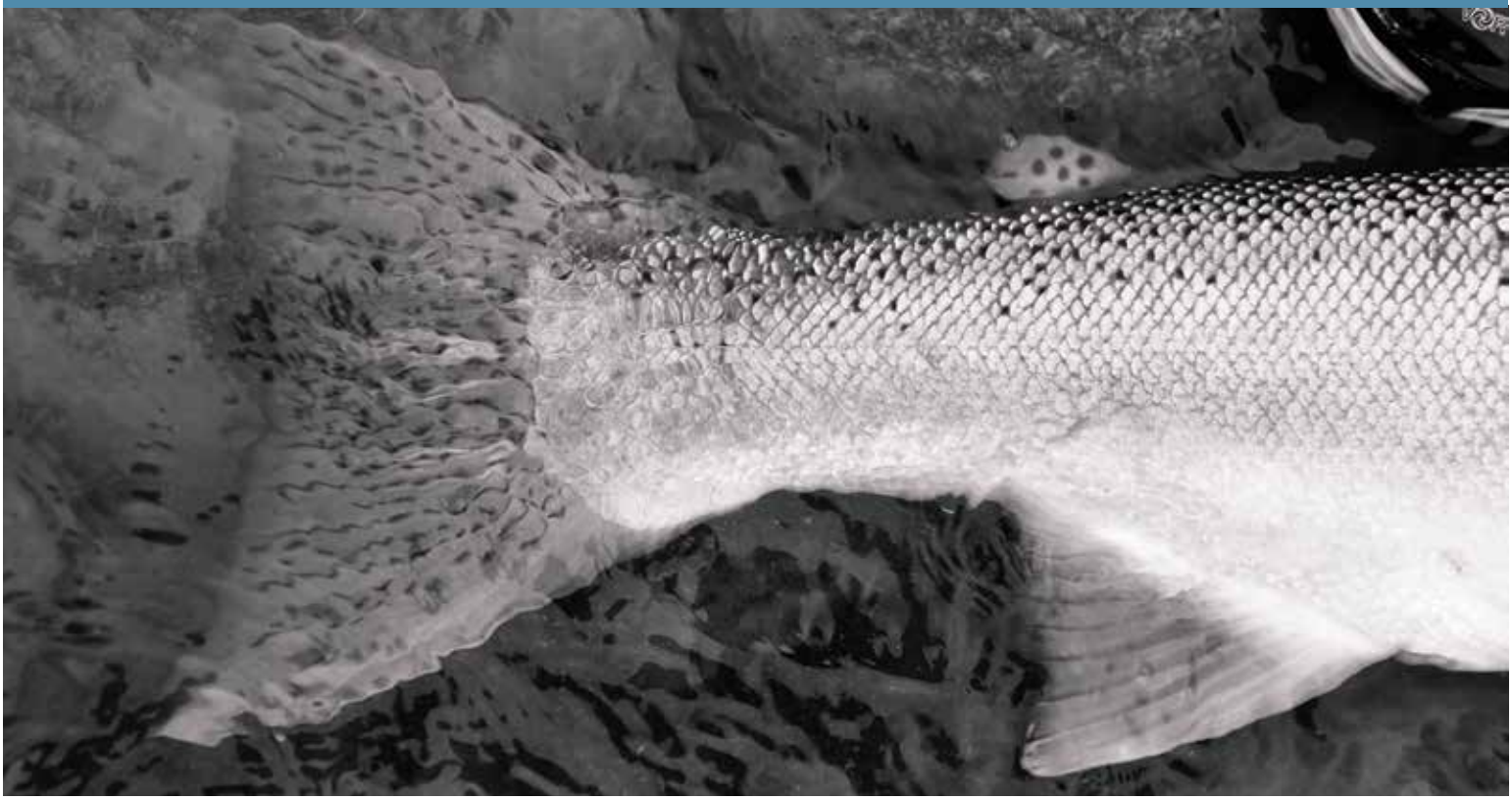
Newaukum River Headwaters Prioritized Restoration Plan

Chehalis Basin Lead Entity • Newaukum Work Group

June 2023



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Front Cover: Top - South Fork Newaukum Headwaters, photo by John Gaffney; Bottom - photo by Luke Kelly

Contributors and Acknowledgments

The Newaukum River Headwaters Prioritized Restoration Plan was developed by the Newaukum Work Group, a subcommittee to the Chehalis Basin Lead Entity. This dedicated team consisted of resource managers, conservation professionals, scientists, locals, foresters and tribal representatives.

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This plan is a project of the Coast Salmon Partnership and is one in a series of Prioritized Watershed Restoration (PWR) plans for the Washington Coast watershed region. Special thanks to the Wild Salmon Center for its leadership in producing the Strategic Action Plan for Coho Salmon Recovery and guiding efforts to model these plans after their work.

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South Fork Newaukum Headwaters looking northwest. Photo by John Gaffney

Executive Summary

The Newaukum River is a 332 square mile watershed in southwest Washington that supports diverse runs of wild fish and is a stronghold for the imperiled spring Chinook salmon in the Chehalis River Basin. Like much of the Chehalis River Basin, the Newaukum watershed's mainstem and tributaries were once made up of soggy wetlands, cool head-water streams, meandering channels, and lush riparian corridors. These healthy and diverse habitats were and are critical to sustain aquatic life, including the freshwater phase of anadromous fish life cycles (e.g., salmon and steelhead) and the entire life cycle of resident fishes (e.g., rainbow and cutthroat trout), and the terrestrial species that depend on them.

Since the late 19th century, the Newaukum River watershed has suffered from land use changes, habitat degradation, and climate change, as have the fish populations that rely on habitats created through natural riverine processes. Riverine habitats in the Newaukum River watershed have been degraded by human modifications to both rivers and land including splash damming rivers, harvesting trees to the stream bank, "cleaning"' streams of fallen timber and log jams, and building roads across unstable hillslopes. Today, land use practices have improved under state and federal regulations and changes to the management of commercial forest lands. However, the legacy impacts to fish habitat remain. In addition, continued degradation of watershed health occurs from the lack of native riparian trees, spread of invasive plants, and stream fragmentation from road systems in agricultural and rural residential areas. Threats to watershed health will continue to increase because of human demand on the land and climate-induced changes.

Healthy wild fish stocks and long-term habitat resilience in the Newaukum River watershed is possible. The Newaukum Headwaters Restoration Plan was developed thanks to a dedicated and creative collaboration among local partners and is informed by people with expertise in salmon, salmon habitat needs, local values, and local landscape conditions. The plan is focused on 151 square miles of the North Fork Newaukum River and upper extent of the South Fork Newaukum River. The plan provides a list of science-based restoration priorities and directs practitioners to take the highest priority actions in the highest priority areas. This plan is grounded in the recommendation by Roni et. al (2010) that a minimum of 20% of a watershed's streams and their floodplain should be restored by a cumulative suite of actions in order to

obtain a measurable response from salmon populations. The proposed actions in this plan are physical instream and riparian treatments that can be taken on by restoration groups in a feasible timeframe, including: 13.1 miles of riparian restoration, 12.7 miles of wood placement, and three fish passage projects that reconnect 16.4 miles of anadromous fish habitat. These actions will be supported by an outreach strategy focused on engaging landowners in high priority areas for restoration and protection.

The time to restore ecological function and fish habitat in the Newaukum River is now. Salmon and steelhead numbers are at an all-time low, but stakeholder collaboration is at an all-time high. The Newaukum Headwaters Restoration Plan offers a comprehensive and science-based approach built with a collaborative effort that can endure. Participants who developed the plan are stakeholders with the ability to generate support for the plan's recommendations and restoration experts with the responsibility to implement the plan's recommendations.

Salmon and steelhead numbers are at an all-time low, but stakeholder collaboration is at an all-time high. The Newaukum Headwaters Restoration Plan offers a comprehensive and science-based approach built with a collaborative effort that can endure.

Photo by Kenna Fosnacht

Definitions

Baseflows – Physical definition: The portion of the streamflow that is sustained between precipitation events. Definition under Washington State law: "a level of streamflow established in accordance with provisions of chapter 90.54 RCW required in perennial streams to preserve wildlife, fish, scenic, aesthetic, and other environmental and navigational values."

Basin – Synonym to watershed (see below).

Fish Passage Barrier – man-made structure such as a culvert or fish way that prevents or slows the movement of fish along the river corridor due to factors such as water surface drop, velocity, gradient, or water depth.

Habitat Enhancement - Improving the quality of habitat through direct manipulation (e.g. placement of instream structures; addition of nutrients)

Habitat-Forming Processes - Habitat is maintained through the downstream flow of water, sediment, nutrients, and wood matter, and through the growth and decay of vegetation along the stream's corridor. These dynamic processes, known as "habitat forming processes" are the primary physical, chemical and biological drivers that create and sustain river and floodplain ecosystems. Habitat forming processes are dynamic. The following habitat-forming processes are the focus of this restoration plan.

LWD - Large Woody Debris is a term used to describe logs and root wads that are of sufficient size that when they are present in streams they affect stream channel structure and hydrology. Also referred to simply as "wood."

Process-based restoration - A means of reestablishing normative rates and magnitudes of physical, chemical, and biological processes that create and sustain river and floodplain ecosystems. (Beechie et. al. 2010)

Protection - Using laws, purchase or other mechanisms to safeguard and prevent areas of intact habitat from future degradation

Reach – Length of stream with similar geomorphic conditions

Restoration - Returning an aquatic system or habitat to its original, undisturbed state. This can be further divided into passive (removal or human disturbance to allow recovery) or active (active manipulations to restore processes or conditions).

Spawning Escapement - The number of fish that escape the fisheries and return to spawn.

Splash Dam - Early forestry practices in this region included a practice known as "splash damming" designed to move logs from forested slopes to the nearest mill. This practice led to inadvertent disruption of salmon habitat through flooding and then washing habitat features from the river.

Stream Reach - a stream length, most commonly defined as being from tributary junction to tributary junction. Reaches can also be defined based on geomorphological characteristics such as channel form and valley width.

Sub-basin – An area of land that drains all flowing surface water. Flows from each sub-basin merge with other sub-basins at river confluences in a hierarchical pattern (see Watershed below)

Watershed - An area of land that drains all flowing surface water to a shared body of water such as a single stream, river, lake or ocean. A watershed may consist of smaller watersheds (sub-watersheds or sub-basins) that merge at river confluences in a hierarchical pattern.

Watershed Scale – A watershed scale integrates all processes occurring within the boundaries of a given watershed. In this report, watershed scale mostly refers to all streams in a watershed or sub-watershed that are first order and larger, but sometimes refers to processes in the uplands and subsurface, as well.

Photo by Mara Zimmerman

Background

A Vision for the Newaukum River

The greatest chance for watershed recovery is comprehensive restoration across a sufficiently large landscape. Scientific studies suggest that measurable responses from salmon populations will occur when a suite of cumulative habitat restoration actions are concentrated in at least 20% of floodplain and in-channel habitat in a sub-watershed (Roni et al. 2010, Bilby et al. 2022). Consequently, the Coast Salmon Partnership adopted the "Prioritized Watershed Restoration" (PWR) program as part of its salmon recovery strategy for the Washington Coast Region (Pittman 2021). The PWR program is focused on strategic, process-based restoration at the watershed scale. The goal is to address the highest priority restoration and protection needs in single watersheds that can feasibly be taken on by restoration groups within a defined timeframe. The Newaukum Restoration Plan follows the PWR program guidelines for this level of comprehensive watershed scale restoration.

We envision wild fish populations in the Newaukum River watershed that are abundant and diverse, sustained by habitats that are resilient to land use and climate change and stewarded by local communities who will enjoy the salmon and rivers for centuries to come.

Stakeholder Engagement

The Newaukum Restoration Plan is a watershed scale restoration plan developed by individuals knowledgeable about the watershed and its salmon populations: both technical experts and those who are connected to the local communities that live, work, and recreate in the watershed. The Newaukum Work Group (Appendix A) crafted a vision statement, identified habitat-forming processes and their impairments, established restoration goals and objectives, and developed plans for outreach and for monitoring and adaptive management. Work Group participants will also carry the plan forward, as they are stakeholders with the ability to generate support for the plan's recommendations and restoration experts with the responsibility to implement the plan's recommendations.

Cultural Setting

The Newaukum watershed is within the traditional territories of Chehalis and Cowlitz peoples who have established a number of shared-use sites within the Newaukum watershed; their presence has been traced back to the last glacial period (13,500 to 11,000 years ago). The Newaukum watershed is also said to cross into lands shared between the Salish and Athapaskan-speaking Kwalhioqua people (Krauss 1990:531). The name 'Newaukum' is an anglicized form of the ɻʷayɻiɬ (Upper Chehalis) language placename nɻwaqʷm which translates to "big prairie," a place known for being where carrots and camas were gathered (Kinkade 1991: 332). (See additional cultural history in Appendix B).

The descendants of the original inhabitants of the Newaukum are now represented by the tribal governments associated with the Confederated Tribes of the Chehalis Reservation, the Quinault Indian Nation, and the Cowlitz Indian Tribe, among others.

Physical Geography

The Newaukum River valley was formed under much different hydrological conditions than present. Between 25,000 and 50,000 years ago, increased discharge and sediment that was generated by melting glaciers filled the South Fork valley with a thick layer of glacial outwash deposits. This upstream

Field of camas, photo by Kirsten Harma

Ridge in South Fork Newaukum headwaters, photo by John Gaffney

end of the South Fork once drained east into the Tilton River. The modern river flows west through semi-consolidated layers underlain by more resilient marine sedimentary rock (Inter-Fluve, 2018).

The present day Newaukum River watershed drains 332 square miles and enters the Chehalis River near river mile (RM) 75.2 just south of the City of Chehalis (Figure 1). The watershed originates in the Bald Hills, a lower-elevation spur of the Cascade Mountains. The geology of this area is predominantly volcanic and continental sedimentary rocks, including sandstone and conglomerate. The North Fork Newaukum River and the South Fork Newaukum River join at RM 10.8 to form the mainstem Newaukum River. The North Fork Newaukum River originates near Windy Knob at approximately 2,600 feet above sea level; steep headwater streams flow into a broad valley with a meandering mainstem river and fed by lower gradient tributaries. The South Fork Newaukum River originates nearly 3,000 feet above sea level at Newaukum Lake; steep headwater streams transition to moderate gradient as the terrain broadens in a downstream direction. Below the forks, the mainstem Newaukum River is low gradient and meandering.

Hydrology

Precipitation amounts throughout the Newaukum River vary spatially, with average amounts ranging from 111 inches precipitation per year at the headwaters to 47 inches per year at the confluence with the Chehalis River (Inter-Fluve, 2018). Precipitation is primarily in the form of rain, and streamflow is sustained year-round by surface and groundwater rather than snowmelt. Peak precipitation events are typically caused by atmospheric weather systems in November-February, which funnel moisture from the tropics to locations along the Pacific coast, resulting in heavy precipitation and large, rapid increases in flow, often to 20 times summer base flows and as much as 20 times the winter average flow . Average January flow is 624 cfs on the Newaukum River, and August has average flows of 30 cfs (Inter-fluve, 2018).

Target regulatory stream base flows are set by the Department of Ecology under WAC-173-522-020. The regulatory base flow varies by time of year, and the lowest values in the Newaukum watershed occur between August 15 and September 30. During this period, base flows are set as follows: North Fork Newaukum 7 cfs, South Fork Newaukum 27 cfs, Newaukum River 35 cfs.

Focal Sub-Basins

Pittman (2021) recommends that the selection of focal areas for watershed scale restoration be based on:

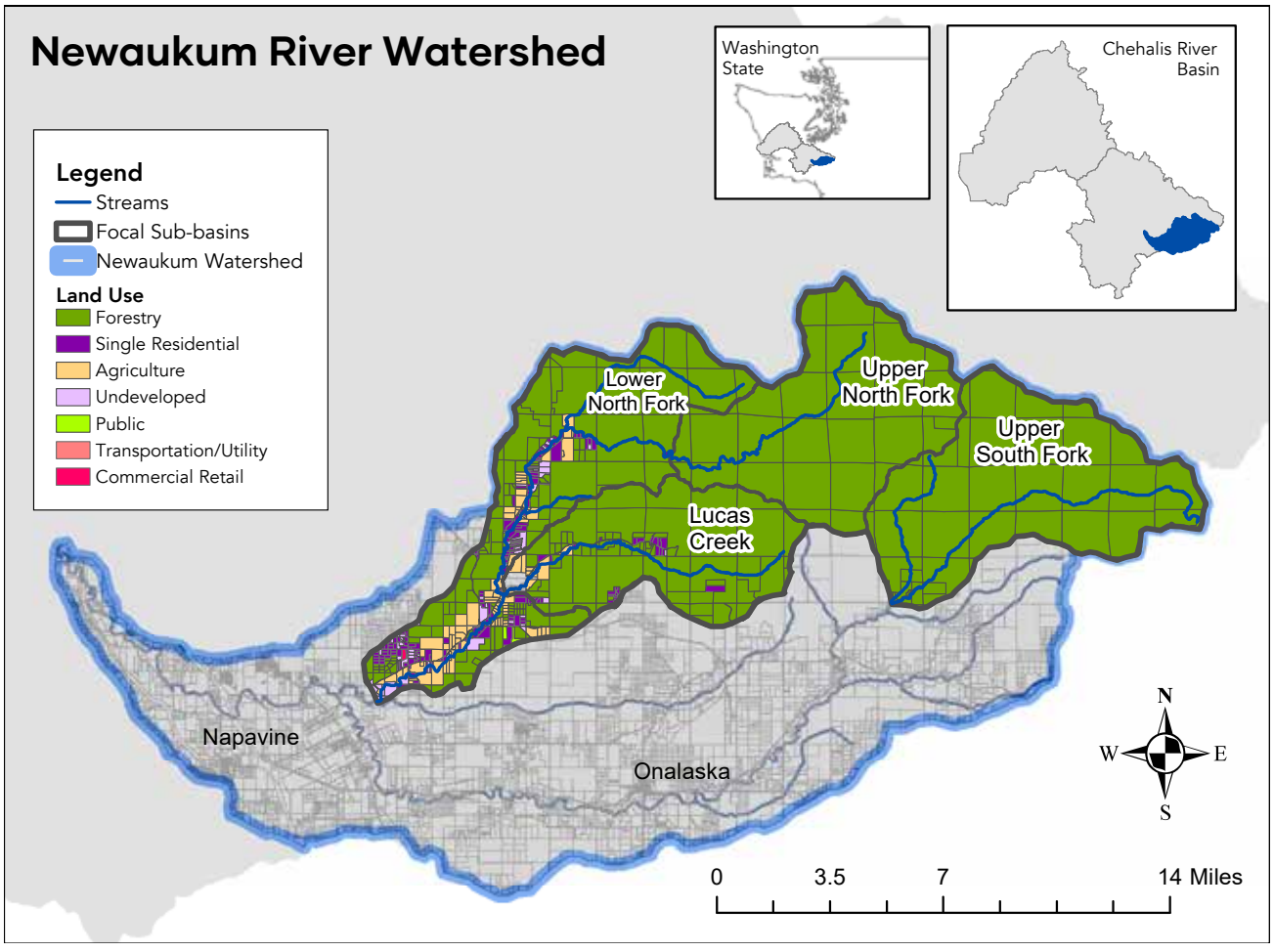
1. capacity to realistically complete work within a defined time frame;
2. watershed size and whether a few large or many smaller actions are needed to achieve goals;
3. current land use and existing protections;
4. community support.

Effective, watershed scale restoration requires that a significant portion of a watershed's streams be restored, so that cumulative restoration actions have a measurable impact on fish populations and watershed function (Bilby et al. 2022). This means the area must be small for this amount of effort to be feasible to meet project timelines. The Work Group took these factors into consideration and selected four focal sub-basins in the Newaukum River watershed for this restoration plan (Figure 1):

- Upper South Fork Newaukum
- Upper North Fork Newaukum
- Lower North Fork Newaukum
- Lucas Creek

The 151 square miles of these four sub-basins are largely in industrial forest management, reducing the overall need for riparian planting because riparian protections are in place by state law (Washington Department of Natural Resources, 2022). Unlike other areas in the watershed, these sub-basins have few remaining fish passage barriers, meaning that connectivity is relatively intact. Work Group members identified multiple properties where restoration actions would be acceptable by the current tenants of the rural residential lands in these sub-basins. Given this combination of landscape simplicity and opportunity, Work Group members felt that reasonable actions could be taken to significantly improve fish populations and watershed function.

Figure 1. Map of Newaukum River watershed and focal sub-basins for restoration. Focal sub-basins are the lower and upper North Fork Newaukum River, Lucas Creek, and the upper South Fork Newaukum River.



Land Ownership and Land Use

The ownership of the 151 square mile area is 98.5% privately owned (the major private landowner is Weyerhaeuser Corporation), 0.5% US Forest Service, 1% state. The majority of the upper North Fork and South Fork sub-basins, which encompass the steeper headwater tributaries and mainstem rivers, are managed as industrial forest land (Table 1). Land use of the lower North Fork and Lucas Creek sub-basins, with lower gradient streams flowing through the valley, is a combination of forestry, residential, and agricultural. These sub-basins are sparsely populated and homes are generally owner occupied. Agricultural use occurs in the form of family farms and small operations. In the future, more development may occur in these areas. In Lucas Creek, there are several new houses on 5-acre lots, with the potential for more (K. Verd, personal communication 2023). Of note, 18% of the land in the lower North Fork sub-basin is currently undeveloped, with the potential for future habitat degradation depending on how the land is eventually used.

Table 1. Land use type within focal sub-basins of the Newaukum River watershed

Land Use	Upper SF Newaukum	Upper NF Newaukum	Lower NF Newaukum	Lucas
Forestry	96.7%	98.1%	27.8%	56.7%
Single-Residential		<1%	34.1%	23.8%
Agriculture	<1%	-	19%	19.4%
Undeveloped	-	2.0%	18.2%	-
Public	3.2%	-	0.4%	-
Transportation/Utility	-	-	0.4%	-
Commercial Retail	-		0.1%	-

Photo by John Gaffney

Fish Populations and Distribution

The Newaukum River watershed supports anadromous runs of spring and fall Chinook salmon, coho salmon, and steelhead trout and resident populations of rainbow and cutthroat trout. In the North Fork Newaukum River, spring and fall Chinook salmon spawn up to RM 12.5 and coho and steelhead have been documented to RM 18.5. Coho, steelhead, and resident trout also use larger tributaries to the North Fork Newaukum River, including the Middle Fork Newaukum River, and Lucas, Bear, and Mitchell Creeks. In the South Fork Newaukum River, spring and fall Chinook salmon spawn up to RM 31 and coho and steelhead have been documented to RM 34.4. Coho, steelhead, and resident trout also use larger tributaries to the upper South Fork, including Bernier, Beaver, Frase, and Kearney creeks.

Spring and fall Chinook, coho salmon, and winter steelhead were identified as "healthy" status by the Washington Department of Fish and Wildlife (WDFW) in 2002, but declining numbers have been noted in more recent analysis. Spring Chinook salmon runs have steadily declined since 2000 (Lestelle et al. 2019) resulting in recent years of fishery closures. Total spawning escapement for steelhead (2001-2021) and coho also show declining trends over the last 20 years (L. Ronne, personal communication, 2022). No status designation is available for coastal cutthroat trout.

Traditional Fish and Riverine Resource Use

The Chehalis, Quinault and Cowlitz have relied heavily on fish and other riverine resources for sustenance and cultural sanctity for millennia. The rivers provide an ample supply of varying species of salmon, steelhead, and eels migrating back to the ocean. Salmon runs were once so immense and heavily utilized in a way that could last the entire winter. Freshwater clams, mussels and crayfish could also be found in abundance in the rivers. Additional food sources sustained by the rivers are wild game such as deer, elk, and bear. Floodplains and wet prairies support a variety of plants, berries and roots. Camas (camassia) is the most prominent of these plant resources, its edible bulb made into bread, soup and served with fish and salmon eggs.

Such is the importance of fish in the lives of the people that the word cɨłn serves to represent 'fish' and 'food' interchangeably in the closely related Chehalis and Cowlitz languages. The spiritual importance of salmon can be observed in the stories of x̱ʷeni x̱ʷən, a supernatural changer figure (here anglicized as Honne), as he teaches the salmon to protect the eggs so they one day may return:

Photo by Mara Zimmerman

"Won't the eggs float downstream?" asked the fish. "No," said Honne, " because Grandmother (a small creature who is supposed to hold the eggs between the rocks) will take care of the eggs." Silverside could not understand how it was done so Honne got down on the gravel and dove under the water on the riffle, he kicked the gravel with his feet; each time that he kicked he dropped two or three eggs off his hands and as he laid the eggs he sang, under the gravel, Under the sand, You lay and Grandmother will take care of you." They went under the gravel and lay there. They were to lie there so many days before they would become fish. And Honne told the eggs that they must not leave the fish until they were able to swim. He told them that when the fish grew up, they must come each year to the same place (Sanders and Van Winkle Palmer: 42-43).

According to the Chehalis Tribe, "the rivers have provided for the Chehalis and Cowlitz people before and throughout an era of damaging colonial practices, but by taking initiative to protect the land and water, we can ensure the rivers will continue to provide for future generations."

The Quinault Indian Nation has treaty fishing rights that include the Newaukum and its tributaries, and is currently working to protect these traditional resources.

Habitat Types and Habitat-Forming Processes

Processes that sustain rivers and salmon in the Newaukum River include growth and change in the riparian ecosystem (riparian process), the transport of sediment from headwaters to mouth (erosional process), the connection between a river and its floodplain (channel/floodplain interactions), and the movement of water into and out of the physical and biological landscape (hydrologic process).

Riparian Processes

Native vegetation along a stream bank is cited as one of the most important determinants of stream health. These areas, called "riparian" areas directly affect the adjacent stream through supplying wood, leaf litter and food that fish and other aquatic life need, shade, root stabilization of banks, sediment retention, and filtration of pollutants (Roni and Beechie, 2012). Processes occurring at the riparian scale affect habitat locally and downstream.

Erosional Processes

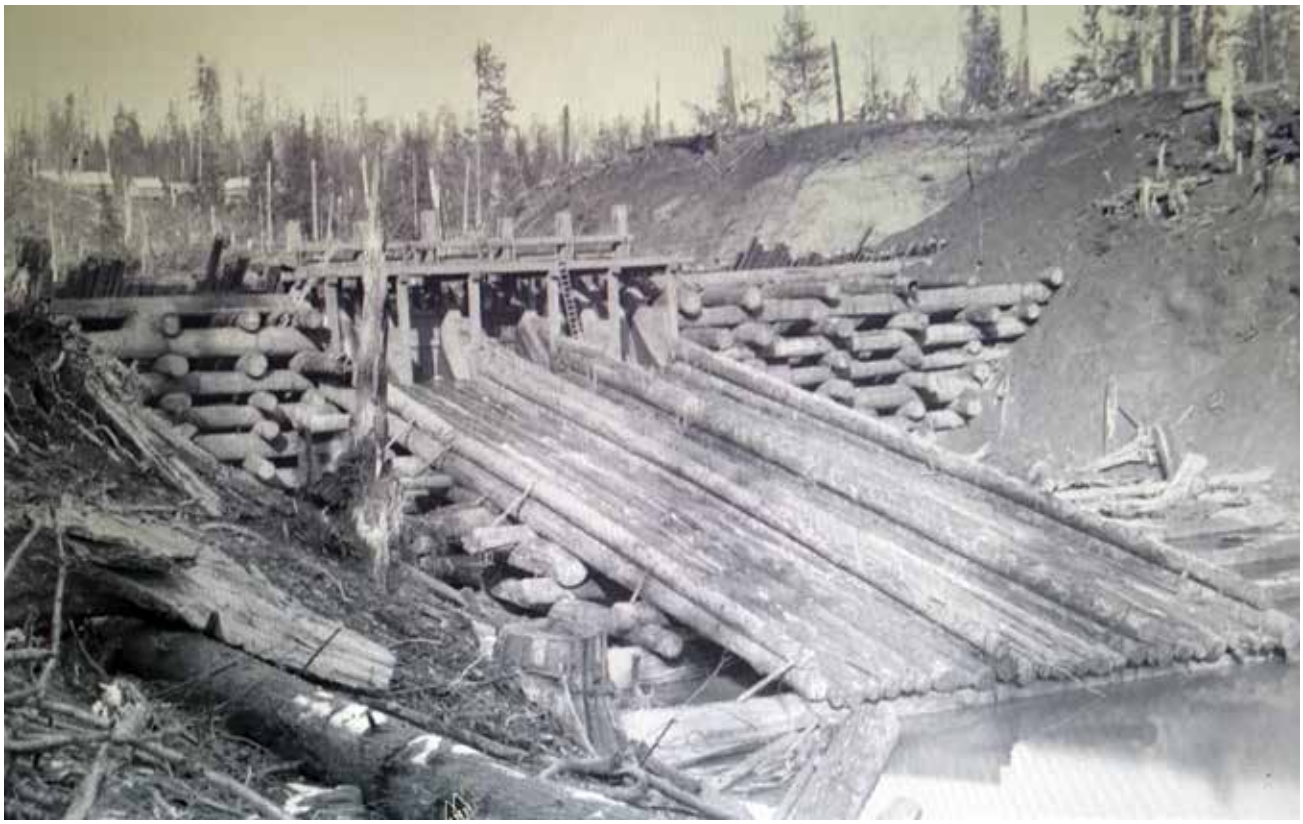
Water's transport of sediment (i.e., soil and rock) from mountain top to sea is a natural physical process to which aquatic life is adapted. Gravel provides the spaces in which salmon lay their eggs. Fine sediment that makes it to the ocean forms coastal dunes and spits. Salmon rely on the continued renewal of sediment to complete their life cycle. Both "not enough" and "too much" sediment have been observed as conditions affecting salmon and other aquatic life.

Channel/Floodplain Interactions

A stream exists as a dynamic interaction between main channel, side channels, and floodplain. Dredging or armoring may reduce connectivity between the channel and floodplain habitats. Lack of wood affects the stream channel characteristics, pool formation, and connection between the streams and their floodplains.

Hydrologic Processes

The water level in a stream occurs in accordance with regional geology and precipitation patterns, and aquatic life adapts to the range of stream flow conditions present throughout the year. Water runoff – both surface and subsurface – is a function of the size and features of an entire watershed, thus when flows are not within historical range (approximately 200-years pre-European settlement) the problems are potentially derived from conditions throughout the watershed.



Mill and Splash Dam, Elk Creek, circa 1910. Photo provided by Larry Dominguez

Habitat Impairment

Information on degradation of habitat forming processes was gathered from the Chehalis Basin Lead Entity Strategy (2011), new scientific research conducted in the basin since 2015, Ecosystem Diagnosis and Treatment (EDT) modeling (ICF, 2019), and expert opinion.

Historical landscape alterations in the Newaukum River watershed were substantial (Table 2). Most of the alterations are from legacy forest practices. Severe scouring of streams from splash damming, a practice of storing logs behind a dam in a stream and later washing them down for transport, was one of the earliest European settler disturbances in streams across the Pacific Northwest that led to exposed bedrock and reduced channel complexity (Sedell and Luchessa 1982). Direct removal of trees from stream banks in the late 1880s through early 1990s degraded in-stream habitat and water quality. Extensive road systems created for forestry led to altered stream discharge patterns, mass wasting, and increased rates of sediment delivery to streams.

Non-forestry related alterations on the North Fork Newaukum River included the development of water intake structures for the cities Chehalis and Centralia and a fishway intended to enhance adult fish passage that ultimately created a barrier to juvenile salmon. Rural development in the later 1900s and 2000s has led to a second removal of riparian trees, alteration of the floodplain, and the introduction of non-native invasive plants which outcompete and eliminate the growth and succession of native plants in the riparian areas.

"The rivers have provided for the Chehalis and Cowlitz people before and throughout an era of damaging colonial practices, but by taking initiative to protect the land and water, we can ensure the rivers will continue to provide for future generations."

~ The Chehalis Tribe

Table 2. Land alterations and anthropogenic impacts on habitat-forming processes in the Newaukum River watershed.

Historic Alterations	Impact to Habitat and/or Habitat-Forming Processes
SPLASH DAMS	
Impact	Exposed bedrock, fewer pools, incised stream channels, reduced channel complexity, greater flooding downstream, and removal of habitat features from the river.
Newaukum Specifics	There was a mill and splash dam present in the focal area upstream of the present-day bridge crossing of North Fork Road over the North Fork Newaukum River (K. Verd, personal communication 7/15/2022). Historical splash dams included a two 10-foot pond dams on the North Fork Newaukum River, one near the confluence of the Middle Fork Newaukum River and a second located upstream that formed the water supply for Chehalis and Centralia. A third historical splash dam was located on the lower reach of Mitchell Creek (Wendler and Deschamps 1955, Coast Salmon Partnership web map).
RIPARIAN TREE REMOVAL	
Impact	Loss of shade, food, and wood recruitment needed by fish and other aquatic life.
Newaukum Specifics	Riparian areas on residential and agricultural lands are currently in poor condition or lacking entirely, primarily in the Lucas Creek and North Fork sub-basins. Riparian conditions in areas managed for industrial timber are intact in buffer areas protected by forest practice rules; however, those rules have not been in place long enough for the trees to grow and forest composition to mature (defined as 200 years to reach Site Potential Tree Height).
ROAD CONSTRUCTION	
Impact	Roads indirectly increase erosion rates, leading to altered stream discharge patterns, mass wasting, and increased rate of sediment delivery to streams. Elevated fine sediment levels decrease the quality of spawning gravels (Northwest Indian Fisheries Commission, 2016,).
Newaukum Specifics	Road densities in the focal sub-basins are more than 3.0 miles per square mile, above the level at which streams function properly. Density of road crossings per mile of stream is less than 0.5, which is on the lower end of road impact in the Washington Coast region. (Northwest Indian Fisheries Commission, 2016,).
FOREST COVER REMOVAL	
Impact	A decrease in forest cover negatively alters salmon habitat by increasing peak flow and water yield from a watershed and increasing sediment delivery (Northwest Indian Fisheries Commission, 2016). These changes affect the processes identified as "hydrologic" and "erosional" in this report and occur at the watershed scale.
Newaukum Specifics	Much of the upper watershed is in active timber harvest according to forest practice rules. According to the Northwest Indian Fisheries Commission "State of the Watersheds" 2016 report includes an analysis of change in forest cover between 2006 and 2011. The headwaters in the North Fork and South Fork were rated as "poor forest conditions" and showed a high amount of loss (> -5%) during this period.

Table 2 *cont.* Land alterations and anthropogenic impacts on habitat-forming processes in the Newaukum River watershed.

Historic Alterations	Impact to Habitat and/or Habitat-Forming Processes
DIRECT SURFACE WATER WITHDRAWALS	
Impact	Direct surface water withdrawals for human consumption impair habitat if stream water levels get below minimum baseflows needed for ecological function. Low stream flows are associated with warm water temperatures, which can lead to fish stress and mortality. In the early fall, low stream flows can impeded access of salmon on their spawning migration.
Newaukum Specifics	Water withdrawals from surface water were identified as a contributor to low flows in the 2001 Smith Wegner report. A major surface water withdrawal occurs at RM 17 of the North Fork Newaukum River, which is the primary drinking water intake for the City of Chehalis. The water right associated with this intake is for 10 cfs year-round established in 1923 (HDR, City of Chehalis Water System Plan, Feb. 2012). Although no flow monitoring occurs at the intake, the presumed withdrawal is between 1.7 and 2.7 cfs as determined by how much water is processed at the treatment plan (J. Riddle personal communication June 14, 2022).
GROUNDWATER WITHDRAWALS	
Impact	Groundwater withdrawals for human consumption can impair habitat if stream water levels get below minimum baseflows needed for ecological function. Low stream flows are associated with warm water temperatures, which can lead to fish stress and mortality, and can inhibit adult salmon access to spawning grounds in the early fall.
Newaukum Specifics	The Newaukum basin is expected to have an additional 703 wells by 2040, with an impact of 80 af/year (0.11 cfs) of consumptive water use (Chehalis Basin Partnership, 2020). This is approximately 1% of baseflows, as a relatively minor impact. Most of these wells are projected for the lower South Fork Newaukum and lower mainstem Newaukum, areas downstream of the focal areas included in this plan.
CULVERTS AND FISHWAY	
Impact	Fish migration in a stream channel can be limited by undersized culverts placed under roads or other anthropogenic structures that degrade linear connectivity of a stream.
Newaukum Specifics	Two water crossing structures in Lucas Creek are in the top 33% barriers needing correction in the Chehalis Basin. A fishway structure the North Fork Newaukum near the City of Chehalis water intake does not meet current standards for drop height, velocity, or energy dissipation to provide upstream juvenile passage.
INTRODUCTION OF INVASIVE PLANTS	
Impact	Invasive plants often outcompete native plants, arresting succession of riparian habitats. This limits diversity of food sources for fish and other biota, lowers water quality leading to fish stress, causes increased bank instability and soil erosion, and results in loss of properly functioning aquatic habitats.
Newaukum Specifics	Himalayan blackberry and reed canary grass are the two most widespread invasive plants in the Newaukum River watershed causing degradation of riparian and instream habitats.

Photo by Kathy Jacobson

Recent land use practices have improved under state and federal regulations which protect further habitat impairment. The Forest Practices Act of 1973 (chapter 76.09 RCW) was designed to protect public resources such as water quality and fish habitat while maintaining a viable timber industry. Forests and Fish legislation (ESHB 2091), established in 1999, give further guidance on how to implement the act and comply with federal Endangered Species Act and Clean Water Act (Forest and Fish website). The rules specify restrictions and treatments for riparian management, as well as and rules regarding water crossings and road maintenance. Washington's Road Maintenance and Abandonment Plan (RMAP) was established in 2001, requiring large forest landowners to correct fish passage barriers.

Instream flow rules for the South Fork and North Fork Newaukum were set through statute (WAC-173-522-020) and are administered by the Department of Ecology in order to protect water quantity in streams. A temperature TMDL for the Chehalis Basin was developed by Ecology in 2001 to improve water quality through designating shade targets (an increase of 35% is recommended for the Newaukum Basin) and recommending Best Management Practices (BMPs) for landowners to take to reduce non-point pollution (D. Rosterfer, personal communication, January 2021).

In addition to rules in place to prevent further impairment, reversing impairments on habitat forming processes will require voluntary actions and the funding to implement those actions. High priority voluntary actions needed in the selected Newaukum River sub-basins are outlined in the Goals, Objectives and Actions section of this report.

Photo by Inter-Fluve

Prioritized Impaired Habitat Processes

The Work Group identified the most impaired processes for each focal sub-basin included in this Newaukum River restoration plan (Table 3). Additional detail is provided in the following paragraphs.

Table 3. Impaired habitat-forming processes in focal sub-basins of the Newaukum River watershed.

Habitat Process	Upper South Fork	Upper North Fork	Lower North Fork	Lucas Creek
Riparian			x	x
Erosional	x	x	x	x
Channel/Floodplain	x	x	x	x
Hydrologic	x	x	x	x

Riparian

The lower section of the North Fork Newaukum River does not have riparian vegetation, primarily an overstory that provides shade. In Lucas Creek, the middle section has poor riparian vegetation, while the upper and lower sections are in better condition.

Erosional

Erosional conditions are mixed with reaches of either 'too little' or 'too much' sedimentation. Portions of the upper South Fork and upper North Fork Newaukum River (above the junction with Lucas Creek) have exposed bedrock and limited gravel retention, while other portions are accumulating gravel. Throughout the four sub-basins there are reaches with too much fine sediment due to excessive stream bank erosion and landslides. Landslides are tracked by the Washington Department of Natural Resources' landscape polygon database. Timber companies are required by forest practice rules to address erosion issues caused by newer roads and culverts but not on older roads that have been abandoned and not accessible by vehicle.

Channel/Floodplain

In the managed forests of the upper North Fork and upper South Fork sub-basins, the riparian buffers are established but immature (20-30 years old) with limited instream wood recruitment and restricted channel-floodplain interactions. In the residential areas of the lower North Fork and Lucas Creek sub-basins, bank hardening and increased impervious surfaces have disconnected the river and floodplain.

Hydrologic

Impaired summer stream flow in all four sub-basins has been identified by multiple previous reports (Smith and Wenger, 2001, Grays Harbor County Lead Entity Habitat Work Group, 2011) and by observations by Work Group members. Smith and Wenger (2001) reported that the river was below administrative baseflow for an average of 59 days a year at the gaging station near Chehalis.

Impaired summer temperatures result from lack of tree cover and exposed bedrock and warm temperatures are typically associated with low levels of dissolved oxygen (warmer water has less capacity for dissolved gasses, including oxygen). The mainstem and all three forks of the Newaukum River have at least one water quality impairment each and are on the current 303(d) list of impaired waters by the Washington Department of Ecology. For example, during 2018, the seven-day average daily maximum temperature reached 26.4 °C in the lowest extents of the Newaukum River watershed with oxygen levels of 6.84 mg/L during the same period, well below the minimum state criterion. And in the summer of 2021, fish kills were observed in warmer parts of the North Fork Newaukum River (L. Ronne pers comm.).

Photo by Inter-Fluve

Future Habitat Impairment

Climatic conditions over the next several decades will have a large negative impact on freshwater salmon habitat (Battin et al., 2007, Mantua et al., 2010) that include increased summer stream temperature, decreased summer streamflow, increased flooding and winter flows, and rising sea levels. Changes in stream flow and temperature will affect fish metabolism and migration as well as sediment transport (erosional processes) and habitat connectivity. Further stressors on stream flow are anticipated from consumptive permit-exempt wells, for which some of the highest impacts in the Chehalis River basin are predicted to occur in the Newaukum River watershed (Chehalis Basin Partnership, 2020). Adaptation for the future will require practitioners to incorporate climate impacts and exacerbating factors into the design of habitat protection or restoration projects. Recommended actions to adapt or mitigate these future habitat impairments are provided in Adams and Zimmerman (2023) and should be incorporated into project designs associated with the Newaukum River restoration plan.

Adaptation for the future will require practitioners to incorporate climate impacts and exacerbating factors into the design of habitat protection or restoration projects.

Spawning Lamprey in the North Fork Newaukum River. Photo by Lea Ronne

Goals, Objectives, and Actions

Restoration Goals

Restoration goals for riparian restoration, wood placement, and fish passage that address impaired processes and improve watershed function are describe below.

RIPARIAN RESTORATION

The goal for riparian restoration is to establish native vegetated riparian buffers and initiate long-term successional processes that will improve future stream shading, bank stability, nutrient filtration, and future wood recruitment. Addressing the streamside conditions and increasing tree species and age class diversity allows the system to seed its own wood from the riparian zone into the future.

WOOD PLACEMENT

The goal of wood placement is to kick-start long-term improvements in habitat forming processes at the reach scale. Specifically, strategic wood placement leads to creation of new pools within the channel, improvement of pool quality and lower peak flows. Sometimes wood placement contributes to moving water out of incised channels and re-engagement of wetlands and side-channels, which in turn cools surface water through its exchange with groundwater. Wood placement is needed now because the riparian vegetation is not mature or lacking. After riparian areas mature, these processes sustain over the longer term through natural wood recruitment.

FISH PASSAGE

The goal for fish passage is to improve longitudinal connectivity of the stream to allow for juvenile and adult fish passage among migration, spawning, and rearing habitats.

Restoration Objectives

A minimum of 20% of a watershed's instream habitat and floodplain should be restored by a cumulative suite of actions in order to obtain a measurable response from salmon populations (Roni et al. 2010). Restoration objectives for riparian restoration, wood placement, and fish passage are described by the cumulative miles of stream to be restored or reconnected. Given that there are 124 miles of stream channel (National Hydrography Database 1:24,000) in the geographic footprint of this restoration plan, our objective is to restore and reconnect approximately 25 miles (20%) of stream habitat.

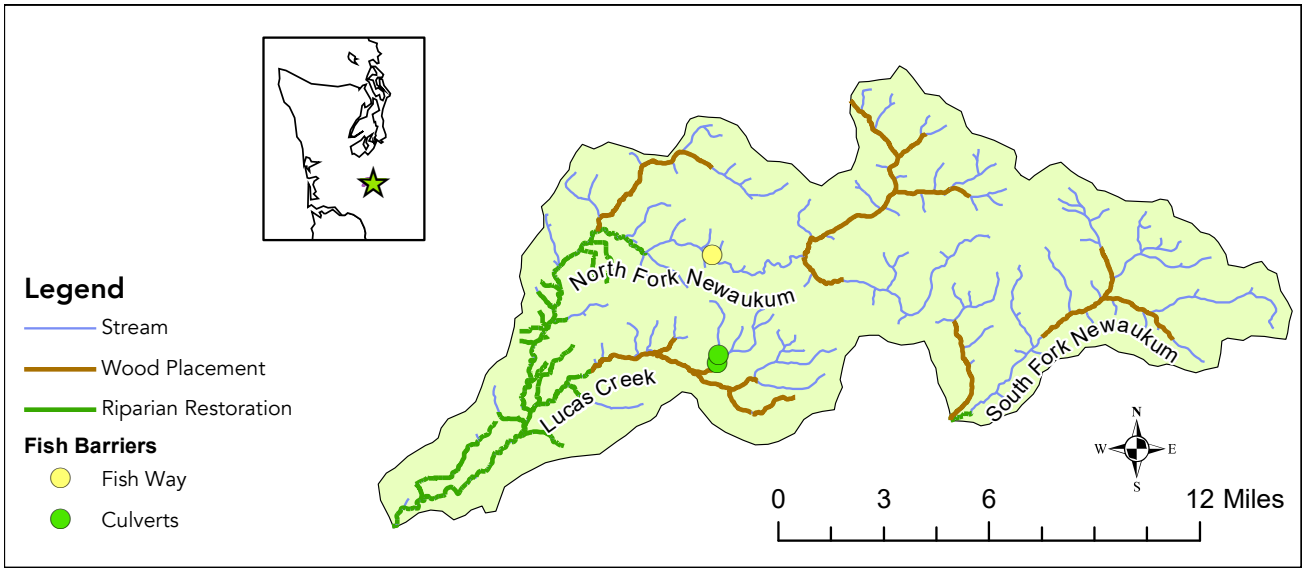
GIS modeling was used to identify the best locations and opportunities to achieve each restoration goal. Suitability models for riparian restoration and wood placement were developed from inputs including fish distribution, land use, and stream temperature (links to documentation provided below). Individual metrics were classified and scored with stakeholder input to provide the best result possible for the local condition.

Wood Treatment Model Map and Wood Model Input Documentation

Riparian Restoration Model Map and Riparian Model Input Documentation

By following this approach, we have narrowed the geographic focus from the 124 miles of stream channel to 52 miles for field assessment (Figure 2). However, field assessments are needed to validate the model outputs and further narrow the geographic focus from 52 miles of restoration opportunity to 25 miles of restored stream reaches.

Figure 2. Priority locations identified for wood placement, riparian restoration, and fish passage projects in the Newaukum River watershed. In-field assessment will be used to develop a specific project list.



Getting to Actions

Achieving the described restoration objectives will require assessing 26.4 miles of stream channel and adjacent floodplain for riparian restoration need and opportunity and a separate 25.6 miles for wood placement need and opportunity. Field assessments should identify project locations that will contribute to the cumulative restoration objectives for the basin. The information collected should include on-the-ground conditions and landowner willingness to participate.

Field assessments for wood placement projects should include, but not be limited to:

- in-channel habitat metrics
- wood counts
- measures of floodplain connectivity or incision

Field assessments for riparian restoration projects should include, but not be limited to:

- percent cover invasive plants
- percent cover native vegetation
- the presence of over-story trees within a buffer width of one potential tree height (see WDFW, 200-year site potential tree height online mapper)
- landowner's agreement on restored buffer width

A list of reaches for field assessment are included in Tables 4 through 7. Assessments should result in a project list (i.e., actions) and estimated costs for the restoration. The Work Group should then prioritize these projects and update the information in Tables 4 through 7. Importantly, assessments conducted along continuous reaches should result in projects that affect processes at the reach scale. Such improvements of reach-scale processes in specific locations improve habitat-forming processes locally and throughout the watershed.

In addition to riparian restoration and wood placement actions, this plan includes additional actions to correct upstream fish passage at three sites: two water crossing structures and an aged fishway (Figure 2). These are the only known remaining anthropogenic barriers to fish passage in these sub-basins and there are no known downstream barriers.

Note that actions to improve human altered erosional and hydrologic processes are not listed in Tables 4 through 7 but they should not be forgotten about during the field verification process. Potential projects to address impairments should be further discussed with the Work Group and added to a prioritized list based on their relative impact on watershed function. Specific actions to address sediment include road abandonment, addressing cross-drains, and implementing bioengineered approaches to bank stabilization.

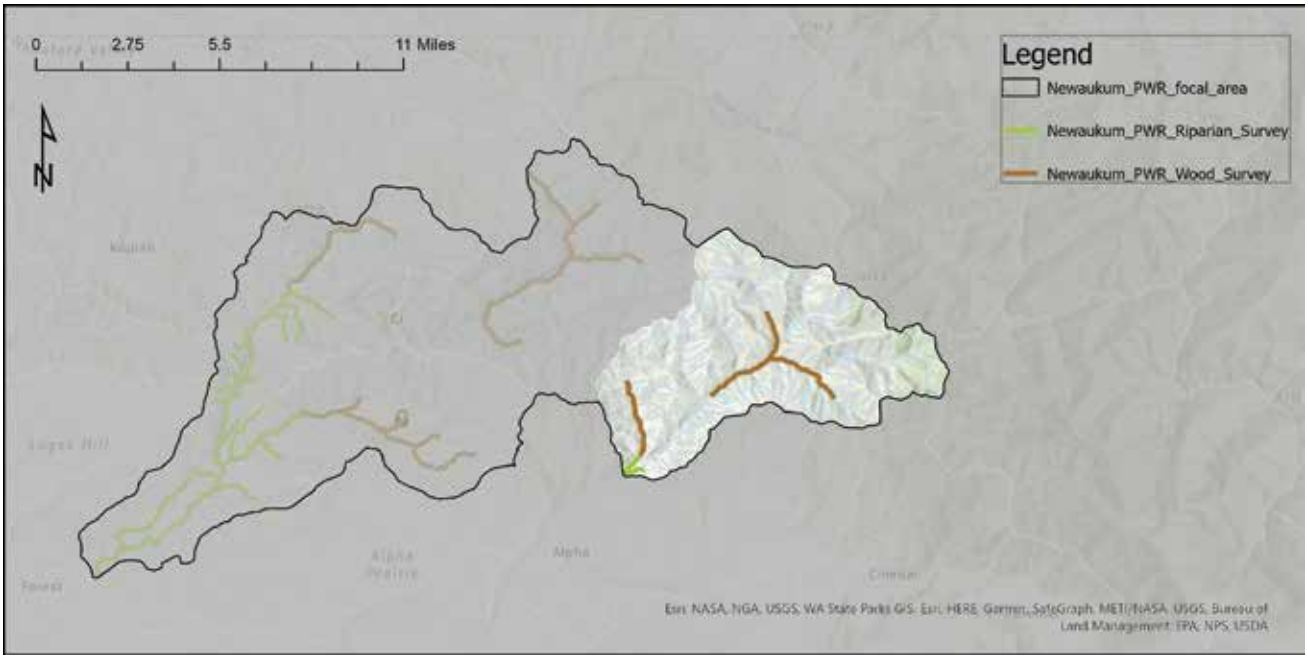
Preliminary scoping has identified two potential hydrological enhancement projects in the headwaters of the North Fork and South Fork Newaukum rivers. Measurements taken from aerial photos suggest that restoration of the outlet of pond #2 (South Fork "Newaukum Lake") would increase its surface area from a currently estimated 3 acres to a historic maximum of about 4.4 acres (Chehalis Basin Partnership, 2020).

Photo by Kirsten Harma

Photo by Inter-Fluve

South Fork Newaukum

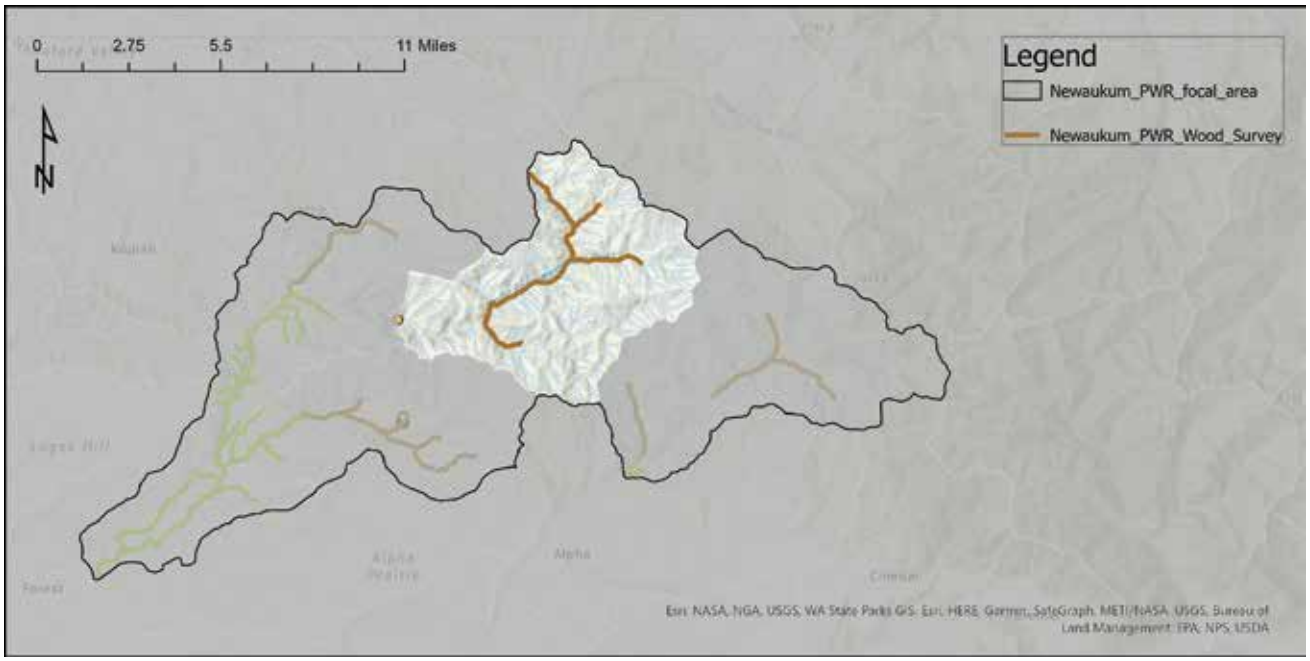
Table 4. Restoration actions for the upper South Fork Newaukum sub-basin



Goal	Assessment Need	Objective	Action
Establish more riparian buffer on lands not covered by the Forest Practices Act, and initiate successional processes that will increase future stream shading, deliver wood, and filter nutrient runoff at the reach scale	Assess 1.0 miles of stream channel for riparian restoration need/opportunity	Treat at least 0.5 miles of stream channel with riparian planting and invasive plant control methods as prescribed	TBD
Initiate or improve habitat forming processes and improve pool quality, floodplain connection, and gravel sorting at the reach scale	Assess 6.6 miles of stream channel for prime wood placement locations	Place wood over at least 3.3 miles of stream channel at densities per Fox and Bolton (2007)	TBD
Total	7.6 miles	3.8 miles	

Upper North Fork Newaukum

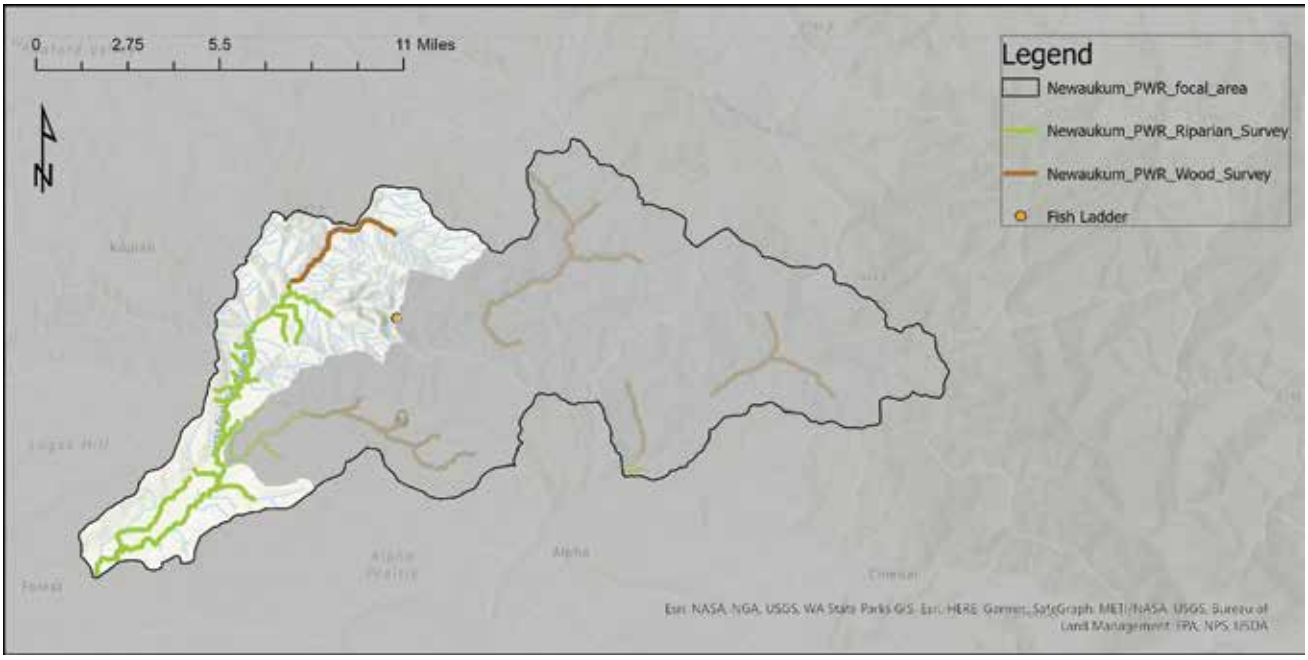
Table 5. Restoration actions for the upper North Fork Newaukum River sub-basin



Goal	Assessment Need	Objective	Action
Initiate or improve habitat forming processes and improve pool quality, floodplain connection, and gravel sorting at the reach scale	Assess 8.3 miles of stream channel for prime wood placement locations	Treat at least 4.2 miles of stream channel with wood placement at densities per Fox and Bolton (2007)	TBD
Total	8.3 miles	4.2 miles	

Lower North Fork Newaukum

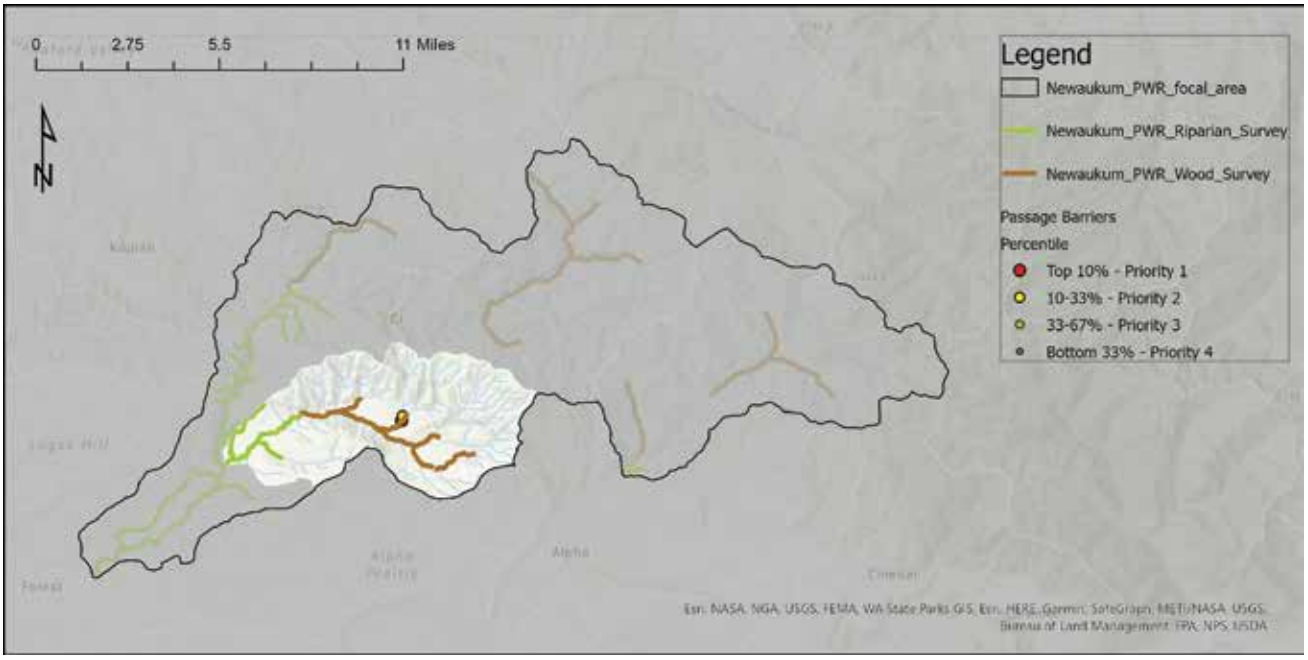
Table 6. Restoration actions for the lower North Fork Newaukum River sub-basin



Goal	Assessment Need	Objective	Action
Establish a riparian buffer and initiate successional processes that will increase future stream shading, deliver wood, and filter nutrient runoff at the reach scale.	Assess 21.2 miles of stream channel for riparian restoration need/opportunity	Treat at least 10.5 miles of stream channel with riparian planting and invasive plant control methods as prescribed	TBD
Initiate or improve habitat forming processes and improve pool quality, floodplain connection, and gravel sorting at the reach scale	Assess 3.5 miles of stream channel for prime wood placement locations	Place wood over at least 1.7 miles of stream channel at densities per Fox and Bolton (2007)	TBD
Correct upstream passage for all species and all life stages of fish	Conduct alternatives analysis for correction of aged fish ladder	Restore upstream juvenile salmonid passage to 13.0 miles of stream	TBD
Total	24.7 miles	25.2 miles	

Lucas Creek

Table 7. Restoration actions for Lucas Creek sub-basin



Goal	Assessment Need	Objective	Action
Establish a riparian buffer and initiate successional processes that will increase future stream shading, deliver wood, and filter nutrient runoff at the reach scale.	Assess 4.2 miles of stream channel for riparian restoration need/opportunity	Treat approximately 2.1 miles of stream channel with riparian planting and invasive plant control methods as prescribed	TBD Protection of intact habitat under the Lucas Smith Conservation Easement
Initiate or improve habitat forming processes and improve pool quality, floodplain connection, and gravel sorting at the reach scale	Assess 7.2 miles of stream channel for prime wood placement locations	Place wood over at least 3.5 miles of stream channel at densities per Fox and Bolton (2007)	TBD
Correct upstream passage for all species and all life stages of fish	NA	Restore fish passage to 3.4 miles of fish habitat	Replace existing structures at MP 4.24 and 4.39 of Lucas Creek Road
Total	11.4 miles	9.0 miles	

Implementing Actions

Once the tables above are updated to include a list of actions, the Work Group will need to convene to prioritize actions for implementation and determine the most appropriate sequence, based on the approach described in Pittman (2021). Next, it should identify appropriate project sponsors. This important step ensures that organizational staff expertise and capacity is best used on the highest priority projects and that there is no duplication of effort. The Work Group should also collaboratively determine funding sources that are the best fit for each action (see Appendix D) and support each other in securing project funding.

Outreach Strategy

OUTREACH GOALS

1. **Gain support of major landowners for implementing watershed restoration projects on their lands.**
2. **Equip community members with information needed to protect spring Chinook salmon, native riparian vegetation, and instream wood.**
3. **Increase community member awareness of salmon in their backyards, the importance of habitat projects, and the benefits of healthy watersheds.**

Since the restoration actions identified in this plan occur entirely on private property, local landowner support will be essential to achieving plan goals. Additionally, "coordination with entities beyond local landowners and the habitat restoration community is necessary to achieve desired population responses to habitat restoration." (Pacific Northwest Aquatic Monitoring Partnership, 2022). Thus, this outreach plan includes both local landowners and the broader community of stakeholders.

Outreach goals are listed in order of priority, with the highest priority goals being those anticipated to have the strongest impact on success of our restoration work. For each outreach goal, we describe the target audiences, restoration targets, and specific outreach actions that will be needed for each target audience.

Lewis County Stream Team Planting on South Fork Newaukum, Photo by Kenna Fosnacht

Outreach Audiences, Targets

1. **Gain support of major landowners for implementing watershed restoration projects on their lands**

Weyerhaeuser

Restoration Target: Add wood in streams.

Outreach Targets: Gain landowner permissions and support.

The Work Group identified in-stream wood treatments as a priority restoration action. Weyerhaeuser is the largest landowner in the focal watershed, owning the majority of the land that is zoned as industrial timber. Weyerhaeuser's support is key to this plan's success as we will need permissions to access lands for field assessment and surveys and to subsequently design and implement projects. As a result, establishing a positive working relationship with Weyerhaeuser is the highest priority for implementing this plan.

City of Chehalis

Restoration Targets: Improve fish passage near water intake; improve stream flow.

Outreach Targets: Gain landowner permissions and support.

The Work Group identified stream flow improvements and fish passage as priority restoration actions. Improvements to the WDFW owned fishway and City water intake structure just upstream on the North Fork Newaukum River are needed to address these issues. Continued engagement with the City of Chehalis will be critical to finding solutions that work for everyone.

The Washington Department of Fish and Wildlife, though not a landowner, holds responsibility for maintenance of a fishway at this site and will be a critical partner for any work here.

Other Private Landowners

Restoration Targets: Add wood in streams; plant riparian areas with native trees; remove invasive plants.

Outreach Targets: Landowner permissions and support.

The Work Group identified in-stream wood treatment and riparian restoration as priority restoration actions. Outside of industrial timber ownership, land use is primarily small family forest and rural residential. Outreach to these landowners will rely heavily on the expertise and relationships built by the Lewis Conservation District who provides technical assistance to landowners in this area. The Conservation District's service will be critical for secure landowner support to implement actions identified in this plan. The Work Group will continue to serve as a forum for restoration practitioners to communicate about which landowners they are meeting with and what messages they will be sharing. This technique, employed for over the last five years, has proven an effective way to avoid duplication of efforts and increase efficiency.

2. **Equip community members with information needed to protect spring Chinook salmon, native riparian vegetation, and instream wood.**

Residents who Live, Recreate, and/or Fish on the Newaukum River and its tributaries

Protection Targets: Reduce the following activities – illegal harvest of spring chinook, building rock dams, disturbing gravels, planting invasive plants, removing native shrubs and trees from the river bank, removing wood from the river.

Outreach Targets: Equip residents who live, recreate on or fish on the river with information on how to protect fish.

Protection of salmon and their habitat will ultimately rely on the relationships that local residents have with the land and the river. Local residents have close ties to the rivers and many are interested in seeing the salmon return to their backyards. In addition, they will be the most impacted by the restoration projects themselves. As a result, education and outreach work with community members who live on, recreate on, or fish in the river is a high priority for implementing this plan.

Work Group members identified illegal fishing as a major threat to spring Chinook salmon, the most imperiled species in the basin. Targeted education is needed on this topic. Those doing outreach should seek out community members who care about fish and are willing to help educate their neighbors about the plight of spring Chinook salmon and the harm of illegal fishing. Work Group members also identified gravel disturbance as a threat to spawning and rearing salmon and rock dam building as a threat to juvenile rearing salmon. Those engaged in these recreational activities may have little awareness that their activities have negative consequences for salmon and steelhead. Lack of state capacity to enforce habitat violations makes citizen-to-citizen education on these topics even more important. Rock hounding during spawning season can disturb redds, harming the next generation of fish. The "1,000 Trails" community group may be a potential ally to educate the rock hounding community about when spawning fish are in the stream and how to avoid harming them. Rock dam building during the summer rearing season can fragment the river and disrupt juvenile fish access to cool-water refugia. Targeted educational material is needed on this topic. Those doing outreach should seek out community members who care about the fish and are willing to help educate their neighbors about the importance of river gravels for juvenile salmon.

Cottonwood removal in Newaukum River. Photo by WDFW

3. **Increase community awareness of salmon in their backyards, why habitat projects are important, and how healthy watersheds will benefit them.**

Community volunteers for restoration projects

Restoration Targets: Plant native trees in riparian areas; remove invasive plants

Outreach Targets: Connect interested volunteers with local Stream Team; encourage local "adoption" of a stream

The Work Group identified native tree planting and invasive plant removal as high priority restoration actions. This work is particularly well suited for volunteer involvement and is needed at many stream restoration locations. Volunteer opportunities provide hands-on engagement that energize community members and increase their investment in healthy watersheds.

The Lewis County Stream Team was formed in 2021 and has been identified as an ally to help organize volunteer planting and maintenance events. Occasionally there are key landowners who are interested in stewardship in their local creek and in increasing their neighbors' awareness of the actions that can be taken to enhance or protect salmon in these streams. Interested parties can be encouraged and mentored by the existing Lewis County Stream Team.

Everyone living in the Newaukum River watershed

Restoration Target: Sustained habitat restoration and protection taking place over decades to come

Outreach Target: General community understanding and support for salmon and their habitat

In general, people support actions that have some benefit or value to them. Outreach to residents in the larger Newaukum River watershed is needed to increase community awareness of the existence and benefits of watershed recovery projects. Organizations conducting outreach should be equipped with answers to challenging but real questions posted by the general public through a Frequently Asked Questions sheet to address questions such as "there are no salmon in this stream so why are we spending all this money?", "hatcheries provide fish so why do we need restoration?", "won't this wood just wash away in the next flood anyways?", "I like to see the river out my back window, why should I plant trees?"

Local residents may also benefit from learning through seeing healthy, intact habitat. Over time, landowners may come forward who are willing to showcase intact and functioning habitat on their properties and host tours for the community.

Table 8. Prioritized outreach action plan

Priority	Action	Who Implements
1	1a. Build on positive working relationship with Weyerhaeuser staff through timely communications when seeking permissions, permits, and support	Lewis Conservation District, Coast Salmon Partnership
	1b. Continued engagement with the City of Chehalis city manager and staff regarding the fishway near their water intake and engagement in alternatives analyses for this location	Lead Entity Coordinator
	1c. Continued engagement with WDFW staff regarding the fishway; engagement in alternatives analyses for the location	Lead Entity Coordinator, Coast Salmon Partnership
	1d. Outreach to landowners in land use categories of family forest, agriculture, and rural residential to provide technical assistance and engage in riparian restoration planning	Lewis Conservation District
	1e. Coordination at Newaukum Work Group regarding landowner communications and outreach status	Newaukum Work Group
2	2a. Develop educational fliers and FAQs/ talking points regarding protection actions for Spring Chinook and salmon habitat	Coast Salmon Partnership
	2b. Distribute educational flyers regarding protection actions for Spring Chinook and salmon habitat	Lewis Conservation District, WA Department of Fish and Wildlife
	2c. Conduct workshops for community groups, e.g. connect with "1,000 Trails" community group for outreach about the impacts of rock hounding	Lewis County Stream Team
	2d. One-on-one outreach to community members who care about fish and may be willing to educate their neighbors in order to reduce illegal and harmful actions	Lewis Conservation District, WA Department of Fish and Wildlife
	2e. Connect Lewis County Stream Team with priority areas for projects	Newaukum Work Group
	2f. Host volunteer planting projects and invasive plant treatments	Lewis County Stream Team
	2g. Identify interested landowners who may have enthusiasm for starting a local stream team	Newaukum Work Group; Lewis County Stream Team

Table 8 *cont.* Prioritized outreach action plan

Priority	Action	Who Implements
3	3a. General awareness public service announcements or media interviews	Lead Entity Outreach Contractor
	3b. Develop Frequently Asked Questions responses about general salmon and habitat topics	Lead Entity Outreach Contractor
	3c. Develop and install educational signage. A potential location is the intersection of North Fork Road and Alpha Road where people park their vehicles to access the river	Coast Salmon Foundation
	3d. Install warning signs that a restoration project may present a hazard to recreational users of the river	Project sponsors
	3e. Host an educational booth at community events including Onalaska Apple Festival, Lewis County Youth Fair, Southwest Washington Fair and meetings of the Onalaska Alliance	Lewis Conservation District, Lead Entity Outreach Coordinator; WDFW habitat biologists; Conservation Northwest
	3f. Conduct public tours of intact habitat and/or successful restoration projects in the focus watersheds	Landowners, with support of restoration partners

To achieve these outreach goals, it will be important to communicate and coordinate with other initiatives in the basin in order to leverage capacity and eliminate redundancy (See Appendix C).

Stream monitoring. Photo by Kirsten Harma

Monitoring and Adaptive Management

Monitoring data is essential for evaluating success of the Newaukum Restoration Plan and necessary for implementing adaptive management practices. Because monitoring activities are not eligible under most salmon grant programs in Washington State, the Work Group designed a monitoring program that leverages existing capacity and activities rather than proposing a state-of-the-art program that is unlikely to launch. This plan (Table 9) focuses on collecting consistent pre- and post-project observations at project sites, sharing observations and lessons learned among Work Group members, and adapting restoration actions or priorities as needed. Work Group involvement is critical to sustain the monitoring and adaptive management process.

Four elements of the Newaukum PWR monitoring program are 1) restoration milestones, 2) project implementation, 3) landowner feedback, and 4) status and trends monitoring. This will take place through an annual process where a different entity provides an overview on each monitoring element and facilitates discussion among Work Group members. This annual process should identify lessons learned and any adjustments needed to future restoration activities.

- **Restoration Milestones.** The list of instream wood, riparian, and fish passage projects will be tracked over time with respect to their project stage – 1) Conceptual, 2) Design phase, 2) Construction phase, 3) Complete. These milestones will be tracked through the Salmon Recovery Portal database. The Lead Entity Coordinator will review these data for accuracy and subsequently provide an annual progress report on milestones.
- **Project Implementation.** Monitoring will occur before and after implementation of three types of restoration actions – 1) wood placement, 2) riparian restoration, and 3) fish passage. Metrics, targets, and monitoring schedule are listed for each type of restoration action below (See Table 9). Implementation monitoring will evaluate whether projects were implemented as described and whether the implemented actions are sustained over time. A standardized list of project implementation monitoring for each project type (fish passage, riparian, and instream wood) is provided in Table xx. Coast Salmon Partnership staff will oversee the project implementation monitoring program and will provide an annual summary of project implementation. Pre- and post-project data may be gathered in collaboration with or independently of project sponsors, depending on the logistics and capacity.
- **Landowner Feedback.** Landowner feedback is primarily gathered by project sponsors as projects are developed and implemented. Conservation District staff will lead an annual Work Group discussion on key themes and emerging issues with the Work Group. This feedback may be particularly useful for adaptively managing outreach activities.
- **Status and Trends Monitoring.** Status and trends monitoring include adult abundance, juvenile production, fish distribution, and water quality and quantity. These are ongoing activities in the Newaukum River conducted by state and tribal natural resource departments and nonprofit organizations (see Appendix E). Although these data are typically collected for purposes other than salmon habitat restoration, their results provide meaningful context for the restoration activities. For example, the observed delay in migration of adult spawners at the water intake structure on the North Fork Newaukum in 2022 was an important observation that informs restoration needs at this location. An annual update on these monitoring activities will be requested from the Washington Department of Fish and Wildlife (Region 6 Fish Program) and Washington Department of Ecology.

Photo by Kathy Jacobson

Table 9. Implementation monitoring plan

Wood Placement

Metric	Target	Schedule
Wood Density. This metric is the wood count per 100m of stream channel. The stream channel will be surveyed through the treated area and wood of dimensions >0.1m in diameter and 2m in length will be counted (Washington Forest Practice Board minimum size criteria for Large Wood Debris).	75th percentile of wood loading observed by Fox and Bolton 2007. 63 pieces of wood per 100m for most bankfull widths in the treatment area (for channels >6m to 30m in width, and 38 pieces for channels 0-6m in width)	• Baseline • Immediate survey within 1 month of treatment • 1-year post-project • 5-year post project
Channel Incision. The metric is the incision depth averaged over the treatment reach. The stream channel will be surveyed through the treated area and incision depth will be measured as the difference between the floodplain and bank full height at 100m intervals along the stream.	Decreasing values from pre- to post-treatment.	• Baseline, • 1-year post project • 5-year post project
Annual Operating, Maintenance, and Liability Costs. This metric includes all costs to operate or maintain a site once the project is completed (e.g., staff time, volunteer time, materials, insurance).	Minimal difference between anticipated and actual costs.	Annual estimate for five years post project.

Photo by Ned Pittman

Table 9 *cont.* Implementation monitoring plan

Riparian Restoration

Metric	Target	Schedule
Species Count and Density. The metrics are the total number of native plant species and non-native plant species and the species count per acre. Riparian assessments will follow vegetation plot (transect/quadrat) methods outlined by the National Coastal Resiliency Fund adapted to local conditions. Counts will focus on native species that were planted and invasive plant species that were removed. The survey includes a randomized sub-sample (up to 10% depending on the number and size of sites) of the stream, floodplain, and riparian area that was treated.	Number and density of live non-native species decreases in post-treatment survey. Number and density of live native species increases in post-treatment survey and reflects the list of planted native species.	• Baseline • Immediate re-survey (within 1 month) • 1-year post project • 5-year post project
Riparian Buffer Width. The metric will be the distance between the outermost planting and the stream channel averaged over all transects in the treated area. Measure the width of riparian buffer established by new plantings. The stream channel, floodplain, and riparian area will be surveyed along lateral transects as described above. For each transect, record the location of the outermost planting as a distance from the stream channel (laser range finder).	Full target is site potential tree height at 200 years as defined by the Washington Department of Fish and Wildlife online mapping tool. Minimum target is 35 feet per Natural Resource Conservation Service standard.	• Baseline • Immediate re-survey (within 1 month) • 1-year post project. • 5-year post project.
Annual Operating, Maintenance, and Liability Costs. The metric will be all costs to operate or maintain a site once the project is completed and will include staff time, volunteer time, materials, and insurance costs.	Minimal difference between anticipated and actual costs.	Annual estimate for five years post project.

Plantings on the Chehalis Discovery Trail, Photo by Kathy Jacobson

Table 9 *cont.* Implementation monitoring plan

Fish Passage

Metric	Target	Schedule
Site Passability. The metric will be fish passability at the site as defined by the Washington Department of Fish and Wildlife's Fish Passage, Inventory, and Assessment Manual (WDFW, 2019). Field data collection will follow standard WDFW protocols for Level A (or B if needed) analysis and include measures of channel width, channel gradient, and water surface drop.	100% passability to all species and life stages	Baseline, one-year and five-year post project.
Presence of Target Fish Species. The metric will be the presence/absence of anadromous or resident fish species and life stage limited by barrier. Data will be collected via a combination of visual survey, snorkeling, electrofishing, and eDNA upstream of the project site and may be coordinated with ongoing status and trend monitoring efforts. A negative result should be confirmed by at least three field sampling events at the appropriate time of year for the target life stage.	Target species and life stage present.	• Baseline • 1-year and post project. • 5-year post project.
Annual Operating, Maintenance, and Liability Costs. This metric includes all costs to operate or maintain a site once the project is completed (e.g., staff time, materials, insurance).	Minimal difference between anticipated and actual costs.	Annual estimate for five years post project.
Safety Hazard. The metric will be an identified hazard associated with the fish barrier (i.e., upstream flooding, boat or raft safety), if present.	Diminish or eliminate the hazard.	Baseline, one-year and five-year post project

Civic and Community Enhancement

Metric	Target	Schedule
Civic or Community Enhancement. The metric is any change to infrastructure, utilities or recreational facilities for community benefit. Quantifying this metric will be site specific, but one anticipated example is improvement in the City of Chehalis water intake facility on the North Fork Newaukum.	Improvement to community benefit.	• Baseline, • 1-year post project • 5-year post project

Chehalis River, Steelhead Spawning. Photo by Nick Vanbuskirk

Conclusion

The time to restore fish habitat in the Newaukum River is now. Salmon and steelhead numbers are at an all-time low, but stakeholder collaboration is at an all-time high.

The Newaukum Restoration Plan offers a comprehensive and science-based approach with a strategic plan for community outreach that is needed both to achieve the restoration goals and to encourage community stewardship of the watershed for generations to come.

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Appendices

Appendix A

History of Watershed Planning and Restoration in the Newaukum

As a result of the Washington State Legislature's Salmon Recovery Act (RCW 77.85), watershed groups (Lead Entities) have been developing and finding funding for restoration projects for nearly two decades. The collaborative and inclusive Lead Entity process lays a cooperative foundation for this work. The Lead Entity developed a Chehalis Basin Restoration and Preservation Strategy for WRIA 22 and 23, which is a comprehensive plan for restoring and enhancing salmon habitat throughout the Chehalis Watershed. It was first released in 2004 and updated in 2011.

In 2015, the Washington Coast Region began a "Pilot Watershed Restoration" (PWR) approach to guiding restoration along all Washington Coast Lead Entity areas. The PWR approach to restoration will be an important component of future lead entity strategy updates by laying out a method to implement recommendations at a smaller scale within a defined timeframe. The Region assisted each Lead Entity with scientific assessment and bringing additional resources to bear on restoration. The PWR approach is to be specifically focused on impactful projects in a specific area in a defined timeframe. Key elements are the 1) specific-watershed focus, 2) process-based approach, 3) sequencing restoration priorities, all of which will have cumulative benefits to salmon. The title of this effort was updated in 2023 to "Prioritized Watershed Restoration" to better reflect that the pilot work has occurred and more work will happen using this model throughout the region.

The Chehalis Basin Lead Entity's steering body, the Habitat Work Group, selected the Newaukum for their target watershed. When the Fish Barrier Removal Board made the request for a Watershed Pathway to barrier removals in the Chehalis, the group also recommended the Newaukum in order to focus more resources there. The group identified many benefits of attempting a comprehensive restoration program in the Newaukum: existing landowner involvement and approachability in key areas; relatively low number of fish passage barriers compared to the rest of the Chehalis Basin; relatively good habitat and water temperature conditions in tributaries; and research and monitoring work starting as part of the Chehalis Strategy.

Along with the above-mentioned work, a variety of other projects have begun in the Newaukum. The Department of Ecology's Watershed Assessment program chose the Newaukum for effectiveness monitoring (one of only about a dozen in the state), and its Nonpoint Pollution Reduction program targets this watershed in working with landowners to find non-regulatory solutions to reducing water quality pollution. The USFWS conducted a lamprey use survey. The Wild Fish Conservancy conducted a watertyping study for unmapped streams in the South Fork of the Newaukum. The Lewis Conservation District has been working with landowners to identify bank erosion and protection projects, as well as a range of fish and habitat restoration projects. WDFW is conducting a number of other studies including a summer juvenile fish use, stream temperature, and spawning use surveys. All of this work is generating new environmental data for the Newaukum and will lead to restoration projects that will be more effective for having taken place in concert.

Restoration partners have been meeting as the Newaukum Work Group since 2015 to collaborate, align work in priority areas, and avoid duplication of landowner outreach. This committee was the foundation of the Pilot Watershed Work Group process.

All completed habitat restoration projects and other landscape actions intended to improve watershed conditions or species habitat are identified on a Webmap made by the Ecology Environmental Assessment Program. Most of these past projects and project concepts under development are included on the Salmon Recovery Portal.

A draft Aquatic Species Restoration Plan (ASRP) for the entire Chehalis Basin was released in 2019 and continues to be under development with the addition of implementation and adaptive management strategies. This plan builds on the work and investment of previous efforts to restore and protect Chehalis Basin habitat. The ASRP's near term goals, defined as ac-

tions to be implemented in the next ten years, are: restore high priority core habitats; protect unique, at risk habitat; spring Chinook; riparian restoration. In the Newaukum, ASRP priority actions focus on improving core habitat for Spring Chinook. The priority restoration areas they identified In the Newaukum include the mainstem South Fork and Mainstem North Fork, which are included within and downstream of the focus area of this plan. The priority restoration actions they identified for this area are for placing large wood in the mainstem rivers, replanting degraded riparian areas, and connecting rivers to their side-channels and wetlands (South Fork only).

In 2018 the Washington State legislature passed the Streamflow Restoration Act (Chapter 90.94 RCW). The Act designates planning unit in each WRIA to develop an approved plan for offsetting the impacts of the next 20 years of permit exempt well growth on streamflows and aquatic habitat. In the Chehalis Basin, this work was undertaken by the Chehalis Basin Partnership. The Newaukum watershed was one of the subbasins expected to have high permit exempt well growth. These wells will lead to 80.1 af/yr consumptive water use. The Chehalis Basin Partnership identified 18 offset projects in the Newaukum watershed. These include 5 water offset projects and 13 habitat projects. Three of these conceptual projects were developed in the focal watershed: two barrier corrections in Lucas Creek and "Newaukum Lake Restoration and Enhancement Planning." The latter projects would improve surface water retention through the placement of wood, BDAs, or other instream structures within the egress channels of Newaukum Lake proper and three adjacent and connected ponds. The Department of Ecology's Streamflow Restoration grant program may provide funds to complete some of the recommended actions identified in this plan.

The Newaukum Work Group process for developing this plan began in earnest in 2020. Meetings were held virtually starting in December 2020. The Work Group process for this pilot watershed plan followed Pittman (2021). Work Meeting agendas and minutes were distributed to team members to document the proceedings and accomplishments. The decision-making process amongst the Work Group was iterative and based on consensus. A small core team comprised of Mara Zimmerman and Ned Pitman of Coast Salmon Partnership, Bob Amrine of Lewis Conservation District, Alex Gustafson of Trout Unlimited and the Lead Entity Coordinator Kirsten Harma was responsible for the overall strategy of the work group's tasks required for building the Plan, as well as writing the plan. Methodology and execution of model building and map development were led by the Coast Salmon Partnership. Trout Unlimited' s Alex Gustafson led facilitation of the meetings and group coordination.

Appendix B

Additional Cultural Context of the Newaukum Area

Ethnically Chehalis People who occupied the prairies of the upper Chehalis River Basin were comprised of five main bands that had residence at the tributary drainage of the Chehalis River and the Newaukum River. Bands were politically independent confederations that kept strong community relationships through linguistic, cultural, and social ties (Hajda 1990; Taylor 1974). War and treaty conflicts were resolved when bands would gather together at these traditional sites (King 1994; Spier 1936; Swanton 1952; Taylor 1974). The Cowlitz were split into four main groups based on geography, historical state of affairs, and language. Their villages were located along the Toutle, Cowlitz, and Newaukum Rivers (Hajda 1990; Ray 1974).

The Chehalis and Cowlitz have been documented as having permanent villages at the confluence of the Chehalis and the Newaukum Rivers, as well as close to the Chehalis and directly on the Newaukum River near Jackson Highway (Berger 2016; Marr et al. 1980). Cedar longhouses measuring 80-100-foot-long were erected to house families and extended families. During the summer months the vertical slats could be removed and utilized on the temporary pole framed structures at the summer camps (King 1994).

When not at their permanent villages, the economy, social interaction, and livelihood of the Chehalis and Cowlitz people heavily relied on seasonal movement in the spring, summer and fall to base camps. Artifacts found at these sites such as lithic debris, formed tools, scrapers, and fire-modified rock structures, suggest that the camps were used for shorter seasonal durations for the purpose of processing plants, game and refining medicine (Kopperl et al. 2016).

The Cowlitz River Valley is a natural transportation corridor between the Columbia River and Puget Sound. Well maintained trail systems were used extensively for travel over the region and Cascade mountains. The Cowlitz Trail was an overland route starting at Cowlitz landing close to Toledo to Budd's Inlet in present day Tumwater (Pacific-hwy-.net 2022). These trails were the building blocks for I-5 and other well used highways today. The trail intersects the Chehalis and Newaukum River Valley and connects with the Cowlitz-Yakima Trail that reaches over the crest of the Cascade Range (McClure 1992).

In the years between 1852 and 1853, after joining the U.S. Coast and Geodetic Survey, Issac Stevens quickly applied for governorship of the Washington territory and was successful. In 1854 and 1856, Territorial Governor Stevens set out to negotiate terms of the removal of Indians from usual and accustomed territories to reservations across Washington State. Stevens' treaty negotiations with the Chehalis and Cowlitz people failed. Alternatively, by Executive Order in 1864 The Chehalis Reservation was established. The Cowlitz were approved to establish a reservation under Washington State Senate Resolution 8682 in 2005. (Cowlitz Indian Tribe 2005; Ruby et al 2010).

Appendix C

Allied Initiatives for Restoration and Outreach

To implement this plan, it will be important to communicate and coordinate among all habitat enhancement and protection initiatives working in the basin.

Conservation Northwest's Cascades to Olympics Program seeks to create terrestrial habitat connections over or under I-5 for a suite of species. Restoring, protecting and conserving terrestrial habitat in Newaukum River watershed will help build resilience while maintaining ecological function and restoring aquatic habitat.

The Lewis County Voluntary Stewardship Plan works with agricultural producers to protect critical areas (streams, wetlands, critical aquifer recharge areas, steep slopes) while maintaining agricultural viability. While agriculture is only a small part of the focal area, connections made with landowners through this program could advance restoration goals.

The Aquatic Species Restoration Plan is a restoration and protection program staffed by the Washington Department of Fish and Wildlife and funded through the Department of Ecology. The program prioritizes restoration areas in the mainstem South Fork and Mainstem North Fork, which are included within and downstream of the focus area of this plan. This program may be able to fund some of the actions identified in this plan. They also have staff time available for outreach, including development of outreach materials. Coordination with the Work Group will allow for the best efficiency in sharing resources and not duplicating efforts.

Wild Fish Conservancy and others are pursuing implementation of Beaver Dam Analogue projects in the Chehalis Basin, including the focal area. Coordination among communication material and outreach efforts will be important to provide the public with a consistent understanding of the restoration work.

Capitol Land Trust will be developing a land acquisition strategy for the upper Chehalis Basin, of which the Newaukum pilot watershed is a part (Weismann, pers comm. 7/25/2022). Over the 2023 to 2024 time period, they will determine land conservation priorities and identify willing landowners and partners. They will work with the Newaukum Work Group to help identify overlapping strategies for the Newaukum.

All of these listed initiatives and others have some component of community outreach to gain support for stream habitat restoration. Collectively, these efforts will help create awareness and support for these actions through the landscape.

Appendix D

Funding Sources and Actions they Support

Funding Program*/ Supported Actions	Fish Passage	Instream	Riparian	Invasive Species	Assessment	Design	Construction	Monitoring	Staff Capacity	Outreach
STATE										
Salmon Recovery Funding Board (RCO)	x	x	x	x	x	x	x			
Washington Coast Restoration and Resilience Initiative (RCO)		x	x	x	x	x	x			
Brian Abbott Fish Barrier Removal Board (RCO)	x				x	x	x			
Aquatic Species Restoration Plan (RCO)	x	x	x	x	x	x	x	x	x	x
Streamflow Restoration (Ecology)	x	x	x	x	x	x	x	x		
Combined Water Quality Funding Program (Ecology)			x	x		x	x	x		x
Terry Husseman Account – Coastal Protection Fund (Ecology)		x	x	x			x			x
FEDERAL										
National Fish Passage Program (USFWS)	x				x	x	x			
National Fish Passage Program Bipartisan Infrastructure Law (USFWS)	x				x	x	x			
Restoring Fish Passage through Barrier Removal (NOAA)	x				x	x	x	x		x
Transformational Habitat Restoration and Coastal Resilience (NOAA)	x	x	x	x	x	x	x		x	
Coastal Habitat Restoration and Resilience Grants for Underserved Communities (NOAA)	x	x	x	x	x	x	x		x	
America the Beautiful Challenge (NFWF)	x	x	x	x	x	x	x		x	
Five-Star and Urban Waters Restoration Grant (NFWF)		x	x	x	x	x	x	x	x	x

Appendix D (continued)

Funding Sources and Actions they Support

Funding Program*/ Supported Actions	Fish Passage	Instream	Riparian	Invasive Species	Assessment	Design	Construction	Monitoring	Staff Capacity	Outreach
FEDERAL cont.										
National Coastal Resilience Fund (NFWF)	x	x	x	x	x	x	x	x	x	
Conservation Reserve Enhancement Program (FSA)			x	x	x					x
EQIP (NRCS)		x	x	x						
PRIVATE										
Coast Salmon Foundation - Strong Salmon Futures								x		x
Promise the Pod Tree Credit Program			x				x			

*Details on these funding programs and up-to-date deadlines and application requirements can be found on the Coast Salmon Partnership website: https://www.coastsalmonpartnership.org/funding_sources/

Environmental Monitoring Stations in the Newaukum River Watershed

Agency	Station ID	Map ID	Location	Temperature	Discharge	Turbidity	pH/DO/ Conductivity	Fecal Coliform	E-coli	Biotic/ Watershed Health	Period of Record	Website/Contact
Ecology	23B120	1	South Fork Newaukum at Jorgensen RD	x		x					2017-Present	https://apps.ecology.wa.gov/ContinuousFlowAndWQ
	23B200	2	South Fork Newaukum at Middle Fork RD	x	x						2019-Present	https://apps.ecology.wa.gov/ContinuousFlowAndWQ
	23B190	3	South Fork Newaukum at North Fork RD	x	x	x					2017-Present	https://apps.ecology.wa.gov/ContinuousFlowAndWQ
	23C070	4	North Fork Newaukum at North Fork RD	x	x						2017-Present	https://apps.ecology.wa.gov/ContinuousFlowAndWQ
	23B070	5	Newaukum near Chehalis	x		x	x				2016-Present	https://apps.ecology.wa.gov/ContinuousFlowAndWQ
	WHM_ EFF3	---	Multiple locations in Newaukum watershed							x	2016-2022	https://apps.ecology.wa.gov/eim/search/WHM/WHMSearch.aspx?State=newsearch&Section=all
	WHM_ EFF3	---	Multiple locations in Newaukum watershed	x		x	x	x	x		2016-2020	http://awwecology/sites/itsoi/bsds/EIM/SitePages/Home.aspx

Environmental Monitoring Stations in the Newaukum River Watershed

Agency	Station ID	Map ID	Location	Temperature	Discharge	Turbidity	pH/DO/ Conductivity	Fecal Coliform	E-coli	Biotic/ Watershed Health	Period of Record	Website/Contact
USGS	12024000	6	South Fork Newaukum at Jorgensen RD		x						1998-Present, Seasonally October-April	https://waterwatch.usgs.gov/?m=real&r=wa
	12024400	7	North Fork Newaukum near Forest		x						1998-Present, Seasonally October-April	https://waterwatch.usgs.gov/?m=real&r=wa
	12025000	8	Newaukum near Chehalis		x						1941-Present	https://waterwatch.usgs.gov/?m=real&r=wa
Chehalis Tribe	2.3088E+10	9	Newaukum at Jackson Highway	x		x	x	x			2016-Present	Colleen Parrott; cparrott@chehalistribe.org
	2.3088E+10	10	South Fork Newaukum at Middle Fork RD	x		x	x	x			2006-2009*	Colleen Parrott; cparrott@chehalistribe.org
	2.3088E+10	11	South Fork Newaukum at Guerrier RD	x		x	x	x			2017- Present	Colleen Parrott; cparrott@chehalistribe.org
	2.3088E+10	12	South Fork Newaukum at Jorgenson RD	x		x	x	x			2007-2009*	Colleen Parrott; cparrott@chehalistribe.org
	2.3089E+10	13	North Fork Newaukum at Tauscher RD	x		x	x	x			2006-2009*, 2017-Present	Colleen Parrott; cparrott@chehalistribe.org

*Data Provisional

Environmental Monitoring Stations in the Newaukum River Watershed

Agency	Station ID	Map ID	Location	Temperature	Discharge	Turbidity	pH/DO/ Conductivity	Fecal Coliform	E-coli	Biotic/ Watershed Health	Period of Record	Website/Contact
Chehalis Tribe	2.3089E+10	14	Middle Fork Newaukum at Tauscher RD	x		x	x	x			2006-2009*	Colleen Parrott; cparrott@chehalistribe.org
	2.3088E+10	15	Newaukum at Shorey RD	x		x	x	x			2006-2009*, 2017-Present	Colleen Parrott; cparrott@chehalistribe.org

*Data Provisional

Figure 3. Fish and water quality monitoring stations in the Newaukum River watershed. Number labels correspond to water quality stations in Appendix E.