Pacific Lamprey

2020 Regional Implementation Plan

for the

Lower Columbia/Willamette

Regional Management Unit

Lower Columbia Sub-Unit

Submitted to the Conservation Team August 27th, 2019

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I. Status and Distribution of Pacific lamprey in the RMU

A. General Description of the RMU

The Lower Columbia River sub-unit within the Lower Columbia River/Willamette Regional Management Unit includes watersheds that drain into the Columbia River mainstem from Bonneville Dam at Rkm 235, west to confluence of the Columbia River with the Pacific Ocean. It is comprised of six 4th field HUCs ranging in size from 1,753−3,756 km^2 (Table 1). Watersheds within the Lower Columbia River sub-unit include the Lower Columbia-Sandy, Lewis, Upper and Lower Cowlitz, Lower Columbia-Clatskanie, and Lower Columbia River (Figure 1).

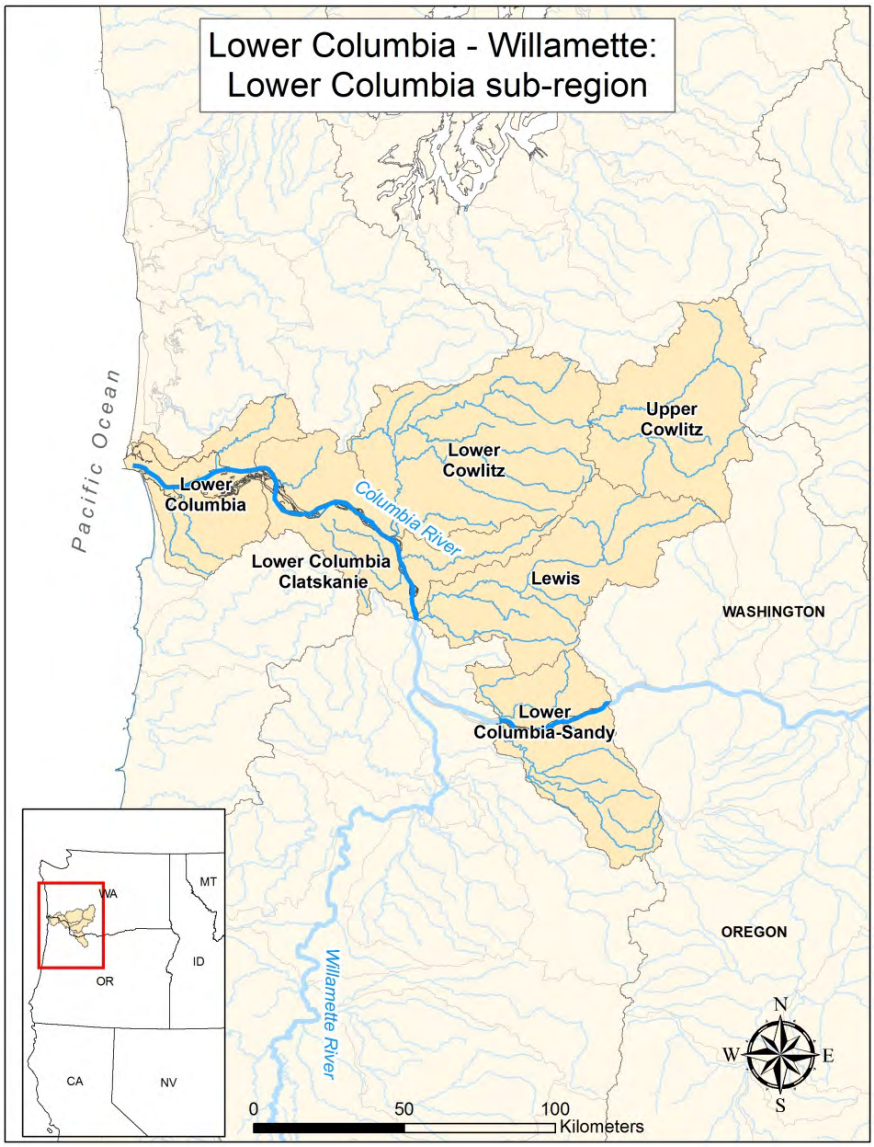


Figure 1. Map of watersheds within the Lower Columbia/Willamette RMU, Lower Columbia sub-unit.

Table 1. Drainage Size and Level III Ecoregions of the 4th Field Hydrologic Unit Code (HUC) Watersheds located within the Lower Columbia sub-unit.

Watershed	HUC Number	Drainage Size (km^2)	Level III Ecoregion(s)
Lower Columbia-Sandy	17080001	2,263	Willamette Valley, Cascades
Lewis	17080002	2,719	Puget Lowland, Willamette Valley, Cascades
Upper Cowlitz	17080004	2,654	Puget Lowland
Lower Cowlitz	17080005	3,756	Puget Lowland, Cascades
Lower Columbia-Clatskanie	17080003	2,349	Coast Range, Willamette Valley
Lower Columbia	17080006	1,753	Coast Range

B. Status of Species

Conservation Assessment and New Updates

Current Pacific Lamprey distribution in the Lower Columbia sub-unit is greatly reduced from historical range (Table 2). The revised Pacific Lamprey Assessment ranking of current distribution was reduced in all HUCs in 2017. 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). Overall, understanding of distribution has expanded considerably in many Oregon State tributaries due to increased sampling effort (e.g., smolt trapping, redd surveys, occupancy sampling). Less is known about lamprey distribution in Washington State tributaries. Existing information is largely based upon anecdotal observations, or has been collected incidentally while monitoring salmonid species. A compilation of all known larval and adult Pacific Lamprey occurrences in the Lower Columbia sub-unit are displayed in Figure 2, which is a product of the USFWS Data Clearinghouse.

Pacific Lamprey population abundance was updated in the Lower Columbia-Sandy, Lower Columbia-Clatskanie, and Lower Columbia River HUCs using new information from Oregon Department of Fish and Wildlife (ODFW) to estimate a range of abundance using available redd counts. As part of the monitoring for winter steelhead spawning populations, the Oregon Adult Salmonid Inventory and Sampling (OASIS) field crews record data on lamprey spawners and redds. These estimates are considered minimum population numbers, as the surveys are focused on steelhead, and end before the completion of Pacific Lamprey spawning (see Jacobsen et al. 2014; Jacobsen et al. 2015; Brown et al. 2017). Abundance estimates were calculated for four lower Columbia River tributaries in multiple run years: the Sandy River (2010, 2012-2016), Clatskanie River (2012-2013, 2015-2016), Youngs Bay and Big Creek (2012-2013). Average abundance of adults ranged from 2-293 fish in the Sandy Basin (avg. of avg. 97 fish), 157-782 fish in the Clatskanie River (avg. of avg. 408 fish), and 25-980 fish in Youngs Bay and Big Creek Combined (avg. of avg. 354 fish). Adult Pacific Lamprey abundance is currently unknown in the Lewis and Lower Cowlitz HUCs, and Pacific Lamprey are believed to be extirpated from the Upper Cowlitz River. The Cowlitz Salmon Hatchery Barrier Dam and Mayfield Dam

effectively block access to the upper portion of the Lower Cowlitz River (above RM 49.6) and upper Cowlitz basin.

Short-term population trend (defined as the degree of change in population size over 3 lamprey generations or 27 years), was ranked as unknown in all HUCs of the Lower Columbia sub-unit (Table 2). Mainstem dam counts provide one of the only long term records of adult Pacific Lamprey numbers in the Columbia River basin. Despite data gaps and monitoring inconsistencies, counts of adult Pacific Lamprey at Bonneville Dam indicate a significant downward trend in abundance over time. Counts of adult Pacific Lamprey prior to 1970 averaged over 100,000 fish (1939-1969), while the recent 10-year average is just over 34,000 fish (FPC 2019). Historical harvest records at Willamette Falls also suggest a decline in adult Pacific Lamprey abundance. Harvest estimates have ranged from a peak of ~400,000 pounds of fish in 1946 to less than 12,000 pounds since 2001 (Ward 2001). This reduction may be attributable to reduced fishing effort, more stringent regulations, different harvest methods, or a decline in lamprey abundance (Kostow 2002). Unfortunately no long term counts of Pacific Lamprey exist in tributary or mainstem areas of the Lower Columbia sub-unit. Populations are believed to be declined (from historical levels), but adequate information does not exist to estimate the magnitude of the decline. Oregon Department of Fish and Wildlife OASIS estimates provide 2-6 years of good abundance information in select lower Columbia tributaries (i.e., Sandy, Clatskanie, Youngs Bay and Big Creek), but this data set is not long enough to infer population trends.

Table 2. Population demographic and conservation status ranks (see Appendix 1) of the 4th Field HUC watersheds located within the Lower Columbia sub-unit. Note – steelhead intrinsic potential 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)
Lower Columbia-Sandy	17080001	S2	1000-5000	100-500	50-1000	Unknown
Lewis	17080002	S1↓	250-1000	100-500	Unknown	Unknown
Upper Cowlitz	17080004	SH	1000-5000	Zero	Zero	Unknown
Lower Cowlitz	17080005	S2	1000-5000	100-500	Unknown	Unknown
Lower Columbia-Clatskanie	17080003	S1S2↓	1000-5000	100-500	250-2500	Unknown
Lower Columbia	17080006	S2	1000-5000	100-500	250-2500	Unknown

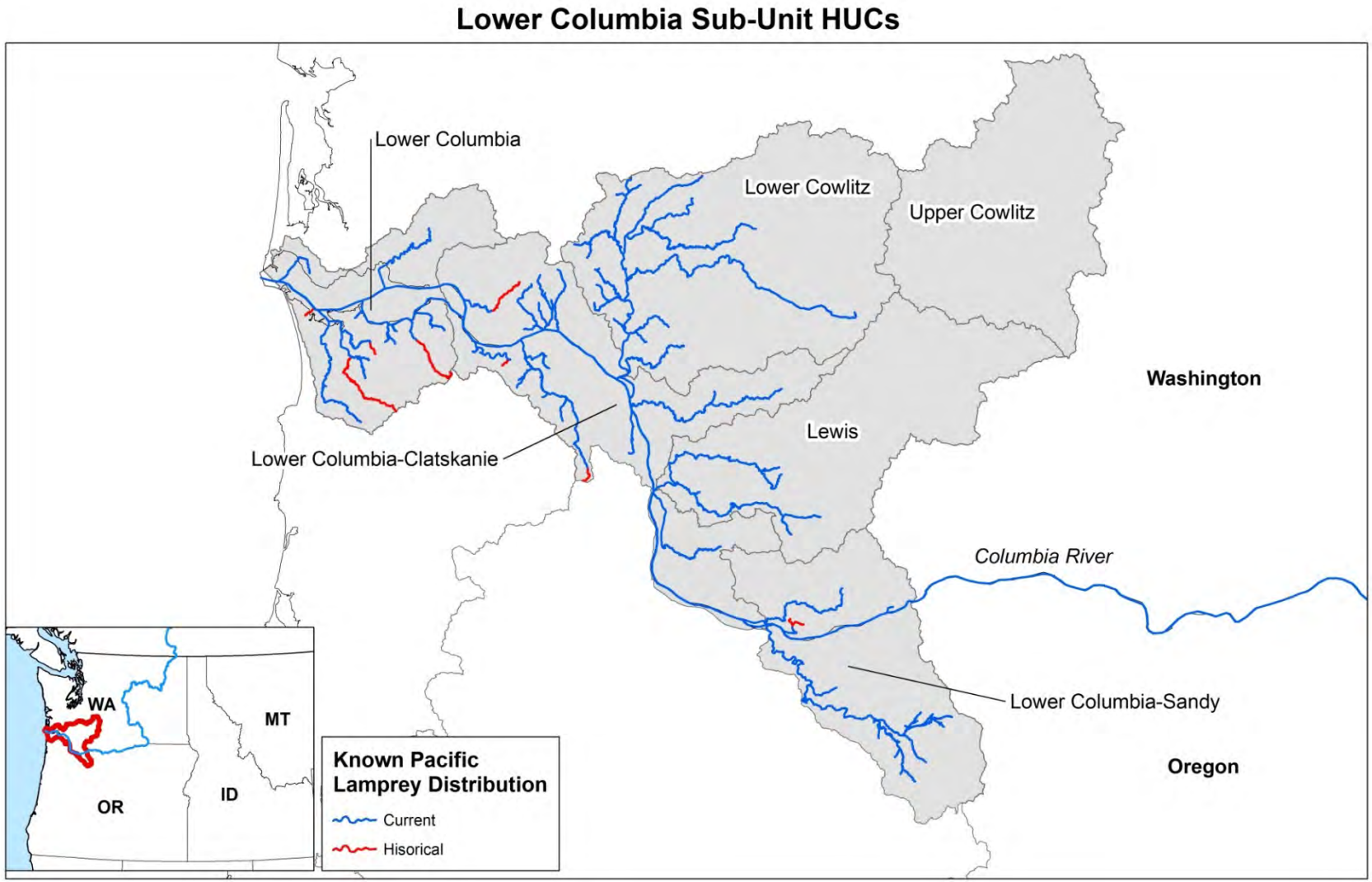


Figure 2. Current and historical known distribution for Pacific Lamprey: Lower Columbia/Willamette Regional Management Unit, Lower Columbia sub-unit (USFWS Data Clearinghouse 2017). Historical Pacific Lamprey distribution depicted in map was obtained from published literature, tribal accounts and state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

Distribution and Connectivity

Threats to passage were considered moderate in the Lower Columbia sub-unit (Table 3). While adult passage is not impeded by dams of the Federal Columbia River Power System (FCRPS), lamprey in these HUCs are affected by other large hydroelectric dam including Merwin, Swift, and Yale Dams in the Lewis Basin, and Mayfield, Mossy Rock and Cowlitz Falls in the Lower and Upper Cowlitz Basins. These dams were built without fish passage and completely block upstream migration and access to important spawning and rearing habitat. To compensate for loss of passage, salmon and steelhead are diverted into a collection facility where they are sorted, hauled by truck and released above dams. Downstream passage for juveniles is accomplished using floating surface collectors. It is unknown whether Pacific Lamprey have ever been collected at Cowlitz Salmon Hatchery or Merwin adult fish collection facilities. No trap-and-haul of lamprey currently takes place above these dams. Other significant passage barriers in the Lower Columbia sub-unit include the multi-dam complex on the Bull Run River in the Sandy basin, and Sediment Retention Structure on the North Fork Toutle River. Culverts, tide gates, and small dams/weirs are also a concern throughout the RMU.

Road crossing culverts are prevalent in the Lower Columbia sub-unit. Poorly designed or installed culverts may fragment aquatic habitat and impede the migration of fish. Culverts with excessive water velocity (>0.86 m/s), inadequate attachment points, perched outlets, or added features with abrupt 90 degree angles (e.g., baffles, fish ladder steps, outlet aprons), may obstruct passage of adult lamprey (Moser et al. 2002; Mesa et al. 2003; Keefer et al. 2003; Stillwater Sciences 2014; Crandall and Wittenbach 2015; LTW 2020a). Many impassable culverts occur low in watersheds (near tributary outlets), preventing access to miles of potential habitat. Barrier removal projects are on-going throughout the Lower Columbia sub-unit, but more effort is needed to address the passage needs of adult Pacific Lamprey and other native fish species (see LTW 2020a). There are still a number of basins within the lower Columbia with no barrier assessments.

Tide gates are broadly distributed in tidally influenced tributaries of the Lower Columbia sub-unit. Estuarine wetlands and floodplains were historically constrained by dikes and gated culverts to prevent flooding and drain land for agriculture, livestock grazing, and/or residential development. Traditional top-hinge tide gates do not allow tidal backflow and thus provide few (if any) passage opportunities for fish. Furthermore, many of the older wood and cast iron tide gates have become damaged or corroded over time and need maintenance. Stakeholder groups, like the Oregon Tide Gate Partnership, are actively working to facilitate the removal, repair or replacement of failing structures throughout the Oregon Coast and Lower Columbia. The Nature Conservancy recently funded a tide gate inventory of the lower Columbia that will be implemented in summer 2020.

Fish hatcheries in the lower Columbia River basin often utilize barrier dams and fish ladders to divert adult salmon into the hatchery during brood collection, or to regulate fish passage above the hatchery. Many of these structures are suspected passage barriers to adult Pacific Lamprey. The USFWS in partnership with ODFW recently completed an evaluation of adult Pacific Lamprey passage efficacy at seven different fishways and barrier dams associated with three salmon hatcheries in Oregon. A similar assessment is underway at 12 fish hatcheries in SW Washington.

C. Threats

Summary of Major Threats

The following table summarizes the known key threats (i.e., score ≥2.50) within the Lower Columbia sub-unit tributaries as identified by RMU participants during the Risk Assessment revision meeting in May 2017. The highest priority threat in the Lower Columbia watersheds is Dewatering and Flow Management followed by, Passage, Stream and Floodplain Degradation, and Water Quality.

Table 2. Key threats to Pacific Lamprey and their habitats within the Lower Columbia River sub-unit, 2017. High = 4; Moderate/High = 3.5; Moderate = 3; Low/Moderate = 2.5; Low = 2; Unknown = no value

Watershed	Passage		Dewatering and Flow Management		Stream and Floodplain Degradation		Water Quality	
	Scope	Severity	Scope	Severity	Scope	Severity	Scope	Severity
Sandy	2.5	3	3.5*	2	2.5	3	3*	3*
Lewis	3	3	4	4	3	3	3	3
Upper Cowlitz	4	4	4	4	3	3	1	1
Lower Cowlitz	3	3	3	4	3	3	1	2
Clatskanie	3.5	4	3*	3*	4	3	3.5*	3.5*
Lower Columbia	2	2.5	2.5	2	3.5	3	3	4
Mean	3.00	3.25	3.33	3.17	3.16	3.00	2.42	2.75
Rank	**M**	**H**	**M**	**M**	**M**	**M**	**L**	**M**
Mean Scope & Severity	3.13		3.25		3.08		2.59	
Drainage Rank	**M**		**M**		**M**		**M**	

"*****" indicates areas that were ranked higher because of the mainstem Columbia River

Current Threats

Dewatering & flow management

Dewatering and Flow Management was ranked a moderate threat in the Lower Columbia sub-unit. Low seasonal streamflow and Bonneville Dam flow regulation were identified as key issues in the region. Low flow conditions occur naturally in many watersheds during summer months (e.g., Grays River), but land use practices and consumptive water use may exacerbate conditions further. Water withdrawals for irrigation, livestock, municipal, or industrial purposes leave many watersheds in the Lower Columbia sub-unit dewatered or with inadequate flow during summer and fall months (e.g., Sandy River, Washougal River, East Fork Lewis River, Kalama River, Clatskanie River, Lewis and Clark River, Youngs River, Big Creek, and the South Fork Klaskanine River). Low flows can impact fish by reducing spawning and rearing habitat availability, creating low water passage barriers, or impairing water quality. 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 the future.

The mainstem Columbia River downstream from Bonneville Dam is susceptible to frequent fluctuations in discharge and water level resulting from the operation of Bonneville Dam for hydropower production and flood control. Flow regulation has significantly altered the natural flow patterns of the Columbia River (see Lower Columbia Fish Recovery Board (LCFRB) 2010). These changes can negatively impact aquatic species that rely on environmental cues (i.e., temperature, photoperiod, flow) to trigger important developmental or behavioral events such as emergence, growth, maturation or migration. In the Columbia River basin, the spring freshet takes place an average of two weeks earlier and flow volume is reduced from historical levels (LCFRB 2010; Naik and Jay 2011). Diminished spring flows may increase the duration of fish migration, potentially increasing exposure to predators and other threats. Additionally, the shift of peak flows to earlier in the spring could result in even longer periods of low flow and warm water temperatures during summer and fall months (Naik and Jay 2011). Rapid water level fluctuations below Bonneville Dam (i.e., hydropeaking) repeatedly inundate and dewater shallow water areas, directly impacting the quantity, accessibility and suitability of spawning and rearing habitat. Lamprey larvae are especially vulnerable to stranding as they rear in fine sediments along river margins and delta regions, but impacts related to hydropeaking below Bonneville Dam are unknown (Jolley et al. 2012; Mueller et al. 2015).

Stream & floodplain degradation

Stream and Floodplain Degradation was also ranked a moderate threat. Channel confinement, channel manipulation, and floodplain development are the primary concerns in the sub-unit. Human settlement and land development have greatly altered the physical habitat of tributaries in the region. In upland areas, stream cleaning, forest fires (e.g., Yacolt Burn), and historical timber harvest practices have completely deforested or altered the diversity and age structure of riparian vegetation and trees. Many watersheds are lacking mature trees that play a pivotal role in bank stability, water quality protection, thermal cover, and input of wood into channels. Large wood can benefit streams by influencing the structural complexity of the channel (i.e., creating

pools or undercut banks), increasing the deposition of fine substrate and organic matter, thereby providing important rearing habitat for juvenile salmonids and larval lamprey (Gonzalez et al. 2017). Within lowland areas, river channels have been straightened, diked and armored to protect property against flooding and erosion. Channel simplification and conversion of land for agriculture, grazing, and development (rural, urban, commercial, industrial) has reduced or eliminated a substantial amount of side channel and wetland habitat.

The Columbia River mainstem below Bonneville Dam has been straightened and confined by major railroad and transportation corridors that run parallel to the river. Much of the shoreline is armored with riprap and connection to tributaries occurs through culverts and bridges. In the Lower Columbia River and estuary, dikes and levees have disconnected the mainstem from floodplain and estuary habitat (e.g., tidal swamp, marsh, wetlands), reducing the river to a single channel. Efforts to maintain the shipping channel (e.g., jetties, pile dikes) have altered flow patterns and increased sediment accumulation that requires periodic dredging to remove. The impacts of channel maintenance dredging on larval lamprey in the Lower Columbia River have not been thoroughly documented. Dredging may displace, injure or kill burrowing larvae, disturb or destroy potential rearing habitat, or re-suspend contaminated sediments into the river (Maitland et al. 2015; Clemens et al. 2017). Preliminary deep water larval sampling in the Lower Columbia River downstream from the City of Skamakawa (RM 33.5) did not detect larval lamprey in the 15 quadrats surveyed (Jolley et al. 2011a). Multiple size class and species of lamprey have been observed in other areas within the Columbia River mainstem (Jolley et al. 2011b; Jolley et al. 2012), but habitat use and distribution within the estuary is still unknown.

Water quality

Elevated water temperature is the primary water quality concern in Lower Columbia tributaries. Excessive temperatures generally occur during summer months and may be attributed to increased air temperature, lack of riparian cover, reduced instream flows associated with water withdrawal, and warm irrigation water returns. 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, pH extremes, and presence of bacteria (e.g., fecal coliform, e coli), that may be associated with elevated water temperatures and agricultural or urban runoff.

Major water quality concerns in the Lower Columbia mainstem include elevated water temperature, low dissolved oxygen, gas supersaturation, and biological and chemical contaminants. Average water temperature below Bonneville Dam often exceeds 19°C in late June to early September (Bragg and Johnston 2016). High water temperatures are likely a result of warmer ambient temperatures and cumulative effects of water withdrawal and land use activities in tributary and mainstem areas. Dissolved gas supersaturation resulting from spill from Bonneville Dam can exceed the EPA mandated limit of 110% saturation for several months during normal and low water years (Schneider and Barko 2006). These levels may extend throughout the entire lower Columbia River. Short-term exposure to gas levels <120% has minimal ill effects for juvenile salmonids. However, long term or repeated exposure to sublethal levels (<110%) may increase susceptibility to predation, disease, toxins, or other environmental stressors (McGrath et al. 2006). Furthermore, aquatic organisms inhabiting shallow water

habitats or exposed during vulnerable life stages (e.g., incubating embryos, sac fry, or larvae) may be more sensitive to sublethal effects. The vulnerability of Pacific Lamprey to gas bubble disease or potential sensitivity at different life stages is unknown. Industrial discharge and surface water runoff from farms, roads and urban areas are the primary source of contaminants entering the Columbia River mainstem. Toxic contaminants such as DDE, PCBs, and heavy metals settle out and accumulate in fine sediments, reaching concentrations that may be harmful to aquatic and terrestrial organisms. Toxins and heavy metals may be a particular concern for Pacific Lamprey because direct exposure in water or sediment during larval and adult life stages can result in high concentrations of contaminants accumulating in fatty tissues that may compromise fish health and development (Nilsen et al. 2015; Clemens et al. 2017). Monitoring and restoration efforts to improve and protect water quality for fish, wildlife, and human health are ongoing in the Lower Columbia sub-unit.

Predation

Although not ranked a 'key threat', predation of adult and juvenile lamprey by native and non-native fish, birds, and marine mammals is known to occur in the Columbia River Basin (Close et al. 1995; Zorich et al. 2011; Madson et al. 2017). Pacific Lamprey encounter many of the same predators as salmonids during migration, but the severity of the threat is not well understood. Dams and other human changes to the environment can increase habitat suitability for predator species and may contribute to the decline of lamprey by delaying/slowing migration or exposing fish to increased mortality in areas where piscivorous predators may congregate (e.g. Bonneville Dam tailrace, Sand Island, etc.). In addition, temperature increases predicted with climate change models may expand the territory of warmwater predators into tributaries, putting further stress on native fish communities (Lawrence et al. 2014).

Restoration and Research Actions

To date, the primary lamprey restoration activities that have occurred or are occurring within this RMU are being performed by organizations focused on salmon and steelhead recovery on both the Oregon and Washington side of the river. Many instream and floodplain habitat restoration activities have been identified in subbasin and watershed management plans (e.g., Oregon Lower Columbia River Conservation and Recovery Plan (2010), Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (2010), Lower Columbia River Recovery Plan for Salmon and Steelhead (2013)). The vast majority of these actions have been funded and designed for salmon recovery, but work may improve habitat conditions for lamprey as well. Current Pacific Lamprey research has focused on gaining a better understanding of distribution and habitat use within the Columbia River mainstem and tributaries. The following lamprey research and restoration actions were initiated or recently completed by RMU partners in the Lower Columbia sub-unit from 2012-2019.

HUC	Threat	Action Description	Type	Status
RMU	Population	Environmental DNA, spawning ground surveys, smolt trapping and occupancy sampling to better understand lamprey distribution.	Survey	Ongoing
RMU	Stream Degradation	Implementation of instream and floodplain habitat restoration activities and culvert removal/replacement projects where lamprey salvage efforts occurred.	Instream	Ongoing
RMU	Passage	Evaluation of adult Pacific Lamprey passage efficacy at fishways and barrier dams associated with salmon hatcheries.	Assessment	Underway
RMU	Population	Distribution surveys in mainstem and principal tributaries	Survey	Ongoing
RMU	Population	Use of eDNA to monitor effectiveness of large wood placement projects and recolonization of larval lamprey following restoration	Assessment	Proposed/ Underway
RMU	Lack of Awareness	Consideration of lamprey when planning and implementing instream habitat restoration work (see LTW 2020b)	Coordination	Ongoing
RMU	Lack of Awareness	Compilation of lamprey data from SW Washington tributaries	Assessment	Complete
RMU	Passage	Map, assess and prioritize passage barriers in tributaries and evaluate available lamprey habitat upstream	Assessment	Proposed
RMU	Population	Adult/Juvenile Pacific Lamprey abundance data summary for Southwest Washington tributaries	Assessment	Underway
RMU	Population	Oregon Department of Fish and Wildlife Conservation Plan for Lampreys in Oregon *https://www.dfw.state.or.us/fish/CRP/coastal_columbia_snake_lamprey_plan.asp*	Other	Complete
RMU	Population	Ongoing lamprey genetics work (CRITFC)	Assessment	Ongoing
Sandy	Stream Degradation	Sandy River floodplain reconnection, gravel augmentation in Bull Run River.	Instream	Complete
Sandy	Stream Degradation	Large wood augmentation, side channel reconnection in upper Sandy River.	Instream	Complete
Clatskanie	Population	Conduct adult spawning ground surveys to monitor Pacific Lamprey distribution, timing, and number of redds to develop relative abundance indexes.	Survey	Ongoing
Clatskanie	Population	Deep water sampling to document distribution	Assessment	Complete

		and habitat use of larval lamprey in Columbia River mainstem.		
Clatskanie	Passage	Tide gate and culvert modification and removal projects to restore access to spawning and rearing habitat.	Instream	Ongoing
Clatskanie	Stream Degradation	Assessment of larval lamprey use in areas of salmonid restoration vs no restoration (Abernathy Creek).	Survey	Underway
Lower Columbia	Stream Degradation	Floodplain reconnection on Lewis and Clark & junctions of Big and Little Creeks	Instream	Upcoming
Lower Columbia	Passage	Pilot test of acoustic telemetry array to monitor movement of juvenile lamprey	Instream	Upcoming
Lower Columbia	Passage	Lamprey friendly passage improvements at 3 dams at North Fork Klaskanine Hatchery	Instream	Underway
Lower Columbia	Passage	Evaluation of passage constraints for lamprey at fish hatcheries in Washington State	Instream	Underway
Lower Columbia	Population	Conduct adult spawning ground surveys to monitor Pacific Lamprey distribution, timing, and number of redds to develop relative abundance indexes.	Survey	Ongoing
Lower Columbia	Population	Pilot project to evaluate catchability of western river lamprey in coastal estuaries	Survey	Proposed
Lower Columbia	Passage	Tide gate and culvert modification and removal projects to restore access to spawning and rearing habitat.	Instream	Ongoing
Lower Columbia	Population	Investigation of salinity tolerance and larval lamprey occurrence in tidally influenced estuarine stream.	Assessment	Complete
Lower Columbia	Passage	Formation of Oregon Tide Gate Partnership Group	Coordination	Ongoing
Lower Columbia	Passage	Tide gate inventory in lower Columbia River	Survey	Underway

II. Selection of Priority Actions

A. Prioritization Process

Participating members of the Lower Columbia sub-unit had a virtual meeting on April 23rd, 2020 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 Lower Columbia sub-unit Regional Implementation Plan in 2020:

- Lower Columbia Pacific Lamprey Barrier Evaluation and Project Prioritization
- Assessing and Restoring Lamprey Habitat in Southwest Washington

B. High Priority Proposed Project Information

Project Title: Lower Columbia Pacific Lamprey Barrier Evaluation and Project Prioritization

Project Applicant/Organization: Lower Columbia River Watershed Council (LCRWC)

Contact Person: Allan Whiting, Watershed Council Coordinator

Email: allan@whitingenv.com

Phone: 503.789.9240

Project Type: **Assessment**

Lamprey RMU population(s): Lower Columbia Sub-Region
Multi-RMU project? No

Watershed (5th HUC Field):
NPCC Subbasin (4th HUC Field) name:

Watershed	HUC Number
Lower Columbia-Sandy	17080001
Lewis	17080002
Upper Cowlitz	17080004
Lower Cowlitz	17080005
Lower Columbia-Clatskanie	17080003
Lower Columbia	17080006

Project Location: Regional in extent
Project Coordinates (latitude and longitude, decimal degrees, NAD 1983): N/A

Total Requested funds: **$56,309**

1. ***Short Project Summary (200 words or less):***

The overarching goal of this project is to restore Pacific Lamprey access to blocked high-quality habitats in the Lower Columbia region. This will be accomplished by inventorying and assessing potential barriers to lamprey, prioritizing sites for providing passage, and recommending passage solutions for high priority sites. These tasks will follow existing passage guidance documents and be conducted in collaboration with a Technical Advisory Committee (TAC) of restoration practitioners, regional habitat restoration programs, State and Federal biologists, and the Lamprey Technical Workgroup (LTW). The Lower Columbia River Watershed Council (LCRWC) will convene the TAC and coordinate with the LTW and local restoration groups. Key project outcomes will include (1) a comprehensive spatial database of potential barriers to lamprey in the region that will be shared with the Pacific Lamprey Conservation Initiative (PLCI) and other stakeholders; (2) lists of identified barriers and sites that require further assessment, prioritized by upstream habitat potential; and (3) conceptual approaches for

providing passage at high priority barriers that have been vetted for project feasibility by LCRWC in coordination with the TAC and local restoration organizations. An additional benefit is increased awareness of Pacific Lamprey passage and habitat requirements in the region that will encourage multi-species restoration.

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

Objective #1: Inventory potential barriers to Pacific Lamprey in Study Area

The LCRWC will work with TAC and consultant team with GIS and lamprey expertise to develop a comprehensive inventory of barriers to Pacific Lamprey in a focal Study Area. A 4th Field HUC within the RMU will be selected as the Study Area in consultation with TAC based on relative severity of passage as a threat, data quality, and transferability to this process. The inventory will collate existing barrier databases and completed barrier assessments. Results will be included in a geodatabase to support landscape-scale analyses informing site selection and prioritization for passage evaluation (Objective #2). Site-specific information from existing salmonid-focused assessments will be included in database and used to support both prioritization and determination of barrier status for lamprey (#3).

Deliverable: Comprehensive geodatabase of potential barriers in Study Area compatible with existing formats (e.g., Databasin.org, PacificLamprey.org).

Objective #2: Prioritize potential barriers for evaluation of lamprey passage

The inventory will undergo initial screening to omit sites outside Pacific Lamprey predicted historical distribution, as well sites that are clearly not barriers based on information from Objective 1. Remaining sites will be prioritized for evaluation based on upstream habitat potential, access constraints, and stakeholder input. The PLCI Regional Implementation Plan (Poirier 2019) will also inform prioritization.

Deliverable: Prioritized list of sites requiring Pacific Lamprey passage evaluation.

Objective #3: Determine lamprey passage status at priority sites

Protocols from the LTW (2020) will be applied to assess passage status of priority sites. In some cases, passage status will be determined remotely, but field assessments will be conducted at some sites. Data and observations from field assessments will inform both feasibility and prioritization (#4) and solutions for providing passage at barrier sites (#5).

Deliverable: List of sites that are non-barriers, total barriers, partial barriers, or require further evaluation. Site data will be included in geodatabase.

Objective #4: Project Prioritization

Barrier sites from Objective 3 will be prioritized for passage project development using factors such as:

- extent to which site is a barrier (i.e., total or partial/seasonal),
- relative quality of upstream habitat,
- extent to which providing passage would benefit other aquatic species,
- benefits to downstream habitat by restoring geomorphic processes and wood transport,
- relative cost and feasibility of providing passage.

The prioritization process will be developed in consultation with the TAC and will likely apply an objective scoring-and-ranking approach or decision-support tool. Importantly, the preliminary project list will be vetted for feasibility with local restoration groups.

Deliverable: Prioritized list of barrier sites in the Study Area

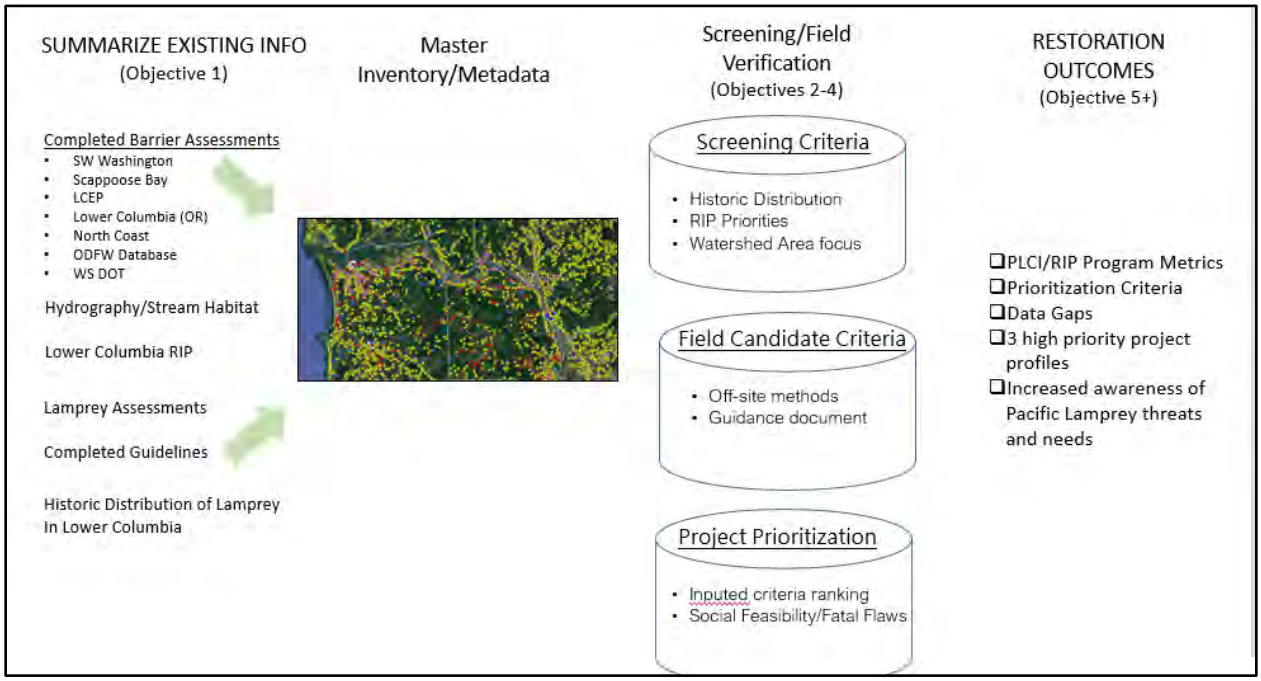
Objective #5: Develop conceptual options for providing passage at high priority sites.
Project concepts and approaches for providing passage will be developed for highest priority sites identified from Objective 4. Potential options for providing passage will be developed for a minimum of three (3) high priority sites in coordination with TAC and local stakeholders. Resulting project concept profiles will include conceptual-level descriptions of passage solutions and outline steps needed to finalize and implement designs at each site.

Deliverables:

- Report summarizing the process and results of Objectives #1-5
- Project concept profiles for high priority sites for next step implementation funding and assessing preliminary regulatory requirements.

3. ***Descriptive Photographs-Illustrations-Maps (limit to three total):***

   Workflow model is provided below to show initial logic to proposed objectives and restoration outcomes for the Lower Columbia RMU and broader PLCI.



4. ***Linkage of Actions to Identified Threats for Lampreys in RMU(s) (300 words or less):***
   - What threat(s) to lampreys does this project address? (See your RIP(s) for key threats) ***Passage , Stream and Floodplain Degradation, Lack of Awareness***
   - Does this project address threat(s) to lampreys specific to this RMU only, or does the project address the threat(s) prevalent in multiple RMUs?
     Single RMU ☒, Multiple RMUs ☐ list additional RMUs:

Lower Columbia RMU is focus area, though process may be adopted to address threats elsewhere in the region.

- Describe how this project addresses key threat(s) to lampreys within the HUC(s) where project is proposed.

The lack of habitat connectivity and access to lamprey habitat is a threat consistently documented across multiple HUCs in the Lower Columbia RMU. Several watershed areas have been highlighted in the Regional Implementation Plan (RIP) offering insight into sub-areas to focus on within the RMU. Road crossings that block lamprey passage are present throughout the RMU. These artificial barriers limit natural migration patterns for adult lamprey. Many of these structures also impact sediment and wood transport, impacting habitat quality for both larval and adult lamprey. Guidance documents completed offer a platform for field investigations to better understand not only condition of these barriers, but their constraints on broader stream and floodplain habitat forming processes. Project addresses these threats through the evaluation of structures blocking the greatest amount of lamprey habitat and developing passage solutions at high priority sites. A list of prioritized structures for modification and/or removal will be major outcome of this project. The list can be adopted by regional entities and local organization for future proposal development, design, and implementation.

5. ***Species/Habitat Benefits (200 words or less***

- Provide citation of literature, distribution maps, and/or surveys demonstrating lampreys are currently and/or were historically present in the project area. How will the project provide meaningful measurable 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?

Distribution layers from the PLCI Pacific Lamprey Data Clearinghouse, as well as published literature and tribal accounts indicate that Pacific Lamprey are currently found throughout accessible portions of the study area. https://www.sciencebase.gov/catalog/item/imap/5745f81fe4b07e28b662c6ee.

Identifying and removing passage barriers to allow migrating adults access to historical habitats is one of the most tangible and cost-effective ways to increase the lamprey population. By identifying barriers that block the most habitat and that are most feasible to remove, the proposed project accomplishes necessary steps towards improving the lamprey population in the study area. By leading to projects that provide passage for migrating adults into reaches with holding, spawning, and rearing habitats, this project benefits all freshwater life stage of the species.

While this project is focused on identifying barriers to Pacific Lamprey passage, the comprehensive inventory of potential barrier for the study area can be used for passage assessments of other species. Moreover, level of benefit to other species will be a key consideration when prioritizing and recommending barrier for removal. Passage solutions that provide unimpeded passage for all native aquatic species, such as the Stream Simulation Design approach will be given precedence in our recommendations where feasible.

6. ***Priority Objectives and Goals:***
    - Indicate the strategies, and/or restoration/management plans are addressed by this project (when available relevant documents/websites are hyperlinked below for reference):
        - PLCI Conservation Agreement ☒
        - National Fish Habitat Partnership National Conservation Strategies ☒
        - USFWS Climate Change Strategies ☐
        - Bonneville Power Administration Northwest Power and Conservation Council Columbia River Basin Fish and Wildlife Program ☒
        - CRITFC Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin ☒
        - US Army Corps of Engineers Pacific Lamprey Passage Improvement Implementation Plan ☐
        - PUD Management Plan (please name below) ☐
        - Other (please name below) ☒
          Lower Columbia Regional Implementation Plan (USFWS, 2019)
          Coastal, Columbia, and Snake Conservation Plans for Lampreys in Oregon (ODFW.2020)

PLCI Conservation Agreement and Lower Columbia RIP

Below are the following PLCI objectives and description that this proposal will attain,

Objective 3: Public Outreach

Working with project practitioners and local organizations will build capacity in the region for community groups to improve understanding habitat requirements of pacific lamprey. Participation in the process will give them the tools needed to develop projects and associated outreach in alignment with needs of the community

Objective 4: Data sharing

Information will be made available to all participants and their partners including summary geodatabase and documentation of the process.

Objective 6: Identify, secure and enhance watershed conditions contained in the RMUs. Protect areas with healthy habitat conditions and strive to improve watershed conditions and migratory corridors where needed. Specifically:

- Objective 6 a) Project leads to identification of high value project opportunities and restoration options for local sponsors to consider for future design and implementation phases.
- Objective 6 b) In project will identify design elements necessary to support all life stages of Pacific Lamprey.
- Objective 6 c) This may in some cases expand benefits for project areas already considered by project sponsors for salmon.
- Objective 6 e) Candidate areas may also serve as monitoring site for program project effectiveness and/or status monitoring.

Lower Columbia sub-unit-Regional Implementation Plan

Project addresses threats and implements actions cited in the region's RIP.

- Summary of Major Threats, Table 2 (p.6): Passage, Stream and Floodplain Degradation.
- Restoration and Research Actions: Map, assess, and prioritize passage barriers in tributaries and evaluate available lamprey upstream (p.10)

NWPCC-2014 Fish and Wildlife Plan

Strategies from completed 2014 Fish and Wildlife Plan for the Columbia basin were identified along with emerging goals from 2020 addenda. Applicable references are as follows:

IV Strategies-Lamprey-Mainstem and tributary habitat

The action agencies, in coordination with agencies and tribes, shall:

- Implement instream habitat projects in a manner that minimizes mortality to lamprey by consulting the Best Management Practices for Pacific Lamprey
- Continue to identify, protect, and restore habitat areas and ecological functions, such as stream channel complexity and function, that are associated with productive spawning, resting, rearing, and migrating lamprey
- Install appropriate and effective juvenile lamprey screening for tributary water diversions

2020 Addendum to 2014 Fish and Wildlife Plan (draft goals)
Reduce the risk of extirpation and improved adult abundance toward sustainable harvestable levels across the historic distribution and range of Pacific Lamprey in the Columbia basin, including across all six Pacific Lamprey Regional Management Units (RMU), measured every five years.

CRITFIC-Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin

Objective 2: Improve tributary passage and identify, protect, and restore tributary habitat

Action 4.2.1 Tributary Passage

a. Implement structural and operational changes within tributaries to improve adult passage b. Implement structural and operational changes within tributaries to improve juvenile passage

Coastal, Columbia, and Snake Conservation Plans for Lampreys in Oregon (ODFW)

Recently completed Conservation plan by State of Oregon identifies the following threats and management priorities this project intends to contribute to:

- #1 Limiting factor-access (passage and screening at artificial obstructions, p. 46)

- Management Priority #1 Education and Outreach-Partner with interested entities and individuals on sharing information about lampreys and providing training; Remain active and engaged in the Lamprey Technical Workgroup (p. 55)
- Management Priority #2-Passage and Screening (Table 6.1, p.52)-Develop and use protocols to prioritize artificial obstructions for passage and screening improvements
  Management Priority #3-Protect and restore habitat (p.56)-Work with habitat restoration implementers to complete or update watershed assessments and increase restoration activities in lower mainstem rivers and estuaries that may benefit anadromous lampreys

7. Project Design / Feasibility:

- Have the designs for the project been completed already or will they be completed before planned project implementation? **N/A**
- 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? **N/A**
- Can the project be implemented within the defined timeframe? (*See BPA & NFHP requirements in the accompanying PLCI RIP Priority Project Guidance document).* **Yes ☒ No☐**
- Please provide a brief description (200 words or less):

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

- What partners are supporting the project?

Representatives from regional and local entities conducting restoration in the area have expressed support for this project. Discussions with SRFB lead entity for the State of Washington, Oregon local watershed councils, Conservation Districts, and USFWS and ODFW research staff has justified the need for passage assessment leading towards a multi-species passage restoration process that builds off previous efforts and ensures consistency with current restoration initiatives.

- What partners are active in implementing the project?

Watershed Council will establish a project Technical Advisory Committee to ensure input from representative groups in the region. Additional space will be created to ensure diversity of communities including Native American organizations.

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

Commitments have been secured for participation in the project TAC providing in-kind services for time spent attending meetings, providing assessment documentation, landowner outreach, and fieldwork support.

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

- How is completion of the project going to be documented? (*See BPA and NFHP requirements in the accompanying PLCI RIP Project Proposal Guidance document).*)

Project deliverables include a technical memo to articulate process and methodology used to prioritize sites for lamprey barrier removal and/or passage improvements and to describe passage solutions for viable, high-priority projects.

- How will the project's benefits to lampreys be monitored over time?

Candidate site for passage restoration identified through this project will be recommended to regional State, Federal, and Tribal biologists permitted to conduct lamprey surveys to help monitor project effectiveness (pre- and post-implementation surveys).

10. Project Budget (including overhead):

The Project Budget is provided in the table below. If insufficient program funding is available to fund each Proposed objective, the budget for this stepwise project can be easily be broken into discrete smaller phases in coordination with the PLCI and funding agency.

Project Budget Table:

	Items	# Hours or Units	Cost per Unit ($)	RIP Funds Requested ($)	Cost Share ($)	Total Cost ($)
A	***Personnel:***	-	-	-	-	-
	a. Watershed Council Coordinator	270	50.00	13,500	3,500	17,000
	b. Consultant Service Contract			37,000		37,000
	c. Technical Advisory Committee (6 representatives @ 36 hours each)	324	50		11,232	11,232
B	***Equipment & Supplies:***	-	-	-	-	-
	a. ArcView License				$1,000	1,000
	b.					
	c.					
	d.					
C	***Travel:***	-	-	-	-	-
	a. Logistical support for field investigations	1200	@$.575/miles	690		690
D	***Other:***	-	-	-	-	-
	a.					
	b.					
E	***Administrative:***	-	-		-	-
	Overhead (10 %)			5,119		5,119
	Indirect Costs (%)					
	Total (Sum of A - E)	-	-	$56,309	$15,732	$72,041

11. Timeline of major tasks and milestones:

Workflow	*Start Date*	*End Date*	*Responsible Party*
Objective 1: Inventory potential barriers	***February 1, 2021***	***April 30, 2021***	***LCRWC, TAC, Consultant Team***
Objective 2: Prioritize potential barriers	***April 15, 2021***	***October 30, 2021***	***Project TAC, Consultant Team,***
Objective 3: Determine lamprey passage status at priority sites	***November 15, 2021***	***March 30, 2021***	***LCRWC, Consultant Team***
Objective 4: Project Prioritization	***April 15, 2021***	***June 15, 2021***	***LCRWC, TAC, Consultant Team***
Objective 5: Develop conceptual options	***August 1, 2021***	***November 30, 2021***	***LCRWC, Consultant Team***
Final Reporting	***January 1, 2022***	***March 30, 2022***	***LCRWC, Consultant Team***

12. References:

Lamprey Technical Workgroup. 2020. Barriers to adult Pacific Lamprey at road crossings: guidelines for evaluating and providing passage. Original Version 1.0, June 29, 2020. 31 pp. + Appendices. Available: https://www.fws.gov/pacificlamprey/LTWGMainpage.cfm.

Poirier, J. 2019. Pacific Lamprey 2019 Regional Implementation Plan for the Lower Columbia/Willamette Regional Management Unit Lower Columbia Sub-Unit. Submitted to the Conservation Team August 27th, 2019. 30 pp.

Project Title: Assessing and Restoring Lamprey Habitat in Southwest Washington

Project Applicant/Organization: Cascade Forest Conservancy
Contact Person: Shiloh Halsey
Email: shiloh@cascadeforest.org
Phone: 503-258-7774

Project Type: **Habitat Restoration**

Lamprey RMU population(s): Lower Columbia Sub-Region
Multi-RMU project? Please list RMUs
Lower Columbia, Mid-Columbia

Watershed (5th HUC Field):
Wind River (1707010510)
South Fork Toutle River (1708000506)
NPCC Subbasin (4th HUC Field) name:
Middle Columbia-Hood (17070105)
Lower Cowlitz (17080005)
Project Location: South Fork Toutle River (Stump Creek), Upper Wind River Watershed (Panther Creek + Pete Gulch)
Project Coordinates (latitude and longitude, decimal degrees, NAD 1983):
Stump Creek (46.21860, -122.35369)
Panther Creek (45.83303, -121.87062)
Pete Gulch (45.98568, -121.88271)

Total Requested funds: **$56,814**

1. ***Short Project Summary (200 words or less):***

Aquatic restoration techniques like instream wood placement, beaver reintroduction, and beaver dam analogues (BDAs) hold great promise as methods to improve Pacific lamprey habitat. In order to better understand and quantify these impacts on lamprey while also working to build quality habitat and create aquatic ecosystems that are complex and resilient to the impacts of climate change, the Cascade Forest Conservancy is seeking funds for our "Assessing and Restoring Lamprey Habitat in Southwest Washington" project. Our goals are to install beaver dam analogues, reintroduce beavers, and collect wood for future instream placement in tributaries of two high priority stream systems: the South Fork Toutle River and the Wind River. During the grant period we intend to install one BDA series containing 4-6 structures in the South Fork Toutle watershed, and reintroduce 3-4 beaver families in the Wind River watershed. In addition, we will assess lamprey presence and sample for Type I lamprey habitat pre- and post-project. These actions will enhance existing lamprey habitat, expand current habitat to upstream tributaries, and will also gather important on-the-ground information to improve future efforts to restore and protect lamprey habitat in the region.

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

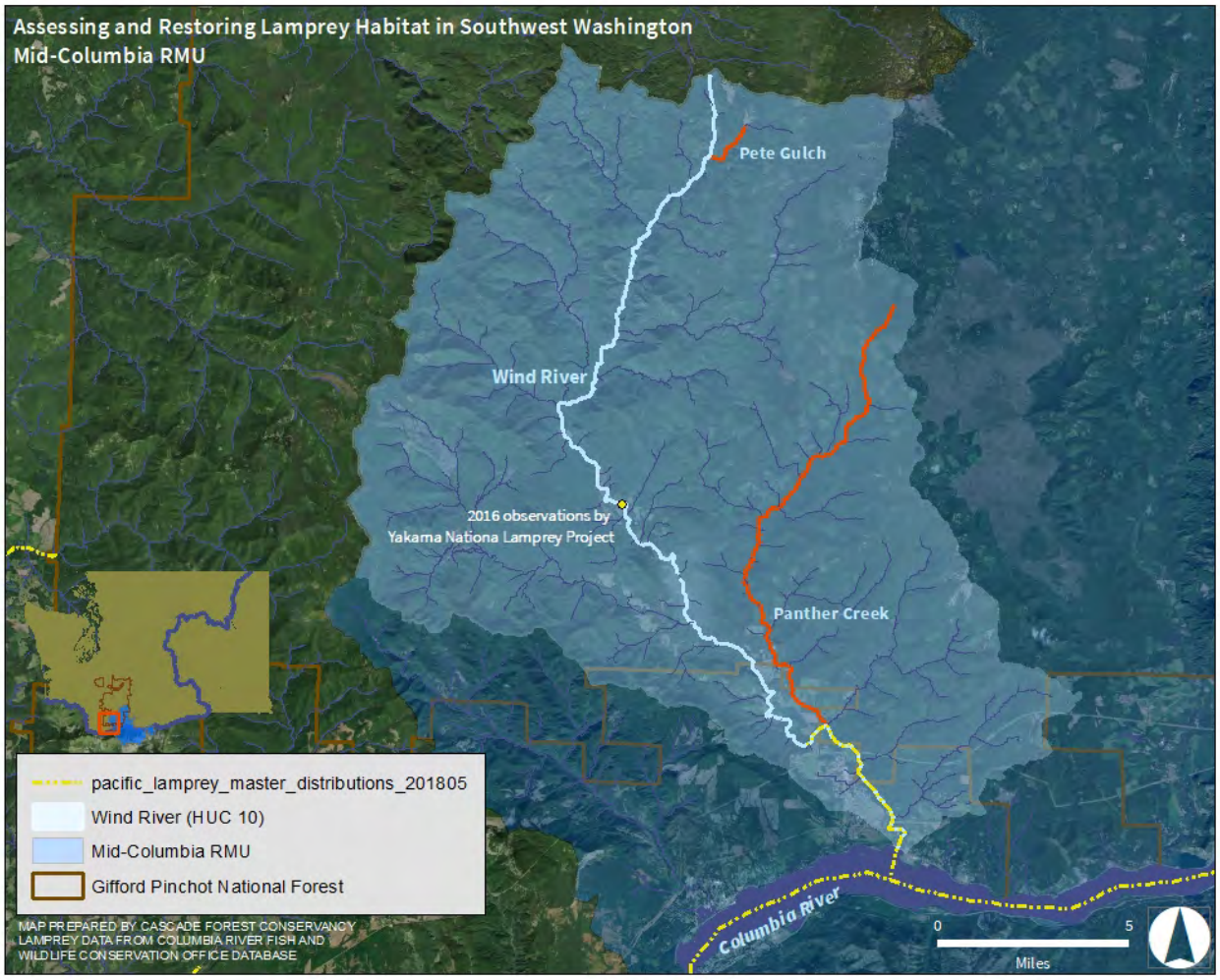
The overall goals of our project are to improve habitat for Pacific lamprey while furthering our understanding of how instream restoration (either in the form of beaver dams, beaver dam analogues, or wood structures) will impact the current and potential spawning and rearing habitat for lamprey. Implementing these targeted restoration projects can reduce the key threats that lamprey face in the Lower Columbia Sub-Region. The colonization of beavers and/or the placement of wood structures and BDAs has the potential to positively impact the current lamprey populations in and around the Wind River and South Fork Toutle River.

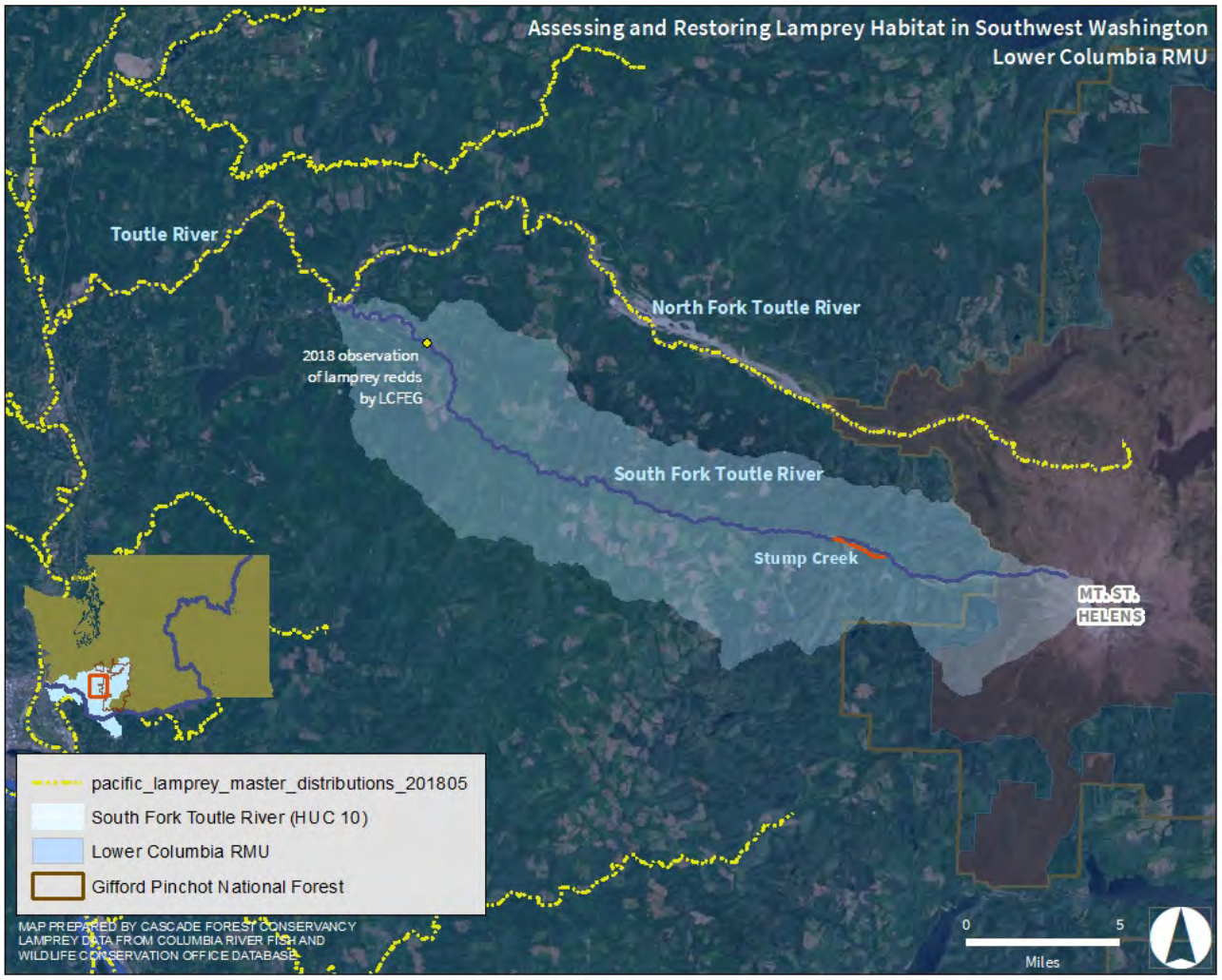
Our project has three objectives: 1) monitor lamprey and their habitat (pre- and post-project implementation), 2) restore and expand lamprey habitat, and 3) develop and implement a public outreach effort. It is well known that there is a dearth of knowledge about the current distribution of lamprey species. Therefore it is necessary for us to conduct extensive monitoring at our projects sites pre- and post-restoration. We will survey larval lamprey distribution in Type 1 habitat to provide baseline data for post-project monitoring. Due to the small size of our streams of interest, larval lamprey presence/absence will be conducted using Surber stream bottom sampler methods proposed by Lasne et. al. 2010. If the Surber sampler method proves ineffective, we will solicit help from PLCI and other lamprey specialists to conduct electrofishing surveys. We will collect presence/absence data on larval lamprey in the Wind River tributaries of Panther Creek and Pete Gulch, and Stump Creek, a tributary of South Fork Toutle River. Habitat assessments will help us identify reaches that lack sedimentation for spawning, reaches that have been channelized or scoured and/or reaches lacking instream wood. This is an important step in identifying priority locations for current and future restoration.

By placing beavers, BDAs, and wood structures into the streams, we hope to improve channel complexity to enhance current habitat and expand future habitat for the health and resilience of local lamprey populations. We will release three to four families of beaver (3-6 beavers per family) to create more Type 1 habitat for lamprey in the Wind River watershed. In Stump Creek, we will install a series of beaver dam analogues to enhance the habitat for the current lamprey populations. To support critical efforts to build instream habitat in this reach, we will also be collecting and storing non-merchantable trees for future instream wood placement work that will be carried out after the project conclusion by LCFEG.

As an organization, we offer educational volunteer trips to the local community. For this project, we will utilize volunteers to help with the monitoring that will occur pre- and post-project implementation. Community members will have the opportunity to engage in a conservation project while learning the interesting life history, biology, and cultural importance of lamprey.

3. Descriptive Photographs-Illustrations-Maps (limit to three total):





4. ***Linkage of Actions to Identified Threats for Lampreys in RMU(s) (300 words or less):***
    - What threat(s) to lampreys does this project address? (See your RIP(s) for key threats) ***Water Quality Stream and Floodplain Degradation Dewatering & Stream Flow Management*** Choose an item.
    - Does this project address threat(s) to lampreys specific to this RMU only, or does the project address the threat(s) prevalent in multiple RMUs?
      Single RMU ☐, Multiple RMUs ☒ list additional RMUs: Mid-Columbia RMU
    - Describe how this project addresses key threat(s) to lampreys within the HUC(s) where project is proposed.

    Elevated water temperature is the greatest concern related to water quality for lamprey in the Lower and Mid-Columbia sub-regions. Beaver dams and BDAs can lower stream temperatures by creating deep pools and increasing groundwater storage (hyporheic exchange). Additionally the presence of beaver can increase riparian vegetation thus creating more stream shade (Pollock et. al. 2007; Weber et. al. 2017).

The potential negative effects from climate change is of great concern for the Mid-Columbia sub-region. Beavers and BDAs can increase resilience to climate change by re-establishing important processes like increasing channel complexity, creating in-stream habitat for a variety of species, stabilizing hydrologic regimes, and capturing fine sediment (Pollock et. al. 2014).

Stream and floodplain degradation and dewatering & stream flow management are of moderate concern for lamprey in the Lower and Mid-Columbia sub-regions. Decades of channel manipulation, removal of woody debris, forest fires, lava flows, and antiquated timber harvest methods have oversimplified streams within this region. Reintroducing beavers and installing BDAs can reverse some of these negative effects and can benefit streams by enhancing the stream complexity, creating deep pools, and shifting the stream bed compositions from coarse to finer sediments (Pollock et. al. 2007), all of which are preferred by larval lamprey (Roni 2003, Gonzalez et al. 2017).

Low flows can affect the spawning and rearing habitat that is available for lamprey. We expect climate change to cause low flows to occur more frequently, for longer durations and with greater intensity. Adding wood to the system, in the form of natural beaver dams or BDAs will increase the amount of water that is retained in both the surface water and groundwater. The increase in water can elevate the groundwater table and recharge the aquifer more frequently creating more riparian habitat and lowering stream temperatures (Pollock et. al. 2007, Weber et. al. 2017).

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

    - Provide citation of literature, distribution maps, and/or surveys demonstrating lampreys are currently and/or were historically present in the project area.

Information about the current and historical distribution/observations was gathered from the spatial data provided by the Columbia River Fish and Wildlife Conservation Office database data from May 2018.

The mainstem of the Wind River has known populations of Pacific lamprey.

Washington Department of Fish and Wildlife's Wind River Subbasin Summary (November 2000) states: "Sockeye salmon, coho salmon, lamprey (one or more species), and brown trout have recently been observed above Shipherd Falls."

Yakama Nation Pacific Lamprey Project Annual Progress Report (2017): Two index sites were surveyed in the Wind River. Pacific Lamprey were present at both of the sites (100%). Pacific Lamprey were found as far upstream as river km 26.3. This is near the Carson Fish Hatchery

There are known populations of lamprey in the Toutle River and North Fork Toutle River based on the distribution and observation spatial data mentioned above. The data do not show observations of lamprey species in South Fork Toutle, but we have received anecdotal reports of lamprey observations by the staff of the Lower Columbia Fish

Enhancement Group. It should be noted that there are not any natural or man-made barriers stopping lamprey migration to the headwaters valley.

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

Because there is currently limited knowledge how lamprey respond to the addition of instream wood in the form of beaver dams, BDAs or other structures (Clemens et. al. 2017, Gonzales et. al. 2017), our lamprey monitoring pre- and post- structure installation should provide insight to that on measurable results like presence/absence of lamprey pre- and post- projects, depth and width of pools created, depth of sediment post-project, and change in water temperature.

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

The life stages that will benefit from this project are larval lamprey and spawning adults. The addition of wood will allow for increased channel complexity, the buildup of fine sediments and the creation of deep, cool pools which are all necessary habitat for the rearing and spawning of lamprey.

- What other species may benefit from action?

Coho salmon, Chinook salmon, steelhead trout, beavers, a variety of amphibians

6. ***Priority Objectives and Goals:***
   - Indicate the strategies, and/or restoration/management plans are addressed by this project (when available relevant documents/websites are hyperlinked below for reference):
     - PLCI Conservation Agreement ☒
     - National Fish Habitat Partnership National Conservation Strategies ☐
     - USFWS Climate Change Strategies ☐
     - Bonneville Power Administration Northwest Power and Conservation Council Columbia River Basin Fish and Wildlife Program ☐
     - CRITFC Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin ☒
     - US Army Corps of Engineers Pacific Lamprey Passage Improvement Implementation Plan ☐
     - PUD Management Plan (please name below) ☐
     - Other (please name below) ☐
   - Clearly describe how the project addresses the goals and objectives in the strategies, restoration/management plans indicated above (200 words or less).

This project shares objectives with both the PLCI Conservation Agreement and the CRITFC Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin. The PLCI document states three objectives that our project will address:
1) Identify historic and present distributions of Pacific Lamprey in each RMU and

monitor them to detect changes in distribution and status as conservation actions are implemented.
2) Protect areas with healthy habitat conditions and strive to improve watershed conditions and migratory corridors where needed
3) Develop a public outreach effort

The CRITFC plan lists multiple objectives that are current limiting factors that surround the assessment of lamprey life histories and habitat within the Columbia River basin. We plan to address the following limiting factor in our project - 1) monitor water temperature, quality, and stream flow and 2) assess habitat limitations associated with sedimentation of spawning areas, channelization and scouring of rearing areas, lack of shade and riparian cover, and large wood removal. We will also be addressing their objective to improve knowledge of lamprey habitats in the basin.

7. Project Design / Feasibility:

- 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☐**

For beaver reintroductions, we have submitted a Beaver Reintroduction Plan to the Forest Service's Mt. Adams Ranger District and it is currently in review. This will provide us with permission to conduct reintroductions at Panther Creek and Pete Gulch. Shiloh Halsey and Amanda Keasberry are currently permitted by the Washington Department of Fish and Wildlife to reintroduce beaver in Washington.

Permitting for BDAs will be in place and coordinated before planned project implementation.

- Can the project be implemented within the defined timeframe? (*See BPA & NFHP requirements in the accompanying PLCI RIP Priority Project Guidance document*). **Yes ☒ No☐**
- Please provide a brief description (200 words or less):

Yes, all the work described in this project will be completed by December 2022. For the instream wood banking portion we will collect wood that will allow the instream work to move forward, but placement in streams will happen after the grant period. Instream Wood Banking is separated out in our budget under line items 1a and 4a.

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

- What partners are supporting the project?

Our project is highly collaborative and supported by a number of partners. Wood donors include Port Blakely, Weyerhaeuser, the Swift Reservoir, and the Cowlitz River Dam. This supports our wood collection efforts. LCFEG is a supporter for the BDA work for

the South Fork Toutle area. The U.S. Forest Service is a supporter for our beaver reintroduction work in the Wind River watershed.

- What partners are active in implementing the project?

LCFEG will be a partner in implementing this work.

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

Volunteers supply in-kind labor for much of our work, including the work outlined in this proposal. The Forest Service is a partner in beaver reintroduction and offers time and assistance on those efforts. A grant from the Cowlitz Indian Tribe offers financial support for this work.

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

- How is completion of the project going to be documented? (*See BPA and NFHP requirements in the accompanying PLCI RIP Project Proposal Guidance document).*)

A final report will be sent to appropriate entities (grantor, local biologists, and the local Lamprey Regional Management Unit Group or the Lamprey Technical Workgroup) following the completion of the project. The report will detail the results of the lamprey presence/absence data, habitat assessments, structural designs of wooden structures/locations of placements, number of beaver located/current status of relocation sites, and results of the lamprey presence/absence post-project implementation.

- How will the project's benefits to lampreys be monitored over time?

Post-project monitoring is one of our main objectives. It is necessary to understand how the in-water work may have affected the lamprey populations. Measuring occurrence, abundance and distribution after the project is critical in being able to provide results. The different aspects of the project we are proposing should have lasting effects where they are implemented. We would hope to monitor as long as financially possible so we can continue to learn more about the benefits BDAs or beaver dams can have on the lamprey populations. The potential benefits of stream complexity, fine sediment retention, cooler water and the creation of side channels will only increase over time once any of these structures are in the streams.

10. Project Budget (including overhead):

	Items	# Hours or Units	Cost per Unit ($)	RIP Funds Requested ($)	Cost Share ($)	Total Cost ($)
1	***Personnel:***	-	-	-	-	-
	a. Director of Programs (Instream Wood Banking)	110	37	$4,070	$1,000	$5,070
	b. Director of Programs (Beaver Reintroduction)	165	37	$4,070	$1,000	$5,070
	c. Director of Programs (BDA Installation)	142	37	$4,070		$4,070
	d. Science and Stewardship Mgr. (Beaver Reintroduction)	300	27	$8,100	$3,000	$11,100
	e. Science and Stewardship Mgr. (BDA Installation)	210	27	$5,670	$2,000	$7,670
	f. Science and Stewardship Mgr. (Monitoring/Assessment)	242	27	$6,534		$6,534
	g. Volunteer in-kind labor	384	25		$9,600	$9,600
2	***Equipment & Supplies:***	-	-	-	-	-
	a. Post pounder/air compressor rental	1	300/week	$300		$300
	b. untreated wooden posts	50	12/post	$500		$500
	c. Lamprey monitoring tools	4	200	$800		$800
	d. Beaver reintroduction transport materials	3	$150	$450		$450
	e. Wood donations for instream wood banking				$3,500	$3,500
3	***Travel:***	-	-	-	-	-
	a. Mileage (Beaver Reintroduction)	15 days	$100/day	$1,500		$1,500
	b. Mileage (BDA Placement)	7 days	$100/day	$700		$700
	c. Meals and lodging during overnight trips	4 days	$100/day	$400		$400
4	***Other:***	-	-	-	-	-
	a. Contracting for wood transport (Instream Wood Banking)	7 truckloads hauled	$950	$6,650	$5,000	$11,650
	b. Contracting for HPA work (BDA Installation)	1	$600	$600		$600
	c Contracting work for BDA design (BDA Installation)	1	$6,800	$6,800		$6,800
5	***Administrative:***	-	-	-	-	-
	Overhead (0 %)					
	Indirect Costs (10 %)			$5,600		$5,600
	Total (Sum of A - E)	-	-	$56,814	$25,100	$81,914

11. Timeline of major tasks and milestones:

Workflow	*Start Date/Month*	*End Date/Month*	*Responsible Party*
Pre-project preparation	June 2021	August 2021	CFC + LCFEG
Pre-project Type 1 monitoring for lamprey	August 2021	September 2021	CFC
Beaver relocations	September 2021	October 2021	CFC
Post-project monitoring (beaver)	October 2021	April 2022	CFC
BDA installations	August 2022	September 2022	CFC
Post-project monitoring (BDA)	September 2022	November 2022	CFC
Wood collection	June 2021	June 2022	CFC
Data analysis	October 2022	November 2022	CFC
Reporting	November 2022	December 2022	CFC

12. References:

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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.