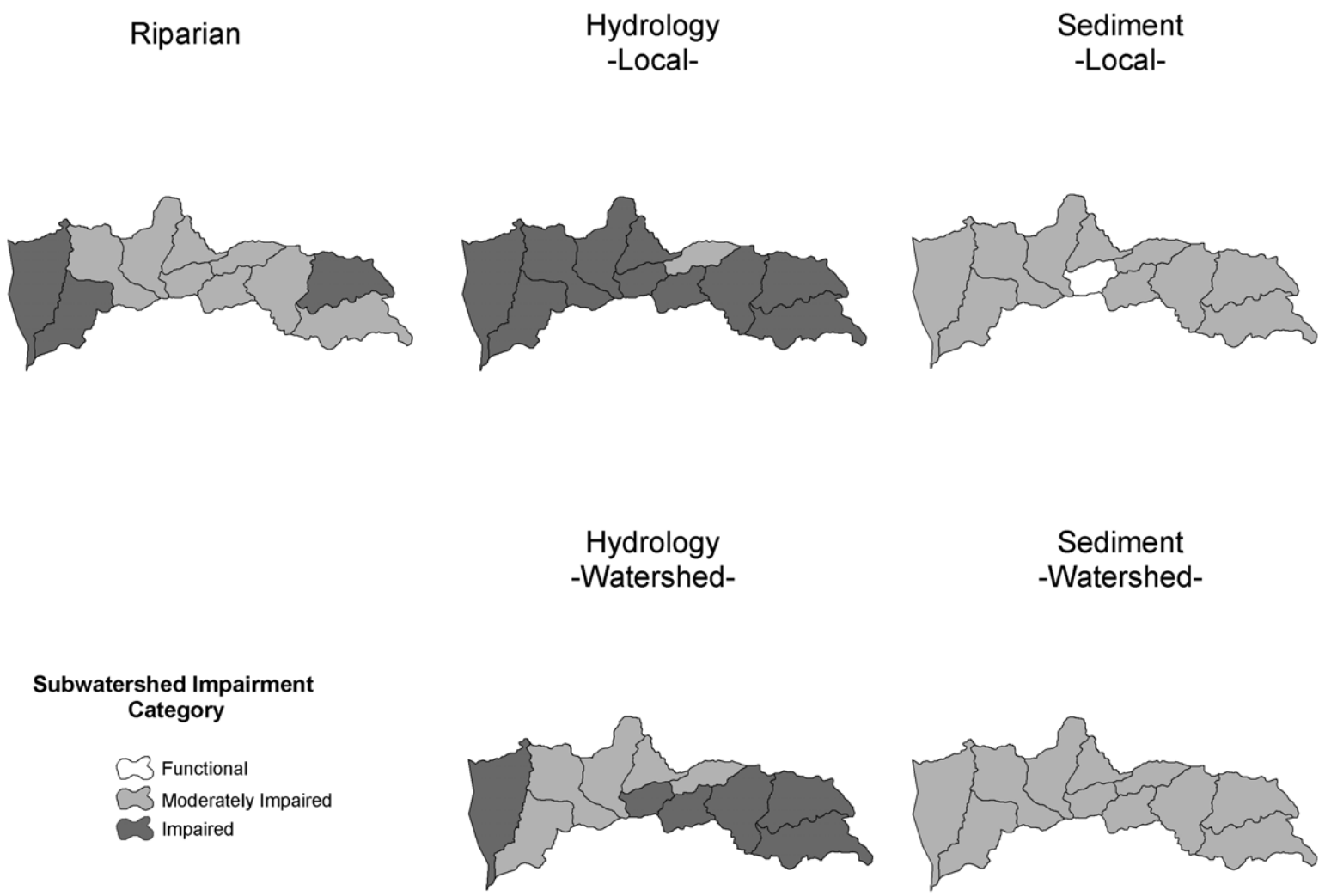


Figure 11-5. IWA subwatershed impairment ratings by category for the lower NF Lewis Basin. Watershed process impairment ratings are based on landscape conditions that influence the hydrologic regime, the sediment regime, and riparian function. See Volume II and Volume V of the Recovery Plan Technical Foundation for additional information.

Table 11-6. Reach- and subwatershed-scale limiting factors in priority areas. The table is organized by subwatershed groups, beginning with the highest priority group. Species-specific reach priorities, critical life stages, high impact habitat factors, and recovery emphasis (P=preservation, R=restoration, PR=restoration and preservation) are included. Watershed process impairments: F=functional, M=moderately impaired, I=impaired. Species abbreviations: ChS=spring Chinook, ChF=fall Chinook, StS=summer steelhead, StW=winter steelhead.

Sub-watershed Group	Sub-watershed	Reaches within subwatershed	Species Present	High priority reaches by species	Critical life stages by species	High impact habitat factors	Preservation or restoration emphasis	Watershed processes (local)			Watershed processes (watershed)	
								Hydrology	Sediment	Riparian	Hydrology	Sediment
A	60503	Cedar Creek 1a Houghton Cr Johnson Cr Lewis 5 Lewis 6	ChF	Lewis 6	Spawning Egg incubation Fry colonization	none	P	I	M	M	M	M
			StW	Cedar Creek 1a	Egg incubation 0-age active rearing 1-age active rearing	temperature	PR					
			Coho	Lewis 5 Lewis 6	Fry colonization 0-age active rearing 1-age active rearing Prespawning holding 0-age inactive Prespawning migrant	habitat diversity key habitat quantity	PR					
			Chum	Lewis 5 Lewis 6	Spawning Egg incubation Fry colonization Prespawning holding	none	P					
	60502	Lewis 2 tidal_B Lewis 3 Lewis 4 Robinson Cr Ross Cr	ChF	Lewis 3 Lewis 4	Egg incubation Fry colonization 0-age active rearing Prespawning holding	sediment	P	I	M	M	M	M
			StW	none								
			Coho	Lewis 3 Lewis 4	Egg incubation Fry colonization 0-age active rearing Prespawning migrant Prespawning holding	habitat diversity predation sediment key habitat quantity	PR					
			Chum	Lewis 4	Spawning Egg incubation Prespawning holding	none	P					
B	60504	Lewis 7	ChF StW Coho Chum	none none none none				I	M	M	M	M
	60404	Bitter Cr Brush Creek Cedar Creek 2 Cedar Creek 3 Cedar Creek 4 Cedar Creek 5 John Creek	StW	Cedar Creek 3 Cedar Creek 4	Egg incubation 0-age active rearing 0,1-age inactive 1-age active rearing	none	P	I	M	M	I	M
			Coho	none								
	60401	Cedar Creek 1a Cedar Creek 1b Grist Mill	StW	Cedar Creek 1a Cedar Creek 1b	Egg incubation 0-age active rearing 1-age active rearing	temperature	PR	I	F	M	I	M
			Coho	none								
C	60501	Lewis 1 tidal Lewis 2 tidal_A	All	none				I	M	I	M	M
	60405	Cedar Creek 6	StW	none				I	M	M	I	M
			Coho	none								
	60402	Cedar Creek 2	StW	none				I	M	M	I	M
			Coho	none								
D	60406	Chelatchie Cr 1 Chelatchie Cr 2 NF Chelatchie Cr	StW	none				I	M	I	I	M
			Coho	none								
	60403	Pup Creek	StW	none				M	M	M	M	M
			Coho	none								
	40602	Lewis 1 tidal	All	none				I	M	I	I	M

Table 11-7. Salmonid habitat limiting factors and threats in priority areas. Priority areas include the middle mainstem (MM) and Cedar Creek (CC) portions of the lower NF Lewis Basin. Linkages between each threat and limiting factor are not displayed – each threat directly and indirectly affects a variety of habitat factors.

Limiting Factors	MM	CC
Habitat connectivity		
Blockages to off-channel habitats	✓	
Habitat diversity		
Lack of stable instream woody debris	✓	✓
Altered habitat unit composition	✓	✓
Loss of off-channel and/or side-channel habitats	✓	✓
Channel stability		
Bed and bank erosion	✓	✓
Channel down-cutting (incision)	✓	✓
Riparian function		
Reduced stream canopy cover	✓	✓
Reduced bank/soil stability	✓	✓
Exotic and/or noxious species	✓	✓
Reduced wood recruitment	✓	✓
Floodplain function		
Altered nutrient exchange processes	✓	✓
Reduced flood flow dampening	✓	✓
Restricted channel migration	✓	✓
Disrupted hyporheic processes	✓	✓
Stream flow		
Altered magnitude, duration, or rate of change	✓	✓
Alterations to the temporal pattern of stream flow	✓	
Water quality		
Altered stream temperature regime	✓	✓
Bacteria		✓
Substrate and sediment		
Excessive fine sediment	✓	✓
Disrupted sediment transport processes (hydro)	✓	
Embedded substrates		✓

Threats	MM	CC
Agriculture/grazing		
Clearing of vegetation	✓	✓
Riparian grazing	✓	✓
Floodplain filling	✓	✓
Rural/suburban development		
Clearing of vegetation	✓	✓
Floodplain filling	✓	✓
Increased impervious surfaces	✓	✓
Increased drainage network	✓	
Roads – riparian/floodplain impacts	✓	
Forest practices		
Timber harvests –sediment supply impacts	✓	✓
Timber harvests – impacts to runoff	✓	✓
Riparian harvests (historical)	✓	✓
Forest roads – impacts to sediment supply	✓	✓
Forest roads – impacts to runoff	✓	✓
Channel manipulations		
Bank hardening	✓	✓
Channel straightening	✓	✓
Artificial confinement	✓	✓
Clearing and snagging (historical)	✓	
Dredge and fill activities	✓	
Hydropower operations		
Flow manipulation	✓	
Changes to sediment transport dynamics	✓	
Changes to stream temperature regime	✓	

Table 11-8. Habitat measures in priority areas, with reference to limiting factors addressed, threats addressed, target species, and estimated time until benefits would be realized (time). Tier 1 and 2 reaches, or other areas of known priority, are listed under the location column for some measures (i.e., stream corridor measures). Reaches not included in the table (Tier, 3, 4, and non-tiered reaches) are considered secondary priority.

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
1. Protect and restore floodplain function and channel migration processes ***A. Set back, breach, or remove artificial channel confinement structures***					
Middle mainstem Lewis Lewis 3-6 ***Cedar Creek*** Cedar Creek 3-4	• Bed and bank erosion • Altered habitat unit composition • Restricted channel migration • Disrupted hyporheic processes • Reduced flood flow dampening • Altered nutrient exchange processes	• Floodplain filling • Channel straightening • Artificial confinement	• All species	2-15 years	Great potential benefit due to improvements in many limiting factors. This passive restoration approach can allow channels to restore naturally once confinement structures are removed. There are challenges with implementation due to existing infrastructure already in place, private property, potential flood risk to property, and large expense.
2. Protect and restore off-channel and side-channel habitats ***A. Restore historical off-channel and side-channel habitats where they have been eliminated*** ***B. Provide access to blocked off-channel habitats*** ***C. Create new off-channel or side-channel habitats (i.e., spawning channels)***					
Middle mainstem Lewis Lewis 3-6 ***Cedar Creek*** Cedar Creek 3-4	• Loss of off-channel and/or side-channel habitat • Blockages to off-channel habitats • Altered habitat unit composition	• Floodplain filling • Channel straightening • Artificial confinement	• All species	2-15 years	Great potential benefit due to improvements in many limiting factors. This passive restoration approach can allow channels to restore naturally once confinement structures are removed. There are challenges with implementation due to existing infrastructure already in place, private property, potential flood risk to property, and large expense.
3. Protect and restore riparian function ***A. Reforest riparian zones*** ***B. Allow for the passive restoration of riparian vegetation*** ***C. Livestock exclusion fencing*** ***D. Invasive species eradication*** ***E. Hardwood-to-conifer conversion***					
Middle mainstem Lewis Lewis 3-6 ***Cedar Creek*** Cedar Creek 3-4	• Reduced stream canopy cover • Altered stream temperature regime	• Timber harvest – riparian harvests • Riparian grazing • Clearing of	• All species	20-100 years	High potential benefit due to the many limiting factors that are addressed. Riparian impairment is related to most land-uses and is a concern throughout the basin. Riparian

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
	• Reduced bank/soil stability • Reduced wood recruitment • Lack of stable instream woody debris • Exotic and/or noxious species	vegetation due to rural/suburban development and agriculture			protections on forest lands are provided for under current harvest policy. Riparian restoration projects are relatively inexpensive and are often supported by landowners. Whereas the specified stream reaches are the highest priority for riparian measures, riparian restoration and preservation should occur throughout the basin since riparian conditions affect downstream reaches. Use IWA riparian ratings to help identify restoration and preservation opportunities.
4. Protect and restore streambank stability ***A. Restore eroding streambanks***					
Cedar Creek Cedar Creek 3-4	• Reduced bank/soil stability • Excessive fine sediment • Embedded substrates	• Artificial confinement • Clearing of vegetation • Roads – riparian / floodplain impacts • Riparian grazing	• Winter steelhead • Coho	5-50 years	Most areas of bank instability in Cedar Creek reach 3 and 4 are related to confinement and grazing. Bio-engineered approaches that rely on structural as well as vegetative measures are the most appropriate. These projects have a high risk of failure if causative factors are not adequately addressed.
5. Protect and restore natural sediment supply processes ***A. Address forest road related sources*** ***B. Address timber harvest related sources*** ***C. Address agricultural sources*** ***D. Address developed land sources***					
Entire basin	• Excessive fine sediment • Embedded substrates	• Timber harvest – impacts to sediment supply • Forest roads – impacts to sediment supply • Agricultural practices – impacts to sediment supply	• All species	5-50 years	High potential benefit due to sediment effects on egg incubation and early rearing. Improvements are expected on timber lands due to requirements under the new FPRs and forest land HCPs. Likelihood is moderate on agricultural lands due to incentive programs and outreach to landowners, but few sediment-focused regulatory requirements. Use IWA impairment ratings to identify restoration and preservation opportunities.
6. Protect and restore runoff processes ***A. Address forest road impacts*** ***B. Address timber harvest impacts*** ***C. Limit additional watershed imperviousness***					

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
D. Manage stormwater runoff					
Entire basin	• Stream flow – altered magnitude, duration, or rate of change of flows	• Timber harvest – impacts to runoff • Forest roads – impacts to runoff • Increased impervious surfaces • Increased drainage network (road ditches, storm drains) • Clearing of vegetation (development, agriculture)	• All species	5-50 years	High potential benefit due to flow effects on habitat formation, redd scour, and early rearing. Improvements are expected on timber lands due to requirements under the new FPRs and forest land HCPs. There are challenges with implementation on developed lands due to continued increase in watershed imperviousness related to rural and suburban residential development. Use IWA impairment ratings to identify restoration and preservation opportunities.
7. Protect and restore instream flows ***A. Water rights closures*** ***B. Purchase or lease existing water rights*** ***C. Relinquishment of existing unused water rights*** ***D. Enforce water withdrawal regulations*** ***E. Implement water conservation, use efficiency, and water re-use measures to decrease consumption***					
Entire basin	• Stream flow – altered magnitude, duration, or rate of change of flows	• Water withdrawals	• All species	1-5 years	Instream flow management strategies for the Lower NF Lewis basin have been identified as part of Watershed Planning for WRIA 27 (LCFRB 2004). Strategies include water rights closures, setting of minimum flows, and drought management policies.
8. Protect and restore instream habitat complexity ***A. Place stable woody debris in streams to enhance cover, pool formation, bank stability, and sediment sorting*** ***B. Structurally modify stream channels to create suitable habitat types***					
Cedar Creek Cedar Creek 3-4	• Lack of stable instream woody debris • Altered habitat unit composition	• None (symptom-focused restoration strategy)	• Coho • Winter steelhead	2-10 years	Moderate potential benefit due to the high chance of failure. Failure is probable if habitat-forming processes are not also addressed. These projects are relatively expensive for the benefits accrued. Moderate to high likelihood of implementation given the lack of hardship imposed on landowners and the current level of acceptance of these type of projects.

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
9. Protect and restore water quality ***A. Restore the natural stream temperature regime*** ***B. Reduce fecal coliform bacteria levels*** ***C. Reduce delivery of chemical contaminants to streams***					
Entire basin	• Altered stream temperature regime • Bacteria • Chemical contaminants (potential)	• Riparian harvests • Riparian grazing • Leaking septic systems • Application of pesticides, herbicides, and fertilizers	• All species	1-50 years	Primary emphasis for restoration should be placed on stream segments that are on the 2004 303(d) list.
10. Manage regulated stream flows to provide for critical components of the natural flow regime ***A. Provide adequate flows for specific life stage requirements (i.e., migration, summer rearing)*** ***B. Address geomorphic effects of hydro-regulation (channel-forming flows, sediment transport)***					
All mainstem Lewis reaches	• Alterations to the temporal pattern of stream flow • Altered stream temperature regime • Disrupted sediment transport processes (hydro)	• Hydropower operations – flow manipulation • Hydropower operations – changes to sediment transport • Hydropower operations – changes to stream temperature	• All species	1-5 years	Large potential benefit due to flow regulation and dam effects on habitat formation, stream temperatures, and fish movements. Adequate flow protections are being negotiated as part of Hydro re-licensing efforts conducted by PacifiCorp in consultation with the Federal Energy Regulatory Commission (FERC) and various stakeholders.
11. Protect and restore fish access to channel habitats ***A. Culverts and dams on various tributary streams***					
Colvin Creek ***Bitter Creek*** ***Other small tribs***	• Blockages to channel habitats	• Dams, culverts, in-stream structures	• Coho • Winter steelhead	Immediate	As many as 16 miles of potentially accessible habitat are blocked by culverts or other barriers (approximately 14 barriers total). The blocked habitat is believed to be marginal in most cases. Passage restoration projects should focus on cases where it can be demonstrated that there is good potential benefit and reasonable project costs.
12. Protect habitat conditions and watershed functions through land-use planning that guides population growth and development ***A. Plan growth and development to avoid sensitive areas (e.g., wetlands, riparian zones, floodplains, unstable geology)*** ***B. Encourage the use of low-impact development methods and materials*** ***C. Apply mitigation measures to off-set potential impacts***					

Location	Limiting Factors Addressed	Threats Addressed	Target Species	Time	Discussion
Privately owned portions of the basin	***Preservation Measure*** – addresses many potential limiting factors and threats		• All species	5-50 years	The mainstem basin and lower Cedar Creek basin are growing rapidly. The focus should be on management of land-use conversion and managing continued development in sensitive areas (e.g., wetlands, stream corridors, unstable slopes). Many critical areas regulations do not have a mechanism for restoring existing degraded areas, only for preventing additional degradation. Legal and/or voluntary mechanisms need to be put in place to restore currently degraded habitats.
13. Protect habitat conditions and watershed functions through land acquisition or easements where existing policy does not provide adequate protection ***A. Purchase properties outright through fee acquisition and manage for resource protection*** ***B. Purchase easements to protect critical areas and to limit potentially harmful uses*** ***C. Lease properties or rights to protect resources for a limited period***					
Privately owned portions of the basin	***Preservation Measure*** – addresses many potential limiting factors and threats		• All species	5-50 years	Land acquisition and conservation easements in riparian areas, floodplains, and wetlands have a high potential benefit. These programs are under-funded and have low landowner participation.

11.5 Program Gap and Sufficiency Analysis

The lower NF Lewis Basin (~102 sq mi) lies below Merwin Dam and is a mix of landuses, including rural residential, small scale agriculture, and forestry:

- The lower NF Lewis has approximately 35 square miles in forestry uses; 16 square miles of state land ownership; the predominant land manager is the Washington Department of Natural Resources and 19 square miles of small and industrial forest lands;
- Agriculture and rural residential uses occur in the valley bottom areas;
- The 2000 population in the NF Lewis was 14,300;
- Lands south of the NF Lewis River are in Clark County;
- Lands north of the NF Lewis River are in Cowlitz County;
- The largest population center in the basin is Woodland, which is situated near the confluence with the Columbia River;
- Other communities include Chelatchie and Amboy, both are located in the Cedar Creek drainage; and
- PacifiCorp and Cowlitz PUD control stream flows released through Merwin Dam.

Protection Programs

Protection programs in the lower NF Lewis Basin are implemented by a variety of agencies, organizations, and private interests. Protection programs in this analysis include those programs that protect habitat conditions or watershed functions through regulatory measures, through the acquisition outright or the purchase of easements, incentives or by applying standards to new development that protects resources by avoiding damaging impacts. Key programs implementing measures are identified below.

Federal Programs

- ***U.S. Army Corps of Engineers***
  - Regulatory Programs: U.S. Army Corps of Engineers administers the Section 10 (Rivers and Harbor Act) and Section 404 (Clean Water Act) permit processes. Section 10 requires approval of any activity in, above, or below a navigable river, which affects course, location, condition, or capacity of navigable waters. Section 404 requires prior approval of dredging, filling, grading, clearing, and bank hardening. In waters used by listed fish species, the permits are subject to ESA Section 7 consultation with NOAA Fisheries to ensure that any approved action is adequately protective of the ESA listed fish. [M.1A; M.2A; M.2B; M.8A; M.8B; M.11A]

- ***Federal Energy Regulatory Commission (FERC)***
  - Licensing of Hydroelectric Projects: PacifiCorp and the Cowlitz PUD operate hydroelectric facilities on the North Fork Lewis. The projects are currently undergoing relicensing pursuant to the federal Power Act using FERC's alternative licensing approach. Under this approach the utilities are working with federal agencies, local governments, tribes, community interests, and environmental organizations to develop a settlement agreement defining terms for a license. Topics affecting the lower North Fork Lewis include flows and habitat protection for ESA listed salmonids and other aquatic and terrestrial species. [M.9A; M.10A; M.10B; M.11A]

- ***NOAA Fisheries*:**
  - Hydroelectric Project Relicensing: Under the federal Power Act, NOAA Fisheries has substantive authority over license provisions relating to listed salmonids. The agency is actively engaged in the relicensing efforts for the Lewis hydroelectric projects. With regard to the lower North Fork Lewis, NOAA is pursuing flow and habitat measures to protect listed salmonids, specifically spawning and rearing fall chinook and chum salmon in the lower North Fork. [M.9A; M.10A; M.10B; M.11A]

State Programs

- ***Department of Natural Resources***
  - State Forest Land HCP:
    State forest lands are managed under the provisions of a Habitat Conservation Plan (HCP). The Habitat Conservation Plan has protects riparian areas through the use of buffers, mitigates impacts on watershed processes through harvest restrictions and new road construction standards that are more stringent than Forest Practices Rules. [M.3A; M3B; M.5A; M.5B; M.6A; M.6B; M.9A]
  - State Forest Practices:
    Riparian areas and watershed functions on small- and industrial forest lands are protected under the State of Washington Forest Practices Rules, including the Forest and Fish Module. These rules provide for riparian buffers, harvest restrictions, sensitive area protections, and protective standards for new road construction. [M.3A; M3B; M.5A; M.5B; M.6A; M.6B; M.9A]

- ***Washington Department of Fish and Wildlife***

  - Hydraulics Project Approval (HPA): The Department administers the state Hydraulic Code. The purpose of this program is to protect stream conditions and habitat. The regulations apply to such activities as streambank protection, instream construction, culvert installation, channel changes or realignments, debris removal, and water diversion facilities. Those proposing such actions must obtain a Hydraulic Project Approval (HPA) permit. [M.1A; M.2A; M.2B; M.8A; M.8B; M.11A]

  - Habitat Program: The Department provides advice to local governments and landowners interested in measures to protect habitat values on their property. [M.1A; M.2A; M.2B; M.3A; M.4A; M.5D; M.6C; M.6D; M.8A; M.8B; M.9A; M.9B; M.9C; M.11A; M.12A; M.12B; M.12C]

  - Hydro Facility Relicensing: The Department is an active participant in the FERC relicensing of the PacifiCorp and Cowlitz PUD hydro facilities on the North Fork Lewis. The Department has worked to address protection of habitat in the lower North Fork affected by hydro operations. Issues include protection of downstream spawning and rearing habitat for fall Chinook, chum, and steelhead through flow measures, gravel augmentation, and large woody debris. [M.9A; M.10A; M.10B; M.11A]

- ***Washington Department of Ecology***

- Water Quality Program/Clean Water Act – Section 401 Certification
  FERC relicensing of the Lewis hydro projects requires the Department to issue a CWA Section 401 water quality certification. The Department of Ecology review and, where necessary, revise flow requirements for the protection of fish and their habitat. [M.9A; M.10A; M.10B]

- Water Resources Program/Water Rights: Department of Ecology, in consultation with the Department of Fish and Wildlife, has administrative closed selected areas within the lower North Fork Lewis watershed to further surface and groundwater withdraws (where groundwater is in continuity with surface water). Existing administrative closures by the Department of Ecology protect surface waters from further withdrawals. Formal rule-making would strengthen the closures. The extent of unauthorized surface water withdrawals is unknown, but could exacerbate summer low flows. [M.7A; M.7B; M.7C; M.7D]

- Water Resources Program/Watershed Planning: In cooperation with the Lower Columbia Fish Recovery Board, other state and federal agencies, tribes, local governments, and citizens, the Department funds and participates in a state authorized watershed planning process for Water Resource Inventory Area (WRIA) 27 pursuant to RCW 90.82. The goal of the plan is to ensure adequate water for people and fish. The planning process is dealing with water quantity and quality, stream flows and fish habitat. Once approved by counties within the WRIA, the plan will be binding on state agencies and local governments. [M.7A; M.7B; M.7C; M.7D; M.9A; M.9B; M.9C; M.12A]

➢ ***Washington Department of Transportation:***
- Highway maintenance program implements best management practices for the protection of habitat. [M.6C; M.9C; M.11A]

➢ ***Salmon Recovery Funding Board (SFRB)/ Lower Columbia Fish Recovery Board (LCFRB)***

- Washington Salmon Recovery Act (RCW 77.85): The SRFB and the LCFRB jointly administer a grant program that allocates federal Pacific Salmon Recovery Funds and State funds for habitat protection and restoration projects by state and local agencies, nonprofit organizations, and landowners. To date the SRFB provided approximately $100,000 to Clark County and other partners for the $1 million purchase of Eagle Island. [M.2A; M.2B; M.3A; M.3B; M.4A; M.8A; M.8B; M.9A; M.11A]

Local Government Programs

➢ ***Clark County*** (Lands south of the NF Lewis)
- ESA Program: The County has established an Endangered Species Program to address ESA requirements and develop a comprehensive county strategy for salmon recovery. An ESA committee with representatives from federal and state agencies, tribes, citizens, the business community and environmental groups has been

established to advise the county as it works to bring its ordinances and programs into compliance with ESA requirements.

- Land Use:
  - ✓ The County is actively engaged in a comprehensive review and revision of its programs to better protect watershed processes and habitat and to secure ESA Section 4d assurances from NOAA Fisheries.
  - ✓ The County comprehensive sets policies calling for the protection of habitat for ESA listed salmon and other aquatic and terrestrial species.
  - ✓ Zoning that directs growth throughout the County and maintains low-density development in rural areas. The County has a designated Urban Growth Area pursuant to the Washington Growth Management Act (GMA). The UGA helps protect rural lands by directing high intensity uses to developed areas.
  - ✓ A Habitat Conservation Ordinance provides stream buffers and measures for the protection of important habitat, including ESA listed salmonids.
  - ✓ Wetland ordinance provides substantial protection. [M.12A; M.12B; M.12C]

- Stormwater Management:
  The County stormwater program, based on Best Available Science, is implementing an NPDES permit, including measures to protect water quality and reduce impacts on stream flows [M.6C; M.6D; M.9A; M.9C];

- Road Maintenance:
  Clark County Road Program utilizes Best Management Practices to guide their operations and is actively seeking programmatic ESA Section 4d assurances from NOAA Fisheries that these measures provide adequate protection for fish. [M.6C, M.6D; M.11A]

- Parks and County Facilities:
  - ✓ The County has an active Conservation Futures program to acquire and protect critical habitat. On the lower North Fork Lewis the County participated in efforts to acquire the 260-acre Eagle Island to protect critical chinook rearing habitat. [M.13A]
  - ✓ The County has not implemented a comprehensive parks and facilities management plan to protect habitat. [M.9C]

➢ ***Cowlitz County*** (Lands north of the NF Lewis)

- Land Use:
  - ✓ The comprehensive plan that applies to the non-federal lands, but contains no significant policies for the protection of watershed processes and stream habitat.
  - ✓ Zoning along State Highway 503 provides for one dwelling per 2 acres and one dwelling per 5 acres along non-county roads.
  - ✓ Cowlitz County has not adopted protective stream buffers.
  - ✓ Wetland buffers vary from 25’ to 200’ and are based upon soil type and wildlife utilization.

- ✓ The County has not developed comprehensive ordinances for the protection of watershed processes or stream habitat conditions. [M.12A; M.12B; M.12C]

- Road Maintenance

The County has not developed or implemented a road maintenance program to protect habitat. [M.6C; M.6D; M.11A]

➢ ***City of Woodland***

- Land Use:
  - ✓ The City has a comprehensive plan conforming to the Growth Management Act.
  - ✓ Generally, urban land use zoning within the City limits and Urban Growth Boundary.
  - ✓ Critical Areas Ordinance primarily requires mitigation impacts. It does require preservation of the natural hydrology of drainage systems and protection of critical fish habitat through maintenance of stable channels, adequate low flows, and management of stormwater, erosion, and sedimentation. Buffers vary from 75' to 200' for riverine wetlands with values of fish and wildlife. No other stream buffer provisions for protection of riparian functions have been adopted.
  - ✓ The City has adopted the Shorelines Management Master Program for Cowlitz County. [M.12A; M.12B; M.12C]

- Stormwater Management: The City has adopted the Cowlitz County Shoreline Master Plan. The intent of the plan is to protect water quality, riparian, stream conditions through the regulation of shoreline development. No specific measures for the protection of ESA listed salmonids are included. [M.6C; M.6D; M.9C]

Community Programs

➢ ***PacifiCorp:*** In conjunction with DFW and Clark-Vancouver Parks, PacifiCorp participated in the acquisition of 260-acre Eagle Island. The island is important rearing habitat for fall Chinook [M.13A].

Restoration Programs

Restoration programs in the lower NF Lewis Basin are implemented by a variety of agencies, organizations, and private interests. Restoration programs are generally organized around agencies, organizations, and private interests that assess threats, develop solutions, and implement projects that are intended to improve habitat conditions or watershed functions. Programs implementing habitat restoration measures are identified below:

Federal Programs

➢ ***Federal Energy Regulatory Commission (FERC)***

- Licensing of Hydroelectric Projects: Under the FERC alternative licensing approach the PacifiCorp and the Cowlitz PUD are working with federal agencies, local governments, tribes, community interests, and environmental organizations to develop a settlement

agreement defining terms for a license. Restoration topics affecting the lower North Fork Lewis include establishing and funding a habitat restoration fund for aquatic species, including those in the lower North Fork Lewis. [M.5D; M.8A; M.8B; M.9A; M.9C; M.10A; M.10B; M.11A; M.13A]

- ***NOAA Fisheries***
  - Hydroelectric Project Relicensing: Under the federal Power Act, NOAA Fisheries has substantive authority over license provisions relating to listed salmonids. The agency is actively engaged in the relicensing efforts for the Lewis hydroelectric projects. With regard to the lower North Fork Lewis, NOAA is pursuing habitat protection measures, gravel augmentation, and large woody debris. [M.5D; M.8A; M.8B; M.9A; M.9C; M.10A; M.10B; M.11A; M.13A]

State Programs

- ***Washington Department of Natural Resources***

  State Forest Land Habitat Conservation Plan (HCP): The Department manages state forest lands pursuant to a Habitat Conservation Plan (HCP). The HCP road maintenance and restoration objectives require barrier upgrades and road abandonment and/or other improvements. [[M.3A; M3B; M.5A; M.5B; M.6A; M.6B; M.9A; M.11A]

  - State Forest Practices Act:
    - ✓ Industrial forests within the lower NF Lewis Basin are governed by Forest and Fish regulations and have rigid schedules for maintaining and improving roads and removing barriers. Industrial landowners have 15 years to bring roads and barriers into compliance with regulations [M.5A; M.5B; M.6A; M.6B; M.9A; M.11A]
    - ✓ Small private forest owners are governed by Forest and Fish regulations; however their road and barrier maintenance and improvement programs are tied to state funding. In the State 2003-05 Biennial Budget, 2 million dollars was allocated statewide to support small private forest owners [M.5A; M.5B; M.6A; M.6B; M.9A; M.11A]

- ***Washington Department of Fish and Wildlife***

  - Habitat Program: The Department provides advice to local governments and landowners interested in measures to protect habitat values on their property. [M.1A; M.2A; M.2B; M.3A; M.4A; M.5D; M.6C; M.6D; M.8A; M.8B; M.9A; M.9B; M.9C; M.11A; M.12A; M.12B; M.12C]

- ***Washington Department of Ecology***

  - Water Resources Program/Watershed Planning:
    The planning process for WRIA 27 is dealing with water quantity and quality, stream flows and fish habitat. Potential restoration efforts address improving summer low flows

through conservation and acquisition of water rights. Once approved by counties within the WRIA, the plan will be binding on state agencies and local governments. [M.7A; M.7B; M.7C; M.7D; M.9A; M.9B; M.9C; M.12A]

- ***Washington Department of Transportation***

  - Barriers: WSDOT has improved several blockages associated with State Route 503 in the lower North Fork Lewis area. [M.6D; M.9C; M.11A]

- ***Salmon Recovery Funding Board (SFRB)/ Lower Columbia Fish Recovery Board (LCFRB)***

  - Washington Salmon Recovery Act (RCW 77.85): As noted under preservation programs above, the SRFB and the LCFRB jointly administer a grant program that allocates federal Pacific Salmon Recovery Funds and State funds for habitat protection and restoration projects by state and local agencies, nonprofit organizations, and landowners. To date the SRFB has provided over $975,000 for to Clark County and other non-profit groups in the area for riparian restoration and barrier removals in Cedar and Chelatchie Creeks. [M.2A; M.2B; M.3A; M.3B; M.4A; M.8A; M.8B; M.9A; M.11A]

- ***Conservation Commission/Clark Conservation District* (CCD)**

  - The CCD is active in the lower NF Lewis Basin. CCD works with agriculture interests to develop farm plans and implements the Conservation Enhancement Reserve Program. [M.3A; M.3C; M.4A; M.5C; M.9A; M.9B; M.9C]

Local Government Programs

- ***Clark County***

  - Clark County ESA Program: The Clark County ESA program encourages and recognizes citizen efforts to conserve and restore habitat for salmon through education and outreach activities.
  - Clark County Culvert Program: The County inventories and replaces priority barriers associated with its roads. [M.11A]

Community Programs

- ***Fish First***: a non-profit group actively performing restoration projects in the lower NF Lewis. Fish First works directly with landowners to develop relationships that facilitate the implementation of habitat projects in the Cedar and Chelatchie. The organization also conducts nutrient enhancement (carcass placement) projects. [M.3A; M.4A; M.8A; M.8B; M.9A; M.11A]

Gap Analysis

Forest-related Programs: Approximately 35% of the lower NF Lewis Basin is in commercial forest production. Accordingly, Washington Department of Natural Resource

forestry programs and forest practice regulations play an important role in protecting and restoring watershed functions and habitat conditions to levels supporting recovery goals. Certainty of forestry-related protection and restoration programs is relatively high because programs are being implemented and, for the most part, fully funded. Program areas of concern include state funding for small commercial forest landowners and the continued potential for hydrologic impacts caused by past harvest practices. Monitoring of watershed processes and habitat conditions will be required to confirm the effectiveness of these measures.

Protection-related Programs: Clark County land use regulatory mechanisms provide significant protections throughout the lower NF Lewis Basin. Protection is further promoted through active public outreach and education efforts. This level of protection should be improved to levels supporting recovery with the completion and implementation of the County's current program review and revision. Cowlitz County land use regulatory mechanisms provide limited, basic protections. However, County programs lack effective provisions that commonly are used to proactively direct growth, protect streams and wetlands, and manage stormwater.

Restoration-related Programs: Relative to the hydroelectric facilities, actions to address downstream impacts are also important to salmon and steelhead recovery efforts. These include: monitoring and augmentation of gravel, where and when necessary; Augmentation of LWD; and assurance of flow regimes needed for downstream spawning and rearing.

Table 11-9. Actions to Address Gaps

Action #	Lead Agency	Proposed Action
LNFL.1	Cowlitz County	Develop and implement stormwater discharge controls to protect water quality and quantity and reduce localized stream flow impacts detrimental to fish —including peak and base flows
LNFL.2	Cowlitz County	Develop and implement controls to adequately protect riparian areas to maintain currently functional habitat as well as restored habitat needed habitat conditions around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Require mitigation, where necessary, to offset unavoidable damage to habitat conditions in riparian management areas
LNFL.3	Cowlitz County	Zoning and development standards to adequately protect wetlands, wetland buffers, and wetland function.
LNFL.4	Cowlitz County	Develop and implement controls to address erosion and sediment run-off during (and after) construction to prevent sediment and pollutant discharge to streams, wetlands and other water bodies
LNFL.5	Cowlitz County	Protect historic stream meander patterns and channel migration zones and avoid hardening stream banks and shorelines
LNFL.6	State of Washington (DNR)	Provide state funding for small forest owners in the lower NF Lewis Basin to a level sufficient to achieve the road and barrier improvements of Forest and Fish on a schedule parallel to private industrial forest owners
	State of Washington (Dept of Agriculture)	Develop and implement agricultural practices and regulations to protect riparian conditions and water quality

	State of Washington (DFW, Ecology)	Close tributaries to the lower NF Lewis to further withdrawal of surface water, including groundwater in connection with surface waters. Curtail unauthorized withdrawals.
LNFL7.	Forest Managers LCFRB, and DFW	Identify and sequence early action forest restoration projects that analysis indicates could provide significant benefits. In these cases, it may be appropriate to identify outside funding to initiate these early actions
LNFL.8	State of Washington, LCFRB, CC	Build institutional capacity for agencies and organizations to undertake protection and restoration projects
LNFL.9	LCFRB, DOE, DFW, NOAA, USFWS, ACOE, BPA	Increase available funding for projects that implement measures and addresses underlying threats
LNFL.10	PacifiCorp and Cowlitz PUD	Provide passage and collection facilities for adult and juvenile coho, steelhead, spring chinook populations to make use of habitats above Swift Reservoir. Monitor and mitigate LWD and sediment (gravel) transport impacts below Merwin Dam.
	WDFW, Department of Ecology, PacifiCorp and Cowlitz PUD	Develop and implement flow regimes that protect salmon and steelhead spawning and rearing below Merwin Dam
LNFL.11	PacifiCorp and Cowlitz PUD	Increase fish and wildlife habitat mitigation measures (upstream and downstream) of hydrosystem commensurate with recovery goals for populations affected by hydrosystem impacts
LNFL.12	Clark CD, Clark County, Cowlitz County, non profit fish recovery organizations.	Utilize a combination of public outreach/education, incentives, and authority to positively influence landowner behaviors toward land stewardship in practices not covered by land use regulations
LNFL.13	Clark County, Cowlitz County, City of Woodland	Apply land use code enforcement across jurisdictions in a consistent manner, using appropriate funding levels and application
LNFL.14	WRIA 27/28 PU, DOE, DFW	Close the NF Lewis River to further surface water withdrawals,
LNFL.15	LCFRB, Clark County, Cowlitz County, DFW	Build institutional capacity for agencies and organizations to undertake additional protection and restoration projects, including noxious weed control
LNFL.16	SRFB,	Increase available funding for projects that implement measures and addresses underlying threats
LNFL.17	LCFRB, , WDFW, PacifiCorp	Address threats proactively by building agreement on priorities among the various program implementers
LNFW.18	FEMA	Update floodplain maps.