Pacific Lamprey

2019 Regional Implementation Plan

for the

Oregon Coast

Regional Management Unit

North Coast Sub-Region

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I. Status and Distribution of Pacific lamprey in the RMU

A. General Description of the RMU

North Oregon Coast Sub-Region

The Oregon Coast Regional Management Unit is separated into two sub-regions equivalent to the USGS hydrologic unit accounting units 171002 (Northern Oregon Coastal) and 171003 (Southern Oregon Coastal). The North Oregon Coast sub-region includes all rivers that drain into the Pacific Ocean from the Columbia River Basin boundary in the north to the Umpqua River boundary in the south. It is comprised of seven 4th field HUCs ranging in size from 338 to 2,498 km^2. Watersheds within the sub-region include the Necanicum, Nehalem, Wilson-Trask-Nestucca, Siletz-Yaquina, Alsea, Siuslaw and Siltcoos Rivers (Figure 1; Table 1).

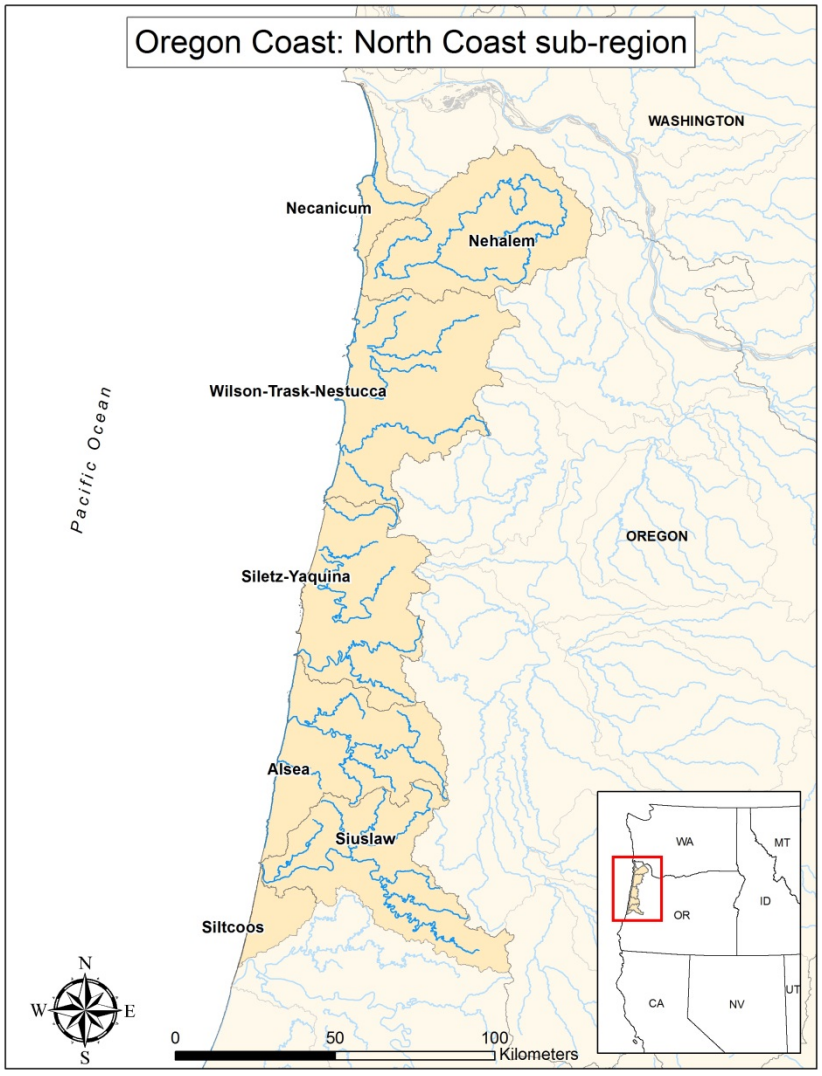

Figure 1. Map of watersheds within the Oregon Coast RMU, North Coast sub-region.

Table 1. Drainage Size and Level III Ecoregions of the 4th Field Hydrologic Unit Code (HUC) Watersheds located within the North Oregon Coast sub-region.

Watershed	HUC Number	Drainage Size (km^2)	Level III Ecoregion(s)
Necanicum	17100201	355	Coast Range
Nehalem	17100202	2,212	Coast Range
Wilson-Trask-Nestucca	17100203	2,498	Coast Range
Siletz-Yaquina	17100204	1,964	Coast Range
Alsea	17100205	1,786	Coast Range
Siuslaw	17100206	2,006	Coast Range, Willamette Valley
Siltcoos	17100207	338	Coast Range

B. Status of Species

Conservation Assessment and New Updates

Increased attention on Pacific lamprey has improved our understanding of this species in the North Coast sub-region. Monitoring efforts, in which lamprey are either the target species or information is collected during other species' monitoring, have expanded the amount of information available and the quality of this information in most watersheds.

Current Pacific Lamprey distribution in the North Coast sub-region is greatly reduced from historical range (Table 2; Figure 2). The 2017 Pacific Lamprey Assessment ranking of current distribution was reduced from 2011 rankings in all HUCs except the Necanicum. The decline in these areas is a result of more accurately calculating the numeric area of occupancy (versus using a visual estimate), rather than a decline in Pacific Lamprey range (USFWS 2018).

Population abundance was estimated within all HUCs using information provided by Oregon Department of Fish and Wildlife (ODFW). ODFW estimated a range of Pacific Lamprey population abundance using extrapolations of published information on the number of Pacific Lamprey per redd, average peak redd counts per mile, multiplied by the number of miles surveyed for Pacific Lamprey (Table 3; Table 4). As part of the monitoring for winter steelhead spawning populations, the Oregon Adult Salmonid Inventory and Sampling (OASIS) field crews have recorded counts of lamprey spawners and redds since 2009. These estimates are considered conservative abundance indices, as the surveys are focused on steelhead, and end before the completion of Pacific lamprey spawning (Jacobsen et al. 2014; Jacobsen et al. 2015; Brown et al. 2017, ODFW 2017).

There was consensus that lamprey populations have declined significantly from historical numbers approximately 50-60 years ago (i.e. Downey 1993). However, short-term population trend which is defined as the degree of change in population size over 3 lamprey generations, was not ranked (determined "unknown") because there is insufficient data available over the past 27 years. Abundance indices have generally increased over the 3 to 5 years (Table 3), but without a longer term data set it is unknown whether this apparent increase is simply an upswing in a larger cyclical trend.

Based on the ODFW data, and noting this information is limited, the Wilson-Trask-Nestucca, Siuslaw and Nehalem HUCs appear to support greater numbers of lamprey than the other HUCs in the North Coast (ODFW 2017).

Table 2. Population demographic and conservation status ranks (see Appendix 1) of the 4th Field HUC watersheds located within the North Oregon Coast sub-region. Note – coho salmon distribution was used as a surrogate estimate of historical lamprey range extent in areas where historical occupancy information was not available. Ranks highlighted in Yellow indicate a change from the 2011 Assessment.

Watershed	HUC Number	Conservation Status Rank	Historical Occupancy (km^2)	Current Occupancy (km^2)	Population Size (adults)	Short-Term Trend (% decline)
Necanicum	17100201	S2↑	250-1000	20-100	250-1000	Unknown
Nehalem	17100202	S2	1000-5000	100-500	1000-2500	Unknown
Wilson-Trask-Nestucca	17100203	S2	1000-5000	100-500	1000-2500	Unknown
Siletz-Yaquina	17100204	S2	1000-5000	100-500	1000-2500	Unknown
Alsea	17100205	S2	1000-5000	100-500	1000-2500	Unknown
Siuslaw	17100206	S2	1000-5000	100-500	2500-10,000	Unknown
Siltcoos	17100207	S1↓	250-1000	20-100	50-250	Unknown

Table 3. Minimum, mean, and maximum abundance indices for adult Pacific Lamprey in the North Coast RMU (ODFW 2017). Estimates are considered conservative.

Year	**MIN**	**MEAN**	**MAX**
2009	1,113	4,271	7,831
2010	289	1,109	2,032
2011	736	2,828	5,184
2012	758	2,911	5,337
2013	2,335	8,968	16,441
2014	1,162	4,459	8,175
2015	2,456	9,429	17,287
2016	2,500	9,597	17,594
2009-2016 MEAN	**1,419**	**5,447**	**9,985**

Table 3. Mean abundance indices for adult Pacific lamprey by HUC from 2009 to 2016 in the North Coast RMU (ODFW 2017). Estimates are considered conservative.

HUC	Mean
Necanicum	177
Nehalem	923
Wilson-Trask-Nestucca	1,178
Siletz-Yaquina	885
Alsea	487
Siuslaw	1,157
Siltcoos	18

Figure 2. Current and historical known distribution for Pacific Lamprey: Oregon Coast Regional Management Unit, North Coast sub-region (USFWS Data Clearinghouse 2017). Historical Pacific Lamprey distribution depicted in map was obtained from published literature, tribal accounts and state and federal agency records.

Distribution and Connectivity

Fish passage was ranked a low threat in the majority of watersheds that were assessed in 2017 (USFWS 2018). However, recent barrier assessments in the Lower Nehalem, Tillamook Bay, Nestucca Neskowin and Sand Lake watersheds have identified a rather large number of barriers at stream-road crossings (for juvenile salmonids). It is likely many more structures could be passage barriers for lamprey given their physiological limitations (i.e. unable to jump, difficulty navigating past sharp angles or through areas with high water velocity, etc.). Culverts, tide gates and water diversions are prevalent throughout the North Coast sub-region and may limit or impede lamprey passage to an unknown extent. It is possible the rankings for passage scope and severity in the 2017 Pacific Lamprey Assessment are lower than they should be.

An extensive effort is currently underway in portions of the North Coast sub-region to identify and prioritize barrier structures for repair (retrofit), replacement, or removal; though, the focus of these efforts is juvenile salmonids. The following are examples of some of the passage improvement projects implemented by RMU partners in the past several years:

- City of Seaside's Diversion Dam was removed and intake screens upgraded on the South Fork Necanicum.
- ODOT breached several dikes in the lower mainstem Necanicum near RM5.
- Several tide gates in the lower North Fork of the Nehalem were replaced.
- Culvert removal in tributary of Siletz River (North Creek), opening access to 14 miles of habitat.
- Multiple culverts have been replaced or removed in the Wilson-Trask-Nestuccca HUC over the past several years as part of the Salmon Super Highway Project (SSH). SSH project partners plan to continue efforts to replace barrier culverts in these basins in coming years.
- A substantial barrier dam on the East Fork South Fork Trask River was removed during summer 2016 and another dam removal at Skookum Lake (Tillamook River Basin) was completed during summer 2017.
- Several perched culverts replaced with open bottom culverts in Necanicum (Joe Creek) and Nehalem HUCs, restoring access to over 15 miles of habitat.
- Upgrades at hatchery barriers and the Lord Creek Culvert in the Alsea watershed.
- Upgrade to Cedar Creek Hatchery barrier on Three Rivers in the Nestucca Basin.

C. Threats

Summary of Major Treats

The following table summarizes the key threats within the North Coast sub-region as identified by RMU participants during the Risk Assessment revision meeting in April 2017. Stream and floodplain degradation, water quality, and lack of awareness were all considered a moderate threat in the North Coast sub-region.

Table 3. Summary of the assessment results for the key threats of the North Oregon Coast sub-region.

	Stream and Floodplain Degradation		Water Quality		Lack of Awareness	
Watershed	Scope	Severity	Scope	Severity	Scope	Severity
North Oregon Coast						
Necanicum	3	3	2	2	4	2
Nehalem	3	3	3	3	4	2
Wilson-Trask-Nestucca	3	3	2	2	4	2
Siletz-Yaquina	3	3	3	3	4	2
Alsea	3	3	3	2	4	2
Siuslaw	3	3	3	3	4	2
Siltcoos	4	3	3	2.5	4	2
Mean	3.14	3.00	2.71	2.50	4.00	2.00
Rank	**M**	**M**	**M**	**M**	**H**	**M**
Mean Scope & Severity	3.07		2.61		3.00	
Drainage Rank	**M**		**M**		**M**	

Current Threats

The highest ranked threats in the sub-region are described below. Stream and Floodplain degradation and Water Quality were ranked slightly higher than in 2011; lack of awareness was determined to be a greater concern than 2011. Although not a key threat in 2017 (Mean Scope & Severity = 2.43), dewatering and Flow Management was also ranked higher than in 2011.

Stream and Floodplain Degradation

Stream and floodplain degradation was ranked moderate in scope and severity throughout all watersheds of the North Coast sub-region. Within lowlands, wetlands and side channels have been channelized, diked, diverted or drained to prevent flooding, create farmland or pastures, and provide land for commercial and residential development. In upland areas, historical and ongoing timber practices, agriculture, and urbanization have deforested or altered the function and diversity of riparian vegetation. Many watersheds in the RMU are lacking mature conifers that play a pivotal role in bank stability, water quality protection, thermal cover, and the provision of large woody debris.

Water Quality

Elevated water temperature is the primary water quality concern in the North Coast sub-region. Excessive temperatures generally occur during summer months and may be attributed to increased air temperature, lack of riparian cover, or reduced instream flows associated with water withdrawals for irrigation, municipal or residential use. The impacts of relatively warm water temperatures (e.g., ≥20°C) on Pacific Lamprey embryonic development, physiology, adult migrations, reproductive capability and evolutionary pressures can be multitudinous and substantial (Clemens et al. 2016). Other water quality concerns in tributaries include low dissolved oxygen and presence of bacteria (e.g., fecal coliform, e coli), that may be associated with elevated water temperatures and agricultural or urban runoff. Monitoring and restoration efforts to improve and protect water quality for fish, wildlife, and human health are ongoing in the North Coast sub-region.

Lack of Awareness

Instream water work, whether for restoration activities or maintenance of diversions, can dewater areas or remove sediments in which juvenile lamprey are burrowed. Such actions without first salvaging lamprey may result in the death of hundreds of juveniles. Increasing public and agency awareness about the presence of juvenile lamprey in the sediments, adult lamprey spawning habitats and timing during inwater work, as well as the effect of water diversions, and education on actions to minimize these impacts, could greatly decrease localized mortality and injury to lamprey populations.

Dewatering and Flow Management

Stream flow conditions have generally improved in the Necanicum since the completion of the 2011 Assessment, however, the scope and/or severity of this threat has increased in the Alsea, Siuslaw, and Siltcoos basins. Water withdrawals for irrigation, municipal, or residential uses leave many watersheds in the North Coast sub-region dewatered or with inadequate flow during summer and fall months. Low flow levels can reduce habitat availability, prevent lamprey access to backwater or side channel habitats, and may contribute to mortality if incubating eggs or burrowing larvae are dewatered or exposed to a high temperature or low oxygen environment. The projected rise in human population and anticipated effects of climate change (i.e., elevated ambient temperatures, decreased surface water availability, altered flow regimes), may increase the frequency, duration and intensity of low flow conditions in the future.

Restoration Actions

Multiple projects are currently underway to restore floodplain connectivity, relocate or reconnect side channel habitat, enhance damaged riparian areas, and remove, replace or improve barriers to fish passage (e.g. culverts, tidegates, and diversion dams). Assessments that identify and prioritize future restoration work and passage problems are also ongoing in these areas. Although the majority of research and restoration projects are developed and implemented with adult and juvenile salmonids in mind, a growing number of projects are incorporating benefits for Pacific lamprey and some passage projects are targeting lamprey specifically. The following conservation actions were initiated or recently completed by RMU partners in the North Coast sub-region from 2012-2018.

HUC	Threat	Action Description	Type	Status
RMU	Stream Degradation	Implementation of instream and floodplain habitat restoration activities (e.g. large wood placement, side channel and floodplain reconnection, channel reconstruction, bank stabilization, etc.).	Instream	Ongoing
RMU	Population	Distribution surveys of mainstem and principal tributaries	Survey	Ongoing
RMU	Lack of Awareness	Consideration of lamprey when planning and implementing instream habitat restoration work	Coordination	Ongoing
RMU	Passage	Map, assess and prioritize passage barriers in tributaries and evaluate available lamprey habitat upstream	Assessment	Proposed
RMU	Population	Conduct spawning ground surveys in mainstem and principal tributaries to monitor Pacific Lamprey distribution, timing, and number of redds to develop relative abundance indexes.	Survey	Ongoing
RMU	Population	Oregon Department of Fish and Wildlife Conservation Plan for Lampreys in Oregon	Other	Complete
Necanicum	Passage	South Fork Necanicum diversion dam removed and intake screens updated/improved.	Instream	Complete
Necanicum	Stream Degradation	Culvert removal or replacement projects to restore access to spawning and rearing habitat.	Instream	Ongoing
Nehalem & Siuslaw	Stream Degradation	Coho Strategic Action Plan – identifies high priority conservation areas for restoration and monitoring. Will likely benefit other native aquatic species.	Instream	Underway
Nehalem	Passage	Several tide gate replacement projects on lower North Fork	Instream	Ongoing
Nehalem	Stream Degradation	Installation and evaluation of lamprey and salmonid response to Beaver Dam Analog stream channel restoration	Instream	Ongoing
Wilson – Trask – Nestucca	Stream Degradation	Numerous culvert removal or replacement projects as part of Salmon SuperHwy Project.	Instream	Ongoing
Wilson – Trask –	Passage	Removal of the East Fork South Fork Trask River Hatchery Dam.	Instream	Complete

Nestucca				
Wilson – Trask – Nestucca	Passage	Skookum Reservoir Dam removal, Tillamook River Drainage	Instream	Underway
Siletz	Passage	Evaluation of passage constraints for lamprey at Siletz Gorge Falls fish ladder/trap	Instream	Proposed
Alsea	Passage	Installation of Lamprey Passage Ramp at water diversion structure upstream from Alsea River Hatchery on North Fork Alsea River.	Instream	Underway
Alsea	Passage	Monitoring relative abundance of larval Pacific Lamprey upstream of water diversion structure pre and post lamprey ramp installation	Assessment	Underway
Alsea	Population	Environmental DNA pilot project to assess Pacific Lamprey distribution	Survey	Underway
Siuslaw	Population	Environmental DNA to assess Pacific Lamprey distribution	Survey	Complete
Siuslaw	Stream Degradation	Environmental DNA to monitor lamprey occupancy pre/post habitat restoration (e.g., Fivemile Bell)	Assessment	Underway
Siltcoos	Passage	Evaluation of passage constraints for lamprey at Siltcoos and Tahkenitch Dam fish ladders.	Assessment	Proposed
Siltcoos	Stream Degradation	Implementation of instream and floodplain habitat restoration activities (Fivemile-Bell, Grant Cr., Fiddle Cr.)	Instream	Ongoing

II. Selection of Priority Actions

A. Prioritization Process

Participating members of the North Coast sub-region had a conference call on April 30th, 2019 to discuss completed and ongoing conservation actions and identify specific projects and research needed to address threats and uncertainties within the region. The following projects were submitted by RMU partners for the North Coast sub-region in 2019:

- Understanding Pacific Lamprey Distribution and Habitat Use in Smaller Streams with No Passage Barriers

- Tweedle Creek Meander Reconstruction

B. High Priority Proposed Project Information

Project Title: Understanding Pacific Lamprey distribution and habitat use in smaller streams with no passage barriers

Project Applicant/Organization: Oregon Department of Fish and Wildlife
Contact: Steve Starcevich and Ben Clemens
Email: steve.starcevich@oregonstate.edu, Ben.Clemens@oregonstate.edu
Phone: 541-231-1806

Project Type: Research

Lamprey RMU population*:* North Oregon Coast Sub-Region
Watershed (5th HUC Field): Nehalem River, Wilson River, Trask River, Nestucca River, Siletz River, and their tributaries
NPCC Subbasin (4th HUC Field) name: Nehalem, Wilson-Trask-Nestucca, Siltez-Yaquina
Project Location: North Oregon Coast Sub-Region study area

Total Requested funds: $50,894

Short Project Summary (200 words or less):

In coastal Oregon basins, there are thousands of potential fish passage barriers (Figure 1). These typically are culverts at road crossings, which disproportionately affect small streams (Figure 2). Pacific Lamprey distribution is associated with low elevations and large stream size (Pirtle et al. 2002, Gunckel et al. 2009); however, this species is also distributed in smaller stream channels (Torgersen and Close 2004, Dunham et al. 2013, Starcevich and Clements 2013). Given barrier numbers and uncertainty about their effect on Pacific Lamprey in these watersheds, understanding the importance of these channels to this species is a critical research need (Mesa and Copeland 2009).

The main goal is to bolster the information databases on distribution and habitat use of Pacific Lamprey. The second goal is to create an occupancy model for Pacific Lamprey in streams with no barriers. The third goal is use this model to identify and prioritize barriers for removal based on their potential impact on Pacific Lamprey. Occupancy electrofishing surveys will occur in selected coastal watersheds in streams with no passage barriers. Reach and site characteristics will be used to model occupancy and detection. This model will be used to refine sampling frames for monitoring, evaluate potential barrier effects, and prioritize barrier removal.

1. Detailed Project Description (500 words or less):

Objectives

The first objective is to obtain an extensive and representative sample of larval lamprey distribution in streams with no passage barriers in the North Coast Oregon Sub-Region. The second objective is to create an occupancy model that describes the habitat characteristics of stream channels where larval

lamprey are likely to occupy or not occupy when not influenced by passage barriers. Finally, the third objective is to apply the model to streams with passage barriers in this sub-region to identify and prioritize barriers by their potential impact on Pacific Lamprey.

Study Areas

The Nehalem, Wilson-Trask-Nestucca, and neighboring watersheds in the North Coast Regional Management Unit (RMU) are the proposed study areas for three reasons. First, the Oregon Coast Regional Implementation Plan (RIP) identifies the threat of culvert barriers to Pacific Lamprey as a main concern in the North and South Coast Sub-Regions, except for the Wilson-Trask-Nestucca. Second, the RIP reports relatively high adult Pacific Lamprey abundance in the Nehalem and Wilson-Trask-Nestucca basins, which suggests there will be relatively high larval seeding of available habitat. Third, these watersheds are adjacent in their respective RMUs and would be logistically easier for a single crew to survey.

Sampling Frame

The sampling frame of streams in Oregon coastal watersheds for this project will be based on the one used by ODFW's Oregon Adult Salmonid Inventory and Sampling (OASIS) monitoring program for estimating salmon and Pacific lamprey status. A subset of candidate streams within the study area will be identified by the main study criterion: no natural or artificial barriers to lamprey movement.

Survey Design

Each sample stream will be divided into 500 m reaches. Basin area for the downstream boundary of each reach will be estimated using GIS and linked to stream width and discharge through hydrological equations and field reconnaissance. Stratified random sampling will be used to select sample reaches at the following stream width stratifications: 10-6 m, <6-3 m, and <3 m. In order to estimate occupancy and detection probability, a subsample of reaches will be surveyed using a spatial revisit occupancy design: Electrofishing surveys of all Type I and Type II rearing habitat will be taken from three different pools in this sample reach. Sampling will occur from July through September.

Field Protocol

The field crew will locate the downstream end of a sampling reach using a GPS, move upstream to the nearest pool channel unit and conduct the electrofishing survey. Captured lampreys >70mm total length will be identified as Pacific Lamprey or Western Brook Lamprey (i.e., Lampetra subspecies). All other lampreys will be counted and recorded. Pools are characterized by relatively high availability of Type I rearing habitat and relatively high densities of rearing larvae (Starcevich and Clemens 2013, Reid and Goodman 2015). A habitat survey will follow the electrofishing survey. Wetted and bankfull channel width and stream discharge will be measured for each reach. Surface area of Type I and Type II larval rearing substrate will be estimated for the sample pool. Pool dimensions will be measured. Reach slope will be estimated for each site using GIS.

Data analysis

Occupancy modeling will be used to evaluate the relationship of covariates to Pacific and Western Brook lamprey occupancy and detection. These covariates will include channel width, pool characteristics, substrate, survey date, and presence or absence of the other lamprey species.

***Descriptive Photographs-illustrations-Maps*:**

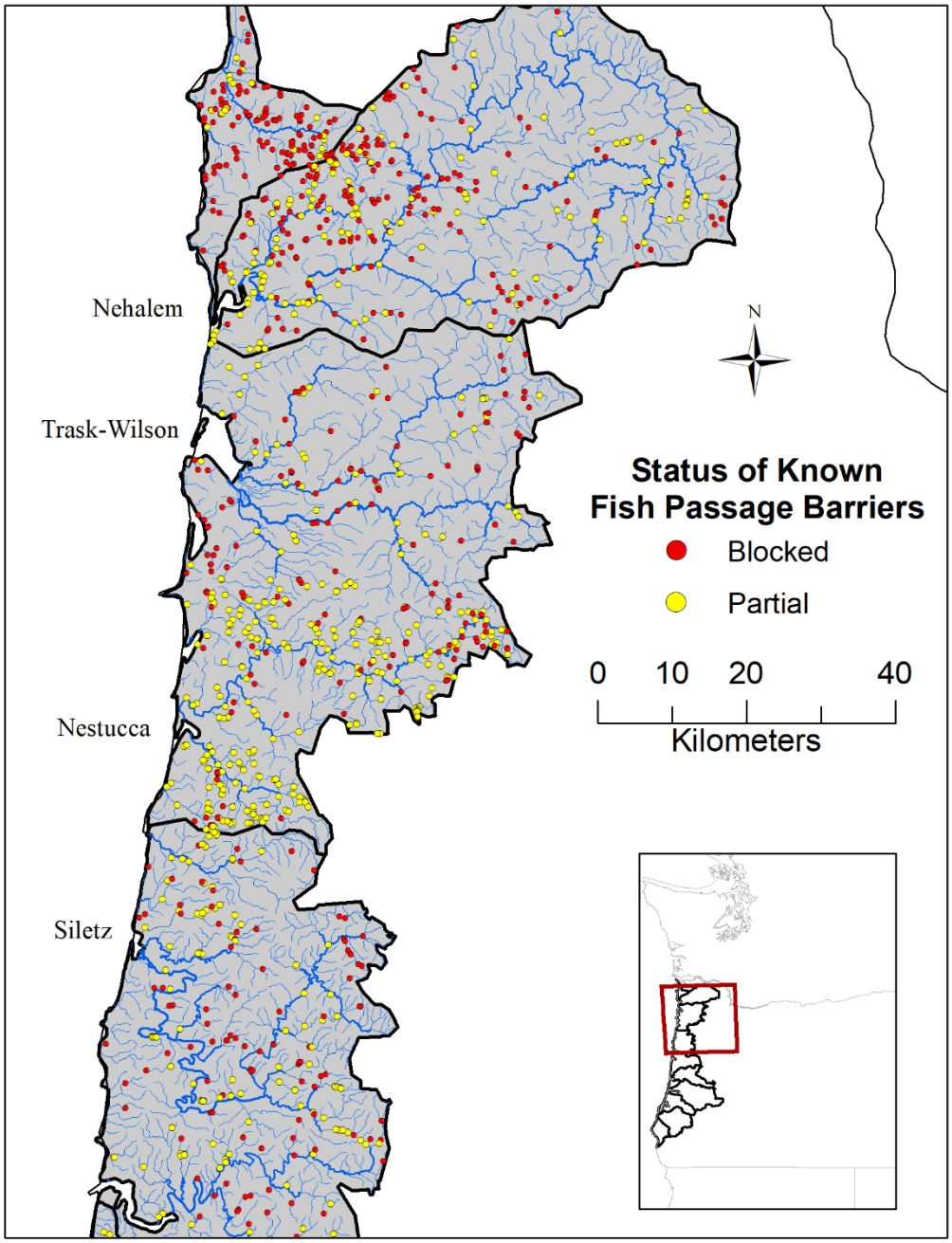

Figure 1. Map of barriers known to block or partially fish passage in North Coast Oregon basins. Point data are from the Oregon Fish Passage Barrier Data Standard dataset, ODFW.

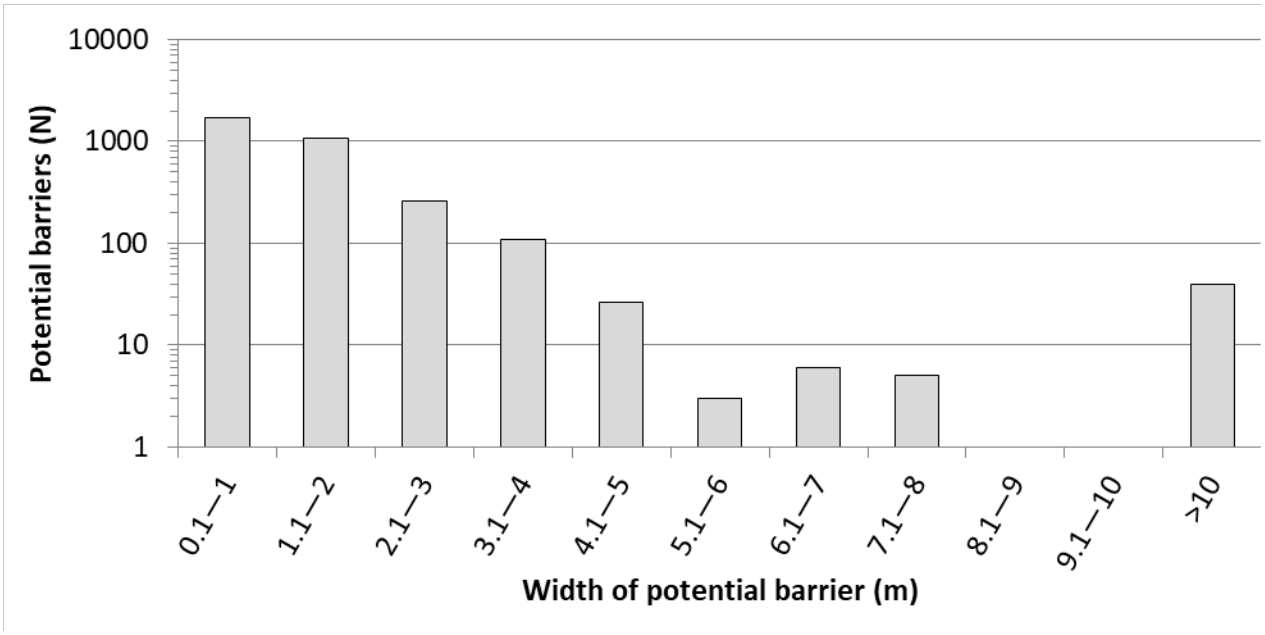

Figure 2. Frequency distribution of barrier width in the coastal Oregon watersheds; 96% of which are culverts (Oregon Fish Passage Barrier Data Standard dataset; figure from Starcevich and Clements 2013). One study in the Siuslaw National Forest provides data that suggest bankfull width of streams with older ("non-replaced") culverts are on average twice as wide as the potential barrier width (Chelgren and Dunham 2015)

3. Linkage of actions to Identified Threats in RMU (300 words or less):

- *What threat(s) does this project address?*
  - **Passage**
- *Project scope: Does this project address threat(s) specific to this RMU only, or does the project address the threat(s) prevalent in multiple RMUs?*
  Single RMU ☐, Multiple RMUs ☒ list additional RMUs: South Coast Oregon RMU
- *How does this project address key threat(s) within the HUC where project is proposed?*

The threat of culvert barriers to Pacific Lamprey has been identified as an important concern in the Nehalem River basin. Some of the culvert barriers on larger stream channels, which are known to restrict Pacific salmon and lamprey distribution and abundance, have been removed or are prioritized for removal. However, there are thousands of culvert barriers in smaller streams (<10 m bankfull width) in this RMU and their impact on Pacific Lamprey is unknown. Pacific Lamprey have been shown to use smaller channels, which suggests that many more culverts than currently recognized may be limiting distribution and abundance of Pacific Lamprey. The extent of this threat is unknown because there is a lack of scientific understanding of how Pacific Lamprey use these stream reaches, which prevents regional managers from adequately evaluating these culvert barriers for their potential impact on distribution. This proposed project addresses this need for information on Pacific Lamprey distribution and habitat use in these stream reaches and will result in a model that can be used to inform culvert removal programs in regard to Pacific Lamprey in these RMUs.

Secondarily, this project focuses its sampling frame in the upper reaches of these watersheds, which may act as refugia from the threats identified in the Oregon Coast RIP of elevated water temperatures

and climate warming. These upper reaches are colder than low elevation reaches and may provide thermally stable spawning and rearing habitat for Pacific Lamprey. This increases the motivation for understanding how Pacific Lamprey use these reaches.

Furthermore, the distribution and habitat use information of this project may be useful in delineating potential Pacific lamprey spawning habitat in other lamprey RMUs and refining the sampling frame of the OASIS monitoring program in the Oregon coastal RMUs to reflect the actual Pacific Lamprey distribution potential.

4. Species/Habitat Benefits (200 words or less):

- *How will the project provide meaningful measureable results to improve lamprey populations and/or their habitat conditions?*
- *What life stage or stages will benefit from action? How?*
- *What other species may benefit from action?*

This project will improve our understanding of Pacific Lamprey and Western Brook Lamprey distribution and habitat use and provide an occupancy and detection model for larval Pacific Lamprey that can be used as a tool for determining suitable habitat for rearing, and indirectly for spawning, in the upper reaches of watersheds. This model can be used to inform management actions (i.e., culvert removal) and improve monitoring programs.

5. Project Design / Feasibility (200 words or less):

- *Have the designs for the project been completed already or will they be completed before planned project implementation?* Yes ☒, No☐
- *Are the appropriate permits (e.g., ESA consultation, Scientific Collection, fish health/transport, etc.) in place already or will they be in place before planned project implementation?* Yes ☒, No☐
- *Can the project be implemented within the defined timeframe?* Yes ☒, No☒

This project is highly feasible because we have allotted enough time for pre-project planning and preparation and possess the expertise to carry out this study (please see the Budget and Timeline section). We have scheduled an extensive pre-project preparation period because of the large size of our proposed study area and the need to determine the sampling frame through a combination of GIS identification and time-consuming in-situ verification of barrier-less streams. Once the sampling frame is delineated, then we need to identify private landowners and contact them for permission to access study sites on their land prior to conducting field work. As such, our timeframe for completion meets all the dates specified by the NFHP except for the final written report due date. We are proposing to conduct the field surveys from July 1 to September 30, 2021, and we will not have time to conduct the analysis and finalize the report by the due date on October 31, 2021. We project that the final report will be completed by May 30, 2022. Our timeframe does not meet the firm and shorter timeframe for completion required by BPA. Regarding miscellaneous end of year funding, the 2-2.5 year timeframe (depending on when the contract begins) we have specified meets the requirement for project completion of 3 years or less.

6. Partner Engagement and Support (200 words or less):

- *What partners are supporting the project?*
- *What partners are active in implementing the project?*
- *What partners are providing matching funds or in-kind services that directly contribute to the project?*

We have begun outreach to the coastal Oregon RMUs and will continue seeking support and active partners from state, federal, and tribal agencies, Oregon State University, and other interested local parties. ODFW will provide in-kind services in the form of sampling frame and study design development, field crew training and supervision, some field gear, data analysis, and summarization of results.

7. Monitoring and Reporting (200 words or less):

- *How is completion of the project going to be documented?*
- *How will the projects' benefits to lamprey be monitored over time?*

The completion of the project will be documented in a final report and may include an annual report, depending on the source of funding and the timeframe of completion.

This project will benefit Pacific Lamprey within this RMU and region-wide by contributing information needed to properly manage and monitor this species. Mainly, it will provide distribution and habitat use information about Pacific Lamprey in small streams, which are disproportionately affected by culvert barriers in this RMU. The effect of culvert barriers on Pacific Lamprey status has been identified as a critical uncertainty in need of research (Mesa and Copeland 2009). The occupancy model developed from this project can be used in this RMU and likely will be useful to managers in other RMUs to identify and prioritize culvert barriers for removal based on their potential impact on Pacific Lamprey abundance and distribution.

8. Project Budget (Including overhead):

Items	Unit	Quantity	Unit Cost	Requested Funds	ODFW	Total Cost
Personnel Services:						
NRS-3 (Project Leader)	Month	2.5	$10,408		$26,020	26,020.00
ODFW Lamprey Coordinator		1	$10,408		$10,408	10,408.00
EBA (Field Technician)	Month	6	$5,154	$30,924		30,924.00
Services and Supplies:						
Employee allowances	Year	2	$300	$600		600.00
Sampling gear & supplies				$1,000		1,000.00
Travel:						
Employee per diem	Day	50	$80	$4,000		4,000.00
Vehicle lease	Month	3.5	$750	$2,625		2,625.00
Adminstrative Overhead:						
Overhead			30%	$11,744.70		11,744.70
		Agency Share		$50,894	$36,428	87,321.70
		Agency Share (%)		58%	42%	100%

9. Timeline of major tasks and milestones:

Workflow	Date completed
Incidental take permits	May 2020 - July 2020
Pre-project preparation	July 2020 - June 2021
Field surveys	July 2021 - Sept 2021
Analysis & summarization	Oct 2021 - May 2022

10. References (If Applicable)

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Project Title: Tweedle Creek Meander Reconstruction – Lamprey/Salmonid Habitat Restoration – Carmichael Property

Project Applicant/Organization: Upper Nehalem Watershed Council
Contact Person: Maggie Peyton – UNWC Executive Director
Email: Maggie@nehalem.org
Phone: 503-396-2046

Project Type: Habitat Restoration

Lamprey RMU population: North Oregon Coast Sub-Region
Watershed (5th HUC Field): Northwest Oregon Coast
NPCC Subbasin (4th HUC Field) name: Nehalem (17100202)
Project Location: Tweedle Creek (at/near it's confluence with the Nehalem River)

Total Requested funds: $50,000

Short Project Summary (200 words or less):

This project will abandon 1,280 feet of artificially straightened lower Tweedle Creek and re-establish a historic relic toe slope channel footprint of 4,800 feet. This action will increase Mid-Nehalem River off-channel - lamprey/salmonid stream rearing/spawning habitat nearly fourfold and will significantly enlarge and enhance an existing associated/connected wetland complex. Grantee will begin by excavating/restoring the relic toe slope stream channel across a 1,250-foot section of floodplain to reconnect into the remainder of the existing historic channel/wetland matrix and then plugging the existing Tweedle Creek channel to capture the live stream flow.

Additionally this project will reconnect two small tributaries to Tweedle Creek, improve floodplain hyporheic connectivity including the wetland complex, create habitat conditions conducive to long-term beaver colonization, provide additional backwater habitat during high winter main stem flows, improve riparian conditions, improve fish passage into the pond, and address the habitat needs of native lamprey & salmonids that spawn and rear in this area of the Nehalem River Basin Watershed.

Grade control(s) throughout the newly reestablished channel will be accomplished with LWD structures and a minimum of two beaver dam analogues. Grantee will also plant a variety of native trees and plants to further enhance the entire restoration site

1. Detailed Project Description (500 words or less):

Aquatic habitat degradation, stream/floodplain disconnect, and hindered access into Off-Channel refuge has contributed to the decline of native lamprey and salmonid production throughout Oregon,

including the habitat for the ESA listed Coho and lamprey populations of the Nehalem River basin. This project seeks $50,000 in cost share funding to restore the historic relic channel alignment and floodplain connectivity of Lower Tweedle Creek and implement the proposed associated habitat restoration actions to significantly increase the availability of both low velocity off channel rearing during winter high flows and provide cooler summer refuge away from the hotter main stem Nehalem by addressing these habitat limiting factors.

This project was selected because it exists in one of the NSAP's high priority 6th fields for restoration (main stem Nehalem) and addresses the needs of native species (native lamprey and salmonids) and a unique salmonid life history strategy for coho salmon also identified in the NSAP planning process (Nomadic spring coho fry dropping out of headwater reaches into the Mid / Lower Nehalem main stem).

The Tweedle Creek project will restore Lower Tweedle Creek (approximately 4800 ft.) into its historic relic toe slope channel and reconnect it with the associated floodplain including two small tributaries, existing wetlands/former Oxbow channel of the Nehalem River, and into an off channel flow through pond located in the oxbow. In total, the project comprises about 40 acres and will enhance critical habitat for Pacific & Western Brook lamprey, Coho & Chinook salmon, winter steelhead, cutthroat trout, and a host of other aquatic and terrestrial species. The Upper Nehalem watershed council will co-manage the project with their associated partners and the landowner. Planning, survey/design, permit acquisition, budget development, etc. are well underway (approximately 85% complete) with implementation set for the 2020 summer instream work period.

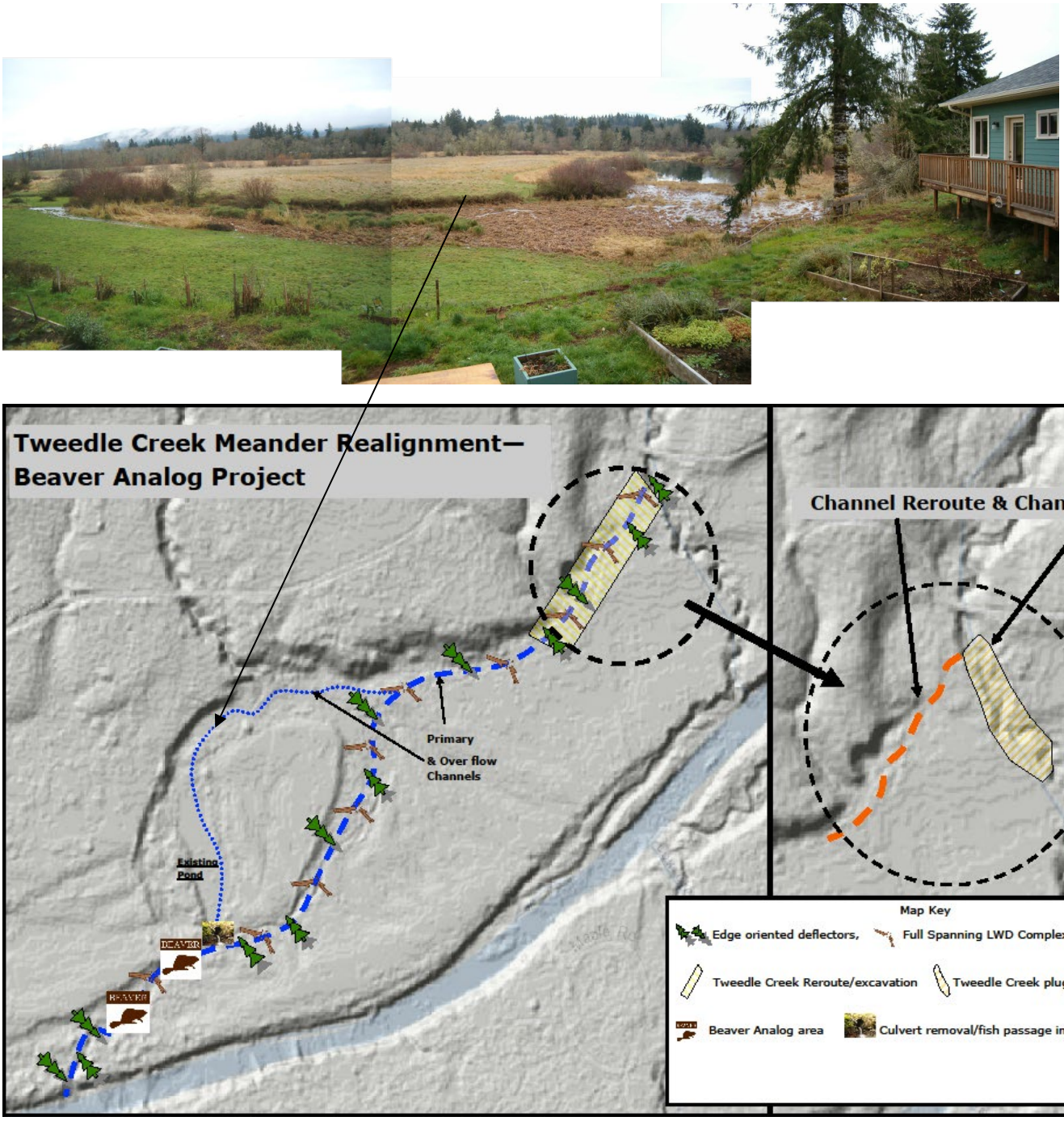
Funding through the Pacific Lamprey Conservation Initiative (Regional Implementation Plan) will address instream, off-channel, and wetland enhancements specific to lamprey life history/habitat needs and mainly support adult spawning and juvenile rearing deficiencies in this part of the Nehalem River Basin. Stream/floodplain connectivity, habitat complexity, and recreation of several acres of historical habitat lost to floodplain development(s) (agricultural mostly) around the turn of the 19th century are all expected outcomes for this project.

Total miles/acres of stream/wetland habitat (inside and outside of project footprint) accessed by lamprey and anadromous fish after channel relocation and wetland enhancement = approx. **2 miles/90+ acres**

Miles of stream to be treated with LWD/BDA (inside project footprint) = **0.9 miles**

- A 0.9 mile stream reach in the vicinity of the wetland complex will be enhanced with BDA and LWD structures for stream/off channel pond/wetland/floodplain habitat improvements.

2. Descriptive Photographs-illustrations-Maps:



3. Linkage of actions to Identified Threats in RMU (300 words or less):

- *What threat(s) does this project address?*
    - **Stream and Floodplain Degradation**
    - **Water Quality**
    - **Dewatering & Stream Flow Management**
- *Project scope: Does this project address threat(s) specific to this RMU only, or does the project address the threat(s) prevalent in multiple RMUs?*
  Single RMU ☐, Multiple RMUs ☒ list additional RMUs:
- *How does this project address key threat(s) within the HUC where project is proposed?*

As identified within the RIP for the Oregon Coast Regional Management Unit – North Coast Sub-Region, the key identified threat is Stream and Floodplain Degradation within lowlands, wetlands, and side channels. These degradations are the result of past land management practices that channelized, diked, diverted or drained to prevent flooding, create farmland or pastures, and/or provide land for commercial and residential development. This project will undo the past degradations of lower Tweedle Creek and restore the stream into its relic toe slope channel and associated floodplain/wetland complex, increasing the available stream channel and floodplain habitat nearly fourfold for lamprey and the other associated affected species that utilize the existing habitat. In addition, the actions of this project restores the historic wetland complex, reconnects two small tributaries to lower Tweedle Creek, improves passage/connectivity into the former Oxbow of the Nehalem River that currently supports a large pond, and improves hyporheic connectivity that will better recharge the floodplain/wetlands for longer sustained summer flows and improved "cooler" water temperatures, all essential attributes for enhanced natural production.

4. Species/Habitat Benefits (200 words or less):

- *How will the project provide meaningful measureable results to improve lamprey populations and/or their habitat conditions?*

Restoring Tweedle Creek to its historic relic toe slope channel will increase the current stream channel length and associated connected floodplain/wetland habitat nearly fourfold. In total the project comprises about 40 acres. Species (lamprey, salmonids, etc.) utilizing the available habitat (approximately 15 acres) should realize an identical response in their own production commensurate to the habitat improvements. In addition, LWD and BDA structures will be installed at key locations along the stream channel's longitudinal profile to provide natural grade control, additionally enhance in stream habitat, and progress stream/floodplain connectivity/interactions (all positive attributes for enhanced habitat).

- *What life stage or stages will benefit from action? How?*

By increasing species specific available habitat, this project addresses the freshwater adult spawning and juvenile rearing stages of the Pacific lamprey and the entire life cycle of the freshwater Western Brook lamprey. Project outcomes include increased habitat (15 acres presently to 40 post project), improved water quality/quantity and availability (all seasons) that will better inundate the substrate

habitat(s) essential to all the species endemic to this tributary and surrounding area of the Nehalem River Basin.

- *What other species may benefit from action?*

Coho & chinook salmon, winter steelhead, cutthroat trout, and a host of other aquatic and terrestrial species including Beaver, amphibians, waterfowl, and all other species that utilize streams and wetlands.

5. Project Design / Feasibility (200 words or less):

- *Have the designs for the project been completed already or will they be completed before planned project implementation?* Yes ☒, No☐

Grummel Engineering and associates will have completed the engineering and plan sets for the stream channel expansion design by the fall of 2019. ODFW and Bio-Surveys have conducted their field reconnaissance, completed their preferred lay-out of site locations, and have been developing site specific specifications for beaver dam analogs and large woody debris structures in consultation with the project engineers.

- *Are the appropriate permits (e.g., ESA consultation, Scientific Collection, fish health/transport, etc.) in place already or will they be in place before planned project implementation?* Yes ☒, No☐

All work will be performed under a USACE removal fill permit, Clatsop County flood plain development permit, ODFW fish passage review, Cultural resources consultation, and a NOAA ESA programmatic review.

- *Can the project be implemented within the defined timeframe?* Yes ☒, No☐

The construction/project completion time frame is defined by the funders who support the project. At this point UNWC has obtained $88,000 in cost share from NOAA towards engineering/design and to develop the project to the level that attracts additional funders for summer 2020 implementation.

6. Partner Engagement and Support (200 words or less):

- *What partners are supporting the project?*

The partners who are supporting the project are the Landowners (Carmichaels), UNWC, ODFW, NOAA, and Wild Salmon Center/funders. The project is also seeking to develop a partnership with Clatsop Co. SWCD to pursue additional cost share for riparian fencing and reforestation thru the Oregon Watershed Enhancement Board supported/funded Oregon Department of Agriculture - Strategic Implementation Area process to improve water quality on agricultural lands in the Cow Creek sub-basin which includes Tweedle Creek.

- *What partners are active in implementing the project?*

Partners who are active in the implementation of the project include the Landowner, UNWC, ODFW, Wild Salmon Center and NOAA.

- *What partners are providing matching funds or in-kind services that directly contribute to the project?*

Partners who are providing matching funds and/or in-kind services to the project include the Landowner, UNWC, ODFW, WSC and NOAA.

7. Monitoring and Reporting (200 words or less):

- *How is completion of the project going to be documented?*
- *How will the projects' benefits to lamprey be monitored over time?*

All restoration actions are georeferenced. All sites will have set photo-point documentation sites (downstream looking up/upstream looking down) to capture photos before, during, and after structure installation – for multiple years of monitoring. Field observations will be recorded during monitoring survey(s). Lamprey presence/absence survey(s) will be conducted by ODFW.

8. Project Budget (Including overhead): See below

9. Timeline of major tasks and milestones:

Workflow	***Start Date/Month***	***End Date/Month***	***Responsible Party***
Environmental compliance/permits	***In progress***	***By Spring 2020***	***UNWC***
Pre-project preparation	***In progress***	***By project start Summer 2020***	***UNWC***
Field surveys	***Completed***	***Completed***	***Contractor & ODFW***
Other tasks….	***In progress and as they develop***	***Fall 2020***	***ALL***
Reporting			***UNWC***

Project Budget:

Project Title:	Tweedle Creek – Meander Reconstruction – Lamprey/Salmonid Habitat Restoration – Carmichael Property				
	2019/20 Funds				
	NOAA Secured ($)	**NCL-RIP Requested ($)**	**State contributions (in-kind staff support for design and monitoring)**	**Other contributions (cash + in-kind) To Be Secured**	**Total cost**
DIRECT COSTS					
a) Personnel Salary: UNWC PM/Bookkeeper	3,000			3,000	6,000
b) Permitting / UNWC	2,500			2,500	5,000
c) Travel	300			300	600
d) Design, Drafting, Layout	20,000		2,500		22,500
e) Implementation Management	7,000		2,500	7,000	14,000
f) Planting Plan Management UNWC	3,000			3,000	6,000
g) Supplies Trees/Shrubs/Tubes	2,000		2,000	2,000	6,000
h) Crew Labor planting 1,000 hrs @ $12 per Hr.	6,000	6,000			12,000
i) Excavator 250 hrs @ $152 per Hr.	9,000	29,000			38,000
j) Dozer 100 hrs @ $80 per Hr.	4,000	4,000			8,000
k) Dump Truck 250 hrs @ $52 per Hr.	7,000	7,000			14,000
l) Equipment Mob	2,000	2,000			4,000
m) Log Trucking	2,000	2,000			4,000

50 hrs @ $50 per Hr.					
n) Supplies (96 structure Logs)	9,600			9,600	19,200
o) Crew Labor Channel reconnect / LWD	6,300			6,300	12,600
p) Dewater supplies	2,000			2,000	4,000
TOTAL DIRECT (a-h)	85,700		7,000	85,700	178,400
INDIRECT COSTS (3%)	2,571			2,571	5,142
TOTAL	88,271	50,000	7,000	88,271	183,542

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Appendix 1

The following are the definitions for interpreting the NatureServe conservation status ranks in Table 2.

SX Presumed Extirpated.—Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. (= "Regionally Extinct" in IUCN Red List terminology).

SH Possibly Extirpated.—Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include: (1) that a species has not been documented in approximately 20–40 years despite some searching or some evidence of significant habitat loss or degradation; or (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction.

SU Unrankable. .—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

S1 Critically Imperiled.—Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.

S2 Imperiled.—Imperiled in the jurisdiction because of rarity due to very restricted range, very few occurrences, steep declines, or other factors making it very vulnerable to extirpation from the jurisdiction.

S3 Vulnerable.—Vulnerable in the jurisdiction due to a restricted range, relatively few occurrences, recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 Apparently Secure.—Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure.—Common, widespread, and abundant in the jurisdiction.