elevations in the Lahontan Basin and are the terminus or “sink” of rivers that flow east from the Sierra Nevada. Three large river systems—the Truckee, Carson, and Walker Rivers—flow eastward through this region from the Sierra Nevada, providing water for agriculture and urban development. The Truckee and Walker Rivers and their tributaries also provide habitat for the threatened Lahontan Cutthroat Trout.

The Central Basin ecoregion includes at least nine known special-status fish species (Appendix E). Among the special-status fish species are Lahontan Cutthroat Trout (*Oncorhynchus clarkii henshawi*), Owens Pupfish (*Cyprinodon radiosus*), and Owens Tui Chub (*Siphateles bicolor snyderi*).

Mojave Basin and Range

Stretching across southeastern California, southern Nevada, southwestern Utah, and northwestern Arizona, this ecoregion is composed of broad basins and scattered mountains that generally are lower, warmer, and drier than those of the Central Basin and Range ecoregion.

The Mohave Basin and Range ecoregion includes at least 12 known special-status fish species (Appendix E). Among the special-status fish species are Arroyo Chub (*Gila orcuttii)*, Mohave Tui Chub (*Siphateles bicolor mohavensis*), and Owens Pupfish (*Cyprinodon radiosus*).

Klamath Mountains/California High North Coast Range

This ecoregion encompasses the highly dissected ridges, foothills, and valleys of the Klamath and Siskiyou Mountains. It extends south into California to include the mixed conifer and montane hardwood forests that occur on mostly mesic soils in the North Coast Ranges. The mild Mediterranean climate of the ecoregion is characterized by hot dry summers and wet winters; the amount of winter moisture in the ecoregion varies, decreasing from west to east. The ecoregion drains to the Klamath, Trinity, Sacramento, Scott, and Shasta Rivers. In much of the ecoregion, all but the larger streams are dry by the end of summer. Natural lakes are absent, but there are a few reservoirs.

The Klamath Mountains/California High North Coast Range ecoregion includes at least 12 known special-status fish species (Appendix E). Among the special-status fish species are Bull Trout (*Salvelinus confluentus*), Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*), and Summer-Run Steelhead Trout (*O. mykiss irideus*).

Northern Basin and Range

The Northern Basin and Range ecoregion is characterized by basin-and-range topography. The ecoregion contains several wide basins bordered by scattered low mountains. Despite regional aridity, natural springs and spring-fed wetlands are scattered around the landscape, sustaining much of the region’s wildlife. The western part of the ecoregion is internally drained; its eastern stream network drains to the Snake River system.

The Northern Basin and Range ecoregion includes one known special-status fish species (Appendix E). The special-status fish species is the Cow Head Tui Chub (*Siphateles bicolor vaccaceps*).

Sonoran Basin and Range

Similar in topography to the Mojave Basin and Range ecoregion to the north, this ecoregion contains scattered low mountains and has large tracts of federally owned land, a large portion of which is used for military training. This ecoregion includes one of the driest and hottest areas of the United States, with annual precipitation of only about 3 inches. The terrain is dissected by dry washes that can flash flood during the infrequent rainfall events.

The Sonoran Basin and Range ecoregion includes at least six known special-status fish species (Appendix E). Among the special-status fish species are Desert Pupfish (*Cyprinodon macularius*), Mohave Tui Chub (*Siphateles bicolor mohavensis*), and Unarmored Threespine Stickleback (*Gasterosteus aculeatus williamsoni*).

Southern California/Northern Baja Coast

This ecoregion includes coastal and alluvial plains, marine terraces, and some low hills in coastal Southern California, and extends more than 200 miles south into Baja California. The Santa Clara River drains a portion of the ecoregion and is perennial. Much of the hydrology of the ecoregion has been greatly modified and channelized. Runoff is rapid except from undissected terraces with vernal pools.

Bays and estuaries in this ecoregion are nestled within an arid region generally fed by smaller, seasonal rivers and streams. As a result, most of these systems are small and more marine in character, dominated by estuarine residents and marine aquatic migrant specie. Bays and estuaries in the region vary greatly in size from numerous small, canyon-mouth estuaries such as Malibu Lagoon to large species such as Anaheim Bay, Newport Bay, and San Diego Bay.

The Southern California/Northern Baja Coast ecoregion includes at least seven known special-status fish species (Appendix E). Among the special-status fish species are Santa Ana Sucker (*Catostomus santaanae*), Mohave Tui Chub (*Siphateles bicolor mohavensis*), and Southern California Steelhead DPS (*Oncorhynchus mykiss irideus*).

3.6.3 Regulatory Setting

This section discusses federal, state, and regional and local plans, policies, regulations, laws, and ordinances pertaining to hydrology and water quality.

Future permitted restoration projects that would be implemented under the Order may be subject to the laws and regulations listed below, as well as other local or individual restoration projects requirements, depending on the project location.

Federal

Endangered Species Act

FESA Provisions

The FESA applies to proposed federal, state, and local projects that may result in the “take” of a fish or wildlife species that is federally listed as threatened or endangered. The law also applies to actions that are proposed to be authorized, funded, or undertaken by a federal agency and that may jeopardize the continued existence of a

federally listed fish, wildlife, or plant species or may adversely modify or destroy designated critical habitat for such species.

Section 9 of the FESA protects listed wildlife species from take, defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct” (U.S. Code Title 16, Section 1532[19] [16 USC 1532(19)]). Federal regulations define “harm” as “an act which actually kills or injures wildlife.” This definition includes significant habitat modification or degradation that results—or is reasonably expected to result—in death or injury to wildlife by substantially impairing essential behavioral patterns, including breeding, feeding, sheltering, spawning, rearing, and migrating (Code of Federal Regulations Title 50, Sections 17.3 and 222.102). “Harass” is defined similarly broadly.

If a project could result in take of a federally listed species, either a habitat conservation plan and incidental take permit under FESA Section 10(a) or a federal interagency consultation under FESA Section 7 is required. Under the FESA, USFWS has jurisdiction over all terrestrial and plant species, as well as freshwater fish species and a few marine mammals (such as the California sea otter). NMFS has jurisdiction over anadromous fish species.

NMFS Programmatic Biological Opinions for Restoration

As described in Chapter 2, NMFS has developed programmatic Biological Opinions for restoration projects for the North Coast (NMFS 2012), Central Coast (NMFS 2016), South Coast (NMFS 2015), and Central Valley (NMFS 2018) regions of California (collectively referred to as the NMFS Restoration PBOs).[1] These PBOs provide FESA coverage for several categories of restoration project types, which are similar to those described in this Order. In order for the projects to be eligible for coverage under the PBOs, they must meet the definition of "restoration project," which is defined as one that will result in a net increase in aquatic or riparian resource functions and services. Projects permitted by the PBOs may include multiple benefits, such as flood management, groundwater recharge, recreation, or climate change adaptation, all permitted projects must meet the criteria of a restoration project defined by the PBO and must remain consistent with NMFS’ Recovery Plans. Avoidance and minimization measures are also described in the PBOs and must be included in the proposed projects, as applicable. The avoidance and minimization measures included in the PBOs are similar to the general protection measures developed as part of the Order (Appendix E) and species protection measures included as part of the proposed project for purposes of this PEIR (Chapter 2 and Appendix F) to avoid and/or minimize potential impacts to special-status wildlife, fish and plant species.

Clean Water Act

Under the Federal Water Pollution Control Act Amendments of 1972, better known as the Clean Water Act (CWA), the U.S. Environmental Protection Agency (EPA) regulates discharges of pollutants into the waters of the United States, establishes water quality standards, conducts planning studies, and provides funding for grant projects.

[1] Note: NMFS PBOs have 10-year permit terms and will be periodically updated.

The CWA has been amended by Congress several times since 1972. EPA has provided most states with the authority to administer many of the provisions of the CWA. In California, the State Water Board has been designated by EPA to develop and enforce water quality objectives and implementation plans. The State Water Board has delegated the specific responsibilities for development and enforcement actions to the Regional Boards.

Coastal Zone Management Act

The Coastal Zone Management Act is summarized in Section 3.11, *Hydrology and Water Quality*. California's coastal zone management program was approved by the Secretary of Commerce in 1978.

Central Valley Project Improvement Act

The Central Valley Project Improvement Act (CVPIA), enacted by Congress in 1992, amended the CVP's authorization to include fish and wildlife protection, restoration, and mitigation as project purposes of the CVP having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation. The CVPIA requires the Secretary of the Interior, through the U.S. Bureau of Reclamation and USFWS, "to operate the CVP consistent with the purposes of the act, to meet the federal trust responsibilities to protect the fishery resources of affected federally recognized Indian tribes, and to achieve a reasonable balance among competing demands for the use of CVP water."

The CVPIA mandated the following changes to the CVP:

- Dedicating 800,000 acre-feet annually to fish, wildlife, and habitat restoration (Section 3406[b][2])
- Authorizing water transfers outside the CVP service area (Section 3405)
- Implementing an anadromous fish restoration program (Section 3406[b][1])
- Creating a restoration fund financed by water and power users (Section 3407)
- Providing for the Shasta Temperature Control Device (Section 3406[b][6])
- Implementing fish passage measures at Red Bluff Diversion Dam (Section 3406[b][10])
- Calling for planning to increase the CVP yield (Section 3406[j])
- Mandating firm water supplies for Central Valley wildlife refuges and wildlife habitat areas (Section 3406[d])
- Improving the Tracy Fish Collection Facility (Section 3406[b][4])
- Meeting the federal trust responsibility to protect fishery resources in the Trinity River (Section 3406[b][23])

The CVPIA is being implemented as authorized; CVP operations reflect the provisions of the CVPIA.

The CVPIA included several provisions governing the use of environmental water accounts. Among these were Section 3406(b)(2), which dedicated 800,000 acre-feet to fish, wildlife, and habitat restoration. On May 9, 2003, the U.S. Department of the Interior issued its Decision on Implementation of Section 3406(b)(2) of CVPIA.

Trinity River Mainstem Fishery Restoration

In 1994, USFWS and Trinity County, as lead agencies under the National Environmental Policy Act (NEPA) and CEQA, respectively, began the public process for developing the Trinity River Mainstem Fishery Restoration Environmental Impact Statement/ Environmental Impact Report. In December 2000, the Department of the Interior signed the record of decision for a variable annual flow regime, mechanical channel rehabilitation, sediment management, watershed restoration, and adaptive management. Based on the record of decision, 368,600–815,000 acre-feet per year are allocated for Trinity River flows. This amount is scheduled in coordination with USFWS to best meet habitat, temperature, and sediment transport objectives for the Trinity Basin.

Bay-Delta Accord of 1994

This topic is discussed in Section 3.11, *Hydrology and Water Quality*.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act (Public Law 104-297), requires federal agencies to consult with NMFS on any activity or proposed activity authorized, funded, or undertaken by that agency that may adversely affect essential fish habitat for commercially managed marine and anadromous fish species. “Essential fish habitat” includes specifically identified waters and substrate necessary for fish spawning, breeding, feeding, or growing to maturity. Essential fish habitat also includes all habitats necessary to allow the production of commercially valuable aquatic species, support a long-term sustainable fishery, and contribute to a healthy ecosystem (16 USC 1802[10]).

To protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries such as Pacific salmon, the Pacific Fishery Management Council has designated the Delta, San Francisco Bay, and Suisun Bay as essential fish habitat. Because essential fish habitat applies only to commercial fisheries, habitat for Chinook salmon is included in the designation, but habitat for steelhead is not included.

The Pacific Fishery Management Council has issued three fishery management plans (for Pacific salmon, coastal pelagic species, and groundfish species) that cover the following species occurring in the study area:

- *Starry flounder*: Identified as a “Monitored” species by the Pacific Coast Groundfish Fishery Management Plan (PFMC 2011)
- *Northern anchovy*: Identified as a “Monitored” species by the Pacific Coast Groundfish Fishery Management Plan (PFMC 1998, 2008)
- *Pacific sardine*: Identified as an “Actively Managed” species by the Coastal Pelagic Species Fishery Management Plan (PFMC 1998)

measures would depend on the individual restoration activities, project location, and the potentially significant impacts of the individual restoration project. Implementation of the mitigation measures would be the responsibility of the project proponent(s) under the jurisdiction of the State Water Board, appropriate Regional Board, or other authorizing regulatory agency.

Impact 3.6-1: Implementing future restoration projects permitted under the Order could adversely affect special-status fish species directly, or indirectly through habitat modifications.

Effects of Project Construction Activities

Physical Disturbance

In-water aquatic habitat may be physically disturbed during construction of restoration projects permitted under the Order, from activities such as dewatering, excavation, fill, and placement of materials. This disturbance could affect the juvenile and adult life stages of special-status fish species by causing direct injury or mortality, or by displacing fish or disrupting their normal behaviors. The size and extent of in-water construction activities would vary by the restoration objective. However, most of these activities would be discrete, affecting only localized areas.

Juvenile and adult fishes may be able to detect areas of construction disturbance (e.g., changes in sound, pressure, sheer) and move to adjacent areas of suitable habitat, if present and available, as equipment enters the water. The river bottom would only be temporarily disturbed and subject to associated turbidity at a given time by placement or removal of structures (e.g., culverts, bridges, fish screens, ladders, pilings); removal of small dams, tide gates, flood gates, or legacy structures; placement of bioengineered stabilization materials; breaching of tidal habitat; or installation of cofferdams during construction. Therefore, juveniles would be able to move elsewhere in the channel (or upstream or downstream) to avoid direct disturbance and potential injury or death. Juvenile and adult fishes would likely move to adjacent areas of suitable habitat areas before equipment enters the water. In addition, habitat isolation and fish relocation activities would safely remove fish from the area (*Dewatering and Fish Relocation Activities* discussed below) before the start of other water-disturbing activities. Therefore, construction-related impacts on juvenile and adult fishes are unlikely.

Smaller projects, such as placement or removal of structures and bank stabilization projects, would likely affect only a portion of a stream’s or river’s width. By contrast, larger restoration efforts with extensive in-water work (e.g., enhancement of spawning gravels, extensive instream habitat enhancement) may have much larger construction footprints, making them more difficult for special-status fish species to avoid. Instream construction work for larger projects—particularly those involving operation of heavy equipment and removal and placement of materials—would likely cause temporary stress on juvenile and adult special-status fish species, disturbing them and requiring them to avoid and/or relocate from the disturbance area.

Even during construction of projects with a larger footprint, fish that use the locations of proposed habitat modifications should generally be able to avoid these areas, moving away from them temporarily during construction activities. Fish would be more likely to

relocate during lengthier disturbances, such as the repeated addition of gravel to an area or excavation/disturbance of a large area to modify fish habitat. Juvenile fish may experience increased predation risks while they search for new holding/rearing areas.

In-water construction activities would not likely occur as part of multiple other types of project types, such as floodplain and off-channel restoration. Construction work would typically occur during the dry season, when seasonally inundated areas are dry, thus avoiding or minimizing potential in-water impacts for these project types.

Juvenile fishes are expected to avoid areas where equipment would place or excavate material or remove or install in-water structures. Still, some juveniles may attempt to find shelter in the substrate and could be injured or killed by equipment. Instream and off-channel enhancement may require applying gravel directly to the riverbed, grading the material, placing river crossings at some sites, and using heavy equipment in the river. These activities would increase the likely exposure of, and chance of adverse impacts on, listed juveniles in the area.

Juvenile special-status fishes of all species practice avoidance behavior, the areas affected by construction would be small at most sites, and the number of juveniles present in construction areas would be limited given the lack of suitable habitat. Therefore, the number of juveniles that would be injured or killed as a result of physical disturbance is expected to be low.

To reduce the impacts of project construction activities during in-water work, the Order includes the following general protection measures (Appendix E):

- GPM-2: Construction Work Windows
- IWW-2: In-Water Vehicle Selection and Work Access
- IWW-3: In-Water Placement of Materials, Structures, and Operation of Equipment
- IWW-4: In-Water Staging Areas and Use of Barges

Additionally, projects with in-water work would be conducted consistent with the following species protection measures (Appendix F).

- SPM-3: Species Protection Construction Work Windows
- FISH-1: Habitat Disturbance Avoidance and Minimization.
- FISH-2: Habitat Assessment and Surveys
- FISH-3: Fish Capture and Relocation
- FISH-4: Reporting

Based on the analysis presented above for all special-status fish species and consistent with analyses presented in the NMFS Restoration PBOs for anadromous fish species, by implementing these general protection measures and species protection measures during in-water work, restoration projects would avoid or minimize potential impacts of physical disturbance on special-status fish species.

Release and Exposure of Sediments and Turbidity

All types of restoration projects requiring ground disturbance in or adjacent to streams or wetlands could increase turbidity and levels of suspended sediment within the project

worksites and downstream. The resuspension and deposition of instream sediments would be an indirect impact of operating construction equipment and excavating and placing materials in the river. Short-term increases in turbidity and suspended sediment levels during construction may negatively affect fish populations and other aquatic organisms temporarily by reducing the availability of food, reducing feeding efficiency, and increasing the exposure of fishes to sediment released into the water column.

Short-term increases in turbidity could occur during either dewatering or construction, or both. Research with salmonids has shown that high turbidity concentrations can reduce feeding efficiency and food availability, deplete dissolved oxygen in the water column, diminish respiratory function and disease tolerance, and cause fish mortality (Berg and Northcote 1985; Gregory and Northcote 1993; Velagic 1995; Waters 1995). Even small pulses of turbid water could cause multiple species of fish to disperse from established territories (Waters 1995), which could displace fish into less suitable habitat or increase competition and predation, thus reducing their chances of survival.

However, much of this research focused on turbidity levels much higher than those that would likely result from restoration activities permitted under the Order, especially with implementation of the general protection measures. In addition, when small volumes of sediment are added to stream channels infrequently, the streams may not experience dramatic morphological changes (Rogers 2000).

Elevated sediment and turbidity concentrations from the proposed restoration projects would not likely be severe enough to cause the injury or death of listed juvenile fishes. Rather, the anticipated minor levels of turbidity and suspended sediment generated by instream restoration projects permitted under the Order would likely affect fish behavior only temporarily.

Sediment generated by each individual project would likely affect only the immediate footprint of the project site and habitat immediately downstream. For example, studies of sediment impacts from culvert construction determined that the levels of sediment that had accumulated in the streambeds returned to control levels 358–1,442 meters downstream of the culverts (LaChance et al. 2008). Many construction activities for the projects permitted under the Order would be expected to have similar sediment impacts.

Construction-induced turbidity plumes would extend downstream of the in-water activity, affecting the behavior of fish in the area of impact. In-stream activities will have large variation in turbidity concentration and plume size. In-stream construction that may generate the greatest turbidity plumes, such as dredging activities needed for creation of floodplain habitat or wetlands, could create temporary plumes of total suspended sediment that extend up to 1,500 m at concentrations up to 1,100 mg/L (Wilber and Clarke 2001). However, most restoration projects would create much smaller turbidity plumes at lower turbidity concentrations.

Larger restoration efforts that may involve extensive in-water work (e.g., enhancement of spawning gravels, bank stabilization, or wetland restoration) may result in greater turbidity or sedimentation impacts. However, several in-water general protection measures described below, such as cofferdam construction and sediment containment activities, would minimize these potential impacts during construction.

To reduce the impacts of project construction activities during in-water work to minimize the mobilization of sediment, the Order includes the following general protection measures (Appendix E):

- IWW-1: Appropriate In-Water Materials
- IWW-3: In-Water Placement of Materials, Structures, and Operation of Equipment
- IWW-5: Cofferdam Construction
- IWW-11: Sediment Containment during In-Water Pile Driving
- IWW-13: Dredging Operations and Dredging Materials Reuse Plan

Additionally, projects with in-water work would be conducted consistent with the following species protection measures (Appendix F).

- SPM-3: Species Protection Construction Work Windows
- FISH-1: Habitat Disturbance Avoidance and Minimization
- FISH-2: Habitat Assessment and Surveys
- FISH-3: Fish Capture and Relocation
- FISH-4: Reporting

With these general protection measures and species protection measures, downstream sediment impacts of the proposed restoration projects should extend downstream for a distance consistent with the range identified by LaChance et al. (2008) as described above for all special-status fish species and consistent with analyses presented in the NMFS Restoration PBOs for anadromous fish species. In addition, the limited temporal and spatial scale at which many project activities would occur would likely preclude significant sediment-related impacts.

Noise, Motion, and Vibration Disturbance

Several types of restoration projects permitted under the Order could generate noise, motion, and vibration from the use of heavy equipment, including pile driving and/or through the use of explosives for small dam removal.

Hydrostatic pressure waves and vibration generated by pile driving can adversely affect all life stages of fish and other aquatic organisms. Hydrostatic pressure waves may rupture the swim bladders and other internal organs of all life stages of fish and could permanently injure their inner ears and lateral line organs (Hastings and Popper 2005). These injuries could reduce the ability of fish (including special-status fish species) to orient in the water column, capture prey, and reduce the ability of fish to avoid predators (California Department of Transportation (Caltrans) 2009).

Heavy equipment would be expected to operate primarily outside the active channel (or in isolated and dewatered areas) and would be present in the wetted channel only infrequently and for short periods. Thus, noise, motion, and vibration disturbance from the use of this equipment would be infrequent and occur over short durations.

For projects where pile driving is required, there could be periods of time when the underwater sound levels exceed injury and harm thresholds established by NMFS. To avoid direct physical injury, pile driving should be conducted using vibratory or non-impact techniques and during periods when special-status species (or their most

sensitive life stages) are least likely to be present, and be managed (through operational controls) to be lower than a single-strike sound levels of less than 206 decibels (dB) peak (dB^{peak}) and 183 dB (fish less than 2 grams) and 187 dB (fish greater than or equal to 2 grams) sound exposure level (dB^{SEL}) measured at a distance of 10 meters (Fisheries Hydroacoustic Working Group 2008).

To reduce the impacts of project construction activities during in-water pile driving, the Order includes the following general protection measures (Appendix E):

- IWW-9: In-Water Pile Driving Plan for Sound Exposure
- IWW-10: In-Water Pile Driving Methods
- IWW-11: Sediment Containment during In-Water Pile Driving
- IWW-12: Pile-Driving Monitoring

Additionally, projects with in-water work would be conducted consistent with the following species protection measures (Appendix F).

- SPM-3: Species Protection Construction Work Windows
- FISH-1: Habitat Disturbance Avoidance and Minimization
- FISH-2: Habitat Assessment and Surveys
- FISH-3: Fish Capture and Relocation
- FISH-4: Reporting

Consistent with the analyses presented in the NMFS Restoration PBOs, implementing these general protection measures and species protection measures would ensure that restoration projects permitted under the Order would avoid or minimize noise, motion, and vibration impacts on aquatic biological resources. Underwater noise levels would be reduced to below thresholds for injury and the potential for sediment releases would be minimized. Most special-status fish species would be able to avoid interacting with instream machinery by temporarily relocating either upstream or downstream into suitable habitat adjacent to the worksite.

As described in Chapter 2, the use of explosives for removal of a small dam must be justified by site-specific conditions including equipment access difficulties. The use of explosives must occur in dry or dewatered conditions and potential harm to special-status species from the explosives blast and pressure waves must be analyzed. Using explosives is an eligible activity; however, this approach would also require additional review and approval by appropriate regulatory agencies.

Disturbance of Riparian Vegetation

Riparian forest and scrub is an important component of the land/water interface between aquatic and terrestrial ecosystems, contributing to the quality of aquatic habitat for native fish species by providing shade, instream cover, and food to fishes. Potential construction activities (e.g., removing or adding structures, modifying the morphology and topography of streams and banks) may alter bank and riparian habitat through removal of native and nonnative vegetation, excavation, and grading. Numerous other project types, such as restoring off-channel, floodplain, wetland, or riparian habitat, would create additional riparian vegetation that would enhance fish habitat.

To avoid and/or minimize potential impacts on riparian vegetation during project construction activities, the Order includes the following general protection measures (Appendix E):

- VHDR-1: Avoidance of Vegetation Disturbance
- VHDR-2: Native and Invasive Vegetation Removal Materials and Methods
- VHDR-3: Revegetation Materials and Methods
- VHDR-4: Revegetation Erosion Control Materials and Methods
- VHDR-5: Revegetation Monitoring and Reporting
- VHDR-6: Herbicide Use
- VHDR-7: Herbicide Application Planning
- VHDR-8: Herbicide Application Reporting

The general protecting measures identified above, would ensure, to the extent feasible, that disturbed riparian areas would be revegetated with native plant species and mulched with certified weed-free hay. Revegetation and mulching would be timed to maximize survival but would occur within a year after completion of construction work. Restoration projects would result in both the indirect and direct loss of riparian vegetation. An indirect impact would result from creating and maintaining temporary access points to the river and covering vegetation with gravel; the temporary removal of vegetation to enhance floodplains and side channels would result in a direct impact.

Most restoration projects are expected to avoid and/or minimize disturbing riparian vegetation by implementing the proposed general protection measures. In general, the goal of these projects would be to improve habitat conditions for fishes; thus, the projects would be expected to avoid riparian vegetation as practicable. However, there may be limited situations in which avoidance is not possible to meet the restoration objectives. Any loss of streamside riparian vegetation is expected to be small and temporary, given the general protection measures. Removal would be mostly limited to shrubs and smaller trees.

Using herbicides to remove invasive plant species could cause short-term impacts on special-status fish species. These potential indirect impacts include the short-term loss of shading and habitat provided by the invasive plants. To minimize these potential impacts, restoration projects would implement general protection measures that require the use of best practices (e.g., spraying practices) and herbicides and/or surfactants containing labels approving their use within or adjacent to waterways.

Based on the analysis presented above for all special-status fish species, which is consistent with analyses presented in the NMFS Restoration PBOs for anadromous fish species, by implementing the general protection measures above, impacts to riparian vegetation would be avoided and/or minimized.

Release and Exposure of Construction-Related Contaminants

Heavy equipment and construction materials would be required for the construction of several types of restoration projects. Equipment refueling, fluid leakage, and maintenance activities in and near stream channels pose some risk of contamination by toxic chemicals and potential take.

In addition, water that comes into contact with wet cement and other construction materials during project construction could adversely affect water quality and may harm special-status fish species. If not properly contained, contaminants (e.g., fuels, lubricants, hydraulic fluids, construction materials) could be introduced into the water system, either directly or through surface runoff. Contaminants may be toxic to fish or cause altered oxygen diffusion rates and acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival.

To reduce the impacts of project construction activities, the Order includes the following general protection measures (Appendix E):

- WQHM-1: Staging Areas and Stockpiling of Materials and Equipment
- WQHM-2: Storm Water Pollution Prevention Plan
- WQHM-3: Erosion Control Plans
- WQHM-4: Hazardous Materials Management and Spill Response Plan
- WQHM-5: In-Water Concrete Use
- WQHM-6: Accidental Discharge of Hazardous Materials

Consistent with analyses presented in the NMFS Restoration PBOs, these general protection measures would address and minimize the risk of release of pollutants into receiving waters during project construction. Implementing these measures would minimize potential degradation of aquatic habitat and the resulting harm to all special-status fish species. Therefore, the potential impacts of projects permitted under the Order related to the release and exposure of construction-related contaminants would be minimal.

Dewatering and Fish Relocation Activities

Dewatering entails placing a temporary barrier, such as a cofferdam, to isolate the work area; rerouting streamflow around the dewatered area; pumping water out of the isolated work area; relocating fish from the work area; and restoring the project site upon project completion. The life stage of fishes most likely to be exposed to the potential impacts of dewatering would be juveniles. However, the number of juvenile fish present at a given project site may be low. Migrating adult fish may be present, but in most cases, their mobility would enable them to avoid construction areas.

Any fish present during installation of a cofferdam could be injured by the in-water construction activity itself or could become trapped behind the cofferdam. Fish trapped behind a cofferdam would experience degraded water quality (e.g., higher temperatures, less dissolved oxygen). They would also become entrained in or impinged on the pumps used for dewatering or would become stranded after dewatering is complete.

Consistent with analyses presented in the NMFS Restoration PBOs, restoration projects permitted under the Order would minimize the potential impacts of dewatering and relocating fish by implementing the following general protection measures (Appendix E)

and species protection measures (Appendix F), which require best practices for dewatering and fish relocation:

General protection measures:

- IWW-5: Cofferdam Construction
- IWW-6: Dewatering/Diversion Restrictions
- IWW-7: Fish and Aquatic Species Exclusion while Installing Diversion Structures
- IWW-8: Removal of Diversion and Barriers to Flow

Species protection measures:

- SPM-3: Species Protection Construction Work Windows
- FISH-1: Habitat Disturbance Avoidance and Minimization.
- FISH-2: Habitat Assessment and Surveys
- FISH-3: Fish Capture and Relocation
- FISH-4: Reporting

Populations of benthic (i.e., bottom-dwelling) aquatic macroinvertebrates may be temporarily lost or their abundance reduced when creek habitat is dewatered (Cushman 1985). However, the impacts of streamflow diversions and dewatering on aquatic macroinvertebrates would be temporary. Construction would be relatively short-lived, and macroinvertebrates would be expected to recolonize disturbed areas rapidly after re-watering (in about 1–2 months) (Cushman 1985; Thomas 1985; Harvey 1986). In addition, the project-related loss of macroinvertebrates would likely have only a negligible effect on listed fishes; streamflows would be maintained around project worksites, so food from upstream sources (via drift) would be available downstream of the dewatered areas.

Streamflow diversions and dewatering of project work areas are expected to cause the temporary loss, alteration, and reduction of aquatic habitat for juvenile fishes. These sites would be restored before project completion with implementation of general protection measure IWW-8 (Removal of Diversion and Barriers to Flow) and would ultimately be enhanced by the restoration projects. Project-related flow fluctuations outside of dewatered areas should be small, gradual, and short-term, and are not expected to harm special-status fish species.

Impact Conclusion

Special-status fish species may be present in the study area, and the construction of restoration projects permitted under the Order has the potential to disturb habitat for these species. Therefore, this impact would be **potentially significant**.

However, to be eligible for the Order, restoration projects would be required to include all applicable general protection measures (Appendix E).

As described above, implementing the following general protection measures would avoid and/or minimize construction impacts on special-status fish species:

- GPM-2: Construction Work Windows
- GPM-3: Construction Hours

- GPM-4: Environmental Awareness Training
- GPM-5: Environmental Monitoring

In addition, as identified in the preceding impact discussions, general protection measures and species protection measures would be implemented to minimize the following specific impacts on listed fishes:

- *Physical disturbance:* IWW-2 through IWW-4, SPM-1, FISH-1 through FISH-5
- *Mobilization of sediment:* IWW-1, IWW-3, IWW-5, IWW-11, and IW-13, SPM-1, FISH-1 through FISH-5
- *Noise, motion, and vibration disturbance:* IWW-9 through IWW-12, SPM-1, FISH-1 through FISH-5
- *Disturbance of riparian vegetation:* VHDR-1 through VHDR-13
- *Chemical contamination from equipment fluids:* WQHM-1 through WQHM-6
- *Dewatering and fish relocation:* IWW-5 through IWW-8, SPM-1, FISH-1 through FISH-5

Implementing restoration projects permitted under the Order could result in construction-related disturbance and associated impacts on special-status fish species. However, the general protection measures and species protection measures identified above would avoid and/or reduce potential impacts to a **less-than-significant** level.

The only exception would be for the use of explosives for small dam removal. As described in Chapter 2 and above, in order to be considered a project eligible for the Order, the use of explosives for small dam removal would have to be justified due to site-specific conditions, including equipment access difficulties. Further, the use of explosives must be conducted in dry or dewatered conditions and potential harm to fish from the explosives blast and pressure waves would need to be analyzed. Incorporation of general protection measures and species protection measures identified above would avoid and/or reduce in most cases, however, because the exact details of blasting is yet to be determined for a given project, analysis this type of activity is not possible at this time. As a result, the use of explosives for small dam removal would be a **significant and unavoidable impact**.

Effects of Constructed Facilities (Natural or Artificial Infrastructure) and Operations and Maintenance of those Facilities

Most long-term impacts on aquatic biological resources of implementing the restoration projects permitted under the Order should be beneficial, because the specific purpose of these projects would be to restore or enhance existing conditions. Overall, completing the activities permitted under the Order would be expected to increase the quality and quantity of habitat for special-status fish species:

- Constructing fish passage facilities and/or removing legacy structures would enhance migratory habitat for adult and juvenile fishes.
- Completing bioengineered bank stabilization projects and revegetating with native plants would enhance riparian habitat important for juvenile rearing and food production.

- Enhancing or creating floodplain, wetland, off-channel, instream, and riparian habitat would increase the complexity of habitat on project sites and serve to enhance the habitat available for a range of life stages of special-status fish species.

However, some restoration projects could result in adverse long-term impacts on aquatic biological resources. The beneficial impacts of the restoration projects are described in detail below, followed by a discussion of the potential adverse impacts.

Beneficial Impacts of Restoration Projects

For all types of restoration projects permitted under the Order, the resulting restored and/or enhanced habitat is expected to have beneficial impacts on aquatic resources. The following sections describe the anticipated benefits for each project type.

Stream Crossing and Fish Passage Improvements

Modifying instream barriers for fish passage improvement projects would improve fish passage and increase access to suitable habitat. These projects would result in long-term beneficial impacts by improving passage at sites that are partial barriers or providing passage at sites that are total barriers. In both instances, the project work would improve fish passage and increase access to available habitat.

Reestablishing linkages between migratory habitat in mainstem waters and spawning/rearing habitat in headwaters, including tributaries, would greatly facilitate the recovery of fishes in many regions throughout the study area. Reintroducing special-status fish species into previously unavailable upstream habitat would also likely increase the species' reproductive success, ultimately helping to increase fish population sizes in watersheds where the amount of quality freshwater habitat may be a limiting factor.

Removal of Small Dams, Tide Gates, Flood Gates, and Legacy Structures

Similar to stream crossing and fish passage improvement projects, projects to remove legacy structures would improve fish passage and increase their access to suitable habitat. These projects would result in long-term beneficial impacts by improving movement at sites that are partial barriers or providing passage at sites that are total barriers. Removing man-made structures may also reduce the habitat available for predators, potentially lessening the predation risk for listed fish species.

Bioengineered Bank Stabilization

Bioengineered streambank stabilization projects would reduce ongoing sedimentation from bank erosion, lessen turbidity levels, and improve long-term water quality for fishes. Reducing the amount of sediment delivered to streams would improve fish habitat and survival by increasing the survival of fish embryos and alevins in spawning gravels/beds, reducing injury to juveniles from high concentrations of suspended sediment, and minimizing the loss of quality and quantity of pools from excessive sediment deposition.

Restoration and Enhancement of Off-Channel/Side-Channel Habitat

Instream habitat structure and improvement projects would enable fish to escape from predators. These projects would provide resting cover, increase spawning habitat,

improve upstream and downstream migration corridors, improve pool-to-riffle ratios, and add habitat complexity and diversity. Some structures would be designed to reduce sedimentation, protect unstable banks, stabilize existing slides, provide shade, and create scour pools. Instream habitat structures such as woody material and boulders contribute to habitat diversity and create and maintain foraging, cover, and resting habitat for both adult and juvenile anadromous and resident special-status fish species. Placing instream woody material on the banks of the active channel would create instantly available habitat by creating diverse cover for juvenile rearing.

Restoration activities would improve the quality of spawning habitat over the long term. Spawning habitat would be improved because various types of erosion control would reduce the amount of sediment that would enter the stream in the long term. In addition, augmenting gravels would increase the amount of spawning habitat available.

Water Conservation Projects

Water conservation projects such as offstream storage tanks and ponds, including projects with necessary off-channel infrastructure to reduce low-flow stream diversions, would provide benefits to fish that experience habitat limitations during low-flow periods.

Floodplain Restoration

Projects to restore floodplains would enhance the availability of food and habitat for many species of rearing juvenile fishes. The water that resides in and flows from Central Valley floodplains is rich in plankton, coarse organic matter, and other sources of food for riverine and estuarine fishes and insects. Therefore, floodplains improve the productivity of rivers, promoting healthy and abundant fish populations.

Removal of Pilings and Other In-Water Structures

Like removal of legacy structures, removal of artificial structures may improve fish passage and access to suitable habitat, and may reduce the habitat available for predators, potentially lessening the predation risk for special-status fish species.

Removal of Nonnative Invasive Species and Revegetation with Native Plants

Removing nonnative terrestrial and aquatic invasive species and revegetating with native plants improves aquatic, riparian, and wetland habitat for fish and wildlife in a variety of ways. These types of projects would improve the composition, structure, and abundance of native biological communities important for bank stability, stream shading, the riparian canopy, and understory establishment and diversity; input of large wood and other organic material into streams; and other ecological benefits, all of which are important elements of species habitat and water quality.

This project type also includes removal and/or management of nonnative predatory fish and other nonnative fish and wildlife, as long as the activity is associated with a restoration project. These activities would have the potential to increase the survival of native special-status species, especially in cases where predatory fish and predation are an important stressor to special-status species.

Establishment, Restoration, and Enhancement of Tidal, Subtidal, and Freshwater Wetlands

Like floodplain restoration projects, wetland restoration projects would provide enhanced food and habitat for rearing juvenile fishes. Wetlands are nurseries for juvenile fish and provide habitat for small fishes that use the edges of wetlands to feed and avoid predation by larger fish.

Establishment, Restoration, and Enhancement of Stream and Riparian Habitats

Like native plant revegetation project types, stream and riparian restoration projects would enhance native riparian forests or communities, provide increased cover (large wood, boulders, vegetation, and bank protection structures), and provide a long-term source of all sizes of instream wood.

Adverse Impacts of Operations and Maintenance

As described above, most impacts of constructed facilities and operations and maintenance for restoration projects permitted under the Order would be beneficial. However, temporary impacts could occur during maintenance activities for projects that would leave infrastructure at project sites after construction (e.g., stream crossings and fish passage improvements and water conservation projects) would require operations and maintenance of those structures, which could lead to limited, ongoing adverse impacts on special-status fish species. Such maintenance activities could result in impacts similar to those described above in the *Effects of Project Construction* section, although they would be reduced in magnitude and duration relative to the impacts of project construction. Maintenance activities could include sediment removal within or near the facilities, vegetation removal, and inspection and maintenance of facilities. These activities may lead to temporary mobilization of sediment, ground disturbance, chemical contamination, or vegetation removal. Overall, this impact would be **potentially significant**.

Implementing the general protection measures described in the *Project Construction* section above would reduce or further reduce potential impacts to a **less-than-significant** level.

Impact 3.6-2: Implementing future restoration projects permitted under the Order could result in adverse direct effects on the movement of native resident or migratory fish.

Effects of Project Construction Activities

Project construction activities could temporarily affect fish movement. For example, installing a cofferdam to facilitate construction would have the potential to temporarily impede or delay migrating adults, limiting their ability to reach spawning and/or rearing areas. Installing a cofferdam could also hinder migration of juveniles, potentially exposing them to increased predation and unsuitable aquatic habitat conditions.

Instream construction activities also could impede upstream passage of fishes by causing altered hydrologic conditions, such as temporarily increased velocities. However, because cofferdams typically do not block the entire width of affected

waterways, the movement of juvenile or adult fishes are unlikely to be substantially affected.

Riparian corridors and rivers often serve as the main routes for movement and migration of numerous fish and wildlife species. Thus, the loss, fragmentation, or alteration of riparian and riverine habitats could limit access to habitats for breeding (e.g., seasonal spawning areas for fish), rearing, foraging, and other needs. However, impacts on riparian vegetation from construction activities are expected to be temporary, limiting the impact on fish movement.

Implementing restoration projects permitted under the Order could result in construction-related impacts on fish movement, but the impacts are expected to be minimal and temporary. Therefore, the impact of project construction activities on fish movement would be **less than significant**. The Order does not include any general protection measures applicable to this impact.

Effects of Constructed Facilities (Natural or Artificial Infrastructure) and Operations and Maintenance of those Facilities

The long-term effects of restoration projects permitted under the Order on fish movement are expected to be beneficial or neutral. The specific purpose of all project types would be to restore and enhance existing conditions that contribute to degradation of fish habitat. Removing artificial structures, improving fish passage, restoring habitat, and revegetating with native plants would all provide benefits for the migration of native fishes, either by directly creating new passage or by indirectly creating more suitable habitat, thus providing an improved migratory corridor for fish.

Therefore, impacts on fish movement from construction of facilities and operations and maintenance of restoration projects permitted under the Order would be **beneficial**. The Order does not include any general protection measures applicable to this impact.