UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

January 24, 2022 **Refer to NMFS No:** WCRO-2021-03144

Randy LaVack
Caltrans Environmental Stewardship Branch Chief
California Department of Transportation, District 5
50 Higuera Street
San Luis Obispo, California 93401

Re: Endangered Species Act Section 7(a)(2) Biological Opinion for the Jack Creek Road Bridge Replacement Project (BRLO-5949(156))

Dear Mr. LaVack:

Thank you for the California Department of Transportation's (Caltrans)[1] letter of November 17, 2021, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Jack Creek Road Bridge Replacement Project.

The enclosed biological opinion is based on our review of the proposed project and describes NMFS' analysis of potential effects on threatened South-Central California Coast (S-CCC) steelhead and designated critical habitat in accordance with section 7 of the ESA. In the enclosed biological opinion, NMFS concludes that the project is not likely to jeopardize the continued existence of S-CCC steelhead; nor is it likely to adversely modify S-CCC steelhead critical habitat. However, NMFS anticipates that take of S-CCC steelhead may occur. An incidental take statement which applies to this project with terms and conditions is included within the enclosed opinion.

If you have any questions concerning this consultation, or if you require additional information please contact Elena Meza, North Central Coast Office in Santa Rosa, California at 707-575-6068 or via email at elena.meza@noaa.gov.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Kelda Wilson, District Biologist, Caltrans, kelda.wilson@dot.ca.gov
Barrett Holland, District Biologist, Caltrans, Barrett.Holland@dot.ca.gov
Matthew Willis, Environmental Specialist, County of San Luis Obispo, MWillis@co.slo.ca.us
e-file ARN 151422WCR2021SR00246

[1]Pursuant to 23 USC 327, and through a series of Memorandum of Understandings (MOU) beginning June 7, 2007, the Federal Highway Administration (FHWA) assigned and Caltrans assumed responsibility for compliance with Section 7 of the federal Endangered Species Act (ESA) and the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the federally-funded highway projects in California. Therefore, Caltrans is considered the federal action agency for consultations with NMFS for federally funded projects involving FHWA. Caltrans proposes to administer federal funds for the implementation of the proposed project. Thus, per the aforementioned MOU, Caltrans is considered the federal action agency for this project.

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Jack Creek Road Bridge Replacement Project (BRLO-5949(156))

NMFS Consultation Number: WCRO-2021-03144
Action Agency: California Department of Transportation (Caltrans)

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
South-Central California Coast steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: January 24, 2022

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the California Coastal NMFS office.

1.2. Consultation History

By email dated November 17, 2021, we received an initiation package from the California Department of Transportation (Caltrans) requesting formal consultation for their project. Caltrans' request included a biological assessment with the following appendices: project plans, diversion and dewatering plan, species lists, conceptual mitigation and monitoring plan, fish relocation plan, and site photographs. We reviewed these materials, and on December 2, 2021, we requested additional information via email. In our correspondence we requested the following: dimensions of the existing bridge structure and the proposed amount of rock slope protection, description of any permanent facilities that will be installed on the new bridge to treat stormwater, length of creek proposed to be dewatered, and clarification of the work window and number of construction seasons needed to complete the project. The aforementioned information was requested to ensure that NMFS has sufficient information to estimate the risk to listed species and critical habitat from the proposed action. On December 20, 2021, Caltrans responded to our information request via email. We reviewed these additional materials and determined that they provided sufficient information in response to our December 2, 2021 information request, and that consultation could be initiated. On December 21, 2021, we notified Caltrans via email that their ESA consultation was initiated on December 20, 2021.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02).

The County of San Luis Obispo (County) proposes to replace the Jack Creek Road Bridge (Bridge No. 49C-0342) on the existing alignment on Jack Creek Road where it crosses over Paso Robles Creek[2] with Federal Highway Administration (FHWA) funding from the federal

[2] Lat./Long of Jack Creek Road Bridge where it crosses Paso Robles Creek: 35.548611, -120.792500.

highway bridge program. Caltrans is the lead federal agency for the project with its FHWA-delegated authority. The purpose of the project is to improve public safety after an inspection determined that the bridge is structurally deficient, and at the end of its service life. The existing Jack Creek Road Bridge was constructed in 1938 and lengthened in 1969 after a portion was washed out during winter storms. The original structure was six spans and 116 feet in length; of which 80 feet collapsed due to the flooding. The repair resulted in the addition of 5 spans, bringing the total bridge to an 11-span, 204-foot-long structure that is approximately 28 feet wide (0.131 acres). The original portion of the bridge is comprised of a combination of 1-foot-wide timber posts, and a concrete abutment, supported by concrete pedestals on spread footings. The lengthened portion of the bridge is supported by driven steel H-piles with concrete infill walls. The proposed new bridge will be a two span, cast-in-place/prestressed concrete box girder structure approximately 225 feet long and 28 feet wide (0.145 acres). The new bridge will accommodate two 10-foot-wide traffic lanes, two 2-foot-wide shoulders, and two concrete barrier rails with guardrail end treatments. The new bridge will be supported by two abutments and a single pier on five cast-in-drilled-hole (CIDH) concrete piles. Two CIDH concrete piles, each 48 inches in diameter, will be installed above the OHWM on both the north and south banks to support the new bridge abutments. A single CIDH concrete pile, approximately 84 inches in diameter, will support the middle portion of the bridge and is also located above the ordinary high water mark (OHW). The CIDH piles are anticipated to be socketed into shale bedrock. Completion of the project is expected to take one construction season.

The fields located west and south of the bridge are being considered as potential staging areas, and access to the creek is expected to occur along the southwest bank. To gain access to the creek, the work area will be cleared and grubbed. Clearing involves removing and disposing of all unwanted surface material such as trees, brush, grass, weeds, downed trees, and other materials. Grubbing entails removing unwanted vegetative matter from beneath the ground surface, such as stumps, roots, buried logs, and other debris. Trees, shrubs, and landscaping in the proposed action area in conflict with new construction and staging/access areas will be removed and/or trimmed when feasible. The areas around the corners of the new bridge would be cleared of vegetation and fencing to gain access for constructing the new bridge. To complete the project approximately 0.096 acres of habitat will be temporarily impacted, and approximately 44 native trees will be removed above the OHWM. Following completion of the project, all temporary construction areas will be revegetated. A draft Habitat Mitigation and Monitoring Plan (HMMP) that provides for 1:1 restoration for temporary impacts and a 3:1 ratio for permanent impacts is outlined in Appendix F of Caltrans' biological assessment (2021). Replanting of riparian trees, removal of invasive species and a five-year monitoring program will be implemented to achieve 70% riparian cover within that timeframe.

Access to the creek bed is needed to remove the existing bridge and to construct the new bridge. Instream construction work will be conducted during the dry season when flows are at annual lows (June 1 to October 31). A creek diversion will be necessary if flows are present within the action area. To gain access, water, if present, will be temporarily diverted around the work area using a series of pipes or k-rail to allow flows to remain within the low-flow channel of the creek. To contain water throughout the dewatered area, washed gravel-filled bags, impermeable

sheet plastic, and/or water filled bladder dams will be used as cofferdams. Dewatering will be accomplished by isolating flow with gravel bag berms, dewatering pumps with screened intakes, and discharging water into a settling tank or downstream into an upland vegetation location using filter socks to minimize the potential for direct channel impacts.[3] A maximum of 100 linear feet of Paso Robles Creek will be diverted/dewatered to complete the project. S-CCC steelhead, if present in the work area, will be collected and relocated prior to dewatering the work site.

While some materials may be salvaged (wooden stringers and steel support structures, etc.), the existing bridge will be completely demolished according to Caltrans' specifications modified to meet environmental permit requirements (2021), and materials will be properly disposed of offsite. Any debris that enters into the creek bed immediately below the bridge will be removed. The project will result in 0.003 acres of permanent beneficial impacts to the Paso Robles creek bed from removal of the piers below OHWM that support the existing bridge. The new bridge will be constructed following demolition of the existing bridge, and will require falsework and placement of concrete and reinforcements for the new bridge. Falsework may be constructed below the OHWM, but will be at the discretion of the contractor and existing conditions during construction. Rock slope protection (RSP) will be installed on the north and south banks to protect the new bridge abutments and roadway embankment. The RSP will be located above and outside the OHWM. The south bank RSP will be approximately 100 feet wide and 60 feet long, and RSP along the north bank will be approximately 60 feet wide by 40 feet long (totaling 0.193 acres). RSP will be backfilled with soil and native vegetation, and hydroseeded to provide habitat for wildlife.

While the existing bridge does not treat stormwater runoff, new impervious surface associated with the proposed bridge is greater than 1 acre; thus, the County will incorporate permanent biofiltration swales as part of the proposed bridge. The two swales will be approximately 1.5 feet deep, with a bottom basin comprised of 1.5 feet of bioretention filter media underlain by an additional 1 foot of class 2 permeable base that will collect bridge and roadway stormwater, allowing natural filtration to treat runoff.

Typical equipment used to complete the project is expected to include the following: air compressors, backhoes, bobcats, bulldozers and loaders, compaction equipment, concrete trucks and pumps, cranes, debris bins, drill rigs, dump trucks, excavators, front-end loaders, graders, hoe rams and jack hammers, holding tanks, hydraulic hammers, paving equipment, roller/compactors, and water trucks.

The County proposes to include several avoidance and minimization measures (AMMs) that will be implemented before, during, and after construction to prevent and minimize project-related effects to S-CCC steelhead and their designated critical habitat. These measures include:

- working within the in-water work window of June 1 to October 31;
- development of a final HMMP, a stormwater pollution prevention plan (SWPPP), a spill prevention control and countermeasure plan, and erosion control measures;
- environmental training for all construction personnel;

[3] Ultimate design and materials used to create the dewatering/diversion system will be at the discretion of the contractor and may depend on field conditions at the time of construction.

- preventing introduction of contaminants into waterways and ensuring complete removal and proper disposal of all construction waste;
- Caltrans or the County will provide a written report to NMFS by January 15 of the year following construction of the project. The report will contain, at a minimum, the following information:
    - **Project Construction and Fish Relocation Report** – The report(s) will include the dates construction began and was completed; a discussion of design compliance including: vegetation installation, and post-construction longitudinal profile and cross sections; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, including a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any effect on ESA-listed fish; the number of salmonids killed or injured during the project action; and photographs taken before, during, and after the activity from photo reference points.
    - **Fish Relocation** – The report will include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electrofisher was used for fish collection, a copy of the logbook will be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects. whether or not the activities had any unforeseen effects.
    - **Post Construction Vegetation Monitoring and Reporting** – Caltrans will develop and submit for NMFS' review a plan to assess the success of revegetation of the site. A draft of the revegetation monitoring plan will be submitted to NMFS for review and approval prior to the beginning of the in-stream work season. Reports documenting post-project conditions of vegetation installed at the site will be prepared and submitted annually for the first five years following project completion, unless the site is documented to be performing poorly, then monitoring requirements will be extended. Reports will document vegetation health and survivorship and percent cover, natural recruitment of native vegetation (if any), and any maintenance or replanting needs. Photographs must be included. If poor establishment is documented, the report must include recommendations to address the source of the performance problems.

For a full list of AMMs and additional best management practices (BMPs) please see Caltrans' biological assessment (2021). We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS, and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for S-CCC steelhead use(s) the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.

- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources and the biological assessment for this project. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

There were limitations in the information available for this assessment. Historical S-CCC steelhead survey data in the action area or surrounding streams is not available. This assessment relied on stream and hydrological characteristics, anecdotal observations from fisheries biologists familiar with the action area and incomplete survey data from sub-populations within the Interior Coast Range Biogeographic Population Group (BPG) of the S-CCC steelhead distinct population segment (DPS).

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species. Paso Robles Creek is designated S-CCC steelhead critical habitat.

2.2.1. Species Description and Life History

Threatened South-Central California Coast (S-CCC) Steelhead DPS
(*Oncorhynchus mykiss*)
Listing Determination (71 FR 834, January 5, 2006)
Critical Habitat Designation (70 FR 52488, September 2, 2005).

The S-CCC steelhead DPS includes all naturally spawned steelhead populations in streams from the Pajaro River watershed (inclusive) to, but not including, the Santa Maria River, (71 FR 5248) in northern Santa Barbara County, California. There are no artificially propagated steelhead stocks within the range of the S-CCC steelhead DPS.

2.2.1.1 Steelhead General Life History

Steelhead are the anadromous form of *O. mykiss*, spawning in freshwater and migrating to marine environments to grow and mature. Steelhead have a complex life history that requires successful transition between life stages across a range of freshwater and marine habitats (i.e., egg-to-fry emergence, juvenile rearing, smolt outmigration, ocean survival, and upstream migration and spawning.). Steelhead exhibit a high degree of life history plasticity (Shapovalov and Taft 1954; Thrower et al. 2004; Satterthwaite et al. 2009; Hayes et al. 2012). The occurrence and timing of these transitions are highly variable and generally driven by environmental conditions and resource availability (Satterthwaite et al. 2009; Sogard et al. 2012).

Steelhead are divided into two ecotypes based on timing and state of maturity when returning to freshwater: summer-run and winter-run. Winter-run steelhead are the most common ecotype and are the only ecotypes that occur in the S-CCC steelhead DPS. Winter-run steelhead enter natal streams as mature adults with well-developed gonads. They typically immigrate between December and April and spawn shortly after reaching spawning grounds (Shapovalov and Taft 1954; Moyle et al. 2008).

Adult steelhead spawn in gravel substrates with low substrate embeddedness and suitable flow velocities. Females lay eggs in nests, called redds, where they are quickly fertilized by males and covered. Egg survival depends on oxygenated water circulating through the gravel, facilitating gas exchange and waste removal. Adults typically select spawning sites in pool-riffle transition areas with gravel cobble substrates between 0.6 to 10.2 cm diameter and flow velocities between 40-91 cm/s (Smith 1973; Bjornn and Reiser 1991). Eggs incubate in redds for approximately 25 to 35 days (Shapovalov and Taft 1954). Incubation time depends on water temperature, with warmer temperatures leading to lower incubation periods due to increased metabolic rates. Eggs hatch as alevin and remain buried in redds for an additional two to three weeks until yolk-sac absorption is complete (Shapovalov and Taft 1954). Optimal conditions for embryonic development include water temperatures between 6 and 10°C, dissolved oxygen near saturation, and fine sediments less than 5% of substrate by volume (Bjornn and Reiser 1991; USEPA 2001).

Upon emerging from redds, juvenile steelhead occupy edgewater habitats where flow velocity is lower and cover aids in predator avoidance. Rearing juveniles feed on a variety of aquatic and terrestrial invertebrates. As they grow, juveniles move into deeper pool and riffle habitats where they continue to feed on invertebrates and have been observed feeding on younger juveniles (Chapman and Bjornn 1969; Everest and Chapman 1972). Juveniles can spend up to four years

rearing in freshwater before migrating to the ocean as smolts, although they typically spend one to two years in natal streams (Shapovalov and Taft 1954; Busby et al. 1996; Moyle 2002).

Successful rearing depends on stream temperatures, flow velocities, and habitat availability. Preferred water temperature ranges from 12 to 19°C and sustained temperatures above 25°C are generally considered lethal (Smith and Li 1983; Busby et al. 1996; Moyle 2002; McCarthy et al. 2009). In central California streams, juvenile steelhead are able to survive peak daily stream temperatures above 25°C for short periods when food is abundant (Smith and Li 1983). Response to stream temperatures can vary depending on the conditions to which individuals are acclimated, however, consistent exposure to high stream temperatures results in slower growth due to elevated metabolic rates and lower survival rates overall (Hokanson et al. 1977; Busby et al. 1996; Moyle 2002; McCarthy et al. 2009).

Juveniles undergo behavioral, morphological, and physiological changes in preparation for ocean entry, collectively called smoltification. Juveniles begin smoltification in freshwater and the process continues throughout downstream migration with some smolts using estuaries for further acclimation to saltwater prior to ocean entry (Smith 1990; Hayes et al. 2008). Juveniles typically will not smolt until reaching a minimum size of 160 mm (Burgner et al. 1992). Smoltification is cued by increasing photoperiod and downstream migration typically occurs from April to June when temperature and stream flows increase. Stream temperatures influence the rate of smoltification, with warmer temperatures leading to more rapid transition. Preferred temperatures for smoltification are between 10 and 17°C with temperatures below 15°C considered optimal (Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Zedonis and Newcomb 1997; Moyle 2002; Myrick and Cech 2005). In coastal systems with seasonal lagoons, smolts may take advantage of higher growth potential in productive lagoon habitats before ocean entry (Osterback et al. 2018).

Adult steelhead are known to be highly migratory during ocean residency but little is known of their habitat use and movements. They have been observed moving north and south along the continental shelf, presumably to areas of high productivity to feed (Barnhart 1986). Adults will typically spend one to two years in the ocean, feeding and growing in preparation for spawning (Shapovalov and Taft 1954; Busby et al. 1996). Upstream migration typically begins once winter rains commence and stream flows increase. For coastal systems with seasonal freshwater lagoons, winter storms are required to breech the sandbars and allow access to upstream spawning sites. Unlike most congenerics, steelhead are iteroparous, meaning they can return to spawn multiple times. Adult steelhead may spawn up to four times in their lifetime, although spawning runs predominantly consist of first-time spawners (~59%) (Shapovalov and Taft 1954). The maximum life span of steelhead is estimated to be nine years (Moyle 2002).

2.2.2. Status of S-CCC Steelhead DPS

NMFS assess four population viability[4] parameters to help us understand the status of S-CCC steelhead DPS and the population's ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany et

[4] NMFS defines a viable salmonid population as "an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100- year time frame" (McElhany et al. 2000).

al. 2000). While there is insufficient information to evaluate these population viability parameters quantitatively, we have used existing information to determine the general condition of the S-CCC steelhead DPS and factors responsible for the current status of S-CCC steelhead DPS.

The population viability parameters are used as surrogates for numbers, reproduction, and distribution, as defined in the regulatory definition of jeopardy (50 CFR 402.20). For example, abundance, population growth rate, and distribution are surrogates for numbers, reproduction, and distribution, respectively. The fourth parameter, diversity, is related to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained, resulting in reduced population resilience to environmental variation at local or landscape-level scales.

Populations of S-CCC steelhead throughout the DPS have exhibited a long-term negative trend since the mid-1960s. In the mid-1960s, total spawning populations were estimated at 17,750 individuals (Good et al. 2005). Available information shows S-CCC steelhead population abundance continued to decline from the 1970s to the 1990s (Busby et al. 1996) and more recent data indicate this trend continues (Good et al. 2005). Current S-CCC steelhead run-sizes in the five largest systems in the DPS (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River) are likely greatly reduced from 4,750 adults in 1965 (CDFG 1965) to less than 500 returning adult fish in 1996. More recent estimates for total run-size do not exist for the S-CCC steelhead DPS (Good et al. 2005).

Recent analyses conducted by NMFS (Boughton et al. 2006, Boughton et al. 2007, Williams et al. 2011, Williams et al. 2016) indicate the S-CCC steelhead DPS consists of 12 discrete sub-populations which represent localized groups of interbreeding individuals, and none of these sub-populations currently meet the definition of viable. Most of these sub-populations can be characterized by low population abundance, variable or negative population growth rates, and reduced spatial structure and diversity. The S-CCC steelhead DPS has four BPGs designated based on geography and physical attributes within the watersheds unique to each group (NMFS 2013). The sub-populations in the Pajaro River and Salinas River watersheds, which are located in the Interior Coast Range BPG, are in particularly poor condition (relative to watershed size) and exhibit a greater lack of viability than many of the coastal subpopulations.

Although steelhead are persistently present in most streams in the S-CCC DPS (Good et al. 2005), their populations are small, fragmented, unstable, and vulnerable to stochastic events (Boughton et al. 2006). Additionally, severe habitat degradation and the compromised genetic integrity of some populations pose a serious risk to the survival and recovery of the S-CCC steelhead DPS (Good et al. 2005). The systematic threats of loss, degradation, simplification and fragmentation of habitat have remained a barrier to recovery though some individual site-specific threats may have been reduced or eliminated as a result of conservation actions since the last status review. S-CCC steelhead habitat quantity and quality has been impacted by several factors including: alteration of streambank and channel morphology; alteration of ambient storm water temperatures; elimination of spawning and rearing habitat; and elimination of downstream recruitment of spawning gravels and large woody debris. In addition, a loss of approximately one third of estuarine habitat has occurred across the S-CCC steelhead DPS (NMFS 2013). NMFS' 2005 status review concluded S-CCC steelhead remain "likely to become endangered in the foreseeable future" (Good et al. 2005). NMFS confirmed the listing of S-CCC steelhead DPS as threatened under the ESA on January 5, 2006 (71 FR 834). Additional information on S-CCC

steelhead DPS is available in NMFS' Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California (Busby et al. 1996), NMFS' final rule for listing steelhead (62 FR 43937), NMFS Southwest Fisheries Science Center (SWFSC) reports (Boughton et al. 2006; Boughton & Goslin 2006; NMFS 2007), and NMFS' recovery plan (NMFS 2013). New and additional information available since Good et al. (2005) has been summarized in the 2011 and 2016 five-year status review updates (Williams et al. 2011; NMFS 2016).

The S-CCC steelhead DPS is particularly vulnerable to climate change being that they are in the southern extent of the species range and subject to higher mean temperatures in early life-stages. During the last status review, California experienced well below average precipitation (2012-2015), record high surface air temperatures (2014-2015) and record low snowpack in 2015 (NMFS 2016). Anomalously high surface temperature resulted in a "hot drought", in which high surface temperatures substantially amplified annual water deficits during the period of low precipitation (NMFS 2016). This affected the S-CCC steelhead DPS and critical habitat in adverse ways including; depleted ground water basins essential for over-summer flows*;* reduced hydrological connectivity in seasonal streams resulting in stranding and mortality; delayed or reduced breaching time of sandbars at the mouth of coastal estuaries resulting in reduced water quality; restricted emigration of juveniles and immigration of adults to spawning grounds; and over summer temperatures that are sub-lethal or lethal resulting in reduced growth and higher prevalence of disease or ultimately resulting in mortality (NMFS 2016).

Current population information on the S-CCC steelhead DPS remains limited domain wide and does not suggest an appreciable change in either direction. Within the domain, the Carmel River population is the only population for which there has been a time-series of adult abundance longer than 20 years (NMFS 2016). Annual monitoring occurred at the San Clemente Dam which has since been removed (2016) opening up approximately 25 additional miles of spawning habitat. Prior to the dam removal, there had been a consistent long-term decline in numbers over the past 20 years (1996-2015) with an average decline of 16.5% per year. This restoration event will be the subject of ongoing monitoring and investigation on steelhead population viability. An extended drought, occurring during the latest status review, and lack of comprehensive monitoring, has limited the ability to fully assess the status of individual populations and the DPS as a whole. The two most recent status updates conclude that the S-CCC steelhead DPS remains "likely to become endangered in the foreseeable future", and in 2011 and 2016 NMFS chose to maintain the threatened status of the S-CCC steelhead DPS (76 FR 76386, 81 FR 33468).

2.2.3. Status of S-CCC Steelhead Critical Habitat

NMFS considered the following requirements in designating critical habitat for the S-CCC steelhead DPS: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for spawning, reproduction, and rearing offspring; and, generally 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (50 CFR 424.12(b)). NMFS also focused on PBFs and/or essential habitat types within the designated area that are essential to the conservation of the species and that may require special management considerations or protection (81 FR 7214).

PBFs for S-CCC steelhead critical habitat and their essential features within freshwater include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. These features are essential to conservation because without them, juveniles cannot access and use the areas needed to forage, grow, and develop behaviors (e.g., predator avoidance, competition) that help ensure their survival.

3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. These features are essential to conservation because without them juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, these features are essential for adults because they allow fish in a non-feeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.

4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential to conservation because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to the conservation of adults because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas.

For the S-CCC steelhead DPS, approximately 1,832 miles of stream habitat, and 442 square miles of estuarine habitat are designated critical habitat (70 FR 52488). Critical habitat for the DPS has been designated in the following CALWATER Hydrologic Units: Pajaro River, Carmel River, Santa Lucia, Salinas, and Estero Bay. Tributaries in the Neponset, Soledad, and Upper Salinas Valley Hydrologic Sub-areas (HSA) were excluded from critical habitat, and Department of Defense lands in the Paso Robles and Chorro Hydrologic Sub-areas were excluded.

The coastal drainages used by the S-CCC steelhead DPS provide relatively higher amounts of the freshwater rearing PBFs, maintain connectivity, and result in a wider distribution of the species in these drainages than in inland drainages. Inland drainages provide important freshwater migration corridors, freshwater spawning, and freshwater rearing PBFs unique within the inland ecotype. However, most areas of critical habitat in both coastal and inland drainages have been degraded compared to conditions that once supported thriving populations of steelhead.

2.2.4. Global Climate Change

Climate change poses a potential threat to long-term survival and recovery of salmonids. Climate projections for central California indicate an increased intensity in the climate patterns that characterize a semi-arid Mediterranean climate, namely increased intensity of periodic droughts and cyclonic rainstorms (NMFS 2013). In California, over the last century, sea levels have risen by as much as seven inches along the coast. The state has also seen increased temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snowmelt and rainwater running off sooner in the spring (IRWM 2018). This would lead to added stress on salmonid populations that are already faced with lethal and sub-lethal temperature profiles in spawning and rearing streams throughout California. There is no clear trend in annual precipitation; however, precipitation records suggest wet and dry years are increasing in intensity (Coats 2010; Kadir et al. 2013). These trends may ultimately lead to changes in hydrology, water management regimes, and shifts in salmonid life history. NMFS believes that the effects of changing climate on salmonids thus far has been limited and that landscape-level anthropogenic disturbance has a higher impact on steelhead abundance.

Climate models predict observed trends will continue into the future, potentially impacting steelhead across a range of habitats. According to the California Department of Water Resources, more climate changes can be expected by the year 2050 and on to the end of the century: California's mean temperature may rise 1.5°F to 5.0°F by 2050 and 3.5°F to 11.0°F by the end of the century; average annual precipitation may show little change, but more intense wet and dry periods can be expected with more floods and more droughts; flood peaks will become higher and natural spring/summer runoff will become lower. Global sea level projections suggest possible sea level rise of approximately 14 inches by 2050 and a high value of approximately 55 inches by 2100 (IRWM 2018). Although no clear trend in precipitation has been observed thus far, precipitation is expected to decrease across most climate regions (Moser et al. 2012; Diffenbaugh et al. 2015). This increased heat and decrease in precipitation is projected to lead to more frequent and intense wildfires across the region (Moser et al. 2012; Gergel et al. 2017). Increased wildfires may lead to subsequent runoff from burned lands, increasing sedimentation in streams and reducing the quality and quantity of spawning habitat. In addition, changes in ocean circulation, temperature and food availability could alter juvenile and adult steelhead bioenergetics and reduce marine survival (Scavia et al. 2002; Feely et al. 2004; Abdul-Aziz et al. 2011).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area is located where Jack Creek Road crosses over Paso Robles Creek in northern San Luis Obispo County, California. The action area comprises 6.19 acres west of the city of Templeton in a rural area surrounded by agriculture and low-density residential land uses. Jack Creek Road is a winding, paved, rural road through rolling oak woodland terrain typical of the Santa Lucia Mountain Range. Paso Robles Creek is inundated with flowing surface water during the wet season (December-June), and dry with a rocky cobbled-bottom during the dry season (July-November). The Jack Creek Road Bridge crosses over Paso Robles Creek just downstream of the confluence of Jack Creek with Paso Robles Creek.

The action area encompasses all areas of potential ground disturbance (including staging areas) and includes the existing bridge and 0.25 acres of stream channel habitat, including the diversion zones approximately 100 feet upstream and downstream from the Jack Creek Bridge.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1. General Watershed Description

The action area is located within the Paso Robles Creek sub-watershed, which is within the larger Paso Robles Creek-Salinas River Watershed (Hydrologic Unit Code (HUC):1806000504). The Paso Robles Creek-Salinas River Watershed encompasses approximately 143,654 acres in northern-central San Luis Obispo County and includes a portion of the Salinas River and adjacent tributaries. Upper Paso Robles Creek and its tributaries are steep pre-Quaternary non-infiltrative headwaters with steep, moderately infiltrative early to mid-tertiary valleys (SLO Watershed Project 2019). There are no dams or water impoundments on most of these mountainous creeks.

The action area occurs on Paso Robles Creek, just downstream of the confluence of Jack Creek with Paso Robles Creek. Both Jack Creek and Paso Robles Creek are intermittent streams that convey water seasonally. Paso Robles Creek flows into the Salinas River at river mile (RM) 128, which drains north-westerly towards the Pacific Ocean. The upper Salinas River is controlled by the Salinas Dam (RM 154) which forms Santa Margarita Lake and flow is intermittent in the summer months. Some sections of the Salinas River maintain perennial flow. Below the confluence with the Nacimiento River (RM 108), which is approximately twenty river miles downstream of the action area, summer flows are maintained by agricultural runoff and water releases from the San Antonio and Nacimiento Reservoirs into the mainstem Salinas. However, in most years the Salinas River does not maintain perennial flow in the lower mainstem as it winds through heavily populated urban areas and intensively farmed agricultural lands.

Major threats to the Salinas River populations include water diversion and impoundment related to residential and agricultural development (NMFS 2013). Summer water releases from San Antonio and Nacimiento reservoirs result in a reverse hydrograph, meaning the highest continuous flows occur in summer rather than winter. A large seasonal dam and diversion structure downstream impounds these releases, providing surface water for agriculture. These facilities alter the timing, magnitude, and duration of flows throughout the lower Salinas River.

In the upper Salinas River, the Salinas Dam impounds water degrading or eliminating flows that may affect migration to/from the upper tributaries including Paso Robles Creek. Agricultural development of riparian corridors has led to a reduction of channel complexity and groundwater through groundwater extraction for irrigation as well as a reduction in water quality from runoff containing fine sediment, pesticides, and fertilizers (NMFS 2013). Instream gravel mining operations in the Salinas River have also led to a decrease in habitat quality by increasing turbidity, reducing habitat complexity, and impeding sediment transport. Recovery actions prescribed by NMFS (2013) to address impairments in the Salinas River include modifying impediments to allow fish passage and improving substrate quality by managing instream mining operations.

In the Salinas River watershed, including the action area, the threat to S-CCC steelhead from climate change is likely going to mirror what is expected for the rest of Central California (see Section 2.2.4.6 Global Climate Change). NMFS expects that average summer air temperatures in the watershed would continue to increase, heat waves would become more extreme, and droughts and wildfire would occur more frequently (Lindley et al. 2007; Moser et al. 2012; Hayhoe et al. 2004; Kadir et al. 2013; Westerling et al. 2011). In future years and decades many of these changes are likely to further degrade S-CCC habitat throughout the watershed by, for example, reducing streamflow during the summer and raising summer water temperatures.

2.4.2. Status of S-CCC steelhead in the Action Area

Paso Robles Creek is part of the upper Salinas River population, which is part of the S-CCC steelhead Interior Coast Range BPG. The Interior Coast Range BPG region is the largest of the four BPGs in the S-CCC steelhead Recovery Planning Area and includes the east-facing slopes of the Central Coast Ranges (Santa Lucia Mountains and Santa Cruz Mountains) and the west-facing slopes of the Inner Coast Range (Diablo, Gabilan, Caliente, and Temblor ranges). This region extends 180 miles across the length of the S-CCC steelhead Recovery Planning Area and includes portions of Santa Clara, San Benito, Monterey, and San Luis Obispo counties. This BPG consists of two major watersheds, the Pajaro River and Salinas River, which flow into the Pacific Ocean at Monterey Bay. The Salinas River steelhead run is identified as a Core 1 population within NMFS' S-CCC steelhead DPS recovery plan and is targeted by NMFS for increased conservation and recovery efforts (NMFS 2013). There is insufficient data to estimate adult steelhead population size in the Salinas River and estimates of steelhead abundance and density in the action area are also lacking. Based on historic estimates, recent observations, and known impairments in the watershed, the Salinas River population is recognized as having experienced significant declines from historic conditions (NMFS 2013). The Monterey County Water Resource Agency (MCWRA) had conducted adult steelhead escapement and juvenile steelhead monitoring in the Salinas River from 2011 through 2014. Adult escapement, estimated from Salinas River weir fish counts from RM 2.5, was below 55 each year from 2011 to 2013, and in 2014 no adult steelhead were identified in the weir (MCWRA 2014b). These are

considered conservative numbers since migration could have occurred prior to weir installation and not all fish passing through the weir were able to be identified.

Juvenile steelhead surveys and outmigration monitoring suggest the highest abundance of steelhead in the Salinas River population are in the Arroyo Seco (Salinas RM 50) while a small, intermittent run persists in the Nacimiento River (Salinas RM 108) (MCRWA 2012, 2013, 2014a, 2014c). The Salinas River S-CCC steelhead population is largely sustained by the high-quality spawning and rearing habitat in the Arroyo Seco River. Rotary screw trap (RST) sampling in the Salinas River, downstream of the Nacimiento confluence with the Salinas River, captured between one and seven juveniles during deployments between 2012 and 2014 (MCWRA 2014a). Capture efficiency tests revealed very low efficiency at the Nacimiento and Salinas River RST sites and it is likely more fish were present than were captured by the RST (MCRWA 2014a). Dive surveys of four sites distributed along the length of the Nacimiento River below the Nacimiento Dam produced the following density estimates: 0.0, 1.11, 3.13, and 5.93 juvenile steelhead per 100 stream feet (MCWRA 2014c). The consistent presence of juvenile steelhead downstream of the action area and the limited surveys conducted in the Paso Robles Creek-Salinas River Watershed indicate the possibility for steelhead to be present in the action area prior to and during construction.

S-CCC steelhead most likely occur in the action area during high flow events in the winter and early spring when spawning migration and smolt migration are at their peaks. However, although Paso Robles Creek is designated critical habitat for S-CCC steelhead, there are no recently reported occurrences of this species within Paso Robles Creek, or within five miles of the action area (Caltrans 2021). Anecdotal reports of adult sightings in Jack Creek and e-fishing of juveniles in Paso Robles Creek occurred in the 1990's (NMFS 2019) when flow conditions were suitable.

2.4.3. Status of Critical Habitat within the Action Area

The action area is largely confined to the stream channel and banks of Paso Robles Creek underneath the Jack Creek Road Bridge, including 100 feet upstream and downstream of the bridge. Paso Robles Creek is S-CCC steelhead designated critical habitat. Essential features of critical habitat include substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, space, and safe passage conditions.

The action area is subject to a Mediterranean climate with hot and dry summer seasons and light to moderate precipitation during the cooler winter months. The majority of the precipitation falls between December and March. The soils within the stream channel below the OHWM consist of gravel and cobble, with a few boulders. The areas above the OHWM consist of more clay material. The vegetation in the area consists of coast live oak woodland, poison oak scrub, and arroyo willow thicket.

There are no active stream gauges in Paso Robles Creek. However, historical United States Geological Survey gauge records (Jack Creek Gauge #11147000 approx. 1.3 miles northwest of the action area, and Santa Rita Creek Gauge (USGS) #1114707 approx. 2.3 miles southeast of the action area) from 1949 through 1978 indicate that average flows in the action area during the anticipated construction window of June 1 through October 31 are expected to be 0 to 9 cubic feet per second (cfs), dropping to 0 to 2 cfs July through October. The nearest USGS gauge

currently recording flows in the watershed occurs on the Salinas River at Paso Robles where there is also intermittent flow from July through October (USGS 11147500).

Paso Robles Creek is hydrologically connected to the Salinas River. In order for anadromous *O. mykiss* to complete their life cycle in Paso Robles Creek, they would need to migrate through the Salinas River as adults and then juveniles. Because portions of the Salinas River run dry during the year, it becomes a migration barrier and/or could create stranding and lethal temperatures during rearing or migration for S-CCC steelhead. A San Luis Obispo County Regional Instream Flow Assessment concluded Paso Robles Creek does not carry sufficient flows to provide steelhead habitat year-round (Caltrans 2021). The assessment relied on the historical stream gauge flows that ended in 1978. However, stream gauge data in the vicinity indicates that hydrology in the area is prone to intermittent flows due to the Mediterranean climate in the region and water impoundment and diversions in the adjacent Salinas River.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Construction activities, both during and post-project completion, associated with the proposed project may affect S-CCC steelhead and their critical habitat. The following may result from construction activities: unintentional direct injury or mortality during fish collection, relocation, and dewatering activities, loss of benthic habitat; increases in suspended sediments and turbidity; reductions in riparian vegetation and cover, hazardous materials and contaminants from heavy machinery, construction materials, streambank hardening, and stormwater runoff.

2.5.1. Fish Collection and Relocation

To facilitate completion of the project, a portion of Paso Robles Creek may need to be dewatered. As discussed above, a maximum of 100 linear feet would be dewatered. The project proposes to collect and relocate fish in the work are prior to, and during dewatering to avoid fish stranding and exposure to construction activities. Before and during dewatering of the construction site, juvenile salmonids will be captured by a qualified biologist using one or more of the following methods: dip net, seine, thrown net, block net, minnow trap, and electrofishing. Collected salmonids will be relocated to an appropriate stream reach that will minimize impacts to captured fish, and to fish that are already residing at the release site(s). Since construction is scheduled to occurr between June 1 and October 31, relocation activities will occur during the summer low-flow period after emigrating smolts have left and before adults have immigrated for spawning. Only juvenile salmonids are expected to be in the action area during the construction period. Therefore, NMFS expects capture and relocation of listed salmonid species will be limited to pre-smolting and young-of-the-year juveniles.

Fish collection and relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes et al. 1996)

has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely, depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following NMFS electrofishing guidelines (NMFS 2000), injury and mortality of juvenile salmonids during capture and relocation will be minimized. Based on prior experience with current relocation techniques and protocols likely to be used to conduct the fish relocation, unintentional mortality of listed juvenile salmonids expected from capture and handling procedures is not likely to exceed 2 percent.

Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat. To reduce the potential for competition, fish relocation sites will be pre-approved by NMFS to ensure the sites have adequate habitat to allow for survival of transported fish and fish already present. Nonetheless, crowding could occur which would likely result in increased inter- and intraspecific competition at those sites. Responses to crowding by salmonids include self-thinning, resulting in emigration and reduced salmonid abundance with increased individual body size within the group, and/or increased competition (Keeley 2003). Relocation sites will be selected to ensure they have similar water temperatures at the capture sites, and adequate habitat to allow for survival of transported fish and fish already present. However, some of the fish released at the relocation sites may choose not to remain in these areas and move either upstream or downstream to areas that have more vacant habitat and a lower density of fish. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. In some instances, relocated fish may endure some short-term stress from crowding at the relocation sites. Such stress is not likely to be sufficient to reduce their individual fitness or performance. NMFS cannot accurately estimate the number of fish likely to be exposed to competition, but does not expect this short-term stress to reduce the individual performance of juvenile salmonids, or cascade through the watershed population of this species. Fish that avoid capture during relocation may be exposed to risks described in the following section on dewatering (see Section 2.5.2 below).

Data to quantify the anticipated number of steelhead in the action area are not available, but estimates can be derived from juveniles steelhead monitoring that was conducted in the Nacimiento River, tributary to the Salinas River, located downstream from the action area. To estimate the number of juvenile steelhead that may be present in the action area, we used data from MCWRA survey and monitoring efforts in the Salinas and Nacimiento rivers, which provide the most recent estimates of juvenile steelhead densities in the vicinity of the action area (Section 2.4.2). S-CCC steelhead juvenile population estimates were conducted by dive surveys in the Nacimiento River at four river reaches in 2014. These sites are approximately 16 miles downstream from the action area and are located where flows for S-CCC steelhead outmigration are regulated by the Nacimiento Dam. Although the hydrology and habitat differ from conditions in Paso Robles Creek, it provides recent data to provide an estimate of the potential S-CCC steelhead populations in the action area. Since multi-year average densities are unavailable, we have opted to use the average of the most recent observed density, which is 2.5 fish per 100 feet of stream (MCWRA 2014c). Using this data, and the proposed dewatered length of 100 linear feet, NMFS estimates that no more than 3 (rounded up from 2.5) juvenile S-CCC steelhead will be present in the dewatered area when relocation and dewatering activities occur during construction. Considering environmental variability such as interannual variation in temperature,

variations in predatory or prey abundance, habitat conditions in the action area, and other factors, NMFS assumes that as many as 25 percent more juvenile S-CCC steelhead may be present in the area to be dewatered. The 25 percent increase is based on NMFS' best professional judgement as to the likely variability in S-CCC steelhead density between the time of this biological opinion and when the project is constructed. If 25 percent more than 3 juvenile steelhead are present, this would result in 4 juvenile S-CCC steelhead (rounded up from 3.75) present in the 100-foot-dewatered area during dewatering.[5]

Applying applicable AMMs to fish collection, relocation, and dewatering activities is expected to appreciably reduce the effects of project actions on juvenile steelhead. Specifically, steelhead collection and relocation activities conducted by NMFS-approved fisheries biologists will ensure proper equipment operation and application of NMFS guidelines thereby minimizing injury and mortality to juvenile steelhead. Restricting the work window to June 1 to October 31 will limit the effects to stream rearing juvenile steelhead. NMFS expects applying AMMs will effectively minimize injury and mortality to juvenile S-CCC steelhead in the action area.

2.5.2. Dewatering

As described above, completion of the project will require dewatering of Paso Robles Creek. Cofferdams and a series of pipes will be used to temporarily divert flows around the work site during construction. Dewatering of the channel is estimated to affect up to 100 linear feet of the creek. NMFS anticipates temporary changes to instream flow within, and downstream, of the project site during installation of the diversion system and during dewatering operations. Once installation of the diversion systems is complete, stream flow above and below the work site should be the same as free-flowing pre-project conditions, except within the dewatered reaches where stream flow is bypassed. These fluctuations in flow are anticipated to be small, gradual, and short-term, and, in the case of areas that will be dewatered, will likely result in mortality of any steelhead that avoid capture during fish relocation activities.

Stream flow diversion and dewatering at the project site could harm individual rearing juvenile salmonids by concentrating or stranding them in residual wetted areas before they are relocated. Juvenile salmonids that avoid capture in the project work areas will likely die during dewatering activities due to desiccation, thermal stress, or be crushed by equipment or foot traffic if not found by biologists while water levels within the reaches recede. Because the pre-dewatering fish relocation efforts at the project site will be performed by qualified biologists, NMFS expects that the number of juvenile salmonids that will be killed as a result of stranding during dewatering activities will be very small, likely no more than one percent of the salmonids within the work sites prior to dewatering.

Dewatering operations at the project site may affect benthic (bottom dwelling) aquatic macroinvertebrates, an important food source for salmonids. Benthic aquatic macroinvertebrates at the project site may be killed or their abundance reduced when river habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from the stream diversion and dewatering activities will be temporary because construction activities will be short lived, and the dewatered reach will not exceed 100 linear feet in Paso Robles Creek. Rapid

[5] 3 juvenile steelhead /100 linear feet * 1.25 = 3.75, rounded up to 4.

recolonization (typically one to two months) of disturbed areas by macroinvertebrates is expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile salmonids is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered area since stream flow, if present, will be bypassed around the project work site. Based on the foregoing, juvenile steelhead are not anticipated to be exposed to a reduction in food sources at the project site from the minor and temporary reduction in aquatic macroinvertebrates as a result of dewatering activities.

Beyond the dewatered area, the temporary stream diversion at the project site is expected to resemble typical summer low flow conditions. The diversion system could restrict movement of steelhead in a manner similar to the normal seasonal isolation of pools by intermittent flow conditions that typically occur during summer within a portion of some streams through the range of S-CCC steelhead. Because the quality of habitat in and around the action area is adequate to support rearing steelhead, NMFS expects steelhead will be able to find food and cover downstream of the action area as needed during dewatering activities.

2.5.3. Increased Sedimentation and Turbidity

The proposed project will result in disturbance of the streambed and banks for construction. Construction activities within the action area may result in disturbance of the dewatered streambed and banks for equipment access, construction activities, and placement/removal of stream diversion structures. Instream and near-stream construction activities have been shown to result in temporary increases in turbidity (reviewed in Furniss et al. 1991, Reeves et al. 1991, Spence et al. 1996). While the cofferdams and stream diversion systems are in place, construction activities are not expected to degrade water quality in Paso Robles Creek because the work area will be dewatered and isolated from the flowing waters. Disturbed soils on the creek bank are easily mobilized when later fall and winter storms increase streamflow levels. Thus, NMFS anticipates disturbed soils could affect water quality and critical habitat in the action area in the form of small, short-term increases in turbidity during re-watering (i.e., cofferdam removal), and subsequent higher flow events during the first winter storms post-construction.

Increases in sediment may affect fish by a variety of mechanisms. High concentrations of suspended sediment can disrupt normal feeding behavior and efficiency (Cordone and Kelley 1961, Bjornn et al. 1977, Berg and Northcote 1985), reduce growth rates (Crouse et al. 1981), and increase plasma cortisol levels (Servizi and Martens 1992). High turbidity concentrations can reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and cause fish mortality (Sigler et al. 1984, Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat, and/or increase competition and predation, decreasing chances of survival. Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986).

Chronic elevated sediment and turbidity levels may affect salmonids as described above. However, sedimentation and turbidity levels associated with cofferdam removal, rewetting of the construction sites within the action area, and subsequent rainfall events are not expected to rise to the levels described in the previous paragraph because the projects proposed soil and channel

stabilization measures to prevent sediment mobilization. Additionally, Caltrans proposes AMMs and BMPs (associated with its stormwater pollution prevention plan) specifically aimed at reducing erosion, scour, and sedimentation in storage and staging areas, riparian areas, and from water diversions (Caltrans 2021). Therefore, any resulting elevated turbidity levels would be minor, occur for a short period, and be well below levels and durations shown in the scientific literature as causing injury or harm to salmonids (Sigler et al. 1984, Newcombe and Jensen 1996). NMFS expects any sediment or turbidity generated by the projects would not extend more than 100 feet downstream of the worksites, based on site conditions and methods used to control sedimentation and turbidity. Thus, NMFS does not anticipate harm, injury, or behavioral impacts to juvenile salmonids associated with exposure to the minor elevated suspended sediment levels that are expected to be generated by the project.

2.5.4. RSP Installation

Development in and over channels has the potential to impair stream habitat by fortifying natural stream banks through RSP or other permanent fill. Habitat impairments associated with streambank hardening may include confinement of the channel, prevention of lateral channel migration, flow constraints, and impairment of bed and bank habitat. These constraints have the potential to result in poor habitat complexity, including poor cover and refugia. The existing bridge piles that sit below the OHWM may have resulted in habitat impairments (i.e., bed and bank impairment) within the immediate area around the bridge, but these existing piles will be removed during demolition of the existing bridge. The proposed new Jack Creek Bridge will add new RSP (60 linear feet along the south bank and 40 linear feet along the north bank) to the project area where none currently exists; yet, the 0.193 acre increase in RSP is not expected to result in impacts to individual steelhead within the area because the RSP will be located outside and above the OHWM. Furthermore, following project construction, and during revegetation of the project area, the RSP will be backfilled with soil and native vegetation, will be hydroseeded, and new vegetation will be monitored for 5-years to ensure survival (see section 1.3. above). Thus, NMFS expects that habitat (i.e., cover and refugia) resulting from the proposed project will be of similar or improved condition when compared to the current cover and refugia on site once vegetation becomes established within the 5-10 year construction/revegetation regrowth time frame.

2.5.5. Pollution from Hazardous Materials and Contaminants

Operating equipment in and near streams has the potential to introduce hazardous materials and contaminants into streams. Potentially hazardous materials include wet and dry concrete debris, fuels, and lubricants. Spills, discharges, and leaks of these materials can enter streams directly or via runoff. If introduced into streams, these materials could impair water quality by altering the pH, reducing oxygen concentrations as the debris decomposes, or by introducing toxic chemicals such as hydrocarbons or metals into aquatic habitat. Oil and similar substances from construction equipment can contain a wide variety of polynuclear hydrocarbons (PAHs) and metals. PAHs can alter salmonid egg hatching rates and reduce egg survival as well as harm the benthic organisms that are a salmonid food source (Eisler 2000). Disturbance of streambeds by heavy equipment or construction activities can also cause the resuspension and mobilization of contaminated stream sediment with absorbed metals.

The equipment needed to complete the project has the potential to release debris, hydrocarbons, concrete, and similar contaminants into surface waters at the work site. These effects have the potential to harm or injure exposed fish and temporarily degrade habitat. However, AMMs proposed will substantially reduce or eliminate the potential for construction material and debris to enter waterways. Limiting the work window to the dry season from June 1 to October 31 will limit hazardous material exposure to juvenile salmonids, and eliminate potential for contaminants to adversely affect the most sensitive life stages (i.e., eggs, alevin, and fry). Equipment will be checked daily at the work site to ensure proper operation and avoid any leaks or spills. Proper storage, treatment, and disposal of construction materials and discharge management is expected to substantially reduce or eliminate contaminants entering the waterway via runoff. A SWPPP will be implemented to maintain water quality during and after construction within Paso Robles Creek, and render the potential for the project to degrade water quality and adversely affect steelhead improbable. Furthermore, Caltrans will also construct permanent bio retention structures and develop a maintenance program for these structures for long-term management of stormwater. Due to these measures, permanent structures, and long-term management plan, conveyance of toxic materials into active waters at the work site both during and after project construction is not expected to occur, and the potential for the project to degrade water quality and adversely affect S-CCC steelhead is improbable.

2.5.6. Removal of Riparian Vegetation

The project will result in permanent and prolonged reductions in riparian vegetation, including tree removal, necessary for construction access and staging, and during removal of the existing bridge. Riparian vegetation helps maintain stream habitat conditions necessary for salmonid growth, survival, and reproduction. Riparian zones and wetland/aquatic vegetation serve important functions in stream ecosystems such as providing shade (Poole and Berman 2001), sediment storage and filtering (Cooper et al. 1987, Mitsch and Gosselink 2000), nutrient inputs (Murphy and Meehan 1991), water quality improvements (Mitsch and Gosselink 2000), channel and streambank stability (Platts 1991), source of woody debris that creates fish habitat diversity (Bryant 1983, Lisle 1986, Shirvell 1990), and both cover and shelter for fish (Bustard and Narver 1975, Wesche et al. 1987, Murphy and Meehan 1991). Riparian vegetation disturbance and removal can degrade these ecosystem functions and impair stream habitat. Removal of riparian vegetation increases stream exposure to solar radiation, leading to increases in stream temperatures (Poole and Berman 2001).

Removal of 44 trees will likely result in both permanent and prolonged temporary reductions in shade and cover for fish; however, of the total number of trees proposed for removal, there are not any trees proposed for removal below the OHWM. Furthermore, as part of the proposed AMMs, trees will be trimmed and limbed to prevent erosion and to reduce potential impacts of riparian vegetation removal on salmonids (Caltrans 2021). Any shade lost from tree trimming, limbing, or removal may be offset by the increase in shaded areas provided by the new wider bridge (0.014 acres). The shade provided by the new bridge may provide nominal benefits (i.e., cooler water temperatures) to steelhead within the action area. In addition, Caltrans will also backfill RSP with native plants that will also provide the area with additional shade that can offset any shade lost from existing tree and vegetation removal.

Trimmed vegetation is expected to grow back, and trees and other native vegetation disturbed during construction will be replanted on-site and monitored to ensure the success of revegetation

efforts to restore areas impacted by removal of riparian vegetation. Therefore, other services provided by vegetation, such as sediment storage and filtering, nutrient inputs, sources of woody debris, and habitat complexity (i.e., cover) will remain degraded at the sites until new vegetation is replanted and becomes established. When considering complete removal of trees, we expect riparian vegetation attributes at the site will return to pre-project levels after native trees are replanted and established; possibly within 5-10 years due to the proposed AMMs, revegetation measures, and vegetation growth rates. Because of the timing and establishment of the on-site revegetation, the temporary prolonged loss of cover may cause individual salmonids to seek alternative areas for cover and forage. Such temporary displacement of salmonids is not expected to reduce their individual performance because there are sites nearby that provide these features and can accommodate additional individuals without becoming overcrowded. Thus, impacts of reduced shade and other vegetative services (i.e., sediment storage and filtering, nutrient input, etc.) from removal of riparian vegetation are not expected to significantly change the behavior, and in turn, the fitness of individual salmonids with the action area.

2.5.7. Critical Habitat Effects

The action area is designated critical habitat for S-CCC steelhead. Generally, PBFs of critical habitat for steelhead found within the action area include sites for migration and rearing (see Section 2.4.2). As discussed above, construction activities are expected to result in disturbance to the stream channel and adjacent streambank which could result in impacts to critical habitat in the action area by diminishing PBFs.

Mobilization of sediment during construction and post-construction activities has the potential to result in high levels of turbidity and suspended sediment if appropriate AMMs are not implemented. Caltrans, however, is proposing AMMs that will isolate work sites from live streams and prevent pulses of sediment from entering streams after construction is complete. Some minor and temporary increases in turbidity and suspended sediment is expected to occur within the dewatered reaches and portion of streams downstream of the active work sites. Such increases are not expected to alter water quality, substrate conditions, or pool habitat to the extent that PBFs in the action area would be diminished.

Dewatering approximately 100 linear feet of Paso Robles Creek in the action area for up to 4 months during the dry season will expose habitat in these areas to artificially dry conditions. Steelhead forage at these sites will be reduced for up to 2 months following rewatering, after which, macroinvertebrate abundance is expected to return to pre-dewatering levels (Cushman 1985, Thomas 1985, Harvey 1986). Thus, forage supporting juvenile development will be diminished at the site for up to 6 months. Furthermore, steelhead rearing habitat at the site will be reduced in area equal to the dewatered area for up to 4 months during the dry season.

Critical habitat will also be impacted as a result of riparian vegetation removal within the action area. Impacts to freshwater rearing sites that provide shade, sediment storage and filtering, nutrient inputs, and habitat complexity will occur as a result of tree removal, trimming, and limbing, and removal of other herbaceous vegetation to complete construction at the work site. Assuming complete removal of trees, we expect riparian vegetation attributes at the site will return to pre-project levels within 5-10 years due to proposed AMMs, revegetation measures, and vegetation growth rates. Some shade at the site will be maintained despite the reduction in vegetation because of the expansion of the bridge (0.014 acres). However, during the construction and revegetation timeframe of 5-10 years, habitat at the sites will suffer reductions

in vegetation associated cover and forage. These reductions will diminish the quality of salmonid freshwater rearing and adult forage sites, and migration corridors at the site during the 10-year construction and revegetation timeframe. Following the 5-10 year construction and revegetation period, the action area may see an increase in native plants and resulting vegetative cover as a result of the revegetation efforts.

Streambank habitat degradation and long-term preclusion of natural fluvial and geomorphic processes resulting from RSP installation can result in adverse effects to S-CCC steelhead critical habitat. And while the project proposes to add 0.193 acres of new RSP to the action area to protect the new bridge abutments, the new hardened banks are not expected to have any meaningful adverse impact on critical habitat because the entire footprint of RSP, on both banks, is above and outside of the OHWM. Thus, NMFS does not expect that installation of RSP within the action are will compromise the value of available migrating and rearing critical habitat PBFs by reducing passage, water quality, or increasing water velocities and obstruction within the action area because the RSP is not expected to interact with the flowing waters of Paso Robles Creek. Therefore, the increase in RSP is not expected to result in adverse impacts to critical habitat.

Finally, the proposed action may nominally improve freshwater rearing and migration PBFs by removing 0.003 acres of fill (i.e., existing piles supporting the bridge) from within the Paso Robles creek bed. Removal of this fill will provide a nominal amount of migratory and/or rearing habitat to steelhead that travel through the action area that has not been accessible since construction of the Jack Creek Bridge.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation [50 CFR 402.02 and 402.17(a)]. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4).

NMFS does not anticipate any cumulative effects in the action area other than those ongoing actions already described in the Environmental Baseline above and resulting from climate change. The action area is subject to a Mediterranean climate within an intermittent stream. The hydrology within this stream is subject to annual shifts in precipitation coupled with long term effects of climate change. The Salinas River is a highly modified and controlled system that will continue to affect the ability of S-CCC steelhead to complete their lifecycle in mountainous streams in the Paso Robles Creek-Salinas River Watershed. Given current baseline conditions and trends, NMFS does not expect to see significant improvement in habitat conditions in the near future due to existing land and water development in the watershed.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

The Upper Salinas River subpopulation is part of the larger Interior Coast Range BPG, and as noted in section 2.2.2 above, are in particularly poor condition and exhibit a greater lack of viability than many of the coastal subpopulations. Loss of habitat and extensive habitat degradation have led to poor conditions throughout the S-CCC recovery domain, including the upper Salinas River. As a result, S-CCC steelhead densities are substantially lower than historic estimates. The Salinas River population is primarily sustained by the high-quality spawning and rearing habitat in the Arroyo Seco River, and secondly by the Nacimiento and San Antonio rivers. All of these tributaries are many miles downstream of the action area and drain into a section of the Salinas River that has managed flow from reservoir releases. The habitat within Paso Robles Creek is not an important migratory corridor and therefore, provides inconsistent opportunities to help sustain the DPS. This is further evidenced by the lack of steelhead presence in the upper Salinas mainstem (above the Nacimiento River confluence), and in Paso Robles and Jack creeks. Although there are not dedicated surveys to monitor steelhead presence or abundance, there is evidence that habitat units connecting the upper mainstem to the aforementioned tributaries lack sufficient water velocity to support food delivery or to provide contiguous migration in the spring and summer. Additionally, the likelihood that steelhead will be in the vicinity of Paso Robles Creek is greatly diminished based on timing of construction coinciding with the dry season.

As described in section 2.5, NMFS identified the following components of the project that may result in effects to S-CCC steelhead and designated critical habitat: fish collection and relocation, dewatering, increases in suspended sediment and other construction related contaminants, RSP installation, and reductions in riparian vegetation and cover. Of these, fish collection and relocation, and dewatering have the potential to result in reduced fitness, injury, and/or mortality to S-CCC steelhead. Designated S-CCC steelhead critical habitat could be negatively affected by dewatering, construction related turbidity and sedimentation, and vegetation removal.

2.7.1. Listed Species

The project proposes to dewater approximately 100 linear feet of Paso Robles Creek for up to 4 months; in-channel construction is scheduled to occur from June 1 to October 31. Therefore, it is anticipated that only rearing juvenile steelhead would be affected by project activities, and no adult steelhead or migrating steelhead smolts would be affected by the project activities. Furthermore, due to the small area of stream affected and low summer streamflow, NMFS estimates that a very small number of juvenile S-CCC steelhead (up to 4) may be present in the dewatered reach prior to construction. Individuals present will make up a very small proportion of the S-CCC steelhead population in the Salinas River. Anticipated mortality from relocation is

expected to be two percent (or less) of the fish relocated (4 fish), and mortality expected from dewatering is expected to be one percent (or less) of the fish in the area prior to dewatering (combined mortality not to exceed three percent, or 1 fish). Due to the relatively large number of juveniles produced by each spawning pair, steelhead spawning in the Salinas River watershed in future years are likely to produce enough juveniles to replace the 1 juvenile steelhead that may be lost at the project site due to relocation and dewatering. Thus, it is unlikely that the potential loss of 1 juvenile steelhead during the life of the project will impact future and adult returns.

For short-term effects, climate change is not expected to significantly worsen existing conditions over the time frame considered in this biological opinion. Considering the above, we do not expect climate change to affect S-CCC steelhead in the action area beyond the scope considered in this biological opinion. For the long-term effects, climate change would likely worsen conditions if total precipitation in California declines and critically dry years increase. These conditions would likely modify water quality, streamflow levels, rearing habitat and salmonid migration. The overall reduction in habitat quality caused by the project is minor and limited to a small area of a watershed where there is no recent documented use by salmonids, and therefore, even if climate change reduced the overall habitat quality in the future, when combined with this proposed action any amplification in habitat degradation would be very small.

In addition to the adverse effects described above, we also consider the potential impacts of increased sedimentation and turbidity, pollution from hazardous materials and contaminants, removal of riparian vegetation, habitat loss, RSP installation, and increased shading. The implementation of proposed AMMs is expected to render the potential for fish to be exposed to pollution from hazardous materials and contaminants during and after construction improbable. Increased sedimentation and turbidity and temporary loss and degradation of habitat in the dewatered areas will cease shortly after construction is complete and will only result in minor impacts to steelhead. Riparian vegetation removed to construct the project will take 5-10 years to return to pre-project levels. During this timeframe, individual steelhead exposed to reduced cover and forage will be able to successfully complete their life cycle in the action area or alternative nearby habitats. The small shaded area that will be created by the new bridge (0.014 acres) is expected to only have negligible effects on steelhead. The RSP placed to stabilized the new bridge is not expected to result in impacts to individual steelhead because it is above and outside the OHWM. Furthermore, the RSP will be backfilled with soil and native plants, hydroseeded, and monitored to ensure survival resulting in habitat (i.e., cover and refugia) that will be of similar or improved condition when compared to the current cover and refugia on site once vegetation becomes established within the 5-10 year time frame.

Based on the above, we do not expect the proposed project to affect the persistence or recovery of the Upper Salinas River subpopulation of steelhead in the S-CCC steelhead DPS.

2.7.2. Critical Habitat

The project site is critical habitat for S-CCC steelhead DPS. In our adverse modification analysis, we consider the condition of critical habitat, the potential effects of the project (complete and pending) on critical habitat, and whether or not those effects are expected to directly or indirectly diminish the value of critical habitat for the conservation of S-CCC steelhead. We consider the potential for climate change to alter conditions in the action area such that critical habitat may be affected over the duration of time we consider for this consultation. These elements (conditions of critical habitat across the DPS, in the watershed, and in the action

area; effects of the project on critical habitat, and effects of climate change on critical habitat) are considered further below.

Across the S-CCC steelhead DPS, critical habitat has been degraded by habitat alteration and development. While conditions vary throughout, critical habitat is generally impaired by habitat alteration and fragmentation, water diversion, and groundwater extraction. Some of these factors also affect S-CCC steelhead critical habitat in Paso Robles Creek, which has been impaired by bank stabilization and urban development. Both watershed-wide factors and action area-specific factors affect critical habitat in the action area leading to reduced habitat complexity and accessibility, poor substrate quality, increased water temperatures, and limited juvenile rearing habitat.

Regarding future climate change effects in the action area, California could be subject to higher average summer air temperatures and lower total precipitation levels. Reductions in the amount of snowfall and rainfall would reduce streamflow levels in Northern and Central Coastal rivers. For this project, in-water activities would occur on a short-term basis; thus, the above effects of climate change are not likely to be detected within that period. If the effects of climate change are detected over the short term, they will likely materialize as moderate changes to the current climate conditions within the action area. As discussed above, climate change could modify water quality, stream flow levels, rearing habitat, and salmonid migration over the long-term. Because the overall reduction in rearing habitat quality cause by the project is minor, or limited to a small area of the watersheds, even if climate change reduced the overall habitat quality in the future, when combined with this proposed action any amplification in habitat degradation will be very small.

Effects to critical habitat from the proposed project are expected to include temporary impacts during construction activities, altered habitat conditions post-construction from reduced riparian vegetation, and permanent beneficial impacts post-construction from removal of fill from within the creek bed of Paso Robles Creek. During dewatering activities, forage supporting juvenile development will be diminished at the work site for up to four months. Therefore, steelhead summer rearing habitat will be reduced in area equal to the dewatered area (up to 100 linear feet) for 4 months, and another 2 months after the site is rewatered as a result of macroinvertebrate reductions. Sedimentation and turbidity following rewatering of the site and during subsequent storms could result in minor and temporary effects to juvenile rearing areas within 100 linear feet downstream of the construction area. Critical habitat at the site will also suffer reductions in vegetation associated cover and forage during the construction and revegetation timeframe of 5-10 years. These reductions will diminish the quality of steelhead freshwater rearing and adult forage sites at the site during the 5-10 year construction and revegetation timeframe.

Conversely, the installation of RSP at the site is not expected to result in significant impacts to critical habitat within the action area because the footprint of the RSP is above and outside the OHWM. Furthermore, the RSP will be backfilled with soil and native plants, hydroseeded, and monitored for 5 years to ensure survival resulting in similar or improved conditions when compared to the current cover and refugia on site once vegetation becomes established within the 5-10 year time frame. In addition, the removal of 0.003 acres of fill from within the Paso Robles creek bed will provide beneficial impacts to freshwater rearing and migration PBFs by restoring a nominal amount of migratory and/or rearing habitat to steelhead that travel through the project area.

The project as a whole is therefore expected to temporarily degrade migrating and rearing critical habitat PBFs in the action area. However, the overall degradation of migration and rearing PBFs in the action area is minor or of limited extent, and suitable migration and rearing opportunities will remain. When added to the environmental baseline, cumulative effects, species status, the effects to critical habitat from the proposed action are not expected to appreciably reduce the quality and function of critical habitat at the larger S-CCC steelhead DPS level.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of S-CCC steelhead, or destroy or adversely modify its designated critical habitat.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Take of listed juvenile S-CCC steelhead is likely to occur during fish relocation and dewatering of Paso Robles Creek between June 1 and October 31. The number of S-CCC steelhead that are likely to be incidentally taken during dewatering activities is expected to be small, and limited to the pre-smolt and young-of-the-year juvenile life stage. NMFS expects that no more than two percent of the juvenile steelhead within the dewatered portion of Paso Robles Creek will be injured, harmed, or killed during fish relocation activities. NMFS expects that no more than one percent of the fish within the same dewatered area will be injured, harmed, or killed during dewatering activities. Because no more than 4 juvenile steelhead are expected to be present within the 100 linear foot dewatered reach of Paso Robles Creek, NMFS does not expect more than 1 juvenile S-CCC steelhead will be harmed or killed by the project. If more than 4 juvenile steelhead are captured or more than 1 juvenile steelhead are harmed or killed, incidental take will have been exceeded.

2.9.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. undertake measures to ensure that injury and mortality to steelhead resulting from fish relocation and dewatering activities is low;
2. undertake measures to minimize harm to salmonids from construction of the project and degradation of aquatic habitat; and
3. prepare and submit plans and reports regarding the effects of fish relocation, construction of the project, and post-construction site-performance.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:
    a. Caltrans or the contractor will retain qualified biologists with expertise in the area of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. Caltrans or the contractor shall ensure that all fisheries biologists be qualified to conduct fish collections in a manner which minimizes all potential risks to ESA-listed salmonids. Electrofishing, if used, shall be performed by a qualified biologist(s) and conducted according to the *NOAA Fisheries Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act, June 2000*. See: https://media.fisheries.noaa.gov/dam-migration/electro2000.pdf
    b. The biologist will monitor the construction sites during placement and removal of cofferdams and channel diversions to ensure that any adverse effects to salmonids are minimized. The biologist will be on site during all dewatering events to capture, handle, and safely relocate salmonids to an appropriate location. The biologist will notify Elena Meza at 707-575-6068 or elena.meza@noaa.gov (or current Caltrans Liaison) one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities. During fish relocation activities the fisheries biologist shall contact NMFS staff at the above number, if mortality of federally listed salmonids

exceeds the three percent of the total steelhead collected, at which time NMFS will stipulate measures to reduce the take of salmonids.

c. The salmonids will be handled with extreme care and kept in water to the maximum extent possible during rescue activities. All captured fish will be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding anytime they are not in the steam, and fish will not be removed from this water except when released. To avoid predation, the biologist will have at least two containers and segregate young-of-the-year from larger age classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location (preapproved by NMFS) in which suitable habitat conditions are present to allow for adequate survival of transported fish and fish already present.

d. If any steelhead or salmon are found dead or injured, the biological monitor will contact NMFS staff at 707-575-6068 or elena.meza@noaa.gov. All salmonid mortalities will be retained until further direction is provided by the NMFS biologist (listed above).

   i) Tissue samples are to be acquired from each mortality prior to freezing the carcass per the methods identified in the NMFS Southwest Fisheries Science Center Genetic Repository protocols: Either a 1 cm square clip from the operculum or tail fin, or alternately, complete scales (20-30) should be removed and placed on a piece of dry blotter/filter paper (e.g., Whatman brand). Fold blotter paper over for temporary storage. Samples must be airdried as soon as possible (don't wait more than 8 hours). When tissue/paper is dry to the touch, place into a clean envelope labeled with Sample ID Number. Seal envelope.

   ii) Include the following information with each tissue sample using the Salmonid Genetic Tissue Repository form or alternative spreadsheet: Collection Date, Collection Location (County, River, Exact Location on River), Collector Name, Collector Affiliation/Phone, Sample ID Number, Species, Tissue Type, Condition, Fork Length (mm), Sex (M, F or Unk), Adipose Fin Clip (Y or N), Tag (Y or N), Notes/Comments.

   iii) Send tissue samples to: NOAA Coastal California Genetic Repository, Southwest Fisheries Science Center, 110 McAllister Way, Santa Cruz, CA 95060.

e. Non-native fish that are captured during fish relocation activities shall not be relocated to anadromous streams, or areas, where they could access anadromous habitat.

2. The following terms and conditions implement reasonable and prudent measure 2:

   a. To ensure that the project is built as designed and contractors adhere to construction best management practices, monitoring will be performed during construction by skilled individuals. Monitors will demonstrate prior knowledge and experience in stream channel design and restoration, fish passage design, construction minimization measures, and the needs of native fish, including steelhead. Monitoring will be performed daily. The monitor(s) will work in close coordination with project management personnel, the project design

(engineering) team, and the construction crew to ensure that the project is built as designed.

b. Any pumps used to divert live stream flow will be screened and maintained throughout the construction period to comply with NMFS' Fish Screening Criteria for Anadromous Salmonids (2000).

c. Construction equipment used within the river channel will be checked each day prior to work within the river channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel, Caltrans or their contractors will contain the spill and remove the affected soils.

d. Once construction is completed, all project-introduced material must be removed, leaving the creek as it was before construction. Excess materials will be disposed of at an appropriate disposal site.

3. The following terms and conditions implement reasonable and prudent measure 3:

a. Caltrans must provide a written report (as described above in section 1.3) to NMFS by January 15 of the year following construction. The report must be submitted to Elena Meza (or current Caltrans Liaison) at elena.meza@noaa.gov.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, "conservation recommendations" are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). NMFS has no conservation recommendations at this time.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Jack Creek Bridge Replacement Project.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

3.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are Caltrans, Santa Cruz County and their contractors. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

3.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

3.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA reviewed in accordance with West Coast Region ESA quality control and assurance processes.

4. REFERENCES

Abdul-Aziz, O. I., N.J. Mantua, and K.W. Myers (2011). Potential climate change impacts on thermal habitats of Pacific salmon (*Oncorhynchus spp*.) in the North Pacific Ocean and adjacent seas. Canadian Journal of Fisheries and Aquatic Sciences 68: 1660-1680.

Alexander, G.R., and E.A. Hansen. (1986). Sand bed load in a brook trout stream. North American Journal of Fisheries Management 6:9-23.

Barnhart, R.A. (1986). Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest), steelhead. United States Fish and Wildlife Service Biological Report 82 (11.60). 21 pages.

Berg, L., and T.G. Northcote. (1985). Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Bjornn, T.C., M.A. Brusven, M.P. Molnau, J.H. Milligan, R.A. Klamt, E. Chacho, and C. Schaye. (1977). Transport of granitic sediment in streams and its effect on insects and fish. University of Idaho, Forest, Wildlife, and Range Experiment Station, Bulletin 17, Moscow, ID.

Bjornn, T.C. and D.W. Reiser (1991). Habitat requirements of salmonids in streams. In: Meehan W.R. (ed.), Influence of forest and rangeland management on salmonids fishes and their habitats. Special Publication 19. Bethesda, MD: American Fisheries Society. 751 p.

Boughton, D. A., and M. Goslin (2006). Potential steelhead over-summering habitat in the South-Central/Southern California coast recovery domain: Maps based on the envelope method. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SWFSC-391. 37 pages.

Boughton, D. A., P.B. Adams, E. Anderson, C. Fusaro, E. Keller, E. Kelley, L. Lentsch, J. Nielson, K. Perry, H. Regan, J. Smith, C. Swift, L. Thompson, and F. Watson (2006).

Steelhead of the South-Central/Southern California Coast: Population characterization for recovery planning. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SWFSC-394. 117 pages.

Boughton, D. A., P.B. Adams, E. Anderson, C. Fusaro, E. Keller, E. Kelley, L. Lentsch, J. Nielson, K. Perry, H. Regan, J. Smith, C. Swift, L. Thompson, and F. Watson (2007). "Viability criteria for steelhead of the South-Central and Southern California coast. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum Draft. 28 pages.

Bryant, M.D (1983). The role and management of woody debris in west coast salmonid nursery streams. North American Journal of Fisheries Management 3:322-330.

Burgner, R.L., J.T. Light, L. Margolis, T. Okazaki, A. Tautz, and S. Ito. (1992). Distribution and origins of steelhead trout in offshore waters of the North Pacific Ocean. International North Pacific Fisheries Commission, Bulletin #51, Vancouver, B.C.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino (1996). Status review of West Coast steelhead from Washington, Idaho, Oregon and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-27. 261 pages.

Bustard, D.R. and D.W. Narver (1975). Aspects of the winter ecology of juvenile coho salmon (Oncorhynchus kisutch) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 32: 667-680.

California Department of Fish and Game (CDFG) (1965). California Fish and Wildlife Plan Vol. 1-3. Inland Fisheries Division, Sacramento, California.

California Department of Transportation (Caltrans). (2021). Jack Creek Road Bridge Replacement Biological Assessment. District 5, Local Assistance, San Luis Obispo County.

Chapman, D.W., and T.C. Bjornn (1969). Distribution of salmonids in streams, with special reference to food and feeding. Pages 153-176 in T. G. Northcote (ed.). Symposium on Salmon and Trout in Streams; H.R. Macmillan Lectures in Fisheries. University of British Columbia, Institute of Fisheries.

Coats, R. (2010). Climate change in the Tahoe basin: Regional trends, impacts and drivers. Climatic Change 102:435-466.

Cooper J.R., J.W. Gilliam, R.B. Daniels, and W.P. Robarge (1987). Riparian areas as filters for agricultural sediment. Soil Science Society of America Journal. 51:416–420.

Cordone, A.J., and D.W. Kelley. (1961). The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47:189-228.

Crouse, M.R., C.A. Callahan, K.W. Malueg, and S.E. Dominguez. (1981). Effects of fine sediments on growth of juvenile coho salmon in laboratory streams. Transactions of the American Fisheries Society 110:281-286.

Cushman, R.M. (1985). Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. North American Journal of Fisheries Management 5: 330-339.

Diffenbaugh, N.S., D.L Swain, and D. Touma (2015). Anthropogenic warming has increased drought risk in California. Proceedings of the National Academy of Sciences 112: 3931-3936.

Eisler, R. (2000). Handbook of chemical risk assessment: health hazards to humans, plants, and animals. Volume 1, Metals. Boca Raton, FL, Lewis Press.

Everest, F.H., and D.W. Chapman (1972). Habitat selection and spatial interaction by juvenile Chinook salmon and steelhead trout. Journal of the Fisheries Research Board of Canada 29: 91-100.

Feely, R.A., C.L. Sabine, K. Lee, W. Berelson, J. Kleypas, V.J. Fabry, F.J. Millero (2004). Impact of anthropogenic CO2 on the CaCO3 system in the oceans. Science 305: 362-366.

Furniss, M.J., T.D. Roelofs, and C.S. Lee (1991). Road construction and maintenance. Pages 297-323 in W. R. Meehan (ed.). Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society Special Publication 19.

Gergel, D.R., B. Nijssen, J.T. Abatzoglou, D.P. Lettenmaier, M.R. Stumbaugh (2017). Effects of climate change on snowpack and fire potential in the western USA. Climatic Change 141: 287-299.

Good, T.P., R.S Waples, and P. Adams. (2005). Updated status of federally listed ESUs of West Coast salmon and steelhead, U.S. Department of Commerce: 598.

Gregory, R.S., T.G. Northcote. (1993). Surface, Planktonic, and Benthic Foraging by Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) in Turbid Laboratory Conditions. Canadian Journal of Fisheries and Aquatic Sciences, 50: 233-240.

Harvey, B.C. (1986). Effects of suction gold dredging on fish and invertebrates in two California streams. North American Journal of Fisheries Management 6: 401-409.

Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, , E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville (2004).

Hayes, J.P., M.D. Adam, D. Bateman, E. Dent, W.H. Emmingham, K.G. Mass, and A.E. Skaugset (1996). Technical commentary: Integrating research and forest management in riparian areas of the Oregon coast range. Western Journal of Applied Forestry 11: 85-89.

Hayes, S.A., M.H. Bond, C.V. Hanson, E.V. Freund, J.J. Smith, E.C. Anderson, A.J. Ammann, and B.R. MacFarlane (2008). Steelhead growth in a small central California watershed: Upstream and estuarine rearing patterns. Transactions of the American Fisheries Society 137: 114-128.

Hayes, S.A., C.V. Hanson, D.E. Pearce, M.H. Bond, J.C. Garza, and B.R. MacFarlane (2012). Should I stay or should I go? The influence of genetic origin on emigration behavior and physiology of resident and anadromous juvenile *Oncorhynchus mykiss*. North American Journal of Fisheries Management 32: 772-780.

Hokanson, K.E.F., C.F. Kleiner, and T.W. Thorslund (1977). Effects of constant temperatures and diel temperature fluctuations on specific growth and mortality rates and yield of juvenile rainbow trout, *Salmo gairdneri*. Journal of the Fisheries Research Board of Canada 34: 639- 648.

Hubert, W.A. (1996). Passive capture techniques. In B. Murphy and D. Willis (eds.) Fisheries Techniques. Bethesda, Maryland, American Fisheries Society: 732.

Integrated Regional Water Management Plan of the Greater Monterey County Region – Updated" (2018). Miscellaneous Monterey and San Luis Obispo County Documents and Reports. 46. https://digitalcommons.csumb.edu/hornbeck_cgb_5/46

Kadir, T., L. Mazur, C. Milanes, and K. Randles (2013). Indicators of Climate Change in California. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment: 258

Keeley, E.R. (2003). An experimental analysis of self-thinning in juvenile steelhead trout. Oikos 102: 543-550.

Knighton, A. D. 1998. Fluvial Forms and Processes: A New Perspective. Arnold, London., 383 pp.

Lindley, S.T., R.S. Schick, E. Mora, P.B. Adams, J.J. Anderson, S. Greene, C. Hanson, B.P. May, D. McEwan, B.R. MacFarlane, C. Swanson, and J.G. Williams (2007). Framework for assessing viability of threatened and endangered Chinook salmon and steelhead in the Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science 5: 26.

Lisle, T.E. (1986). Effects of woody debris on anadromous salmonid habitat, Prince of Wales Island, Southeast Alaska. North American Journal of Fisheries Management 6: 538-550.

McCarthy, S.G., J.J. Duda, J.M. Emilen, G.R. Hodgson, and D.A. Beauchamp (2009). Linking habitat quality with trophic performance of steelhead along forest gradients in the South Fork Trinity River watershed, California. Transactions of the American Fisheries Society 138: 506–521.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt (2000). Viable salmonid populations and the recovery of Evolutionarily Significant Units. NOAA Technical Memorandum NMFS-NWFSC-42.

Mitsch, W.J., and J.G. Gosselink (2000). Wetlands, 3rd ed. John Wiley & Sons, New York.

Monterey County Water Resources Agency (MCWRA) (2014a). Salinas Valley Water Project. Annual Fisheries Report for 2013. Monterey County Water Resources Agency, Salinas, California.

Monterey County Water Resources Agency (MCWRA) (2014b). Salinas Basin Adult Steelhead Escapement Monitoring. 2014 Annual Report. Monterey County Water Resources Agency, Salinas, California.

Monterey County Water Resources Agency (MCWRA) (2014c). Arroyo Seco and Nacimento Rivers Index Reach Monitoring Dive Count Surveys. Monterey County Water Resources Agency, Salinas, CA.

Moser, S., J. Ekstrom, and G. Franco. (2012). Our Changing Climate 2012 Vulnerability and Adaptation to the Increasing Risks from Climate Change in California. A Summary Report on the Third Assessment from the California Climate change Center. July. CEC-500-20102-007S.

Moyle, P. B. (2002). Inland fishes of California. University of California Press, Berkeley, California

Moyle, P.B., JA. Israel, and SE. Purdy (2008). Salmon, steelhead, and trout in California; status of an emblematic fauna. Report commissioned by California Trout. University of California Davis Center for Watershed Sciences, Davis, CA.

Murphy, M.L., and W.R. Meehan. (1991). Stream ecosystems. Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society, Special Publication Number 19. W. R. Meehan. Bethesda, MD, American Fisheries Society: 17- 46.

Myrick, C., and J.J. Cech, Jr. (2005). Effects of temperature on the growth, food consumption, and thermal tolerance of age-0 nimbus-strain steelhead. North American Journal of Aquaculture 67: 324-330.

National Marine Fisheries Service (2007). Federal recovery outline for the Distinct Population Segment of South-Central California Coast steelhead. National Marine Fisheries Service, Southwest Regional Office, Long Beach, California.

National Marine Fisheries Service (NMFS) (2000). Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. June 2000. 5 pp.

National Marine Fisheries Service (2013). South-Central California Coast steelhead recovery plan. West Coast Region, California Coastal Area Office, Long Beach, California.

National Marine Fisheries Service. (2016). 5-Year Review: Summary and Evaluation of South-Central California Coast Steelhead Distinct Population Segment. National Marine Fisheries Service. West Coast Region. California Coastal Office. Santa Rosa, California.

National Marine Fisheries Service. (2019). Biological Opinion for the Dover Canyon Road Bridge Replacement Project. National Marine Fisheries Service. West Coast Region. California Coastal Office. Santa Rosa, California.

Newcombe, C.P. and J.O.T. Jensen (1996). Channel suspended sediment and fisheries: A synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16: 693-727.

Osterback, A.K., C.H. Kern, E.A. Kanawi, J.M. Perez, and J.D. Kiernan (2018). The effects of early sandbar formation on the abundance and ecology of coho salmon (Oncorhynchus kisutch) and steelhead trout (*Oncorhynchus mykiss*) in a central California coastal lagoon. Canadian Journal of Fisheries and Aquatic Sciences. DOI: 10.1139cjfas-2017-0455.

Platts, W.S. (1991). Livestock grazing. In W.R. Meehan (ed.) Influence of forest and rangeland management on Salmonid fishes and their habitats. American Fisheries Society, Special Publication 19: 389-423.

Poole, G.C. and C.H. Berman (2001). An ecological perspective on in-stream temperature: natural heat dynamics and mechanisms of human-caused thermal degradation. Environmental Management 27: 787-802.

Reeves, G.H., J.D. Hall, T.D. Roelofs, T.L. Hickman, and C.O. Baker (1991). Rehabilitating and modifying stream habitats. In W.R. Meehan (ed.) Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society Special Publication 19: 519-557.

Satterthwaite, W.H., M.P. Beakes, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel (2009). Steelhead life history on California's Central Coast: Insights from a state-dependent model. Transactions of the American Fisheries Society 138: 532–548.

Scavia, D., J.C. Field, D.F Boesch, R.W. Buddmeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, J.G. Titus (2002). Climate change impacts on U.S. coastal and marine ecosystems. Estuaries 25: 149-164.

Servizi, J.A., and D.W. Martens. (1992). Sublethal responses of coho salmon (Oncorhynchus kisutch) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.

Shapovalov, L. and A.C. Taft (1954). The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri)* and silver salmon (*Oncorhynchus kisutch*) with special reference to Waddell Creek, California, and recommendations regarding their management. Fish Bulletin 98.

Shirvell, C. (1990). Role of instream rootwads as juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) cover habitat under varying streamflows. Canadian Journal of Fisheries and Aquatic Sciences 47: 852-861.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. (1984). Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150.

SLO Watershed Project. (2019). Lower Salinas-Paso Robles Creek Area. Available at: http://slowatershedproject.org/watersheds/lower-salinas-paso-robles-creekarea/.

Smith, A.K. (1973). Development and application of spawning velocity and depth criteria for Oregon salmonids. Transactions of the American Fisheries Society 102: 312- 316.

Smith, J.J. and H. Li (1983). Energetic factors influencing foraging tactics of juvenile steelhead trout, *Salmo gairdneri*. In D.L.G. Noakes, D.G. Lingquist, G.S. Helfman, and J.A. Ward (eds.) Predators and prey in fishes. Pp 173-180. The Hague, The Netherlands.

Smith, J.J. (1990). The effects of sandbar formation and inflows on aquatic habitat and fish utilization in Pescadero, San Gregorio, Waddell, and Pomponio creek estuary/lagoon systems, 1985-1989. Prepared for California Department of Parks and Recreation. Report Interagency Agreement 84-04-324, San Jose State University.

Sogard, S.M., J.E. Merz, W.H. Satterthwaite, M.P. Beakes, D.R. Swank, E.M. Collins, R.G. Titus, and M. Mangel (2012). Contrasts in habitat characteristics and life history patterns of *Oncorhynchus mykiss* in California's Central Coast and Central Valley. Transactions of the American Fisheries Society 141: 747-760.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki (1996). An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services, Inc. Report prepared for National Marine Fisheries Service, Portland, Oregon.

Thomas, V.G. (1985). Experimentally determined impacts of a small, suction gold dredge on a Montana stream. North American Journal of Fisheries Management 5: 480-488.

Thrower, F.P., J.J. Hard, and J.E. Joyce (2004). Genetic architecture of growth and early life-history transitions in anadromous and derived freshwater populations of steelhead. Journal of Fish Biology. 65: 286-307.

U.S. Environmental Protection Agency (USEPA) (2001). Issue Paper 5: Summary of technical literature examining the effects of temperature on salmonids. Region 10, Seattle, WA. EPA 910-D-01-005. 113pp.

Velagic, E. (1995). Turbidity study: a literature review. Prepared for Delta planning branch, California Department of Water Resources by Centers for Water and Wildland Resources, University of California, Davis.

Waters, T.F. (1995). Sediment in Streams: Sources, Biological Effects, and Control. American Fisheries Society Monograph 7.

Wesche, T.A., C.M. Goertler, and C.B. Frye (1987). Contribution of riparian vegetation to trout cover in small streams. North American Journal of Fisheries Management 7: 151-153.

Westerling, A.L., B.P Bryant, H.K. Priesler, T.P Holmes, H.G. Hidalgo, T. Das, S.R. Shrestha (2011). Climate change and growth scenarios for California wildfire. Climatic Change 109: (Suppl 1):S445–S463.

Williams, T.H., S.T. Lindley, B.C. Spence, and D.A. Boughton (2011). Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. 2011 update to 2011 Report to Southwest Region National Marine Fisheries Service from Southwest Fisheries Science Center, Fisheries Ecology Division.

Williams, T.H., B.C. Spence, D.A. Boughton, R.C. Johnson, L. Crozier, N. Mantua, M. O'Farrell, and S.T. Lindley (2016). Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. February 2016 Report to National Marine Fisheries Service, West Coast Region from Southwest Fisheries Science Center, Fisheries Ecology Division, Santa Cruz, California.

Wurtsbaugh, W.A. and G.E. Davis (1977). Effects of temperature and ration level on the growth and food conversion efficiency of *Salmo gairdneri*, Richardson. Journal of Fish Biology 11: 87-98.

Zedonis, P.A. and T.J. Newcomb (1997). An evaluation of flow and water temperatures during the spring for protection of salmon and steelhead smolts in the Trinity River, California. United States Fish and Wildlife Service, Arcata, CA.