

Appendix K – Fisheries Technical Report



FISHERIES TECHNICAL REPORT

INCLUDING BIOLOGICAL EVALUATION FOR SENSITIVE FISH AND FRESHWATER
MUSSEL SPECIES AND EFFECTS ANALYSIS FOR ENDANGERED SPECIES ACT
LISTED FISH SPECIES

TRINITY RIVER WATERSHED RESTORATION PROJECT

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Acronyms

<u>Acronym</u>	<u>Definition</u>
ACS	Aquatic Conservation Strategy
ANSI	American National Standards Institute
BiOp	biological opinion
BLM	US Bureau of Land Management
Caltrans	California Department of Transportation
CH	critical habitat
CMs	conservation measures
CVP	Central Valley Project
dB	decibels
DC	direct current
DPS	distinct population segment
EA	Environmental Assessment
EFH	essential fish habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FMP	fishery management plan

GPM	general protection measure
HUC	hydrologic unit code
KMP	Klamath Mountains Province
L _{PEAK}	instantaneous peak sound pressure level
LW	large wood
mm	millimeters
MSA	Magnuson Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NTUs	nephelometric turbidity units
PAHs	polycyclic aromatic hydrocarbons
PBFs	physical and biological features
Project	Trinity River Watershed Restoration Project
Reclamation	Bureau of Reclamation
Regional Water Board	North Coast Regional Water Quality Control Board
RMS	root mean square sound pressure level
ROD	Record of Decision
SEL	sound exposure level
SONCC	Southern Oregon/Northern California Coast
TRD	Trinity River Division
TRH	Trinity River Hatchery
TRRP	Trinity River Restoration Program
UKTR	Upper Klamath-Trinity Rivers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmonid Population

Executive Summary

This Technical Report analyzes the effects to fish and freshwater mussel species with documented presence within the Trinity River watershed as a result of activities proposed as part of the Trinity River Watershed Restoration Project (Project). Some species were not analyzed in detail because the Project is not anticipated to have measurable effects on these species. Table 1-1 lists effects summaries for each species or group analyzed in detail in this document. A detailed list of all general protection measures (GPMs), design guidelines, and conservation measures (CMs) is included in Appendix B of the Environmental Assessment (EA). Effect determinations for special status species are provided in Section 6.

Table 1-1. Summary of effects on special-status freshwater mussels and fisheries.

Species / Group	Effects Summary
Salmon and steelhead	Minor adverse effects anticipated as a result of construction impacts to riparian vegetation, in-channel heavy equipment use, turbidity/sedimentation, chemical contamination, hydroacoustic noise, dewatering, and fish relocation. Long-term benefits include an increase in habitat quantity and quality, which would lead to an increase in salmonid rearing capacities for coho, Chinook, and steelhead.
Green sturgeon	Negligible effects to the species because of the low numbers of green sturgeon anticipated to be above Gray Falls along the Mainstem Trinity River, which is on the edge of the Project activity area. The historic range of green sturgeon is located outside of the Project activity area ¹ along the South Fork Trinity River. Any individuals present in the Project activity area could experience similar minor adverse effects as those listed for salmon and steelhead as a result of construction impacts. Long-term benefits of the Project for green sturgeon entail increased foraging opportunities as a result of increased salmonid numbers.
Pacific lamprey	Minor adverse effects as a result of construction impacts related to in-channel heavy equipment use, turbidity/sedimentation, chemical contamination, dewatering, and fish relocation. Long-term benefits of the Project entail improved aquatic habitat conditions and fish passage.
Freshwater mussels	Minor adverse effects as a result of construction impacts related to in-channel heavy equipment use, turbidity/sedimentation, chemical contamination, dewatering, and salvage and relocation. Disturbance to mussel beds would be avoided to the extent possible. Long-term benefits of the Project entail an increase in aquatic habitat complexity that could allow for future establishment of mussel beds.

1 Proposed Action

The Trinity River Restoration Program (TRRP) was established to restore the fisheries of the Trinity River affected by dam construction and related diversions of the Trinity River Division (TRD) of the Central Valley Project (CVP). Administered by the Bureau of Reclamation (Reclamation), TRRP is a partnership of federal and state resource agencies, Tribes, and Trinity County. TRRP works to restore the processes and attributes of a properly

¹ The Project activity area boundary lies between Panther and Underwood creeks along the South Fork Trinity River.

functioning river and watershed to support the recovery of diminished salmon and steelhead populations while retaining the Trinity and Lewiston Dams' delivery of water and power to the Trinity River and California's Central Valley.

The purpose of the Project, of which TRRP is the lead agency, is to improve instream and riparian habitat at a watershed scale and to accelerate the recovery of north coast salmon populations (coho salmon, steelhead, and Chinook salmon), thereby fulfilling tribal trust responsibilities and obligations to local communities as well as recreational and commercial fishing industries (per the Shasta-Trinity National Forest Land and Resource Management Plan and state and federal recovery plan goals [NMFS 2014; CDFG 2004]).

The following describes the objectives of the Proposed Action:

- Restore and improve instream conditions sufficient to support all life stages of salmonids and other aquatic species.
- Restore upstream and downstream fish passage for all life stages of salmonids.
- Restore continuous paths for wood dispersal, nutrient cycling, sediment transport, and movement of other vegetative material essential for productive aquatic habitat.
- Maintain or restore native plant communities and vegetative structure impacted by invasive plants and pathogens, while rehabilitating eroding streambanks to improve water quality, shade conditions, and large wood (LW) recruitment.
- Repair, replace, or remove ineffective instream structures.
- Restore and improve riparian and meadow habitat in order to promote healthy conditions for aquatic and terrestrial wildlife populations.
- Improve late summer/fall base flow conditions through process-based restoration, water conservation improvements, and meadow restoration.

The Proposed Action consists of a suite of instream and riparian restoration activities that are designed to meet the objectives described above. Detailed descriptions of each of the proposed activities are included in chapter 4 of the Project's EA document. Proposed Activities are grouped into three general categories: instream habitat restoration; upslope habitat restoration; and road maintenance, rehabilitation, and decommissioning activities. The activities proposed under each of these categories are summarized below.

Instream Habitat Restoration:

1. Restoration and Enhancement of In-Channel Habitat
2. Floodplain Restoration
3. Removal or Retrofitting of Fish Passage Barriers, Small Dams, Flood Gates, Pilings and Other In-water Structures
4. Water Conservation Projects
5. Salmon Carcass Placement
6. Remote Site Incubators

Upslope Habitat Restoration:

7. Bioengineered Bank Stabilization
8. Aquatic, Wetland, Riparian, and Upslope Habitat Enhancement Including Removal of Nonnative Invasive Species and Revegetation with Native Plants

Road Maintenance, Rehabilitation, and Decommissioning Activities:

9. Road Maintenance
10. Road Rehabilitation
11. Road Decommissioning

1.1 Project Location and Timing

The proposed activities would occur within a portion of the Trinity River watershed (Figure 1-1). Individual restoration actions would take place in and along tributaries of and the mainstem Trinity River (both above and below the Lewiston and Trinity dams) on both private (with permission of the landowner) and public lands (primarily managed by the U.S. Forest Service [USFS] and U.S. Bureau of Land Management [BLM]). Key watersheds within the restoration activity area include North Fork Trinity River, South Fork Trinity River, Canyon Creek, and New River. The watershed-scale analysis was performed for each of the hydrological unit code 10 (HUC 10) watersheds. See Table 1-1 below for watersheds included in the Project activity area.

Table 1-1. HUC 10 Watersheds within the Trinity River Basin.

Subregion (HUC 4)	Basin (HUC 6)	Subbasin (HUC 8)	Watershed (HUC 10)	HUC 10 Number	Acres in Project Activity Area
Klamath-Northern California Coastal 1801	Northern California Coastal 180102	Trinity California 18010211	Big French Creek-Trinity River ¹	1801021111	153,325
			Browns Creek	1801021106	47,110
			Canyon Creek ⁴	1801021108	41,033
			Coffee Creek	1801021101	74,835
			East Fork Trinity River	1801021103	74,335
			Horse Linto Creek-Trinity River ²	1801021112	0
			New River ⁴	1801021110	149,597
			North Fork Trinity River ⁴	1801021109	97,483
			Stuart Fork	1801021104	88,264
			Swift Creek-Trinity River	1801021105	121,055
			Tangle Blue Creek-Trinity River	1801021102	101,393
			Weaver Creek	1801021107	142,030
		South Fork Trinity 18010212	Lower South Fork Trinity River ^{3,4}	1801021205	44,229
			Lower Hayfork Creek	1801021203	142,161
			Upper Hayfork Creek	1801021202	105,697
			Middle South Fork Trinity River ⁴	1801021204	145,776
			Upper South Fork Trinity River ⁴	1801021201	73,634

1. ¹ A portion of Big French Creek is excluded from the Project activity area, namely the Sharber Creek HUC 12 subwatershed, because it is in the Six Rivers National Forest.
2. ² Horse Linto Creek is located in the Six Rivers National Forest and is not included in the Project activity area.
3. ³ A portion of Lower South Fork Trinity River is excluded from the Project activity area, namely Grouse, Mingo, and Old Campbell Creeks (HUC 12 subwatersheds), because they are located in the Six Rivers National Forest.
4. Aquatic Conservation Strategy (ACS) Key Watersheds

GPMs, CMs, and design guidelines have been developed for proposed activities to avoid and minimize effects to fish and freshwater mussel species. These would incorporate into the planning, design, and implementation phases of each site-specific project. These have been developed as part of the Project's Endangered Species Act (ESA) Section 7 consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), and collaborative Project planning efforts by TRRP, USFS, and BLM. A detailed list of all BMPs, CMs, and design guidelines by resource is included in Appendix B of the EA.

Project activities within any wetted or flowing channel of tributaries of and the mainstem Trinity River below the Trinity and Lewiston dams shall be restricted to the dry season (i.e., June 15 to October 15 for tributaries and July 15 to October 15 for the Trinity River mainstem) before coho begin spawning. Revegetation outside of the active channel is typically implemented during the wet season, between October and April. Work in intermittent streams may continue beyond November 1, as long as weather conditions permit and the stream channel remains dry. Construction and restoration work within intermittent stream channels must be completed before cumulative seasonal rainfall is sufficient to result in surface flow within the channel.

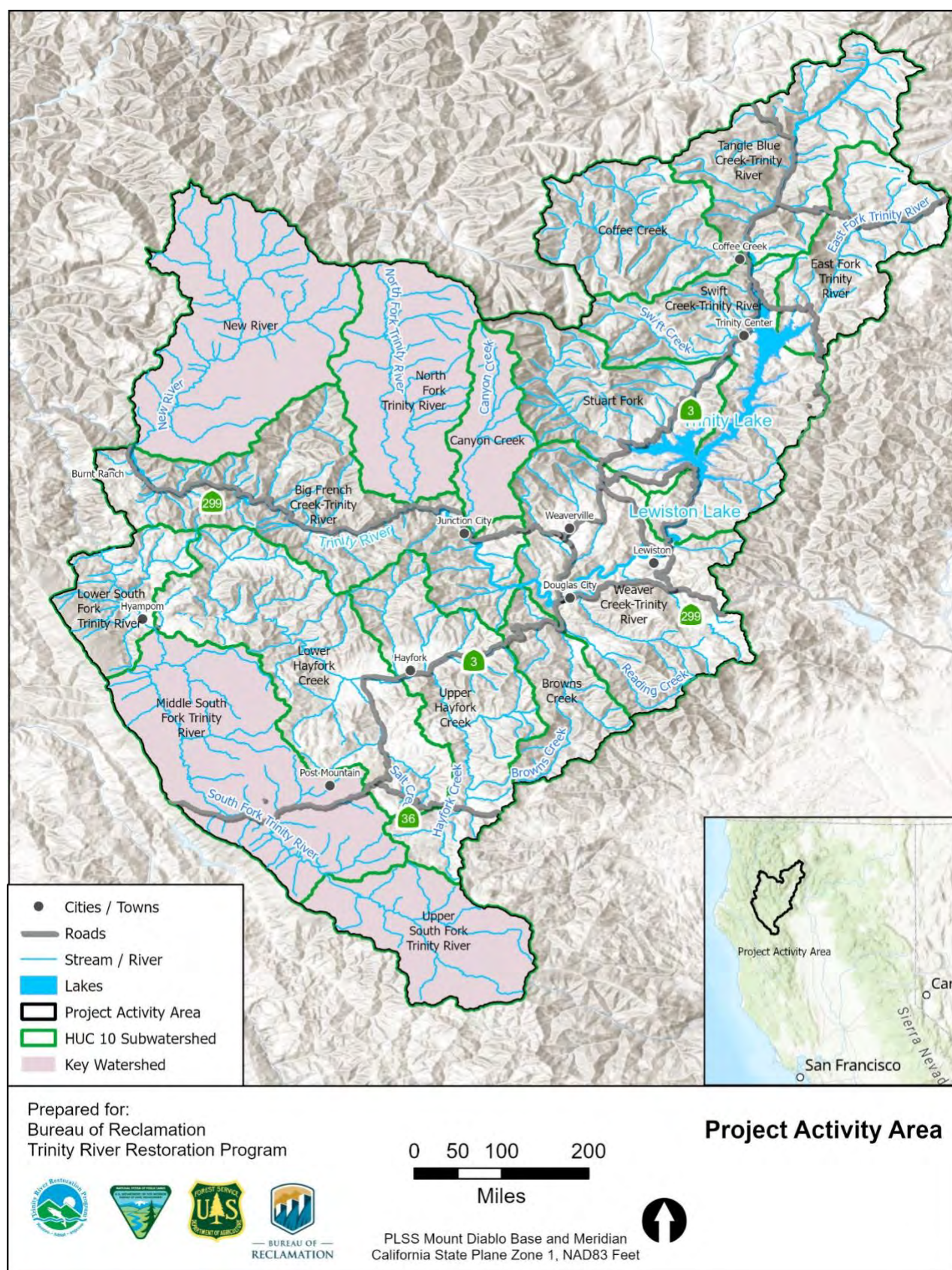


Figure 1-1. Project Activity Area, where restoration activities would occur.

1.2 Fisheries Impact Avoidance and Minimization

The 2020 NMFS Biological Opinion (BiOp; NMFS No. WCRO-2019-03827) specifies a suite of BMPs and CMs related to instream construction, water quality, riparian vegetation, and research and fish capture intended to protect special-status fish species. These are included in Appendix B of the EA and are subject to change during subsequent ESA Section 7 consultations with NMFS. The 2020 NMFS BiOp is anticipated to undergo reinitiation in order to include all activities proposed by TRRP and the Project. Additional BMPs, CMs, and design guidelines are provided by the 2025 USFWS California Statewide Programmatic Restoration Effort BiOp (FWS Ref. 2022-0005149-S7) and are also included in Appendix B.

1.2.1 Limits on Proposed Activities Frequency and Location

Due to the large-scale nature of the Project, there are concerns about the potential for direct physical changes to the environment as a result of implementation at the watershed scale. A key design guideline entails setting annual project limits on the number of projects, which would limit adverse effects to ESA-listed species.

The 2020 TRRP BiOp limits instream watershed restoration projects covered by the BiOp annually to:

- 2 fish passage/dam removal projects;
- 8 channel/floodplain rehabilitation projects (4 mainstem and 4 tributary);
- 2 in-stream habitat enhancement projects;
- 3 streambank stabilization projects; and
- 4 road-related projects with in-water activities (i.e. road decommissioning with culvert removal).

TRRP is in the process of reinitiating consultation with NMFS to include all project activity categories described in the Proposed Action that were not previously analyzed in the 2020 TRRP BiOp. Project limitations will also be reviewed during the reinitiated consultation and are anticipated to change. During meetings with NMFS in regard to the ESA Section 7 consultation for this Project, NMFS recommended setting Project limits to control sedimentation and turbidity that would adversely affect ESA-listed salmonids. Preliminarily, it is being proposed that in addition to utilizing GPMs and CMs, such as erosion and sediment control BMPs, effects of turbidity would be controlled by limiting the number of floodplain reconnection projects that are over 100 acres as well as small dam removals, to one site-specific restoration project (of these specific project types) per HUC-12 watershed, per year. However, the latest applicable BiOp should be referred to, to determine current Project limits during site-specific project implementation.

Project limits would provide spatial and temporal flexibility during site-specific restoration project development and watershed planning efforts. Implementors within the watershed would continue to collaborate with the assistance of TRRP, USFS, and BLM to ensure significant regional effects would not occur.

2 Environmental Setting

The Trinity River originates in the rugged Salmon-Trinity Mountains of northern California in the northeast corner of Trinity County. The entire Trinity River watershed is approximately 2,861 square miles in size and is the largest Klamath River tributary. From Lewiston Dam, the Trinity River flows westward for 112 miles until it

enters the Klamath River near the town of Weitchpec on the Yurok Reservation. The Trinity River passes through Trinity and Humboldt counties and the Hoopa Valley (Hoopa Tribe) and Yurok Indian Reservations. The Klamath River flows northwesterly for approximately 37 miles from its confluence with the Trinity River before entering the Pacific Ocean.

2.1 Aquatic Habitat

Historically, the Trinity River functioned as a dynamic river reach that provided quality spawning and rearing habitat for anadromous fish. In 1955, Congress authorized construction of the Trinity River Division (TRD) of the Central Valley Project (CVP; Public Law 386, 84th Congress, First Session). Authorized water uses from the TRD include irrigation and beneficial uses in the Central Valley, power production, and the preservation of fish and wildlife. The TRD began operations in 1960, blocking 109 miles of important salmonid habitat above the Lewiston Dam and exporting as much as 90% of the Trinity River's inflows into Trinity Lake to the Sacramento River Basin. Fisheries resource managers observed an almost instantaneous decline in the numbers of naturally-produced adult salmonids returning to the Trinity River basin to spawn. Returning salmonid numbers declined by 53% to 96%, depending on species (USFWS and HVT 1999). Diverting water from the Trinity basin to the Sacramento basin caused severe degradation of instream fish habitat of the Trinity River. The minimal flows released were insufficient to maintain the Upper Trinity River and, consequently, much of the river channel between the Lewiston Dam and the North Fork Trinity River confluence became confined within a narrow channel bordered by dense riparian berms.

In addition to the development of TRD, logging practices, road construction, mining, and floodplain development within the Trinity River watershed also contributed significantly to instream habitat degradation (USFWS and HVT 1999). Clear-cut logging, along with hundreds of miles of unpaved roads and skid trails, promoted increased sediment loading in the Trinity River and its tributaries, and removal of streamside vegetation increased water temperatures. Within the mainstem Trinity River, the distribution of coho salmon can likely be explained, at least in part, by water temperature. Moreover, virtually all tributaries have been subjected to hydraulic mining activities that degraded habitat complexity, the volume of large wood within the watersheds, and spawning habitat. Hydraulic mining also led to head-cutting in upstream areas as fine sediments were washed downstream, which decreased groundwater storage and caused subsurface flows in some areas. This has reduced the biological productivity and fish-carrying capacity of much of the Trinity River Subbasin (USFWS and HVT 1999; EPA 2001). In addition, degradation of freshwater habitat has been pervasive in the Lower Klamath River, contributing to declines in native fish runs (Gale and Randolph 2000).

Subsequently, Congress enacted a number of legislative actions to restore Trinity River fishery resources. In 2000, the Secretary of the Interior signed the Record of Decision (ROD) for the Trinity River Mainstem Fishery Restoration Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) which required Reclamation (through TRRP) to implement a suite of actions to increase habitat quality and quantity for native anadromous fish. The five primary components of TRRP's river restoration work include:

1. **Variable Annual Instream Flows** – releasing water from Lewiston Dam, based on the water year type, to mimic natural Trinity River flows and interact with downstream areas to enhance conditions for all life stages of fish and wildlife. These variable annual instream flows are also called restoration releases or restoration flows and have generally occurred starting in April.

2. **Channel Rehabilitation** – restoring the functional floodplain of the river, which has been channelized and simplified by managed river flows and mining. To date, TRRP has constructed 34 of the rehabilitation projects identified in the 1999 TRFEFR and Trinity River FEIS (USFWS et al. 2000).
3. **Sediment Management** – introducing sediment to the river and providing flows to ensure its movement in the river. Sediment entering the river system upstream of Trinity Dam is blocked from the Trinity River below Lewiston Dam, which creates a downstream sediment deficit. TRRP resupplies the river with sediment downstream of the dams to offset the loss of sediment from upstream sources. Typically, coarse sediment additions are used to provide gravels (0.375 to 5 inches in diameter) downstream of Lewiston Dam, where the supply has been curtailed. Fine sediment control reduces silt and sand inputs from watershed sources (e.g., Grass Valley Creek, where sediment retention ponds have been periodically dredged to control impacts on redds). Recent studies indicate that the Trinity River reach near the dam is lacking fine sediment inputs, which is an objective addressed by the Proposed Action (Buxton 2021).
4. **Watershed Restoration** – addressing negative impacts resulting from land management in the Trinity River basin. Watershed restoration activities include ensuring fish passage to tributary habitat and creating better aquatic conditions in watershed areas to support stream life.
5. **Adaptive Environmental Assessment and Management** – monitoring, evaluating, and improving the effectiveness of river restoration actions.

Reclamation has been implementing, and continues to implement, the flows described in the Trinity ROD. Since the 2000 ROD, TRRP has both implemented and funded others to undertake restoration actions to improve instream habitat conditions in both the mainstem Trinity River and the tributaries.

2.2 Fish Passage

There are numerous fish passage barriers and diversions within the Project activity area. In the “Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon (*Oncorhynchus kisutch*)” (NMFS 2014), dams and diversions were identified as a key limiting factor for populations of Southern Oregon/Northern California Coast (SONCC) coho in the Trinity River. Numerous small-scale wells and diversions for domestic uses, stock watering, and small agricultural operations occur throughout the watershed and reduce stream flows during critical low-flow periods in the late summer and fall. A ten-foot defunct concrete diversion dam on Garden Gulch prevents access to high-quality, low-gradient habitat (NMFS 2014).

Numerous vineyards, small farms, and marijuana plantations use water from the South Fork Trinity River and its tributaries including, but not limited to, Rattlesnake Creek and Post Creek (Trinity County 1987; 1994). The effects of water diversions are particularly acute in the Hyampom and Hayfork Valleys, as well as in the Forest Glenn area, where summer low-flows lead to elevated water temperatures and a constriction of summer rearing habitat (NMFS 2014). In addition, the diversions that remain unscreened can lead to fish stranding. Although more recent assessments are necessary, the need for fish screens has already been identified on diversions in Barker, Big, East Fork Hayfork, Upper Hayfork, Little, Olsen, Salt, and Tule Creeks (PWA 1994). Because of the impacts on summer rearing, diversions pose a very high threat to the juvenile life stage of coho salmon and other salmonids (NMFS 2014).

Fish passage barriers and diversions for each HUC 10 watershed are summarized in Table 2-1 below. Appendix A of this document shows fish passage information for each HUC 10. It should be noted that, at the time of the preparation of this document, winter steelhead distribution was in the process of being updated to show that winter steelhead cannot migrate past natural total barriers, which is a change not reflected in the Appendix A figures.

Table 2-1. Number of fish passage barriers per HUC 10 watershed in the Project activity area.¹

HUC 10 Name	Natural Partial Barrier	Natural Total Barrier	Partial Barrier	Total Barrier	Unscreened Diversion	Unknown/ Unassessed	Remediated Barrier ²
Big French Creek-Trinity River	2	16	23	11	28	109	8
Browns Creek	1	6	3	4	0	23	1
Canyon Creek	0	3	7	4	0	2	1
Coffee Creek	0	0	0	1	0	9	0
East Fork Trinity River	0	0	0	3	0	16	0
Lower Hayfork Creek	3	32	20	24	0	64	2
Lower South Fork Trinity River	3	17	1	5	0	12	0
Middle South Fork Trinity River	3	30	12	22	0	51	0
New River	2	2	0	3	0	8	0
North Fork Trinity River	0	8	1	1	0	0	0
Stuart Fork	0	0	1	1	0	20	0
Swift Creek-Trinity River	0	0	7	7	0	11	0
Tangle Blue Creek-Trinity River	0	0	0	3	0	17	0
Upper Hayfork Creek	3	16	16	5	0	36	9
Upper South Fork Trinity River	2	7	0	5	0	8	1
Weaver Creek-Trinity River	2	13	19	16	97	126	4

¹ CalFish 2023. ²Fish response unconfirmed.

In addition, the Trinity County Resource Conservation District (RCD) has evaluated fish passage at culverts within Trinity County (within the watershed) and prioritized them for repair or replacement. This list was updated in 2019 and is included in the *Landscape Level Restoration Gap and Trend Analysis for the Tributaries of the Trinity River, California* (Rupp 2019).

2.3 Water Quality

Water quality is of particular importance to the health of fisheries. The North Coast Regional Water Quality Control Board (Regional Water Board) identified the primary water quality issues in the Trinity River watershed as

sedimentation of streams, high water temperatures, mercury contamination in fish, and historic wood treatment facility contamination. In 1971, Congress created the Trinity River Task Force with a mandate to formulate and implement a management program to restore fish and wildlife populations in the Trinity River watershed and achieve temperature objectives that meet the life cycle needs of the fish (North Coast RWQCB 2018). Both the Trinity River mainstem and the South Fork Trinity River have been declared as sediment impaired and placed on the Clean Water Act (CWA) Section 303(d) list as impaired waters. The U.S. Environmental Protection Agency (EPA) developed and adopted a Total Maximum Daily Load (TMDL) for sediment in the Trinity River in 2001 (EPA 2001) and in the South Fork Trinity River in 1998 (EPA 1998).

2.4 Key Watersheds

As described by the Aquatic Conservation Strategy (ACS), Key Watersheds are watersheds that provide high-quality water, and a large system of refugia that are crucial to at-risk fish species and stocks. These are designated areas that either provide, or are expected to provide, high-quality habitat to be used as refugia for anadromous salmonids and resident fish species. Key watersheds can provide high-quality habitat as well as degraded areas of habitat. In turn, this allows the lower-quality areas to have high potential for restoration, and to become future sources of high-quality habitat with the implementation of a comprehensive restoration program. The Project would work towards enhancing Key Watersheds.

There are four key watersheds within the Project activity area (Figure 1-1) including the North Fork Trinity River, Canyon Creek, New River, and South Fork Trinity River (a portion of which does not lie within the Project activity area).

2.5 Essential Fish Habitat

The Magnuson Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NMFS on all actions, or proposed actions, which are authorized, funded, or undertaken by the agency which may adversely affect essential fish habitat (EFH; MSA §305[b][2]). The EFH mandate applies to all species managed under a federal fishery management plan (FMP). The FMP applicable to this Project is the Pacific Coast Salmon FMP and the species with EFH in the Trinity River are coho and Chinook salmon. Because eight of the Project HUC 10s are documented for coho and all 16 HUC 10s are documented for Chinook, EFH overlaps with the majority of the instream habitat within the watershed.

EFH refers to those waters and substrates necessary for spawning, breeding, feeding, or growth to maturity. As defined, the term “waters” includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish or, where appropriate, have historically been used by fish. The term “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities. “Necessary” means the habitat required for a sustainable fishery and the managed species’ contribution to a healthy ecosystem. Finally, “spawning, breeding, feeding, or growth to maturity” refers to a species’ full life cycle. “Adverse effect” means any impact that reduces the quality and/or quantity of EFH, and may include short-term, long-term, site-specific, or habitat-wide effects, including individual or collective consequences of actions.

2.6 Critical Habitat

Section 7(a)(2) of the ESA requires federal agencies, in consultation with and with the assistance of the Secretaries of the Interior and Commerce, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of critical habitat (CH) of such species (50 CFR 402.02). “Destruction or adverse modification” was clarified to mean “... alteration that appreciably diminishes the value of CH for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (81 FR 7214, February 11, 2016).

CH for the SONCC coho salmon ESU² was designated in 1999 by NMFS. It is identified as, “the water, substrate, and adjacent riparian zone [within the range of an ESU] . . . [below] longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years)” (64 FR 24049, May 5, 1999). NMFS has excluded from the SONCC coho CH designation all tribal lands in northern California and areas that are above certain dams which block access to historic habitats of listed salmonids. This includes a portion of the Lower Klamath River subbasin, which lies within the Yurok Tribe Reservation.

Physical and biological features (PBFs) for SONCC coho CH entail all the water, riverbed, and bank areas, and riparian areas within the ESU boundaries except as noted above. Waterways include estuarine areas and tributaries. Adjacent riparian area is defined as, “the area adjacent to a stream that provides the following functions: shade, sediment, nutrient, or chemical regulation, streambank stability, and input of large woody debris or organic matter” (64 FR 24049, May 5, 1999). In other words, riparian areas are those that produce physical, biological, and chemical features that help to create biologically productive stream habitat for salmonids. PBFs essential to the conservation of SONCC coho include juvenile summer and winter rearing areas, juvenile migration corridors, areas for growth and development to adulthood, adult migration corridors, and spawning areas (64 FR 24049, May 5, 1999).

3 Environmental Consequences

Key considerations for the analysis of potential Project effects to fish and freshwater mussel species include the presence of a species in or near the Project activity area, the scope and nature of Project activities, and the potential effects associated with those activities. This analysis looks at short- and long-term effects to fish and freshwater mussel species and their associated instream habitat. Short-term effects to waterways as a result of construction impacts are commonly related to ground disturbance within the floodplains, streambeds, or streambanks. Long-term effects are caused by the action and are later in time or farther removed in distance. Long-term effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

² Evolutionarily Significant Unit

Specific to fish and freshwater mussel species, construction-related effects may result in immediate physical harm or death to individuals, or the disruption of key behaviors that also harm individuals. Long-term effects include impacts to habitat (e.g., flow, water quality, riparian and aquatic vegetation, etc.) that occur later in time (e.g., a decrease in foraging opportunities) that would affect individuals and populations in the long term.

As previously mentioned, individual restoration actions would take place in and along tributaries of and the mainstem Trinity River (both above and below the Lewiston and Trinity dams) on both private and public lands. Key Watersheds within the restoration activity area include North Fork Trinity River, South Fork Trinity River, Canyon Creek, and New River. Through coordination between TRRP, BLM, and USFS, it was determined that an effects analysis performed at the HUC 10 watershed scale would be sufficient to adequately characterize Project effects. Therefore, 16 HUC 10 watersheds are analyzed in this report. See Table 2-1 for HUC 10 names and acreages and Figure 1-1 for an overview map.

For the purposes of the fisheries analysis for this Project, the intensity of effects is described using the following terms:

- Negligible/No effect: Effects would not be measurable, with no perceptible consequences.
- Minor: Effects are detectable but are small and localized.
- Moderate: Effects are detectable, can be measured, and cover a larger area (e.g., a tributary stream).
- Major: Effects are easily measured, regional, and at the population-scale.

Effect analyses include consideration of avoidance, minimization, and mitigation measures to lessen effects. Compensatory mitigation is not proposed for the Project since the overall intent of the Project is to restore and enhance ecosystem function to benefit fish and wildlife species. Compensatory mitigation means the restoration, establishment, enhancement, and in certain circumstances, preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts that remain after all appropriate and practicable avoidance and minimization has been achieved (33 CFR 332.2).

3.1 Species Analyzed in Detail

The native anadromous fish species of interest in the mainstem Trinity River and its tributaries are Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss irideus*), and Pacific lamprey (*Entosphenus tridentatus*). There are two spawning races of Chinook salmon, spring- and fall-run, and two spawning races of steelhead, winter- and summer-run.

Per the ACS, the BLM and USFS are tasked to conserve and restore native anadromous fish habitat, and TRRP exists to re-establish endangered salmonid populations to the Trinity River, in part through restoration activities within the tributaries. Federal and state special-status fish species of particular concern that occur within the Project activity area include:

- Southern Oregon/Northern California Coast (SONCC coho salmon ESU (federal and California state ESA-listed as threatened, with designated CH)
- Upper Klamath-Trinity rivers (UKTR) spring-run Chinook salmon ESU (federal candidate species, California state ESA-listed as endangered, USFS sensitive).

The UKTR Chinook salmon ESU, while not a federal ESA-listed species and no CH has been designated, is a stock covered under the Pacific Coast Salmon FMP. Therefore, its habitat within the Trinity River watershed is considered EFH. SONCC coho habitat is also considered EFH. EFH receives federal protection under the MSA.

Table 3-1 below displays all special-status fish and freshwater mussel species with the potential to occur within the Trinity River watershed according to the California Natural Diversity Database (2024a), BLM sensitive species Redding Field Office list, USFS sensitive species list for the Shasta-Trinity National Forest, University of California Davis PISCES Database current fish distribution maps (CalFish 2024), and consultation with local expertise, namely TRRP. Table 3-1 includes the species status, documented HUC 10 presence within the Project activity area, and whether designated CH is present within the analysis area. These species are focused on in the fisheries effects analysis, and life history information for each is included in Section 3. See Section 3.2 below for a list of common species found throughout the watershed.

Table 3-1. Special-status fish and freshwater mussel species with potential to occur within the Project activity area.

Common Name	Scientific Name	Federal Status ¹	Other Status ²	Documented HUC 10 Presence	Designated CH in the Watershed?
Fish Species					
Coho salmon, SONCC ESU	<i>Oncorhynchus kisutch</i>	FT	ST, S2	Browns Creek, Big French Creek, Canyon Creek, East Fork Trinity River, New River, North Fork Trinity River, Stuart Fork, Swift Creek-Trinity River, Weaver Creek, Lower Hayfork Creek, Lower South Fork Trinity River, Middle South Fork Trinity River	Yes
Spring Chinook salmon, UKTR ESU	<i>Oncorhynchus tshawytscha</i>	FC	ST,SSC, USFS-S, S2	Big French Creek, Browns Creek, Canyon Creek, Coffee Creek, East Fork Trinity River, New River, North Fork Trinity River, Stuart Fork, Swift Creek-Trinity River, Tangle Blue Creek-Trinity River, Weaver Creek, Lower South Fork Trinity River, Lower Hayfork Creek, Upper Hayfork Creek, Middle South Fork Trinity River, Upper South Fork Trinity River	No
Steelhead, Klamath Mountains Province DPS ³	<i>Oncorhynchus mykiss irideus</i>	NL	SSC,USFS-S, S2	Browns Creek, Canyon Creek, Coffee Creek, East Fork Trinity River, New River, North Fork Trinity River, Stuart Fork, Swift Creek-Trinity River, Tangle Blue Creek-Trinity River, Weaver Creek, Lower South Fork Trinity River, Lower Hayfork Creek, Upper Hayfork Creek, Middle South Fork Trinity River, Upper South Fork Trinity River	No
Green sturgeon, Northern DPS ³	<i>Acipenser medirostris</i>	NL	SSC, S1	Big French Creek ⁴	No

Common Name	Scientific Name	Federal Status ¹	Other Status ²	Documented HUC 10 Presence	Designated CH in the Watershed?
Pacific lamprey	<i>Entosphenus tridentatus</i>	NL	SSC, USFS-S, BLM-S, S3	Big French Creek, Browns Creek, Canyon Creek, Coffee Creek, New River, North Fork Trinity River, Tangle Blue Creek-Trinity River, Weaver Creek, Lower South Fork Trinity River, Lower Hayfork Creek, Upper Hayfork Creek, Middle South Fork Trinity River	No
Freshwater Mussel Species					
Western pearlshell	<i>Margaritifera falcata</i>	NL	S1S2	Common in the Trinity River and tributaries	No
California floater	<i>Anodonta californiensis</i>	NL	USFS-S, S2	Documented in low numbers in the Klamath and Trinity rivers	No

¹ FT = Federally-listed as threatened and species likely to become endangered within the foreseeable future; FC = Federal candidate for listing; NL = Not listed.

² SSC = California Species of Special Concern; SE = State-listed as endangered; ST = State-listed as threatened; BLM-S = BLM sensitive species, USFS-S = USFS sensitive species; NatureServe California State Rank S1 = critically imperiled, S2 = imperiled, S3 = vulnerable.

³ Distinct Population Segment (DPS)

⁴ Green sturgeon is found outside the Project activity area in this HUC 10 watershed.

3.2 Other Fish Species

Other fish species that are not considered special-status species, common within the Project activity area, could be affected by the proposed restoration activities. These activities are proposed to occur within or near aquatic, riparian, wetland, and upslope areas. Other fish species for each HUC 10 are shown in Table 3-2 below.

Table 3-2. Other fish species in HUC 10 subwatersheds.^{1,2}

HUC 10 Watershed	HUC 10 Number	Typical Native Fish Species	Nonnative Fish Species
Big French Creek-Trinity River	1801021111	Threespine stickleback, Klamath smallscale sucker, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown trout, green sunfish, golden shiner, largemouth bass
Browns Creek	1801021106	Threespine stickleback, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown trout
Canyon Creek	1801021108	Threespine stickleback, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, largemouth bass
Coffee Creek	1801021101	Threespine stickleback, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown trout, largemouth bass, sockeye (Kokanee) salmon,
East Fork Trinity River	1801021103	Threespine stickleback, Klamath River lamprey, Klamath speckled dace	Brook trout, brown bullhead, brown trout, green sunfish, largemouth bass, smallmouth bass, sockeye (Kokanee) salmon, western mosquitofish

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HUC 10 Watershed	HUC 10 Number	Typical Native Fish Species	Nonnative Fish Species
New River	1801021110	Threespine stickleback, Klamath smallscale sucker, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown trout, green sunfish, largemouth bass, golden shiner
North Fork Trinity River	1801021109	Threespine stickleback, Klamath smallscale sucker, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown trout, green sunfish, largemouth bass, golden shiner
Stuart Fork	1801021104	Threespine stickleback, Klamath River lamprey, Klamath speckled dace	Brook trout, brown trout, brown bullhead, green sunfish, largemouth bass, smallmouth bass, Western mosquitofish, sockeye (Kokanee) salmon
Swift Creek-Trinity River	1801021105	Threespine stickleback, Klamath River lamprey, Klamath speckled dace,	Brook trout, brown trout, brown bullhead, green sunfish, golden shiner, largemouth bass, smallmouth bass, Western mosquitofish, sockeye (Kokanee) salmon,
Tangle Blue Creek-Trinity River	1801021102	Threespine stickleback, Klamath River lamprey, Klamath speckled dace	Bluegill, brook trout, brown trout, golden shiner, largemouth bass, Western mosquitofish, sockeye (Kokanee) salmon,
Weaver Creek	1801021107	Threespine stickleback, Klamath smallscale sucker, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, golden shiner, green sunfish, largemouth bass, smallmouth bass
Lower South Fork Trinity River	1801021205	Threespine stickleback, Klamath River lamprey, Klamath speckled dace, white sturgeon, UKTR fall Chinook salmon	Brown bullhead, brown trout, golden shiner, green sunfish, largemouth bass
Lower Hayfork Creek	1801021203	Threespine stickleback, Klamath smallscale sucker, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown trout, golden shiner, green sunfish, largemouth bass
Upper Hayfork Creek	1801021202	Threespine stickleback, Klamath smallscale sucker, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, brown bullhead, brown trout, golden shiner, green sunfish, largemouth bass
Middle South Fork Trinity River	1801021204	Threespine stickleback, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon, white sturgeon ³	Brown trout, golden shiner, green sunfish, largemouth bass
Upper South Fork Trinity River	1801021201	Threespine stickleback, Klamath smallscale sucker, Klamath River lamprey, Klamath speckled dace, UKTR fall Chinook salmon	Brook trout, golden shiner, green sunfish, largemouth bass

1. CalFish 2024

2. Resident rainbow trout may be found throughout the basin.

3. Based on limited records.

3.3 Salmon and Steelhead

The following Figure 3-1 demonstrates that salmon and steelhead at various life history stages are present within the Trinity River throughout the entire year. Special-status species are discussed in more detail below.

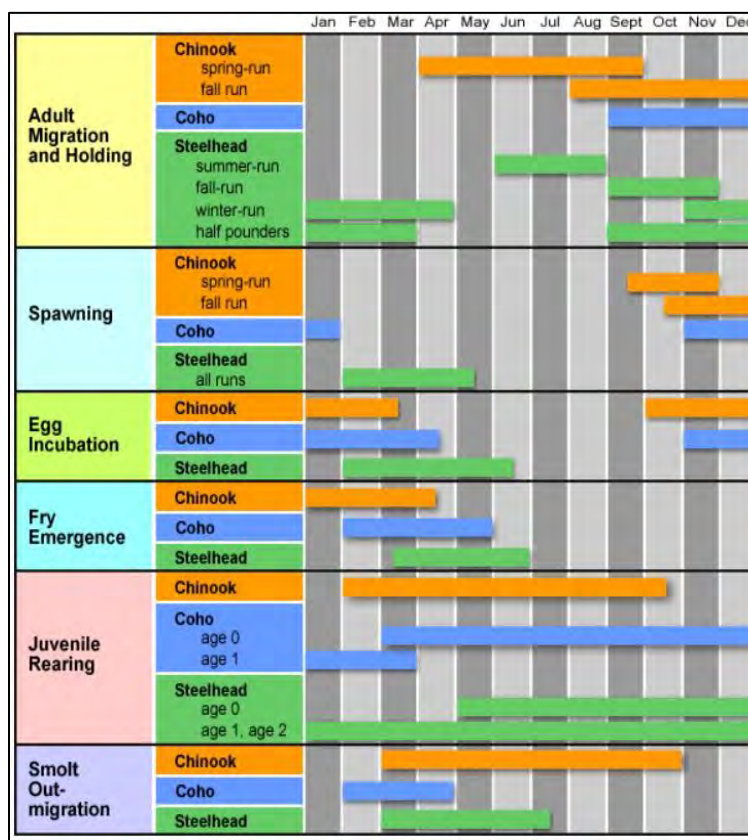


Figure 3-1. Life history timing of Trinity River salmon and steelhead (reproduced from TRRP Website).

3.3.1 SONCC Coho Salmon ESU (*Oncorhynchus kisutch*)

The SONCC coho salmon ESU was first listed as threatened on May 6, 1997 (62 FR 24588) and includes all populations of coho in coastal streams from the Elk River near Cape Blanco, Oregon, southward to, and including, the Mattole River near Punta Gorda, California. CH for this species was designated on May 5, 1999 (64 FR 24049) and includes the mainstem Trinity River and accessible tributary reaches that are occupied by freshwater life stages of coho and include one or more of the PBFs essential to the conservation of the SONCC coho ESU. These PBFs may include, but are not limited to, the following: spawning sites; food resources; water quality and quantity; and riparian vegetation.

Most coho spawning streams flow directly into the ocean or are tributaries of large rivers. Females tend to prepare their redds (gravel nests) and spawn soon after arriving on spawning grounds between November and January, with timing varying by watershed within the ESU (Weitkamp et al. 1995). Klamath-Trinity River basin populations of SONCC ESU coho salmon generally migrate upstream from September through late December with arrival in the upper reaches peaking in November and December (Leidy and Leidy 1984; NMFS 1997; NMFS 2012). In the Trinity River, spawning mainly occurs in November and December Leidy and Leidy 1984; Shaw et al.

1997; CDFG 2024; see Figure 3-1). Prime spawning habitat conditions generally occur near the head of a riffle, just below a pool, where there is abundant small to medium gravel (Shapovalov and Taft 1954) and suitable water depths and velocity.

Depending on river temperatures and dissolved oxygen levels, eggs incubate in the redds for 1.5 to 4 months before hatching as alevins (a larval life stage). The percentage of eggs and alevins that survive to fry emergence is dependent on stream and riverbed conditions during winter flooding, with associated scour and gravel movement accounting for a high proportion of losses (NMFS 2014). In the Trinity River and other Klamath River tributaries, fry emergence typically occurs two to three weeks after hatching, beginning from about February and continuing through mid-May. Following emergence, fry move into shallow areas near streambanks. As coho fry grow, they disperse upstream and downstream, usually remaining in, or moving into, small tributary streams, and establish and defend territories (Leidy and Leidy 1984; Hassler 1987).

The dominant life history pattern is for juvenile coho to feed and rear within streams of their natal watershed for a year before migrating to the ocean. However, they may spend up to two years rearing in fresh water (Bell and Duffy 2007) or emigrate to an estuary shortly after emergence (Tschaplinski 1988). Coho have also been shown to utilize non-natal streams for rearing and to redistribute into riverine ponds following fall rains (Peterson 1982). The extent to which fish utilizing these alternate life history patterns contributes to adult returns is not known, however, they demonstrate the diversity of strategies that are potentially used by juvenile coho in this ESU (NMFS 2014).

During the summer, coho salmon fry prefer shallow pools and riffles with wood cover, undercut banks, boulders, and overhanging vegetation (Shapovalov and Taft 1954). During summer, juvenile coho may also move into deep pools and areas with dense shade and large wood for refuge from high summer temperatures (Nickelson et al. 1992). During the winter, coho salmon fry prefer to rear in large mainstem pools, backwater areas and secondary pools with LW, and undercut bank areas (Hassler 1987). After rearing in fresh water, coho migrate to the sea as smolts generally from February through mid-June, peaking in April and May throughout their range in California, including the Trinity River (Shapovalov and Taft 1954; Leidy and Leidy 1984; Petros et al. 2015).

Recent Klamath-Trinity monitoring data show the average length of out-migrating coho smolts is approximately 128 millimeters (mm), with the largest smolts originating from the Trinity River (average length 147 mm) and the smallest originating from Blue Creek on the Klamath River (average length 104 mm; NMFS 2014; Petros et al. 2015). The large average size of smolts produced from the Trinity River is likely a result of hatchery operations, which generally produce larger smolts when compared to naturally produced smolts (NMFS 2014; Petros et al. 2015).

The status and viability of the SONCC ESU coho salmon were evaluated in the most recent 5-Year Status Review (NMFS 2011) and described in the Final Recovery Plan (NMFS 2014) using the concept of Viable Salmonid Populations (VSPs) and the population viability criteria described by McElhany et al. (2000) and expanded upon by Williams et al. (2008). Long-term population estimates for SONCC coho are scarce; however, available monitoring data indicate that many populations have declined, and that the ESU does not appear to support a single VSP (i.e., a population at low risk of extinction). Most of the 30 independent populations are at high risk of extinction for abundance because they are below or likely below their depensation threshold (NMFS 2014).

To compensate for these declines, hatcheries supplement naturally-spawning SONCC coho (CDFG and NMFS 2001). Supplementation of hatchery salmon into SONCC coho populations with low productivity has

subsequently led to a continued reduction of population diversity. Additionally, recent fish distribution data indicate that the range of SONCC coho has decreased, as evidenced by previously-occupied streams in which coho are now absent (NMFS 2001).

Given the recent trends in population abundance, productivity, spatial structure, and diversity across the ESU, the SONCC coho ESU is not considered to be viable and is at high risk of extinction, with a likelihood to become endangered in the foreseeable future (Williams et al. 2011).

3.3.2 Spring Chinook Salmon, UKTR ESU (*Oncorhynchus tshawytscha*)

In 1998, a status review of all west coast Chinook salmon stocks (Myers et al. 1998) determined that the UKTR Chinook salmon ESU was not warranted for federal ESA listing as a threatened or endangered species. However, UKTR spring-run Chinook salmon (spring Chinook) is a California Fish Species of Special Concern and a California state threatened species (Moyle et al. 1995).

UKTR spring Chinook is known to occur in the mainstem Klamath River, Trinity River, and perennial tributary streams. Similar to coho, Chinook require cool streams with deep pools and riffles, and gravel or cobble substrate. Suitable over-summering, spawning, and rearing habitat as well as migration corridors for Chinook exist throughout the Project activity area.

While spring Chinook salmon are still scattered throughout the lower Klamath and Trinity basins, the only viable wild population appears to be limited to the Salmon River and South Fork Trinity River. Mainstem Trinity River numbers are presumably largely influenced by fish from the Trinity River Hatchery (TRH), as are most tributary populations. Even if Trinity River tributary spawners are considered to be wild fish, the total number of spring Chinook in the UKTR ESU rarely exceeds 1,000 and may drop to less than 300 in many years. Even recent large runs (i.e., approximately 2,500) of spring Chinook returning to the South Fork Trinity and Salmon River, combined, represent less than 3% of the total number of spring Chinook historically spawning in the Klamath Basin (Walbaum 2024).

While UKTR spring Chinook are not a federal ESA-listed species and CH has not been designated, Chinook are included in the Pacific Coast Salmon FMP, for which habitat is protected as EFH (as previously discussed). Effects to UKTR spring Chinook as a result of implementation of the Project would be similar to those described for coho salmon.

3.3.3 Klamath Mountains Province Steelhead DPS (*Oncorhynchus mykiss irideus*)

The Klamath Mountains Province (KMP) steelhead DPS, which includes stock from the Trinity River, was proposed for federal listing as threatened in 1995. However, in 1998, NMFS determined that the population was not warranted for listing under the federal ESA. A court decision overturned the ruling in 2000, finding that NMFS relied too heavily on expected effects of future conservation efforts. A final decision was reached on April 4, 2001 (CFR Vol. 66, No. 65), and the listing of KMP steelhead under the federal ESA was again determined to be unwarranted. The KMP steelhead DPS is also not listed under the state ESA, however, it is a California Fish Species of Special Concern and a USFS sensitive species (Moyle et al. 1995).

KMP steelhead require cool, swift, shallow water, clean loose gravel for spawning, and suitable large pools in which to spend the summers (specific to summer steelhead, CDFW 2024b). They are known to occur in the

mainstem Klamath River, Trinity River, and perennial tributary streams. Suitable spawning, rearing, and migration corridor habitats exist throughout the Project activity area.

Because KMP steelhead have distinctive life history variations (i.e., winter, summer, fall, half-pounder, and resident forms), diverse watershed characteristics and impairments, and are hard to monitor during periods of high flow and turbidity, abundance estimates for the entire KMP steelhead DPS are not available. Instead, abundance is examined by watershed, and because of seasonal conditions, summer and fall adult steelhead have the largest data sets (CDFW 2010). KMP summer steelhead have a spotty distribution throughout their range and specialized habitat requirements, making each subpopulation more susceptible to environmental changes and anthropogenic threats than adult winter and fall steelhead. Adult abundance for summer steelhead was and continues to be small, but most populations appear to be stable. However, specific threats (e.g., fire, sedimentation, increased average temperatures and precipitation extremes, and poaching) are more likely to impact subpopulations, leading to local extirpations. Currently, there are no coordinated basin-wide management plans in place for the protection of summer steelhead. Watersheds identified by McEwan and Jackson (1996) as high priority areas for stream restoration to benefit KMP steelhead included the South Fork of the Trinity River, Scott River, and Shasta River (CDFW 2010).

Potential effects to the KMP steelhead DPS in the Trinity River resulting from implementation of the Project would be similar to those described for coho and Chinook salmon. Long-term benefits are expected to substantially outweigh temporary adverse effects.

3.3.4 Effects on Salmon and Steelhead and Habitat

The Project activity area is used by all life stages of coho, Chinook, and steelhead during proposed work. Adult salmonid spawning and migration, juvenile migration, and juvenile rearing are likely to be affected by the proposed action. In-water Project activities would occur during the summer low flow period (i.e., June 15 through October 15 or the first rainfall) to avoid effects to SONCC coho to the extent possible after the majority of smolts have left the watershed but before most adults return. Restoration activities that may adversely affect salmonids or their habitat include stream dewatering and bypass, fish relocation, bank stabilization, heavy equipment operating in the channel, bridge replacement, bedrock fracturing, large and small wood installation, and instream structure removal.

Existing conditions for SONCC critical habitat PBFs include all water, riverbed, and bank areas, and riparian areas within the ESU boundaries. In the Trinity River basin, the function of these PBFs vary widely from poor to excellent. Climate change and human development have and continue to adversely impact critical habitat. The implementation of some site-specific restoration projects would have short-term adverse effects on PBFs at the site-specific project scale. The long-term effect of these activities across the Project activity area would be anticipated to accrue habitat benefits (and improved PBFs) as projects mature and natural processes take over. It is expected that critical habitat quality and quantity would improve over time as a result of the Project and therefore, the Project would not result in the appreciable reduction in the value of designated SONCC critical habitat.

Likewise, effects to coho and Chinook salmon EFH, the waters and substrates necessary for spawning, breeding, feeding, or growth to maturity, are anticipated to be similar. The implementation of some site-specific restoration projects would have short-term adverse effects on EFH at the site-specific project scale. The long-

term effects to EFH as a result of the Project would entail an increase in quality and quantity at the watershed scale.

While implementation of the Project would have some adverse effects to individual fish and habitat, the Project would have a long-term beneficial effect on salmonid habitat in the Project activity area. Overall improvement of aquatic habitat quantity and quality and salmonid rearing capacities for coho, Chinook, and steelhead would be anticipated.

3.4 North American Green Sturgeon (*Acipenser medirostris*)

The North American green sturgeon (*Acipenser medirostris*) is an anadromous fish species that is also present in the Trinity River basin. These fish spend their early life stages in freshwater, migrate to the ocean for maturation, and return to their natal streams to spawn. Green sturgeon typically spawn during late spring and early summer in the mainstems of large river systems and in relatively fast flow conditions. The Klamath/Trinity River basin is known to contain the largest spawning population of green sturgeon in California (Moyle 2002). Spawning occurs in freshwater rivers in cool, deep water with turbulent flows over clean hard substrate. Juvenile green sturgeon are found in the Trinity River near Willow Creek from June through September, and appear to outmigrate during their first summer to the lower river or estuary, where they rear for some time before moving to the ocean (TRRP 2024).

NMFS published a final rule listing the Southern DPS of green sturgeon as threatened in 2006 (71 FR 17757). Two green sturgeon DPSs are defined: a Southern DPS that spawns in the Sacramento River, and a Northern DPS with spawning populations in the Klamath and Rogue rivers. The Southern DPS includes all spawning populations of green sturgeon south of the Eel River in California, of which only the Sacramento River currently contains a spawning population. The Southern DPS of green sturgeon has been listed as threatened under the ESA (71 FR 17757), whereas the Northern DPS is only a species of concern. McLain (2006) noted that southern DPS green sturgeon were first determined to occur in Oregon and Washington waters in the late 1950s, when tagged San Pablo Bay green sturgeon were recovered in the Columbia River Estuary (CDFG 2002a). Northern DPS green sturgeon have been documented up to Gray Falls (River Mile 43.5) in the mainstem Trinity River outside of the Project activity area. There used to be spawning populations of green sturgeon in the South Fork Trinity River but there is currently no evidence of spawning habitat within the South Fork Trinity River (Moyle 2002) and the historic range for green sturgeon is located outside of the Project activity area. The distribution of northern and southern DPS green sturgeon overlaps outside of their spawning streams in coastal estuaries and marine waters from southern California to Alaska.

CH for southern DPS green sturgeon was designated by NMFS in 2009 (74 FR 52300) but does not overlap with the Project activity area. CH includes specific PBFs essential for the conservation of southern DPS green sturgeon. PBFs for freshwater riverine systems include abundant food sources, suitable substrate for spawning and egg development, adequate flow regime, and suitable water quality. While southern DPS green sturgeon have not been documented in the Trinity River, according to NMFS, the presence of southern DPS green sturgeon is likely (based on limited records of confirmed Northern DPS green sturgeon and those of unknown DPS) but not confirmed within the Klamath/Trinity River Estuary (74 FR 52300).

In 2011, a USFS fisheries biologist (Eric Wiseman, Fisheries Biologist [Yurok Tribe, Trinity River Division], text message to TRRP, November 16, 2018) observed a 50-inch green sturgeon coming down over Gray Falls, which is

the supposed green sturgeon barrier located at River Mile 43.5. Therefore, some green sturgeon may make it upstream of the falls. Though green sturgeon have not been documented within the Project activity area, a small number of individuals could be present in the mainstem Trinity River at the outer edge of the Project activity area.

3.4.1 Effects on Green Sturgeon

Construction-related effects to green sturgeon would be limited to a small number of individuals that are able to move above Gray Falls on the mainstem and are therefore, effects are anticipated to be negligible. Any effects that occur to these individual fish are described in Section 3.6, Effects on Salmon, Steelhead, and other Special-Status Fish Species, below. Overall, the Project is expected to have a beneficial effect to green sturgeon by increasing local populations of salmonids over the long term, which would improve foraging opportunities for green sturgeon.

3.5 Pacific Lamprey (*Entosphenus tridentatus*)

Pacific lamprey are another native anadromous fish within the Trinity River, beginning their life cycle as an ammocoete or larvae, usually within a freshwater stream. Ammocoetes burrow tail-first into mud or soft substrate where they filter-feed on algae and organic matter during their four-to-five-year stay in freshwater. When they grow to the adult (parasitic) form, Pacific lamprey swim downstream toward the Pacific Ocean where they feed for 6 to 18 months. Like salmon, Pacific lamprey return to fresh water and migrate upstream to spawn and die (CalFish 2024). Adult Pacific lamprey spawn from spring through early summer and again in the fall. Pacific lamprey have been documented throughout much of the Trinity River.

Pacific lamprey, along with three other lamprey species, were petitioned for federal ESA listing in 2003. On December 27, 2004, the USFWS announced that the petition accompanied by additional information did not present substantial scientific or commercial information to warrant the listing of these species (CFR Vol. 64, No. 86, December 27, 2004).

3.5.1 Effects on Pacific Lamprey

Potential construction-related effects to fish, including Pacific lamprey, as a result of the Project are described in 3.6, Effects on Salmon, Steelhead, and other Special-Status Fish Species, below. Specific to Pacific lamprey, the removal of riparian vegetation at specific restoration sites would have temporal effects to adult Pacific lamprey by reducing holding and hiding habitat, which is particularly important for upstream migrating adults. However, revegetation efforts following restoration activities would be anticipated to improve conditions in the long term. In addition, special efforts would be made to ensure that burrowed Pacific lamprey ammocoetes are salvaged during dewatering activities. Recent studies have shown that electrofishing after dewatering (or “dry shocking”), which involves positioning probes on moist sediment to entice burrowed larval lampreys to emerge, may be a technique to increase survivorship of ammocoetes. Avoidance and minimization measures specific to Pacific lamprey are incorporated into Project documents. With the incorporation of these measures, only minor effects to Pacific lamprey are anticipated as a result of Project implementation. In the long-term, the Project would benefit Pacific lamprey by improving aquatic habitat conditions and fish passage within the Trinity River watershed.

3.6 Effects on Salmon, Steelhead, and other Special-Status Fish Species

Table 3-3 below summarizes the potential construction components or construction impacts by restoration activity category that could affect individual fish and their habitat. Effects of particular concern are described in more detail below Table 3-3. Construction-related effects on special-status fish per activity category Table 3-3.

Table 3-3. Construction-related effects on special-status fish per activity category.

Restoration Activity Category	Potential Construction-Related Effects with CMs Implemented
1. Restoration and Enhancement of Off-Channel and Side-Channel Habitat	Construction impacts to riparian vegetation, in-channel heavy equipment use, turbidity, incidental chemical contamination, bedrock fracturing hydroacoustic noise, dewatering, fish relocation
2. Floodplain Restoration	Construction impacts to riparian vegetation, in-channel heavy equipment use, turbidity, incidental chemical contamination, dewatering, fish relocation
3. Removal or Retrofitting of Fish Passage Barriers, Small Dams, Flood Gates, Pilings, and Other In-water Structures	Construction impacts to riparian vegetation, in-channel heavy equipment use, sedimentation, incidental chemical contamination, dewatering, fish relocation
4. Water Conservation Projects	Turbidity, incidental chemical contamination, potential for dewatering/fish relocation associated with fish screen installation
5. Salmon Carcass Placement	No adverse construction-related effects anticipated
6. Remote Site Incubators	Minor streambed disturbance during install of system and demobilization.
7. Bioengineered Bank Stabilization	Construction impacts to riparian vegetation, incidental chemical contamination, sedimentation
8. Aquatic, Wetland, Riparian, and Upslope Habitat Enhancement Including Removal of Nonnative Invasive Species and Revegetation with Native Plants	Construction impacts to riparian vegetation, incidental chemical contamination, sedimentation
9. Road Maintenance	Incidental chemical contamination, sedimentation
10. Road Rehabilitation	Construction impacts to riparian vegetation, in-channel heavy equipment use, sedimentation, incidental chemical contamination, dewatering, fish relocation, hydroacoustic noise from pile driving
11. Road Decommissioning	Construction impacts to riparian vegetation, in-channel heavy equipment use, sedimentation, incidental chemical contamination, dewatering, fish relocation

3.6.1 Dewatering and Fish Relocation

Dewatering and fish relocation will be necessary for a number of activity categories as summarized in Table 3-3. This work would take place during seasonally low flow, and salmonids are likely to be exposed to potential adverse effects. Adults are physically able to avoid work activity and are not expected to be present during fish removal, but in the unlikely event that adults are found in the work areas, they will be safely removed via herding to the extent possible.

Dip nets have been successfully employed for collection in the past, but fish relocation may include use of electrofishing following applicable NMFS protocols. Most captured fish would be expected to be released unharmed. However, it is possible that relocation efforts, including electrofishing, could induce physiological stress or mortality even when performed by a skilled fisheries biologist. Any fish-collecting gear, whether passive or active (Hayes 1983), has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of injury and mortality attributable to fish capture varies widely depending on the methods used, the ambient conditions, and the expertise and experience of the field crew. Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects including spinal injuries (Habera et al. 1999, Nielsen 1998, Nordwall 1999).

The long-term effects of electrofishing on salmonids are not well-understood. Although chronic effects may occur, most effects from electrofishing would occur at the time of capture and handling. Referencing results from similar restoration and fish salvage efforts in northwestern California (CDFW 2013, 2014, 2015, 2016, 2017, 2018; NOAA RC 2012, 2018, 2019, 2020), it is anticipated that under typical water temperature conditions within the Trinity River watershed, no more than 2% mortality of captured fish at each fish relocation site would occur (NMFS 2020).

3.6.2 Desiccation or Mechanical Crushing During In-Channel Heavy Equipment Use

Any fish not recovered during salvage operations would be subject to desiccation or mechanical injury. Salmonids may be injured by contact with construction equipment operating in the channel, but numerous measures would be employed to reduce this probability. In-channel construction activities would be conducted during the summer to early fall low-flow conditions (June 15 through October 15), avoiding the potential for construction-related effects on spawning coho salmon and alevins, since this period is outside the adult migration, spawning, and egg incubation season in the action area (Shaw et al. 1997). The in-channel work window also corresponds to the season when the fewest number of juvenile coho salmon are known to occur in the action area, after age -0 pre-smolt emigration, but before active yearling smolt migration (Glase 1994; Petros et al. 2015).

Pre-construction surveys would identify and avoid potential injury to collections of juvenile or adult fish. Heavy equipment would also operate in a slow, deliberate manner, allowing fish to avoid contact with equipment in an open channel. Seining would be employed at some sites to herd fish out of the site before block nets are placed, preventing reentry of juvenile fish into the work area. Based on a report on fish capture efficiency (USDA FA et al. 2013), it is anticipated that up to 5% of juvenile salmonids would not be removed from fish herding or salvage and be left behind to suffer mortality from desiccation or direct mechanical crushing (NMFS 2020).

3.6.3 Increased Suspended Sediment Concentrations

Multiple activity categories have the potential to increase sediment mobilization caused by actions including, but not limited to, in-channel construction, barrier removal, heavy equipment use, and floodplain grading. Suspended sediment concentrations increase rapidly with the initiation of in-channel work and recede markedly with the cessation of work (Reid and Anderson 1998). The effects of suspended sediment, which contribute to turbidity, on fish have been well documented and range from beneficial to lethal. Moderate turbidity levels (i.e., from 35 to 150 nephelometric turbidity units [NTUs]) can provide cover and accelerate foraging rates in juvenile salmonids (Gregory and Northcote 1993). Conversely, higher turbidity concentrations can cause physiological

stress and inhibit growth and survival, while direct mortality can occur at very high concentrations and/or extended durations of suspended solids (Newcombe and Jensen 1996).

Fish would be exposed to increased sediment mobilization by Project activities, but several measures would reduce the potential impact of suspended sediment. Erosion and sediment control BMPs would be maintained to ensure compliance with the turbidity thresholds specified by the Project's Section 401 water quality certification (i.e., more than 20 NTUs at 500 feet downstream of in-river construction when background turbidity is less than or equal to 20 NTUs, and more than a 20% increase in turbidity at 500 feet downstream when background is greater than 20 NTUs). If standards are not met, construction activities would cease.

It should be noted that higher flows in the spring typically produce elevated background turbidity levels, and in the first year following construction, fish within 500 feet downstream of a site could potentially experience adverse effects. Fish would have unrestrained opportunity to physically avoid intense turbidity, but it is assumed that some juvenile salmonids would not vacate these reaches and would be exposed to turbidity levels capable of causing stress and decreased feeding for up to seven days while the turbidity plume persists. These effects would not be expected to significantly change the growth or fitness of any fish. Sustained turbidity generated from the proposed instream restoration projects would likely cause temporary physiological and behavioral effects, such as dispersing salmonids from established territories, potentially increasing interspecific and intraspecific competition, and temporarily increasing predation risk for a small number of affected juveniles (NMFS 2020).

3.6.4 Bank Stabilization

In some cases, bank stabilization is used to protect property by impeding further lateral migration of the channel, which can be a critical process for creating habitat conditions on which salmonids depend. Lateral migration is important for producing undercut banks and side channels and recruiting gravel and woody debris to the channel (Spence et al. 1996). These are features that increase both the quantity and quality of habitat, which are necessary to increase the number of juvenile coho salmon that the action area can support. Bank stabilization generally prevents the channel from lengthening, leading to a relative increase in bed slope and reduction in bed and bank area. The result is often increased stream energy, expressed as erosion downstream from the armoring and/or channel incision at the armoring, and sometimes extending upstream and/or downstream. Increased stream energy and competency can alter particle size distribution in the channel. In addition to destabilizing other portions of the bank and bed, bank protection prevents the channel from creating additional salmonid habitat in the immediate vicinity of the armoring through normal riverine processes (Schmetterling et al. 2002). In summary, bank protection typically reduces both habitat quantity and habitat quality for salmonids over the long term, which eventually reduces the number of fish that the Project activity area can support (NMFS 2020).

Therefore, the long-term effect of channelizing a stream through bank stabilization entails the continuation of impaired juvenile salmonid abundance over successive generations, relative to what would be expected under natural stream conditions and channel function. Some individual fish would likely grow slower due to less food supplied by the channelized stream as compared to a natural streambank. If these smaller fish are unable to move to areas with better resources for growth, they would likely experience lower survival upon ocean entry (Holtby et al. 1990), especially if unfavorable ocean conditions exist. As a result, these smaller fish would be less likely to return and spawn (NMFS 2020).

However, the bioengineered bank stabilization approach (e.g., riparian planting and instream wood placement that create natural cover elements) proposed would improve habitat conditions relative to what currently exists within the channelized Project activity area (Zika and Peter 2002). It is anticipated that more juvenile fish would be able to successfully rear in these areas after bioengineering bank stabilization improves habitat conditions. Successful rearing includes a likelihood of returning to spawn relatively similar to fish rearing in other areas of the watersheds where these bank stabilization projects occur. These improved habitat conditions do not fully offset the ongoing impact to habitat function and future juvenile population growth caused by extending channelization into the foreseeable future, however, adverse effects would be minimized to the extent possible (NMFS 2020).

3.6.5 Electrofishing

Electrofishing can cause a suite of effects ranging from disturbance to mortality. The amount of unintentional mortality attributable to electrofishing varies widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Most studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey et al. 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish are subjected to a lower voltage gradient than larger fish (Sharber and Carothers 1988) and may, therefore, be subject to lower injury rates (Thompson et al. 1997). The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Dwyer and White 1997). Continuous direct current (DC) or low frequency (i.e., 30 hertz) pulsed DC have been recommended for electrofishing (Dalbey et al. 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Sharber et al. 1994, Dalbey et al. 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Dalbey et al. 1996, Ainslie et al. 1998). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely-injured fish grow at slower rates, and sometimes show no growth at all (Dalbey et al. 1996).

Conservation measures for the Project require that all technicians follow NMFS' electrofishing guidelines (NMFS 2020). In all cases, electrofishing is used only when other relocation methods are not feasible. ESA-listed fish would be handled with extreme care and kept in cold water to the maximum extent possible. During relocation operations, a healthy environment must be provided. Electrofishing is not permitted if water temperatures exceed 64 degrees Fahrenheit (NMFS 2020).

3.6.6 Construction Impacts to Riparian Vegetation

Dewatering, heavy equipment use in the channel, removal of riparian vegetation to access sites, grading of floodplain areas, and re-contouring of streambanks would likely result in a temporary reduction of available forage and instream habitat. Project designs would preserve large riparian trees or reuse them to create instream large wood structures to the extent possible. In some cases, riparian vegetative cover would be disturbed or removed, which would result in a temporal reduction of cover and shading, reduced nutrient cycling, and reduced terrestrial invertebrate production on a localized and temporary scale. Displacement of salmonids from preferred habitat may also result in an increased predation risk or reduced feeding efficiency through the loss of cover (Michney and Hampton 1984; Michney and Deibel 1986).

These effects would be short-term and would therefore be negligible for salmonids and other migrating fish. Invertebrates would rapidly recolonize disturbed areas following reintroduction of water (Harvey and White 2008). No net loss of riparian vegetation would occur, and new plantings would offset the temporal loss of riparian function. The addition of large wood structures would provide cover and shade adjacent to pools and encourage natural sediment build-up next to the wood structures, allowing the bank to fill in and recruit more vegetation for improvement of long-term streambank functions and development of habitat features. Increases in shallow-water habitat at point bars and along floodplains, including side channels and alcoves, would benefit invertebrate production, and increases in point bar surface areas would increase salmon spawning habitat within the boundaries of the rehabilitation sites (Goodman et al. 2012; Beechie et al. 2014). Project activities would ultimately increase floodplain connectivity, reactivate channel migration across floodplains, and improve riparian and aquatic habitat diversity for anadromous salmonids throughout the Project activity area.

3.6.7 Invasive Aquatic Species

During instream restoration activities, the invasive aquatic species (e.g., didymo) could spread easily into new areas if construction vehicles, hand tools, or contractors' boots have been in areas where these exist and are not cleaned properly. Once in a stream, these species can alter the stream environment including invertebrate and fish species diversity and population size (Spaulding and Elwell 2007). Effects on the abundance and diversity of benthic macroinvertebrates from the spread of invasive aquatic species would eventually adversely affect fish and other aquatic organisms that feed on them. Avoidance and minimization measures such as educating the contractors working on restoration projects about these species and thoroughly cleaning equipment coming from other streams would prevent the spread of aquatic invasives. With the use of these measures, the effect of the Proposed Action on the spread of these species is anticipated to be negligible.

3.6.8 Activities Taking Place in Dry Conditions

Certain activities, including road maintenance and Stage Zero channel restoration, would take place under dry conditions and are consequently expected to have little adverse impact on fish or habitat. As stated previously, road maintenance activities would include only work that would result in negligible effects on salmonid habitat because of work being accomplished in the dry. After the implementation of Stage Zero restoration activities, a surge of mobilized sediment (first flush) would potentially occur when flow returns to these channels in the winter or spring, but the increase in turbidity is expected to be short-lived and minimal with the use of erosion and sediment control BMPs. The small amount of sediment temporarily mobilized is not expected to persist long enough to cause significant irritation to fish or redistribute in a way that would compromise invertebrate or spawning habitat. Upslope activities are expected to be entirely beneficial in that they will arrest introduction of fine sediment into the channel in the long term and restore habitat access with little immediate risk of sediment mobilization to aquatic habitat. Possible effects to salmonid habitat and individual fish from activities occurring in the dry are therefore expected to be negligible.

3.6.9 Instream Flow Restoration from Diversions

Implementing water conservation measures would benefit salmonids by maintaining or increasing instream flow such that rearing and migration conditions would be improved. Increasing instream flow levels by reducing withdrawals and increasing use efficiency would enhance juvenile salmonid access to suitable rearing habitat, especially during the summer and early fall when flows are lowest. Installing water monitoring devices would

result in discountable effects to listed species because they are nonintrusive, do not hinder salmonid behavior, and installation does not involve significant manipulation of the channel or riparian zone. Additionally, installation of rainwater collection devices and associated storage, forbearance, and other water conservation measures that improve water flow in streams would have beneficial effects. For these reasons, any adverse effects to salmonids and their habitat would be negligible (NMFS 2020).

3.6.10 Incidental Chemical Contamination

Impairment of water quality could result from accidental releases of fuel, oil, and other contaminants that could injure or kill aquatic organisms. Such releases, while rare, could occur from the use of heavy equipment. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can kill salmonids at high levels of exposure, and can cause sub-lethal adverse effects at lower concentrations (Meador et al. 2006). Due to emergency spill control measures and other BMPs, spills into salmonid waterways or releases larger than a few ounces as a result of construction activities would be unlikely to occur. Any fish in the immediate vicinity would experience temporary and minor irritation at most or would disperse from the affected area (NMFS 2020). For these reasons, effects to individual fish and their habitat from PAHs and other chemical contamination would be negligible to minor.

3.6.11 Pile Driving

Impact pile driving conducted in or near waterways can generate underwater sound pressure that has the potential to injure or kill fish (Caltrans 2015). The extent of these effects depend on the intensity and characteristics of the sound pressure, the distance and location of fish in the water column relative to the sound source, the size and mass of the fish, and the fish's anatomical characteristics (Yelverton et al. 1975). Generally, decibels (dB) are the metric used to describe noise levels, including underwater noise, when evaluating environmental effects. Specific to underwater noise, the following key metrics (measured in dB) are used to evaluate hydroacoustic effects:

- L_{PEAK} = instantaneous peak sound pressure level.
- RMS = root mean square sound pressure level.
- SEL = sound exposure level, which is used as a metric for acoustic events and often as an indication of the energy dose (Caltrans 2020).

To avoid injuring fish, specifically ESA-listed species, it was determined necessary to avoid exceeding an underwater L_{PEAK} of 206 dB, which was included in the "Interim Criteria for Injury to Fish from Pile Driving Activities" (FHWG 2008). It is also necessary to estimate the cumulative SEL ($SEL_{CUMULATIVE}$) associated with daily pile strike events. $SEL_{CUMULATIVE}$ can be estimated from a representative single-strike SEL value and the number of strikes that likely would be required to place the pile at its final depth by using the following equation:

$$SEL_{CUMULATIVE} = SEL_{SINGLE\ STRIKE} + 10 \log (\# \text{ of pile strikes})$$

Table 3-4 below provides typical single-strike SELs associated with various types of piles used for project planning purposes.

Table 3-4. Single-strike sound levels associated with different piles (measured at 10 meters from pile).¹

Pile	L _{PEAK} (dB)	RMS (dB)	SEL (dB)
Timber (12-inch) drop ²	177	165	157
CISS ³ (12-inch) drop	177	165	152
Concrete (24-inch) impact	193/183 ⁴	175/171 ⁴	160
Steel H-type (12-inch) impact	190	175	160
CISS (12-inch) impact	190	180	165
CISS (12-inch) impact	200	184	174
CISS (30-inch) impact	208	190	180
CISS (96-inch) impact	220	205	194

¹ Caltrans 2020² Drop impact hammer as opposed to a diesel impact hammer³ CISS = cast-in-shell steel⁴ Dual values for 24-inch concrete represent the range of measured levels

It was also determined that a SEL_{CUMULATIVE} of 187 dB for fish larger than 2 grams and 183 dB for fish less than 2 grams should not be exceeded (FWWG 2008). In April 2024, the California Department of Transportation (Caltrans) released a Hydroacoustic Technical Advisory that reviewed recent studies conducted since the 2008 NMFS Interim Criteria were released. This review of the best-available science suggests that pile driving has less effects on fish than previously thought. Caltrans recommended that the effects thresholds be changed to an L_{PEAK} of 207 dB and a SEL_{CUMULATIVE} of 203 dB for all pile-driving projects in California, per guidelines (Popper et al. 2014) that were accredited by the American National Standards Institute (ANSI; Caltrans 2024). Hydroacoustic effects thresholds are summarized in Table 3-5 below.

Table 3-5. Pile driving hydroacoustic effects thresholds.

Source	Metric	Fish Mass	Threshold
2008 Interim Criteria ¹	L _{PEAK}	N/A	206 dB
	SEL _{CUMULATIVE}	≥ 2 grams	187 dB
		< 2 grams	183 dB
	RMS (behavior)	N/A	150 dB
2014 ANSI-accredited Guidelines ²	L _{PEAK}	N/A	207 dB
	SEL _{CUMULATIVE}	N/A	203 dB

¹ FWWG 2008² Popper et al. 2014

For the Project, timber piles will be used to construct and stabilize some structured log jams and would typically be installed using a vibratory hammer. Therefore, installation of these timber piles would result in minor acoustic effects compared to the installation of metal piles. Metal piles would likely be required for the replacement of bridges as part of the Project, either for temporary construction bridges or for the main bridge structures themselves.

Avoidance and minimization measures would be incorporated into site-specific designs to ensure that all Project activities with pile driving would stay below injury effect thresholds. Specifically, hydroacoustic effects would need to stay below the 207 dB L_{PEAK} and 203 dB $SEL_{CUMULATIVE}$ thresholds (or the most current thresholds accepted by NMFS). The following avoidance and minimization measures would be prioritized as shown below:

1. Design channel spanning bridge structures so that in-channel pile driving would not be required.
2. Avoid installing 24-inch and larger piles when possible
3. Pile driving would be performed during recommended in-water work window.
4. Accomplish pile driving in the dry utilizing dewatering techniques as necessary without impeding fish passage to the extent possible.
5. Utilize vibratory hammers when considered an appropriate installation method according to site conditions.
6. Incorporate attenuation methods into pile driving activities (e.g., bubble curtain, isolation casing, dewatered cofferdam, or a cushioning block could be used between the hammer and pile).
7. If impact pile driving is implemented in, or adjacent to, a wetted stream, monitoring of fish shall occur during pile-driving activity to ensure no fish stranding or mortality occurs. If sound level thresholds are met, pile driving shall cease for a minimum of 12 hours.

Implementors proposing pile driving would provide information similar to that required by the Caltrans Hydroacoustic Project Information Checklist³ during site-specific project design to evaluate potential hydroacoustic effects. This information would then be used in concert with the NMFS Multi-Species Pile Driving Calculator Tool⁴ to ensure that project effects do not exceed hydroacoustic effects thresholds.

Despite the incorporation of avoidance and minimization measures into site-specific project designs, a small number of juvenile salmonids may be exposed to underwater sound levels (greater than 150 dB RMS) that could cause a behavioral response such as startle or disorientation during the initial phases of pile driving but not physical injury. Fish would likely flee the area of disturbance upon initial pile strikes and relocate to other suitable habitat before the number of strikes and sound levels accumulated to a level that can cause physical harm. Fish passage would be prioritized in site-specific designs; however, individuals may be disturbed and temporarily unable to pass through a site or occupy potential rearing habitat. This would only be the case for a few hours at a time over a period of no more than one week until pile driving is completed. Any turbidity generated from pile driving is expected to be short-lived and not in sufficient amounts to interfere with foraging or other behaviors. For these reasons, potential effects to salmonids and associated habitat as a result of pile driving is expected to be limited to a minor disturbance.

It should also be noted that impact pile driving in the dry can also generate underwater noise in adjacent aquatic habitats. Sound flanking occurs when a pressure wave travels down the pile, is transmitted into the soil, and then travels back up through the soil and into the water column. Currently, there is no method for calculating transmission loss through soil outside of the water, to then calculate loss in the water. However, in recent

³ <https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/hydroacoustic-project-information-checklist-ally.pdf>

⁴ <https://www.fisheries.noaa.gov/resource/data/multi-species-pile-driving-calculator-tool>

studies, current hydroacoustic effects thresholds were not exceeded. Therefore, pile driving in the dry is thought to be effective at minimizing hydroacoustic effects, thereby protecting fish (Caltrans 2020).

3.6.12 Blasting

Blasting is proposed as a technique to remove bedrock as part of the “Restoration and Enhancement of Off-Channel and Side-Channel Habitat” activity category. It is seen as a potential tool for channel restoration in case a bedrock area needs to be removed in order to meet design feature and grade criteria, and there is no other reasonable alternative. In addition, blasting could be used to removed fish passage barriers as part of the “Removal or Retrofitting of Fish Passage Barriers, Small Dams, Flood Gates, Pilings and Other In-water Structures” activity category.

Little is known about the potential effects of explosions on fish. Most data available on behavioral responses of fish to impulsive hydroacoustic effects come from pile driving studies. While these studies’ results directly relate to pile driving, they also provide valuable information on potential effects of other impulsive sounds on fish. As such, they have been incorporated into the most recent guidelines for evaluating hydroacoustic effects (Popper et al. 2019). One field study that looked specifically at the effects of underwater explosions on fish found that the SEL_{SINGLESTRIKE} ranged from 182 to 187 dB and the L_{PEAK} ranged from 229 to 239 dB (Govoni et al. 2008). The SEL_{SINGLESTRIKE} for underwater explosions is comparable to those generated by pile driving, whereas the L_{PEAK} is higher than those generated by pile driving (Bolle et al. 2012; Popper et al. 2019).

Because the hydroacoustic effects of blasting are similar to those of pile driving, the Project would take a similar avoidance and minimization approach for proposed blasting activities. Avoidance and minimization measures would be incorporated into site-specific designs to ensure that all Project activities with pile driving stay below injury effect thresholds. Specifically, hydroacoustic effects would need to stay below the 207 dB L_{PEAK} and 203 dB SEL_{CUMULATIVE} thresholds (or the most current thresholds accepted by NMFS). The following avoidance and minimization measures would be incorporated:

1. TRRP personnel and implementors would coordinate with NMFS when blasting is determined to be unavoidable.
2. Blasting would be performed during recommended in-water work windows.
3. Accomplish blasting in dry conditions utilizing dewatering techniques as necessary and without impeding fish passage to the extent possible.
4. Incorporate attenuation methods into blasting activities as directed by NMFS (e.g., bubble curtain, isolation casing, and dewatered cofferdam).
5. If blasting is implemented in, or adjacent to, a wetted stream, monitoring of fish shall occur during pile-driving activity to ensure no fish stranding or mortality occurs.

Implementors proposing blasting would provide information similar to that required by the Caltrans Hydroacoustic Project Information Checklist⁵ during site-specific project design to evaluate potential hydroacoustic effects. Information provided would be adapted to include details about blasting (e.g., types and

⁵ <https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/hydroacoustic-project-information-checklist-ally.pdf>

numbers of explosions, locations of explosions, etc.). This information would then be used in concert with the NMFS Multi-Species Pile Driving Calculator Tool⁶ to ensure that project effects do not exceed hydroacoustic effects thresholds.

In addition to hydroacoustic effects to individual fish, detonation of explosives in or near fish habitat may also result in the physical and/or chemical alteration of fish habitat. Sedimentation resulting from the use of explosives may cover spawning areas or may reduce or eliminate important benthic fish food organisms. Byproducts from the detonation of explosives may include ammonia or similar compounds and may be toxic to fish and other aquatic biota (Wright and Hopky 1998). However, with the incorporation of avoidance and minimization measures to site-specific project designs, the effects of blasting are anticipated to be minor.

3.6.13 Beneficial Effects

In addition to effects associated with proposed construction activities, in the long-term, the Project would also enhance or restore the following aquatic habitat functions: stream structure/complexity, stream sinuosity and length, bank stability, floodplain connectivity, and riparian vegetation structure and diversity. These improvements would promote conditions that maintain or decrease stream temperature, reduce turbidity and sediment discharges (via stable streambanks, improved sediment retention through increased channel structure, riparian areas, and floodplains), and improve nutrient input (via improved riparian conditions) and retention (via increased channel structure, sinuosity, and floodplain areas). Removing or repairing in-water structures would restore fish passage for spawning, migrating, and rearing fish, and would increase aquatic habitat area. Restoration of riparian vegetative communities would improve shade along streambanks in the long-term, which would help maintain water temperatures.

Large wood and boulder placement would enhance habitat elements for migrating and rearing fish. A literature review by Roni et al. (2014) reported that the vast majority of studies on wood placement have reported improvements in physical habitat (e.g., increased pool frequency, cover, and habitat diversity) with most evaluations of fish response showing a positive response from salmonids. The resulting effect of large wood on fish habitat is significant. Crispin et al. (1993) also noted increased salmon spawning activity in an area where gravels accumulated behind large wood. Bjornn and Reiser (1991) cited several studies that documented an increase in fish densities with higher levels of large wood, and Fausch and Northcote (1992) documented that coho salmon and cutthroat trout production was greater in large wood-dominated streams.

Restoring side channels would increase adult and juvenile rearing habitat where low flows and cooler water temperatures would provide refugia from mainstem temperatures. Streambank restoration projects would decrease direct sediment inputs into the stream channel, thereby enhancing conditions for rearing juvenile fish (USFS 2019).

3.7 Freshwater Mussels

Freshwater mussel populations have recently experienced well-documented declines across their historic range in North America. Many watersheds support a fraction of both the richness and abundance found just a few decades ago, and mussel populations in the western US are believed to have experienced a 35% decline in

⁶ <https://www.fisheries.noaa.gov/resource/data/multi-species-pile-driving-calculator-tool>

richness since 1990 (Blevins et al. 2017). Freshwater mussels are valuable to river systems and for the numerous ecosystem services they provide. They filter and store excess nutrients, stabilize river sediment, and increase food web complexity (Vaughn 2018).

The western pearlshell mussel (*Margaritifera falcata*) is one of the most abundant freshwater mussels in the western US. While downward western pearlshell population trends are evident in some river systems, little is known about their distribution within the Trinity River watershed (Felbeck and Hause 2020). Western pearlshell mussels prefer cold clean creeks and rivers that support salmonid populations, such as those of the Trinity River watershed. They are found in smaller headwater creeks but are more common in larger rivers. Sand, gravel, and cobble are their preferred substrates, especially in stable areas of streambeds. Western pearlshells are sensitive to sedimentation and any sort of anthropogenic disturbance (Nedea et al. 2009).

California floater (*Anodonta californiensis*) mussels occur in “lakes and slow rivers” (Taylor 1981), “generally on soft substrates (mud-sand), in fairly large streams and lakes only, in relatively slow current; a low elevation species” (Frest and Johannes 1995). Howard and Cuffey (2003) found that California floater mussels were almost exclusively found in pools, with no occurrences in riffles, and very few in runs in the South Fork of the Eel River (Howard 2010). Emily Davis (2008) and Aaron David (2008) discovered a small population of *Anodonta* mussels below the Iron Gate Dam on the Klamath River. Individuals are believed to reach sexual maturity in about 7 years and live from 10 to 20 years (USFS 2019).

3.7.1 Effects on Freshwater Mussels

Mussels are relatively immobile, and an individual mussel may have been present in a certain location for decades. Mussels are present year-round, and in-channel work windows for salmonids do not protect freshwater mussels (Blevins et al. 2017). Any freshwater mussel beds would be identified during the planning process for each site-specific restoration action that is part of the Project. To the extent practicable, construction-related effects would be minimized through implementation of erosion and sediment control BMPs and/or avoidance of physical disturbance to any freshwater mussel beds using a buffer of 5 meters from any construction activities or any scour as a result of construction activities (Blevins et al. 2019). If avoidance is not possible, freshwater mussel salvage and relocation BMPs described in “Conserving the Gems of Our Waters” (Blevins et al. 2017) would be considered during Project actions. Incorporating these avoidance and minimization measures into site-specific designs would entail minor effects to freshwater mussels within the Trinity River watershed. Benefits to freshwater mussels would entail an increase in aquatic habitat complexity that could provide more locations within floodplains where mussel beds could be established in the long term.

4 Regional Effects

Regional effects include the short- and long-term impacts of the Project together with the past, present, and future actions of other projects. This analysis looks at other actions that have affected or could affect the same resources as action alternatives, in this case, watershed resources. The effects of past actions are reflected in the descriptions of current existing conditions. Lands in the vicinity of the Project activity area include USFS-, BLM-, and privately-owned land.

4.1 Hatchery Influence

The TRH first began releasing coho salmon in 1960. Although substantial efforts were made to trap and haul coho above the dam during the construction of the Trinity Dam, adult returns fell to essentially zero during the 1962 to 1963 run (i.e., zero females, seven males, and nine jacks). Transfer of coho eggs from outside of the Trinity River basin occurred, which imported coho that were likely not as well-adapted to the Trinity River watershed's habitat conditions as were the original stock. TRH originally used Trinity River fish for broodstock, though coho from the Eel (1965), Cascade (1966, 1967, and 1969), Alsea (1970), and Noyo (1970) Rivers have also been reared and released at the hatchery as well as elsewhere in the Trinity River basin (NOAA 2003).

Hatchery influences are substantial in the Trinity River watershed. Each year, TRH releases approximately 300,000 coho smolts, 448,000 steelhead, and 4.3 million Chinook, and currently, returns are dominated by hatchery fish (USFWS and HVT 1999). The Recovery Plan (NMFS 2014) ranked adverse hatchery-related effects as a very high limiting factor for Trinity River SONCC coho.

The TRH likely has played a role in the long-term productivity of the Trinity River population of SONCC ESU coho salmon through the well-documented genetic and ecological interactions between hatchery- and natural-origin salmon (Nickelson 2003; Reisenbichler et al. 2003; Chilcote et al. 2011). Competition with, and predation by, hatchery-origin fish released from TRH may limit rearing and spawning capacity of natural-origin coho in the Trinity River. Competition of hatchery fish with naturally-produced fish has the potential to displace wild fish from portions of their habitat (Flagg et al. 2000; Chilcote et al. 2011). Competition may occur among hatchery and natural adults for spawning sites, and may lead to decreased production, especially for natural origin coho. Hatchery fish, outnumbering natural fish, may overwhelm available spawning habitat when first-generation hatchery-origin fish spawn naturally in the river. The negative effect of such competition is magnified by naturally-spawning hatchery stocks which have been found to exhibit lower reproductive success than natural-origin fish (Reisenbichler et al. 2003). This is especially true for anadromous salmonid stocks near carrying capacity, which may occur more often in river reaches near hatcheries (Lister 2014). Predation on wild coho fry by hatchery-reared salmonids is also an important factor (Naman 2008). In concert with other habitat-related stresses, adverse hatchery-related impacts are a key stressor for the population.

In recent years, hatcheries in California have stopped all inter-basin stock transfers, limited out-planting (e.g., all TRH coho smolts are released volitionally at the hatchery), marked outplants, and placed limits on production levels. Therefore, the current level of impact of hatchery fish on natural fish may be significantly less than in the past (CDFG 2002b). No hatcheries or artificial propagation occur in the Lower Klamath River coho population area, but there are two hatcheries in the Klamath River Basin that influence fisheries: TRH and the Fall Creek Hatchery (which replaced the Iron Gate Hatchery).

4.2 Cannabis Farming

In 2018, the State of California legalized the recreational use of cannabis, as well as the cultivation and manufacture of cannabis plants and products. In Trinity and Humboldt counties, there are many cannabis farms which collectively reduce flow volume and increase discharge of waste and pollutants in streams, which affects water quantity and quality in the Project activity area. Presently, there is no watershed-scale evaluation of the effects of cannabis farming on aquatic habitat in the Trinity River or particular streams. The operation of

cannabis farms throughout the watershed will continue to negatively affect fishery resources in the Trinity River and its tributaries (NMFS 2020).

4.3 Residential Development

Residential development as a result of human population growth in the Project activity area is expected to remain relatively stable over the next 10 years. Once development and associated infrastructure (e.g., roads/trails, drainages, powerlines, and water development) are established, the effects to the landscape are typically permanent. Anticipated effects on aquatic resources include loss of riparian vegetation, changes to channel morphology and dynamics, altered hydrologic regimes (e.g., increased storm runoff and increased water diversions for residential use), increased sediment loading, and elevated water temperatures where shade-providing canopy is removed (NMFS 2020).

The presence of structures, powerlines, and roads/trails near waterways may lead to the removal of large wood features in order to protect those structures from flood impacts. The anticipated impacts to fisheries from continued residential development are expected to be sustained and locally intense. Commonly, there are also effects of home pesticide use and roadway runoff of automobile pollutants, introductions of invasive species to nearby streams and ponds, attraction of piscivorous animals due to human occupation (e.g., raccoons), increased incidences of poaching, and loss of riparian habitat due to land clearing activities. All of these factors associated with residential development can have negative impacts on salmon populations. However, the population growth rate in Trinity County decreased by about 11% between 2010 and 2019 (U.S. Census Bureau 2020). This may indicate a trend that could ameliorate or reduce the effects of residential development (NMFS 2020).

4.4 Resource Extraction

Resource-based industries are likely to continue to have an influence on environmental conditions within the Project activity area for the indefinite future. Logging continues to be conducted on both public and private lands throughout the tributaries of the Trinity River, except in Canyon Creek (Reclamation 2019). STNF's vegetation management projects include those for forest health/thinning and fuels reduction. Some mining for gravel, aggregate, and minor precious metals occurs on the Trinity River floodplain and a few tributary watersheds. Mining operations can affect coarse sediment supplies and impair water quality via contaminated and sediment-laden runoff from operations. The lack of protective measures in existing regulatory mechanisms, including land management plans (e.g., State Forest Practice Rules), contributes in varying degrees to the decline of salmonids. Sedimentation and loss of spawning gravels associated with poor forestry practices and roadbuilding are particularly chronic problems that can reduce the productivity of fisheries. However, resource extraction industries have adopted management practices that reduce many of their most harmful impacts, which were unknown or not commonly used until recently (NMFS 2020). The STNF regularly implements forestry projects using resource protection measures and BMPs to reduce sedimentation into streams and otherwise reduce effects to environmental resources.

4.5 Wildland Fire Control

Control of wildland fires may include the removal or modification of vegetation due to the construction of firebreaks or setting of backfires to control the spread of fire. This removal of vegetation can trigger post-fire

landslides as well as create chronic sediment erosion that can negatively affect aquatic habitat important to fisheries and freshwater mussels. In addition, the use of fire retardants may adversely affect aquatic habitat if used in a manner that does not sufficiently protect streams, with the potential for aquatic organisms to be exposed to lethal amounts of the retardant (NMFS 2020).

4.6 Aquatic Habitat Restoration

Since 2009, the TRRP has implemented Trinity River mainstem channel rehabilitation projects at all the Phase 1 channel rehabilitation sites named in the 2000 Master EIR and at nine of the Phase 2 sites. The Deep Gulch and Sheridan sites were constructed in 2017. The Bucktail site, constructed in 2008, was expanded in 2016 to include additional areas. The Dutch Creek project was constructed in 2020. The Chapman Ranch Phase A site was constructed in 2019 and the Phase B site was completed in 2021. The Oregon Gulch project was completed in 2023. These mainstem projects have improved anadromous fish spawning and rearing habitat throughout the extent of the Trinity River.

TRRP continues to add sediment within the 40-mile reach downstream of the Lewiston Dam. In addition, TRRP-managed flows have been implemented yearly since 2004. Ongoing monitoring efforts by TRRP partners continue to document improvements in aquatic habitat use, alluvial processes, and riparian vegetative communities along the mainstem. Continued sediment and wood augmentation projects are intended to improve anadromous fish spawning and rearing habitat in the Trinity River mainstem.

Beyond TRRP's mainstem channel rehabilitation and sediment augmentation projects, there have been several restoration and road sediment reduction projects implemented by various agencies and organizations throughout the Trinity River watershed. While some of these were considered in the 2009 Master EIR, the USFS, Yurok Tribe, Hoopa Valley Tribe, Nor Rel Muk Wintu Nation, Five Counties Salmonid Conservation Program, Northwest Resource Conservation and Development Council, Watershed Research and Training Center, Trinity County Resource Conservation District, and other local nonprofits and governments have been funded for and/or completed additional projects intended to improve watershed conditions, restore aquatic habitat, improve aquatic connectivity, and reduce road-related sediment delivery to streams and rivers. These watershed restoration projects are intended to improve water quantity and quality as well as rearing and spawning habitat in the Trinity River watershed.

4.7 Proposed Action

The Project's Proposed Action is an extension of the watershed restoration projects mentioned above. The Project focuses on Trinity River tributaries as well as the mainstem. The objectives of the Proposed Action are as follows:

- Restore and improve instream conditions sufficient to support all life stages of salmonids and other aquatic species;
- Restore upstream and downstream fish passage for all life stages of salmonids;
- Restore continuous paths for wood dispersal, nutrient cycling, sediment transport, and movement of other vegetative material essential for productive aquatic habitat;

- Maintain or restore native plant communities and vegetative structure impacted by invasive plants and pathogens, while rehabilitating eroding streambanks to improve water quality, shade conditions, and large wood recruitment;
- Repair, replace, or remove ineffective instream structures;
- Restore and improve riparian and meadow habitat in order to promote healthy conditions for aquatic and terrestrial wildlife populations;
- Improve late summer/fall base flow conditions through process-based restoration, water conservation improvements, and meadow restoration;
- Increase nutrient inputs through salmon carcass placement in the watershed; and
- Stabilize upslope areas around road infrastructure to minimize erosion and sediment discharges within the watershed to bring the sediment impaired watersheds into compliance with sediment reduction total maximum daily loads (TMDLs) for the South Fork Trinity and Trinity Mainstem rivers (EPA 1998 & EPA 2001).

The Project is an effort to streamline design and planning processes, including environmental compliance, for proposed restoration actions across the watershed, thereby increasing the number of restoration actions that can be implemented over time. Ultimately, the Project is anticipated to provide many benefits to aquatic organisms, particularly fish species and populations.

5 Effects Determination

Table 5-1 below summarizes the effects determinations for fish and freshwater mussel species for the Project.

Table 5-1. Fisheries and Freshwater Mussels Effects Determinations

ESA SPECIES CONSIDERED:	Southern Oregon / Northern California Coast (SONCC) coho salmon ESU
ESA CRITICAL HABITAT CONSIDERED:	SONCC coho salmon critical habitat
ESA DETERMINATIONS:	May Affect, Likely to Adversely Affect SONCC coho salmon and its Designated Critical Habitat
SENSITIVE SPECIES CONSIDERED:	Upper Klamath-Trinity Rivers (UKTR) Chinook salmon ESU Klamath Mountains Province (KMP) steelhead DPS Green sturgeon, Northern DPS Pacific lamprey (proposed for ESA listing) Western pearlshell California floater
SENSITIVE SPECIES DETERMINATIONS:	Would not jeopardize the continued existence of the proposed Pacific lamprey. Not likely to result in a trend toward listing or loss of viability of UKTR Chinook salmon, KMP steelhead, green sturgeon, western pearlshell, or California floater in the short- or long-term.
ESSENTIAL FISH HABITAT:	The Project would adversely affect Chinook and coho salmon EFH.

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Appendix A: Trinity River Watershed Fisheries by HUC 10

