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

February 11, 2024 **Refer to NMFS No:** WCRO-2023-02633

Paul Caron
Senior Environmental Planner
California Department of Transportation, District 7
100 Main Street, Suite 100
Los Angeles, California 90012-3606

Re: Endangered Species Act Section 7(a)(2) Biological Opinion for the Bridge Widening and Railing Upgrade Project on State Route-33 along North Fork Matilija Creek near Ojai in Ventura County (EA: 07-29650)

Dear Mr. Caron:

Thank you for your letter of October 11, 2023, requesting reinitiation of formal 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 bridge-widening project on two SR-33 bridges over North Fork Matilija Creek. The California Department of Transportation is the lead federal agency as assigned by the Federal Highway Administration (FHWA), pursuant to 23 USC 326 for this consultation. Enclosed is NMFS' biological opinion for the subject proposed action, addressing effects of the proposed action on the federally endangered Southern California (SC) Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) and its designated critical habitat in accordance with section (7)(a)(2) of the ESA. The biological opinion concludes the proposed action is not likely to jeopardize the continued existence of the endangered SC DPS of steelhead or destroy or adversely modify its designated critical habitat. The proposed action is likely to result in incidental take of steelhead, therefore, the attached incidental take statement includes the amount and extent of anticipated incidental take with reasonable and prudent measures and non-discretionary terms and conditions to minimize and monitor incidental take of endangered steelhead.

Please contact Jess Fischer in Long Beach at (562) 533-6813 or jessica.fishcer@noaa.gov if you have a question concerning this consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Patrick Thompson, Caltrans D7 (Patrick.Thompson@dot.ca.gov)
Copy to E-File: ARN 151422WCR2018CC00075

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion

Bridge Widening and Railing Upgrade Project, State Route-33 along North Fork Matilija Creek

NMFS Consultation Number: WCRO-2023-02633
Action Agency: California Department of Transportation

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?
Southern California Steelhead (*Oncorhynchus mykiss*)	Endangered	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: February 11, 2024

TABLE OF CONTENTS

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 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

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

On July 30, 2019, NMFS issued a biological opinion to the California Department of Transportation (Caltrans) concerning the Bridge Widening and Railing Upgrade on State Route (SR) 33 at North Fork Matilija Creek. The project includes the widening of two bridges along SR-33 with dewatering and instream work being required for portions of construction.

Recently in a letter dated October 11, 2023, Caltrans requested reinitiating the original consultation due to changes to the proposed action. Originally planned for 2022, construction is now anticipated for 2024 and where one season of construction was proposed for one of the bridges, now Caltrans proposes two construction seasons (June 1-November 1). That specific change is expected to increase the originally anticipated effects to endangered steelhead and their designated critical habitat. The second bridge is no longer proposed to be widened, reducing the amount of creek needing to be dewatered in a single season. On October 23, 2023, NMFS inquired Caltrans of any plans to incorporate additional measures to address effects due to 6PPD-quinone that were not considered in the 2019 biological opinion. Possible measures were discussed, such as incorporating biofiltration aspects into the revegetation plan, and consultation was initiated on the same day.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the

2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

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 (50 CFR 402.02).

1.3.1 Overview of the Proposed Action

Caltrans will upgrade the railings on two bridges over North Fork Matilija Creek (Bridge #52-0044 at PM 15.82; #52-0173 at PM 16.13) at SR-33 and widen Bridge #52-0173. Bridge #52-0044 is no longer proposed to be widened and will no longer require creek access for construction. Due to this change, only activities related to Bridge #52-0173 are considered in this biological opinion. Abutments on the embankments would be widened to accommodate the larger structures. The new structure will result in a footprint increase within the ordinary high-water mark (OHWM) of 54.4 ft^2. Construction of the proposed action is now expected to be completed within two construction seasons, instead of one, with all instream work occurring between June 1 and November 1. Best-management practices (BMP) are incorporated into the proposed action and will be implemented when bridge-construction activities are undertaken.

1.3.2 Proposed Activities to Prepare the Work Area for Construction

To prepare for construction in dry conditions, the work area will be temporarily isolated from surface flow and any steelhead within the affected area will be relocated. A diversion will be constructed using double 60-inch corrugated-metal pipes, K-rail, and gravel-berm cofferdam. The diversion will be placed on one side of the creekbank, then moved to the other side of the creekbank to complete construction. Upstream of the diversion inlets the creekbanks will be lined with K-rail, tarps, and gravel sandbags for 22 to 45 feet to divert the water into the pipes. The pipe will be placed 29 feet upstream and 28 feet downstream of the bridge with the diversion temporally affecting a total of 114 linear feet of stream.

Prior to diversion of surface water, Caltrans proposes that a NMFS-approved biologist will survey 0.5 miles upstream and downstream of the project limits to identify suitable relocation areas for steelhead and 6-foot-tall block nets with 1/8-inch mesh will be installed across the channel just upstream and downstream of the diversion. Any steelhead in the area will be removed with dip nets and the dewatered area will be monitored by biologists as the water level drops. Steelhead will be placed in aerated coolers for relocation then released in pre-designated areas, being mindful to avoid overcrowding. Upon completion of the proposed action and construction activities, barriers to surface flow will be removed and the creek will be restored to pre-construction conditions. The following measures will be undertaken to minimize take of steelhead and adverse effects to aquatic habitat during the dewatering process and subsequent construction activities.

- A water diversion plan shall be developed and implemented in consultation with NMFS to divert water through the project site to reduce turbidity and prevent sediments from entering pools downstream of the project site.
- Released fish will be spread throughout the area to prevent overcrowding in release areas.
- Captured steelhead will be held in at least 5-gallons of water for no more than 30 minutes to maintain suitable oxygen and water temperature. If steelhead need to be held longer than 30 minutes due to travel time to relocation sites, appropriate measures will be taken to maintain suitable oxygen and temperature as deemed appropriate by the fisheries biologist.
- If fry are present, no more than 40 fry per 5-gallon bucket will be allowed to prevent overcrowding.
- The water temperatures of the buckets will be frequently measured and compared to the water temperatures at the release points. If the two differ by more than a few degrees, creek water will be added to the bucket to acclimate fish to the release temperature. Additional air and water temperatures will be collected within the block netted and release areas for comparison.
- During construction, qualified biologists will inspect and clean the upstream and downstream block nets daily. In addition, the biologist will monitor the number of steelhead immediately upstream of the block nets for overcrowding and will capture and relocate individuals and move them downstream at his or her discretion.

1.3.3 Proposed Construction Activities

After dewatering, temporary falsework will be installed on the bridge, which will include piles placed in the active channel during construction, though no driving of the piles is proposed. Bridge 52-173 will be widened from 29.5 feet to 40 feet, 10 inches and a barrier will be placed on both sides. The abutments for this single-span bridge are within the OHWM; excavation and widening to support the enlarged structure will result in 54.4 ft^2 of permanent impact to the creek. The widened abutments will be in-line with the existing abutments. The following measures will be taken to minimize adverse effects to aquatic habitat during construction activities.

- Groundwater seepage within the project area will be containerized and taken offsite to prevent sediments from entering the lagoon downstream.
- During construction, a biological monitor will be on-site during all construction activities. Should any issues arise that need to be addressed during construction, the biological monitor will immediately notify the Resident Engineer in charge of the project.
- All staging and maintenance will be performed outside the channel at the roadway level. These areas will be isolated from the creek utilizing standard Caltrans BMP should any rain events be forecast during construction activities. Any heavy equipment used in the project area will be removed at the end of each workday. All heavy equipment will be checked for oil, gas, hydraulic fluid and any other pollutant which could impact water quality and instream habitat each workday prior to being deployed into the project area. Drip pans will be installed on all equipment working in the project area to control leaks

and for the purpose of avoiding water-quality impacts to surface waters.

- Sedimentation-control measures may include siltation curtains, sandbags, hay bales, filter fabrics, and fiber rolls.

1.3.4 Proposed Post-Construction Activities

After bridge construction, Caltrans will restore the creek to pre-construction conditions by replacing any boulders to their original locations and blending the widened portion of the creek into the existing creek bed. This includes placing fines, gravel, rock, and boulders within the widened portion of the creek to simulate a natural stream environment as well as replanting riparian vegetation to provide shade for the creek. Caltrans will replace riparian habitat impacted by the project at a 5:1 ratio for permanent impacts and a 2:1 ratio for temporary impacts. Hydroseeding will be incorporated to compensate temporary impacts. Most of the vegetation impacted will be white alder (*Alnus rhombifolia*) and western sycamore (*Platanus racemose*). A Stream Restoration and Habitat Mitigation Monitoring Plan will be developed by Caltrans in conjunction with a qualified hydraulics engineer, and then implemented, to ensure that the proposed action does not disrupt stream morphology and prevent sediments from naturally entering the lagoon. Caltrans will submit this plan to NMFS for approval prior to implementation. A final project report will be submitted to NMFS once the project and all monitoring has been completed.

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 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 of critical habitat for endangered steelhead uses 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 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.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would 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.

2.2.1 Status of the Species

The endangered southern California (SC) Distinct Population Segment (DPS) of steelhead extends from the Santa Maria River in Santa Barbara County to the Mexican border (inclusive). NMFS characterized the abundance of steelhead in the DPS when the species was originally listed (August 18, 1997, 62 FR 43937) and cited this information as the basis for the re-listing of the SC DPS of steelhead as endangered (May 3, 2006, 71 FR 834). Estimates of historical (pre-1960s) and more recent (1997) abundance show a precipitous drop in numbers of spawning adults for major rivers in the southern California DPS. An updated status report states that the chief causes for the numerical decline of steelhead in southern California include urbanization, water withdrawals, channelization of creeks, human-made barriers to migration, and the introduction of exotic fishes and riparian plants (Good et al. 2005), and these threats have essentially remained unchanged over time (NMFS 2011; Williams et al. 2011; NMFS 2016; Williams et al. 2016; NMFS 2023). Historical data on steelhead numbers for this region are sparse. The historic and recent steelhead abundance estimates, and percent decline are summarized in Table 1. The run-size estimates illustrate the severity of the numerical decline for the major rivers within range of the SC DPS of steelhead (Good et al. 2005; NMFS 2011; Williams et al. 2011; NMFS 2016; Williams et al. 2016; NMFS 2023).

Stream surveys to document the species' current pattern of occurrence concluded that of the 46 watersheds in the DPS which steelhead occupied historically, *O. mykiss* currently occupy only about 40% to 50% of these watersheds (Boughton et al. 2005). Fish surveys by NOAA's Southwest Fisheries Science Center (SWFSC), direct observations by NMFS biologists, and anecdotal information from local biologists working on major rivers and creeks throughout the DPS suggest that although steelhead populations continue to persist in some coastal watersheds, the population numbers are exceedingly small (Good et al. 2005; Williams et al. 2011; 2016; NMFS 2023). On a positive note, there have been observations of steelhead recolonizing vacant watersheds during years with abundant rainfall, notably San Mateo Creek and Topanga Creek (Good et al. 2005; Bell et al. 2011) including a recent observation of *O. mykiss* in San Mateo Creek (NMFS 2017). Also, California Department of Fish and Wildlife discovered an adult female steelhead (TL 57.46 cm) on April 26, 2013, during a flow-rate survey in Conejo Creek (Camarillo, California).

NMFS reviews the status and viability of the SC DPS of steelhead on the basis of available information (including new information) about the species abundance, population growth rate, spatial structure, and diversity (McElhany et al. 2000) every five years as required by the ESA. In the last two status reviews, NMFS concluded that the risk of extinction of the endangered SC

DPS of steelhead was unchanged (NMFS 2011, 2016). The most recent 5-year status review reaffirms the species is at risk of extinction, with survival and recovery of the species remaining tenuous and highly susceptible to impacts of ongoing and new anthropogenic activities (NMFS 2023).

The most recent viability assessment (Boughton 2022) concluded that the recent drought had large negative impacts on the DPS, with no adult steelhead at all observed in many streams over the past five to seven years. In streams where adult steelhead runs were actually observed, the counts have been in the single digits. During the drought expression of the adult steelhead life history has nearly disappeared. Based on the 2023 status review, NMFS concluded that SC steelhead DPS remains endangered (NMFS 2023).

Table 1. Historical and recent abundance estimates of adult steelhead in the Southern California DPS. Data are from Good et al. (2005); (NMFS 2011), and NMFS SWR redd surveys 2009-2011 (R. Bush, NMFS, personal communication).

	Pre-1950	Pre-1960	1990s	2000s	Percent Decline
Santa Ynez River	20,000-30,000		< 100		99
Ventura River		4,000-5,000	< 100	< 100	96
Santa Clara River		7,000-9,000	< 100	< 10	99
Malibu Creek		1,000	< 100		90

2.2.1.1 General Life History of Steelhead

O. mykiss possess an exceedingly complex life history (Behnke 1992). Distinctly different from other Pacific salmon, steelhead adults can survive their first spawning and return to the ocean to reside until the next year to reproduce again. For returning adults, the specific timing of spawning can vary by a month or more among rivers or streams within a region, occurring in winter and early spring. The spawning time frames depend on physical factors such as the magnitude and duration of instream flows and sand-bar breaching. Once they reach their spawning grounds, females will use their caudal fin to excavate a nest (redd) in streambed gravels where they deposit their eggs. Males will then fertilize the eggs and, afterwards, the females cover the redd with a layer of gravel, where the embryos (alevins) incubate within the gravel. Hatching time can vary from approximately three weeks to two months depending on ambient water temperature. The young fish (fry) emerge from the redd two to six weeks after hatching. As steelhead begin to mature, juveniles or "parr" will rear in freshwater streams anywhere from 1-3 years. Juvenile steelhead can also rear in seasonal coastal lagoons or estuaries of their natal creek.

Juvenile steelhead emigrate to the ocean (as smolts) usually in late winter and spring and grow to reach maturity at age 2-4, but steelhead can reside in the ocean for an additional 2-3 years before returning to spawn. The timing of emigration is influenced by a variety of parameters such as photoperiod, temperature, breaching of sandbars at the river's mouth and streamflow. Extended droughts can cause juveniles to become landlocked, unable to reach the ocean (Boughton et al. 2006).

Through studying the otolith (ear stone) microchemistry of *O. mykiss*, researchers further understand the complex and intricate life history of steelhead. Specifically, resident rainbow trout can produce steelhead progeny; likewise, steelhead can yield resident rainbow trout progeny (Zimmerman and Reeves 2000). Additionally, evidence indicates that sequestered populations of steelhead (e.g., above introduced migration barriers) can exhibit traits that are the same or similar to anadromous specimens with access to the ocean. Examples include inland resident fish exhibiting smolting characteristics and river systems producing smolts with no regular access for adult steelhead. This evidence suggests the ecological importance of the resident form to the viability of steelhead and the need to reconnect populations upstream and downstream of introduced migration barriers. The loss or reduction in anadromy and migration of juvenile steelhead to the estuary or ocean is expected to reduce gene flow, which strongly influences population diversity (McElhany et al. 2000). Evidence indicates genetic diversity in populations of southern California steelhead is low (Girman and Garza 2006).

2.2.1.2 Steelhead Habitat Requirements

Habitat requirements of steelhead generally depend on the life history stage. Steelhead encounter several distinct habitats during their life cycle. Water discharge, water temperature, and water chemistry must be appropriate for adult and juvenile migration. Suitable water depth and velocity, and substrate composition are the primary requirements for spawning. Furthermore, dissolved oxygen concentration, pH, and water temperature are factors affecting survival of incubating embryos. The presence of interspatial area between large substrate particle types is important for maintaining water-flow through the nest as well as dissolved oxygen levels within the nest. These spaces can become filled with sand and smaller particles. Additionally, juveniles need abundant food sources, including insects, crustaceans, and other small fish. Habitat must also provide places to hide from predators, such as under logs, root wads and boulders in the stream, and beneath overhanging vegetation. Steelhead also need places to seek refuge from periodic high-flow events (side channels and off channel areas), and may occasionally benefit from the availability of cold-water springs or seeps and deep pools during summer. Estuarine habitats can be utilized during the seaward migration of steelhead, as these habitats have been shown to be nurseries for steelhead. Estuarine or lagoon habitats can vary significantly in their physical characteristics from one another, but remain an important habitat requirement as physiology begins to change while juvenile steelhead become acclimated to a saltwater environment.

2.2.1.3 Influence of a Changing Climate on the Species

One factor affecting the rangewide status of endangered steelhead, and aquatic habitat at large, is climate change. For the Southwest region (southern Rocky Mountains to the Pacific Coast), the average temperature has already increased roughly 1.5°F compared to a 1960-1979 baseline period. High temperatures will become more common, indicating that southern California steelhead may experience increased thermal stress even though this species has shown to endure higher than preferable body temperatures (Spina 2007).

Precipitation trends are also important to consider. The Southwest region, including California, showed a 16 percent increase in the number of days with heavy precipitation from 1958 to 2007. Potential impacts to SC steelhead in freshwater streams include damage to spawning redds and washing away of incubating eggs due to higher winter stream flow (USGCRP 2009), and poor freshwater survival due to longer and warmer periods of drought (Hanak et al. 2001; Mastrandrea and Luers 2012), which may lead to lower host resistance of steelhead to more virulent parasitic and bacterial diseases (McCullough 1999; Marcogliese 2001). Snyder and Sloan (2005) projected mean annual precipitation in southwestern California to decrease by 2.0 cm (four percent) by the end of the 21st century.

Wildfires periodically burn large areas of chaparral and adjacent woodlands in autumn and winter in southern California (Westerling et al. 2004). Increased wildfire activity over recent decades reflects sub-regional responses to changes in climate, specifically observations of warmer and earlier onset of spring along with longer summer-dry seasons (Westerling et al. 2004; Westerling and Bryant 2008).

The Thomas Fire impacted SC steelhead viability through direct and indirect effects to PBF mainly in the Ventura River Watershed relative to the Santa Clara River Watershed. The fire burned nearly 80 miles of designated critical habitat. In general, fire impacts include changes in geomorphology (e.g., sediment filled pools and riffles), decreased pool depth, increased solar radiation owing to losses in riparian cover, changes in water quality, increased dissolved nutrients and pH, and changes in pool:riffle ratios (Dunham et al. 2003; Earl and Blinn 2003; Aha et al. 2014). However, these effects may be pronounced or muted depending on the fire burn severity, timing of subsequent rainfalls (e.g., January 9, 2018, storm event), intensity and duration of ensuing rains, and volume of debris and sediment entering streams. After a fire disturbance, decreased water quality and loss of SC steelhead habitat can be facilitated by the following physical, chemical and biological changes (USFS 2018):

- Increased surface flows resulting in flooding;
- Increased sedimentation leading to changes in food web structure, reducing primary productivity, with effects to grazers and other benthic macroinvertebrates and their predators (e.g., fish);
- Changes to water quality and chemistry due to ash, smoke, nutrients, and hazardous materials;
- Increased water temperature due to reduction/elimination of riparian cover and increased fine sediment loads;
- Scouring of riparian/aquatic vegetation;
- Changes in streambed/pool habitat due to geomorphic movement (debris flows);
- Mass failure of culverts leading to stream habitat degradation; and
- Flushing and extirpation of aquatic biota with limited ability to recolonize rivers, including fish, downstream during and after flood events, respectively.

Debris flows are among the most hazardous consequences of rainfall on burned hillslopes (WERT 2018). The January 9, 2018, storm event trigged a debris flow when Matilija Canyon received approximately six inches of rain in 24 hours. This storm event initiated several debris flows within the Santa Ynez Mountains, and consequently inundated areas within Montecito and Carpinteria in Santa Barbara County. The overall peak runoff throughout impacted areas will likely increase relative to unburned areas for the 2-year and 10-year recurrence intervals.

The Thomas Fire affected 11% of total designated critical habitat within the range of the SC DPS of steelhead; burned critical habitat was mainly in the Ventura River Watershed (56%) and to a lesser degree in the Santa Clara River Watershed (18%). Indirect effects from the fire (e.g., mudflow, mudslides) likely increase the extent and amount of habitat destruction downstream to the estuary-ocean interface by altering PBF essential to the conservation of a species including a delay in development of such features, which the species relies upon during various life stages.

Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002). Additionally, upper ocean temperature is the primary physical factor influencing the distribution of steelhead in the open ocean, and a warming climate may result in a north-ward shift in steelhead distribution (Myers and Mantua 2013).

In summary, observed and predicted climate-change effects are generally detrimental to the species, given the unprecedented rate of change and uncertainty about the ability to adapt, so unless offset by improvements in other factors, status of the species and critical habitat is likely to decline over time. The climate change projections referenced above cover the time period between the present and approximately 2100. In general, climate change projections cannot be distinguished from annual and decadal climate variability for approximately the first 10 years of the projection period (see Cox and Stephenson 2007). While there is uncertainty associated with projections beyond 10 years, which increases over time, the direction of change is relatively certain (McClure et al. 2003).

2.2.2 Designated Critical Habitat

Critical habitat for the SC DPS of steelhead was designated on September 2, 2005, and consists of the stream channels listed in (70 FR 52488). Critical habitat has a lateral extent defined as the width of the channel delineated by the ordinary high-water line as defined by the Corps in 33 CFR 329.11, or by its bankfull elevation, which is the discharge level on the streambank that has a recurrence interval of approximately 2 years (September 2, 2005, 70 FR 52522). PBF are components of stream habitat that have been determined to be essential for the conservation of the SC DPS of steelhead, and are specific habitat components that support one or more steelhead life stages and in turn contain physical or biological features essential to steelhead survival, growth, and reproduction, and conservation. These include:

a. **Freshwater spawning sites** with sufficient water quantity and quality and adequate substrate (i.e., spawning gravels of appropriate sizes) to support spawning, incubation and larval development.

b. **Freshwater rearing sites** with sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions and allow salmonid development and mobility; sufficient water quality to support growth and development; food and nutrient resources such as terrestrial and aquatic invertebrates and forage fish; and natural cover such as shade, submerged and overhanging large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

c. **Freshwater migration corridors** free of obstruction and excessive predation with adequate water quantity to allow for juvenile and adult mobility; cover, shelter, and holding areas for juveniles and adults; and adequate water quality to allow for survival.

d. **Estuarine areas** that provide uncontaminated water and substrates; food and nutrient sources to support steelhead growth and development; and connected shallow water areas and wetlands to cover and shelter juveniles.

e. **Marine areas** with sufficient water quality to support salmonid growth, development, and mobility; food and nutrient resources such as marine invertebrates and forage fish; and near-shore marine habitats with adequate depth, cover, and marine vegetation to provide cover and shelter.

Streams designated as critical habitat in the SC steelhead DPS contain the above PBF (PBF 1-3) in differing amounts and to varying degrees, depending on the particular stream, the characteristics of the watershed, and the degree that the watersheds are impacted by anthropogenic factors. Perennial streams with PBF and conditions suitable for steelhead are fewer in the southern portion of the DPS compared to the northern portion. Some of this is due to the amount of coastal development and because there is generally less rainfall in the southern region. During the summer many creeks at the southern edge of the range become intermittent in sections or dry completely (in some cases this occurrence is natural and in other cases it is due to anthropogenic factors), and stream temperatures may become a factor in terms of suitability for rearing steelhead. Overall, steelhead over-summering habitat is thought to have a restricted distribution more so than winter spawning and rearing habitat in the SC steelhead DPS (Boughton et al. 2006).

Streams with high conservation value have most or all of the PBF of critical habitat and extensive areas that are suitable for steelhead spawning, rearing, and migration (NMFS 2012). Streams with medium or low conservation value are less suitable for steelhead in terms of spawning, rearing, and migration, and have less of the PBF necessary for steelhead survival growth and reproduction, generally due to anthropogenic factors. Both the Ventura River and Santa Clara River watersheds have been found to have high conservation value for the survival and recovery of the SC DPS of steelhead. While many streams in the DPS have been found to have high conservation value for survival and recovery of the species, the spawning, rearing, and migratory habitat within the DPS are heavily impacted by dams, diversions, and human development. As a result, much of the available habitat has become severely degraded, and habitat degradation has been a main contributing factor to the current endangered status of the DPS (Good et al. 2005). The most recent status reviews found that these threats have remained essentially unchanged (Williams et al. 2011, 2016; NMFS 2016).

2.2.2.1 Status of Critical Habitat

Habitat for steelhead has suffered destruction and modification, and anthropogenic activities have reduced the amount of habitat available to steelhead (Nehlsen et al. 1991; NMFS 1997; Boughton et al. 2005; NMFS 2006). In many watersheds throughout the range of the SC DPS, the damming of streams has precluded steelhead from hundreds of miles of historical spawning and rearing habitats (*e.g.*, Twitchell Reservoir within the Santa Maria River watershed, Bradbury Dam within the Santa Ynez River watershed, Matilija Dam within the Ventura River watershed, Rindge Dam within the Malibu Creek watershed, Pyramid Dam and Santa Felicia Dam on Piru Creek). These dams created physical barriers and hydrological impediments for adult and juvenile steelhead migrating to and from spawning and rearing habitats. Likewise, construction and ongoing impassable presence of highway projects have rendered habitats inaccessible to adult steelhead (Boughton et al. 2005).

Within stream reaches that are accessible to this species (but that may currently contain no fish), urbanization (including effects due to water use) have in many watersheds eliminated or dramatically reduced the quality and amount of living space for juvenile steelhead. The number of streams that historically supported steelhead has been dramatically reduced (Good et al. 2005). Groundwater pumping and diversion of surface water contribute to the loss of habitat for steelhead, particularly during the dry season (e.g., NMFS 2005; see also Spina et al. 2005). The extensive loss and degradation of habitat is one of the leading causes for the decline of steelhead abundance in southern California and listing of the species as endangered (NMFS 1997, 2006).

A significant amount of estuarine habitat has been lost across the range of the DPS with an average of only 22-percent of the original estuarine habitat remaining (Williams et al. 2011). The condition of these remaining wetland habitats is largely degraded, with many wetland areas at continued risk of loss or further degradation. Although many harmful practices have been halted, much of the historical damage remains to be addressed and the necessary restoration activities will likely require decades. Many of these threats are associated with the larger river systems such as the Santa Maria, Santa Ynez, Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, San Luis Rey, Santa Margarita, San Dieguito, and San Diego rivers, but they also apply to smaller coastal systems such as Malibu, San Juan, and San Mateo creeks. Overall, these threats have remained essentially unchanged for the DPS as determined by the last status review (NMFS 2016) though some individual, site specific threats have been reduced or eliminated as a result of conservation actions such as the removal of small fish passage barriers.

Climate-driven changes to stream and estuarine environments have the potential to significantly impact critical habitat for steelhead populations. Coupled with naturally stressful environments at the southern limit of the species distribution, multiple stressors are likely to be amplified by ongoing increases in temperature, changes in precipitation patterns, and decreases in snowpack (Mote et al. 2003; Hayhoe et al. 2004). Research suggests that a change in climate would be expected to shift species distributions as they expand in newly favorable areas and decline in marginal habitats (Kelly and Goulden 2008). When climate interacts with other stressors such as habitat fragmentation, additional threats to natural resources will likely emerge (McCarty 2001), including threats to the viability of steelhead populations. In particular, seasonal access to perennial, cool water habitats, especially smaller streams at higher elevations, will likely become more important to endangered salmonids seeking refuge from unsuitable temperature and streamflow (Crozier et al. 2008).

While continued changes in climate are highly likely, estimating the magnitude of the change is more difficult the further into the future one must go. For example, increases in air temperatures globally are more certain than increases in air temperature in a particular watershed in California. Increases in global air temperatures may shift wind patterns, and these changes, in combination with regional topography, may affect how air temperatures in a particular watershed change in relation to changes in global air temperatures.

Environmental monitoring data in the southwestern United States indicate changes in climatic trends that have the potential to affect steelhead critical habitat. Southern California is also experiencing an increasing trend in droughts, measured by the Palmer Drought Severity Index from 1958 to 2007 (USGCRP 2009). Snyder and Sloan (2005) project mean annual precipitation in central western California will decrease by about 3-percent by the end of the century. Small thermal increases in summer water temperatures have resulted in suboptimal or lethal habitat conditions and consequent reductions in *O. mykiss* distribution and abundance in the northwestern United States (Ebersole et al. 2001). Thus, climate variability is an important factor in evaluating how the status of the species and critical habitat is influenced by changing climate.

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 includes the linear extent (upstream and downstream) of SR-33 bridge #52-0173 over North Fork Matilija Creek and encompasses the riparian corridor to the top of the bank. The action area extends 200-feet upstream of the bridge where temporary noise impacts are expected to cease, and 500 feet downstream of the 114-foot diversion where temporary aquatic effects such as elevated turbidity are anticipated to cease. The approximate length of North Fork Matilija within the action area is 814 feet.

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 Status of Critical Habitat in the Action Area

Critical habitat within the action area of North Fork Matilija Creek consists of a complex array of pools and pocket water, with short riffles and runs between pools. The active channel of the creek is about 20 to 30-feet wide and is comprised of gravel, cobble, and boulders. North Fork Matilija Creek drains part of the Western Transverse ranges of southern California, a tectonically active area (Florsheim et al. 1991). As a result, debris slides are common, such as those following the Thomas fire in winter 2018, and several large boulders are present through the action area, creating step pools and hydraulic breaks for rearing, migrating, and spawning steelhead. Much of the newly planted vegetation on the right bank near Bridge #52-0044 was wiped out during high flow storm events in spring 2019 (P. Champion, Caltrans, 2019, personal communication). Riparian trees within the action area include several white alders, western sycamores, and arroyo willows that create a dense canopy cover, and provide shade over the creek. In the action area, the threat to SC steelhead from climate change is likely to include a continued increase in summer air temperatures, more extreme heat waves, and an increased frequency in drought (McClure et al. 2003). Overall, the habitat in the action area provides most, if not all, of the PCEs necessary for the growth and survival of steelhead (i.e., cover, shelter, pools, riparian, and migratory habitat).

2.4.2 Status of Steelhead in the Action Area

Juvenile steelhead abundance was surveyed within and upstream of the action area from 2006 to 2012 (Normandeau Associates Inc. 2015). The annual number of juvenile steelhead observed via snorkeling ranged from 26 to 232 steelhead within two half-mile stream reaches of pool habitat. In April 2008, while Caltrans implemented emergency SR-33 repairs at Wheeler Springs, about two-miles upstream of the action area, 782 steelhead fry and 32 yearling steelhead were found within a 350-foot section of the creek and relocated (Swift and Mulder 2008). There were 16 mortalities associated with this capture and relocation effort (2% mortality). Redd surveys from 2008 to 2017 declined significantly as well as the drought intensified (Casitas Municipal Water District 2017). During capture-relocation efforts for a recent Caltrans project near Bridge 44, 2 juvenile steelhead were found in 2017, and none in 2018 (GPA Consulting 2018). Based on a known distribution provided by Normandeau Associates Inc. (2015), Swift and Mulder (2008), GPA Consulting (2018), and habitat within the action area (i.e., pools), NMFS estimates that up to 30 juvenile steelhead may be present in the area to be dewatered each construction season (60 juveniles over two years). Since downstream migration through the project area is not possible during construction activities and juvenile steelhead may accumulate above the upstream block net, NMFS estimates that 5 or fewer juveniles will need to be relocated each construction season (10 juveniles over two years). Thus, NMFS estimates that up to 70 juvenile steelhead will need to be relocated. Adult steelhead are not expected to be present within the action area during the time of construction activities (June 1 to November 1).

2.4.3 Threats to Steelhead and Critical Habitat in the Action Area

2.4.3.1 Migration Barrier

An impediment to steelhead migration exists downstream of the action area within the Ventura River at the Robles Diversion fishway. The fishway was completed in 2004, but the effectiveness of the fishway for passing steelhead without delay has not been reliably assessed. Videotaped sightings of adult steelhead passing upstream through the fishway were recorded during winter 2007 and 2008, so it is believed that the fishway provides some level of passage for steelhead past the diversion. Currently, it is unknown if, and to what extent, steelhead may be delayed at the fish way during their upstream migration. Monitoring and 5-year evaluations continue for the fishway (Casitas Municipal Water District 2017). As a result, overall steelhead productivity and rearing capacity has the potential to be reduced in North Fork Matilija Creek including the action area.

2.4.3.2 Road Encroachment

North Fork Matilija Creek within the action area receives runoff from SR-33; runoff from road surfaces can contain dirt, oils, automotive fluids, and petrochemicals that are harmful to aquatic life, including steelhead (Spence et al. 1996). Stormwater runoff form roadways also contains 6PPD-quinone, a common rubber tire antioxidant, found in urban runoff and known to kill salmonids (Tian et al. 2021; Brinkmann et al. 2022). Additionally, the placement of the road adjacent to the creek required installation of grouted RSP on the creekbank, which has reduced the ability of the creek to meander and diminished the riparian zone on the western and northern banks. The location of the road and grouted RSP appear to be at least part of the reason for the present RSP failure, as well as streamflows slowly undermined and scoured the base of the RSP.

2.4.3.3 Rock Quarry

The Mosler Quarry is on the eastern creekbank in the action area near Bridge 52-44. The quarry is a source of both coarse and fine sediment to the stream channel. In 2006, a complex of large boulders that originated from the quarry on upslope areas of the left stream bank fell into the creek, causing a severe impediment to upstream steelhead migration under most flow conditions. Only during very high flow events were steelhead believed to be able to migrate upstream past the impediment. In August 2010, the boulders that created the impediment were relocated within the channel, eliminating the impediment adjacent to the quarry. Although known barriers have been recently removed, the effects of encroachment by quarry activities on critical habitat within the action area are not fully understood. Activities at the quarry can lead to elevated turbidity in the stream during high flow events. Santa Barbara Channelkeeper (2008) documented extremely high turbidity in the creek just downstream of the quarry during rain events, contrasting with low to moderate turbidity upstream of the quarry.

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).

2.5.1 Effects of the Action on Critical Habitat

2.5.1.1 Temporarily Altering Aquatic Habitat

Dewatering the immediate work area is expected to temporarily eliminate a freshwater rearing area and freshwater migration area for endangered steelhead. About 114-linear feet of North Fork Matilija Creek will be dewatered each construction season for up to five months (June 1 through November 1) to allow construction in the dry.

Aquatic macroinvertebrate forage will be temporarily reduced or eliminated within the action area due to isolating the workspace from flowing water. Aquatic insects provide a source of food for instream fish populations and may represent a substantial portion of food items consumed by juvenile steelhead. Effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because construction activities will be temporary, and rapid recolonization (about one to two months) of the restored channel area by macroinvertebrates is expected following re-watering (Cushman 1985; Thomas 1985; Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile steelhead is expected to be negligible because food from upstream sources would be available downstream of the dewatered area via drift.

Ultimately, the loss of aquatic habitat associated with dewatering will be temporary. Full connectivity between the upstream and downstream reaches will be restored after the water diversion is removed and river flows are returned to the dewatered area, and no long-term diminishment in the physical capacity of the habitat to serve the intended functional role for steelhead will result from the proposed action. Overall, effects to designated critical habitat for the species from water diversion are expected to be temporary.

2.5.1.2 Disturbance to the Streambed

Although manipulation and disturbance of the creekbed can result in changes to channel morphology and hydraulic conditions that may alter the freshwater migration corridor and freshwater rearing area, review of the proposed action indicates the widening of the bridge is not expected to result in substantive changes to creek-channel morphology or rearing conditions.

For instance, the abutment extensions on Bridge 52-0173 will be placed in the same alignment as the existing structures, which is parallel to the direction of streamflow and resulting in the loss of about 54.4 ft^2 of designated critical habitat along the creekbank. Hydraulic computations and a HEC-RAS model were used to analyze potential post-project hydraulic conditions through the project reach. The results of the model showed that the proposed action will not alter steelhead-passage conditions and neither bridge location is considered a barrier. The PBFs of critical habitat for juvenile rearing (i.e., riparian, natural cover, shelter) occur throughout the action area and beyond. Therefore, the discrete loss of critical habitat located underneath the bridge and along the sides of the channel is not expected to diminish the overall functional value of rearing habitat within the action area. Additionally, creekbed contours will be restored to their original condition upon completion of the project. Based on these findings, the proposed action is not anticipated to appreciably reduce the functional value of the action area as a migratory corridor or rearing site.

2.5.1.3 Alteration of Water Quality

Short-term increases in turbidity are anticipated during water diversion and dewatering activities, during the first flush of the creek channel when re-watered, and during the first rainstorms which may mobilize disturbed sediments within the action area. This could affect water quality up to 350-feet downstream of the diversion, and is a concern because water quality is an important feature of steelhead critical habitat (NMFS 2005) and elevated turbidity can affect juvenile steelhead by a variety of mechanisms. However, NMFS does not expect acute or chronic effects on aquatic habitat in the action area of North Fork Matilija Creek because increases in sedimentation and turbidity levels resulting from construction activities are expected to be minimal and temporary (i.e., a few hours during dewatering and a few hours after rewatering to about one day during the first storm), should they occur. This is because the area where the construction will take place is relatively small. Also, much of the research regarding turbidity effects on salmonids was carried out in a laboratory setting with turbidity levels significantly higher than those expected to result from project activities. Furthermore, BMP and sediment control devices (i.e., siltation curtains, sandbags, hay bales, filter fabrics, and fiber rolls) will be deployed prior to construction and thus are expected to minimize the likelihood that effects of sedimentation and turbidity on water quality would be observed. The success of these measures have been documented during other similar projects (J. Ogawa, NMFS, 2019, personal communication), through the efficacy of the proposed measures should be verified in the field at the time of the proposed action. NMFS expects that the disturbance within the stream channel will not result in increases sedimentation within the creek in the long term.

Stormwater runoff from the maintained bridge and adjoining roadway is anticipated to introduce chemical compounds widely associated with automobiles and used in tire manufacturing. For instance, polycyclic aromatic hydrocarbons (PAHs – oils, grease, fuels), heavy metals (copper, zinc, cadmium, chromium, lead) and toxic tire particles (6PPD-quinone) are often found where both rural and urban roadways drain into waterways (Caltrans 2000, 2003a, 2003b; Feist et al. 2018; Sutton et al. 2019; Peter et al. 2020; 2022). In addition, tire-derived products used by Caltrans and others, such as asphalt rubber paving, fill for overpass construction or surface area covers for porous walkways, paths and bike trails, may also contribute harmful chemicals to waterways (CA DTSC 2022). The highest concentration of chemicals harmful to instream habitats and estuaries, should they occur, are expected to be associated with the point of discharge during and shortly after rainfall, particularly "first-flush" rain events after long antecedent dry periods. Should treated sites contribute harmful chemicals, these areas of designated critical habitat have the potential to experience a temporary or permanent reduction in function and value. This is particularly true for treated sites that represent a chronic point of pollutant runoff to designated critical habitat for steelhead.

2.5.1.4 Disturbance of Streamside Vegetation

The proposed action has the potential to temporarily affect riparian vegetation within the action area of North Fork Matilija Creek due to a discrete loss of shade and cover currently present along the active channel. Indirect effects associated with the removal of riparian vegetation can include increased water temperatures (Mitchell 1999; Opperman and Merenlender 2004) and decreased water quality (Lowrance et al. 1985; Welsch 1991) attributable to a loss of shade and cover over the active channel. However, the loss of vegetation as a result of the proposed action is expected to be confined to a small localized area. Additionally, the loss is expected to be temporary because riparian vegetation will be replanted throughout the disturbed areas to minimize impacts from project construction. Specifically, Caltrans will revegetate disturbed areas at a ratio of 5:1 for permanent impacts and 2:1 for temporary impacts with alder (*Alnus rhombifolia*), western sycamore (*Platanus racemose*), and hydroseeding. Based on NMFS's experience observing the response of riparian vegetation to human-made disturbances (J. Ogawa, NMFS 2019, personal communication), the riparian zone is expected to recover one to two years following the completion of construction. Overall, the amount of riparian vegetation affected by the proposed action is not expected to diminish the overall functional value of the migratory corridor and lagoon rearing sites within the action area. This is expected to be verified through the findings obtained from Caltrans's proposed habitat mitigation monitoring plan under the proposed action.

2.5.2 Effects of the Action on Endangered Steelhead

The expected effects of the action on endangered steelhead are related to the proposed dewatering of the action area to facilitate construction in the dry. What follows is a discussion of these effects, including discussion of the proposed capture and relocation of steelhead to minimize effects of the dewatering on individual steelhead in the action area.

2.5.2.1 Dewatering and Fish Relocation

During the dewatering process, the water diversion could harm or kill juvenile steelhead by concentrating or stranding them in residual wetted areas, if individuals don't move to adjacent areas of aquatic habitat during water diversion (Clothier 1953, 1954; Kraft 1972; Campbell and Scott 1984)

However, procedures are proposed to reduce the likelihood of harm and mortality to juvenile steelhead within the area to be dewatered. Biologists will capture and relocate steelhead to the nearest suitable habitat within the creek, though suitable habitat is not described by Caltrans. Biologists will isolate the area with block nets and will use dip nets in residual pools to relocate steelhead from the work area. In the event one or more steelhead are missed by the biologists and stranded in the diversion area, steelhead mortality may be observed. Caltrans proposes that biologists will be approved by NMFS, and would report any steelhead observations within the action area immediately to the resident engineer, though Caltrans does not specify if the biologist will have the authority to halt construction activities for the benefit of reducing harm or mortality of steelhead. Caltrans does not specify the number, qualifications or expertise of the biologists. Although Caltrans proposes to notify NMFS of the number of steelhead that may be harmed or injured because of construction activities, including dewatering, the actual plan for reporting the number and disposition of steelhead that are relocated lacks important details, including a schedule.

The proposed action does not include sufficient detail regarding the criteria Caltrans would apply for selecting relocation sites for juvenile steelhead. Sites selected for relocating juvenile steelhead should have ample habitat, but relocated fish may compete with other fish, potentially increasing competition for available food and habitat (Keeley 2003). Stress from crowding, including increased competition for food among juvenile steelhead in the relocation areas is expected to be temporary, because when the proposed action is finished steelhead will be able to redistribute in the action area. Once the proposed action is completed and the water diversion is removed, living space for juvenile steelhead will return to the dewatered action area.

Based on steelhead surveys and anecdotal observations of juvenile steelhead in the vicinity of the action area on North Fork Matilija Creek, NMFS expects no more than 35 juvenile steelhead will require relocation each construction season (70 juveniles over two years). NMFS expects that 2 juvenile steelhead may be injured or killed as a result of the proposed action each year (4 juveniles total). This estimated mortality is based on NMFS' experience and knowledge gained on similar projects in the Ventura watershed, the recent emergency action at Wheeler Springs, and the recent Caltrans project near Bridge #52-0044. Based on NMFS' general familiarity of steelhead abundance in southern California in general, and Ventura County streams in particular, the anticipated number of juvenile steelhead that may be injured or killed due to the proposed action is likely to represent a small fraction of the overall watershed-specific populations and the entire SC DPS of endangered steelhead. Therefore, the effects of the relocation on steelhead are not expected to give rise to population-level effects.

2.5.2.2 Water Quality Alterations

High concentrations of suspended sediment may affect steelhead by a variety of mechanisms including disruption of feeding (Cordone and Kelley 1961; Bjornn et al. 1977; Berg and Northcote 1985), reduction in growth rates (Crouse et al. 1981), and increased plasma cortisol levels (Servizi and Martens 1992). High turbidity can reduce dissolved oxygen in the water column, resulting in reduced steelhead fitness, and can cause mortality (Sigler et al. 1984; Berg and Northcote 1985; Gregory and Northcote 1993; Velagic 1995; Waters 1995). Although chronic elevated turbidity may affect steelhead, the temporary and minor increases of sedimentation and related turbidity concentration that may result from the proposed action are not expected to adversely affect steelhead. For example, the proposed action includes a number of measures that reduce the likelihood that sand and smaller particles from upland areas or along the creekbanks would erode into the channel while preparing the site for construction and while construction efforts are undertaken. Similarly, the action includes post-construction measures and monitoring that diminish the chance that fine sediment would be transported to a waterway following project completion.

Published work has identified stormwater from roadways and streets as causing a high percentage of rapid mortality of adult and juvenile coho salmon (Scholz et al. 2011; McIntyre et al. 2018; Chow et al. 2019) with mortality or symptoms of exposure noticeable within hours. Subsequent examinations documented impacts to steelhead also within a few hours and neither species recovered when transferred to clean water (Chow et al. 2019; French et al. 2022). Effects occurred at exceedingly low levels (1 part per billion (ug/L) and less) that are realistic and documented in the environment (Challis et al. 2021; Johannessen et al. 2022). Heavy metals such as copper and zinc, well documented contaminants in stormwater from roadways (Caltrans

2000; 2003a, 2003b; DTSC 2021), detrimentally affect salmonids at low and environmentally realistic levels. Effects can lead to disruption in critical fish behaviors and survival responses at concentrations that are at, or slightly above, ambient levels (Hansen et al. 1999a; 1999b; Baldwin et al. 2003; Sandahl et al. 2007; McIntyre et al. 2012).

Although stormwater runoff can be effectively treated by infiltrating the road runoff through soil media containing organic matter, the current requirements that NMFS expects Caltrans will follow (e.g. Caltrans' stormwater BMP and NPDES permit requirements) are unlikely to be 100% effective. Based on the information available regarding Caltrans' use of stormwater BMP and state requirements for stormwater treatment (i.e. NPDES permits), we expect that adverse effects from stormwater discharges will be experienced by steelhead in the action area. In some cases where infiltration areas between stormwater and streams are present, adverse effects on steelhead may be miniscule or may not occur.

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.

NMFS is generally familiar with the activities occurring in the action area and at his time is unaware of such actions that would be reasonably certain to occur. Consequently, NMFS believes no cumulative effects are likely, beyond the continuing effects of present land uses. 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).

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.

Juvenile steelhead are expected in the action area during the time the proposed action will be implemented and, therefore, subject to direct and indirect effects associated with the proposed action. The main risk to individual steelhead involves effects due to dewatering and related capture and relocation. The adverse effects include potential injury or mortality during the process of capture and relocation during dewatering activities, but precautions are in place to minimize, if not eliminate, the risk of injury and mortality, and adjacent instream habitats are expected to suitably harbor the relocated steelhead. The habitat alteration due to the dewatering will be short lived and localized.

Based on steelhead surveys described in the environmental baseline section, NMFS concludes non-lethal take of no more than 35 juvenile steelhead that may be captured and relocated each construction seasons (70 juveniles over two years) as a result of dewatering within the action area, with a potential lethal take of no more than 2 out of the 35 each year (4 juveniles total), thus the risk of mortality is low. Any juvenile steelhead present in the action area likely make up a small proportion of the SC DPS of steelhead.

Overall, the impacts to critical habitat are expected to be temporary and not translate into a reduction in the functional value of the habitat in the long term, even when considering effects due to the environmental baseline and cumulative effects, and the status of the species and critical habitat. The replanted areas are expected to create a functional riparian zone that provides cover and shelter for steelhead within the action area of North Fork Matilija Creek. The impacts from disturbing the streambed are not expected to adversely affect the quality or quantity of aquatic habitat. Impacts due to pollution of hazards material and contaminants will be most prominent during the "first flush" of the winter storm season, but can be reduced by directing stormwater runoff through vegetated areas prior to discharging into the creek. Maintained rearing habitat and steelhead passage conditions within the action area of North Fork Matilija are expected to favor the viability of the endangered SC DPS of steelhead and not reduce the value of critical habitat for the species.

The action area could be subject to higher average summer temperatures and lower precipitation levels in the future as a result of climate change, which would lead to warmer stream temperatures. Reductions in the amount of precipitation would reduce stream flow levels and estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this project, the above effects of climate change are unlikely to be detected by the time construction is completed. The short-term effects of the proposed action would have completely elapsed prior to these climate change effects. The long-term changes in the channel at the bridge site is confined to small areas along the creekbank and are unlikely to significantly magnify the likely climate change impacts.

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 cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of southern California 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: All steelhead in the action area, expected to be no more than 35 juveniles that are captured or harassed during each construction season (70 juveniles over two years). No more than 2 juvenile steelhead are expected to be injured or killed each construction season (4 juveniles total) as a result of dewatering the action area and relocating the species. No other incidental take is anticipated as a result of the proposed action. The accompanying biological opinion does not anticipate any form of take that is not incidental to the proposed action.

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). The following reasonable and prudent measures are necessary and appropriate to minimize and monitor incidental take of steelhead. The results of the analysis provide the basis for the following reasonable and prudent measures:

1. Avoid and minimize harm and mortality of steelhead during relocation and dewatering activities.

2. Avoid and minimize impacts to steelhead and designated critical habitat from construction activities.

3. Implement measures to reduce direct delivery of runoff from the roadway to critical habitat.

4. Prepare and submit a post-construction report regarding the effects of fish relocation and construction activities.

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 shall retain at least 2 biologists with expertise in the areas of resident or anadromous salmonid biology and ecology, fish/habitat relationships, biological monitoring and handling, collecting, and retaining salmonid species.

    b. Caltrans' biologists shall identify and evaluate the suitability of downstream and upstream steelhead relocation habitat(s) prior to undertaking the dewatering activities that are required to isolate the work area from flowing water. The biologists shall evaluate potential relocation sites based on attributes such as adequate water quality (a minimum dissolved oxygen level of 5 mg/L and suitable water temperature), cover (instream and over-hanging vegetation or woody debris), and extent of living space. Multiple relocation habitats may be necessary to prevent overcrowding of a single habitat depending on the number of steelhead captured, current number of steelhead already occupying the relocation habitat(s), and the size of the receiving habitat(s).

    c. Steelhead shall be handled with extreme care and kept in water during rescue activities. All captured fish must be kept in cool, shaded, and aerated water protected from excessive noise, jostling, or overcrowding or potential predators any time they are not in the stream, and fish will not be removed from this holding water except when released to instream relocation areas. Captured salmonids will be relocated as soon as possible to an instream location in which suitable habitat conditions are present to allow for adequate survival for transported fish and fish already present. Fish will be distributed between multiple areas if biologists judge that overcrowding may occur in a single area.

    d. Caltrans's biologist shall contact NMFS (Jess Fischer, 562-533-6813) immediately if one or more steelhead are found dead or injured. The purpose of the contact shall be to review the activities resulting in take and to determine if additional protective measures are required. All steelhead mortalities shall be retained, frozen as soon as practical, and placed in an appropriate-sized sealable bag that is labeled with the date and location of the collection and fork length and weight of the specimen(s). Frozen samples shall be retained by the biologist until additional instructions are provided by NMFS. Subsequent notification must also be made in writing to Jess Fischer, jessica.fischer@noaa.gov, within five days of noting dead or injured steelhead. The written notification shall include (1) the date, time, and location of the carcass or injured specimen; (2) a color photograph of the steelhead; (3) cause of injury or death; and (4) name and affiliation of the person who found the specimen.

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

   a. Caltrans' biologists shall monitor all construction activities, instream habitat, and performance of sediment-control devices for the purpose of identifying and reconciling any condition that could adversely affect steelhead or their habitat. The biologists shall be empowered to halt work activity and to recommend measures for avoiding adverse effects to steelhead and their habitat. The biologists shall immediately contact NMFS (Jess Fischer, 562-533-6813) upon determining that effects on steelhead or aquatic habitat have occurred that were not previously considered.

   b. Erosion control or sediment-detention devices (e.g., settling tank) shall be installed prior to the time of construction activities and incorporated into Caltrans' maintenance activities. These devices shall be in place throughout the entirety of the proposed action as necessary, including the wet season, for the purpose of minimizing sediment and sediment-water slurry input to flowing water. Sediment collected in the devices shall be disposed off-site and not allowed to enter the creek channel.

   c. Heavy equipment shall be positioned away from the creek channel at the end of each workday. When feasible the use of heavy equipment shall be performed from upland areas or the roadway. Each day prior to being deployed into the creek channel, all heavy equipment shall be checked for leaks of oil, gas, hydraulic fluid and any other pollutant that could impact water quality and instream habitat. Such leaks shall be immediately controlled for the purpose of avoiding introducing contaminates to surface water or the creek channel. Casings should be used during the instillation of the CIDH piles to prevent wet concrete from leaking into the stream.

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

   a. Caltrans shall implement all onsite measures within the action area that are necessary to effectively preclude post-construction stormwater runoff from contributing roadway contaminants to the creek. The measures shall include redirecting stormwater runoff in the action area through a robust vegetated buffer created onsite and be effective at removing contaminants from at least the 2 year storm (based on analyses supporting the NPDES permit). Caltrans shall provide the proposed measures to NMFS for review and potential agreement no less than 120 days prior to the start of project construction.

   b. Structures designed and constructed to treat stormwater runoff shall receive regular inspection (no less than one inspection per year) and necessary maintenance within 3 months of detecting the need for maintenance, with a focus on maintenance of the site in the early fall prior to the first rains of the winter season.

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

   a. Caltrans shall provide a written report to NMFS by January 15 of the year following the project. The report shall be sent to Jess Fischer, jessica.fischer@noaa.gov. The reports will contain, at a minimum, the following information:

      i. **Construction related activities --** The report will include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on steelhead, 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 steelhead; the number of steelhead killed or injured during project construction; and photographs taken before, during, and after the activity from photo reference points.

      ii. **Fish Relocation –** The report will include (1) the number and size of all steelhead relocated during the proposed action; (2) the date and time of the collection and relocation; (3) a description of any problem encountered during the project or when implementing terms and conditions; and (4) any effect of the proposed action on steelhead that was not previously considered.

      iii. **Revegetation –** The report will include a description of the locations seeded or planted, the area revegetated, proposed methods to monitor and maintain the revegetated area, criteria used to determine the success of the plantings, and pre-and post-planting color photographs of the revegetated area.

         1. Caltrans shall provide the results of the vegetation monitoring by January 15 following completion of each annual site inspection for the duration defined in the proposed habitat mitigation monitoring plan. Each report shall include color photographs taken of the project area during each inspection and before implementation of the proposed action.

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 recommends developing and implementing measures to treat post-construction stormwater runoff from hard surfaces to reduce contaminant load entering salmonid habitat. Stormwater runoff should be treated to remove contaminants from at least the 2-year, 24-hour storm size. Measures can be designed to avoid or minimize the effects of road-generated runoff to creeks by diverting surface flow through vegetated areas for infiltration and treatment, or through similar constructed features.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Bridge Widening and Bridge Railing Upgrade Project on State Route-33 along North Fork Matilija Creek. 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 is Caltrans. Other interested users could include the California Department of Fish and Wildlife and U.S. Fish and Wildlife Service. Individual copies of this opinion were provided to Caltrans. The document will be available within two 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 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, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

4 REFERENCES

Aha, N., M. Boorman, S. Leidman, and S. Perry. 2014. The Effect of Sediment Deposition on Sierra Riverine Ecosystems Following High-Intensity Fires. University of California, Davis, Center for Watershed Sciences.

Baldwin, D. H., J. F. Sandahl, J. S. Labenia, and N. L. Scholz. 2003. Sublethal effects of copper on coho salmon: impacts on nonoverlapping receptor pathways in the peripheral olfactory nervous system. Environmental Toxicology and Chemistry: An International Journal 22(10):2266-2274.

Behnke, R. J. 1992. Native Trout of Western North America (American Fisheries Society Monograph: No 6). American Fisheries Society, Bethesda, Maryland.

Bell, E., R. Dagit, and F. Ligon. 2011. Colonization and persistence of a southern California steelhead (*Oncorhynchus mykiss*) population. Bulletin, Southern California Academy of Sciences 110(1):1-17.

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(8):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 effects on insects and fish. University of Idaho Forest, Wildlife and Range Experiment Station, Moscow, ID.

Boughton, D. A. 2022. South-Central / Southern California Coast Recovery Domain. Pages 184–218 in Southwest Fisheries Science Center. 2022. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. 11 July 2022. Report to National Marine Fisheries Service – West Coast Region from Southwest Fisheries

Science Center, Fisheries Ecology Division 110 McAllister Way, Santa Cruz, California 95060.
Boughton, D. A., P. B. Adams, E. C. Anderson, C. Fusaro, E. A. Keller, E. Kelley, L. D. Lentsch, J. L. Nielsen, K. Perry, H. Regan, J. Smith, C. C. Swift, L. Thompson, and F. G. R. Watson. 2006. Steelhead of the south-central/southern California coast population characterization for recovery planning. NOAA Tech. Memo. NMFS-SWFSC-394.
Boughton, D. A., H. Fish, K. Pipal, J. Goin, F. Watson, J. Casagrande, J. Casagrande, and M. Stoecker. 2005. Contraction of the southern range limit for anadromous *Oncorhynchus mykiss*. NOAA Tech. Memo. NMFS-SWFSC-380.
Brinkmann, M., D. Montgomery, S. Selinger, J. G. P. Miller, E. Stock, A. J. Alcaraz, J. K. Challis, L. Weber, D. Janz, M. Hecker, and S. Wiseman. 2022. Acute Toxicity of the Tire Rubber-Derived Chemical 6PPD-quinone to Four Fishes of Commercial, Cultural, and Ecological Importance. Environmental Science & Technology Letters 9(4):333-338.
CA DTSC (California Department of Toxic Substance Control). 2022. Product-Chemical Profile for Motor Vehicle Tires Containing N-(1,3-Dimethylbutyl)-N′-phenyl-p-phenylenediamine (6PPD), March 2022 Final Version. California Environmental Protection Agency, Department of Toxic Substances Control, 102 pages. Available at: https://dtsc.ca.gov/wp-content/uploads/sites/31/2022/05/6PPD-in-Tires-Priority-Product-Profile_FINAL-VERSION_accessible.pdf.
Caltrans (California Department of Transportation). 2000. First flush Study 1999-2000 Report, CTSW-RT-00-016, June 2000. 289 pages.
Caltrans (California Department of Transportation). 2003a. Discharge Characterization Study Report, Storm Water Monitoring & Data Management, , CTSW-RT-03-065.51.42, Nov 2003. 93 pages.
Caltrans (California Department of Transportation). 2003b. Roadside Vegetated Treatment Sites (RVTS) Study, Final Report, CTSW-RT-03-028. Caltrans Div of Environmental Analysis, Nov 2003. 63 pages.
Campbell, R. N. B., and D. Scott. 1984. The determination of minimum discharge for 0+ brown trout (*Salmo trutta* L.) using a velocity response. New Zealand Journal of Marine and Freshwater Research 18(1):1-11.
Casitas Municipal Water District. 2017. Robles Fish Passage Facility Progress Report Casitas Municipal Water District, Oak View, CA.
Challis, J., H. Popick, S. Prajapati, P. Harder, J. Giesy, K. McPhedran, and M. Brinkmann. 2021. Occurrences of tire rubber-derived contaminants in cold-climate urban runoff. Environmental Science & Technology Letters 8(11):961-967.
Chow, M. I., J. I. Lundin, C. J. Mitchell, J. W. Davis, G. Young, N. L. Scholz, and J. K. McIntyre. 2019. An urban stormwater runoff mortality syndrome in juvenile coho salmon. Aquatic Toxicology 214:105231.
Clothier, W. D. 1953. Fish loss and movement in irrigation diversions from the West Gallatin River, Montana. Journal of Wildlife Management 17(2):144-158.
Clothier, W. D. 1954. Effect of water reductions on fish movement in irrigation diversions. Journal of Wildlife Management 18(2):150-160.
Cordone, A. J., and D. W. Kelley. 1961. The Influences of Inorganic Sediment on the Aquatic Life of Streams. Califormia Department of Fish and Game 47(2):189-228.

Cox, P., and D. Stephenson. 2007. Climate change: A changing climate for prediction. Science 317(5835):207-208.

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(2):281-286.

Crozier, L. G., R. W. Zabel, and A. F. Hamlet. 2008. Predicting differential effects of climate change at the population level with life-cycle models of spring Chinook salmon. Global Change Biology 14(2):236-249.

Cushman, R. M. 1985. Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. North American Journal of Fisheries Management 5(3A):330-339.

Department of Toxic Substances Control (DTSC). 2021. Rationale Document for Motor Vehicle Tires Containing Zinc, March 2021 Discussion Draft. California Environmental Protection Agency, Department of Toxic Substances Control, 20 pages, Available at: https://dtsc.ca.gov/wp-content/uploads/sites/31/2021/03/Rationale-Document-Zinc-in-Tires.pdf.

Dunham, J. B., M. K. Young, R. E. Gresswell, and B. E. Rieman. 2003. Effects of fire on fish populations: landscape perspectives on persistence of native fishes and nonnative fish invasions. Forest Ecology and Management 178(1-2):183-196.

Earl, S. R., and D. W. Blinn. 2003. Effects of wildfire ash on water chemistry and biota in South-Western USA streams. Freshwater Biology 48(6):1015-1030.

Ebersole, J., W. Liss, and C. Frissell. 2001. Relationship between stream temperature, thermal refugia and rainbow trout *Oncorhynchus mykiss* abundance in arid-land streams in the northwestern United States. Ecology of freshwater fish 10(1):1-10.

Feist, B. E., E. R. Buhle, D. H. Baldwin, J. A. Spromberg, S. E. Damm, J. W. Davis, and N. L. Scholz. 2018. Roads to ruin: conservation threats to a sentinel species across an urban gradient. Ecological Applications 27(8):2382-2396.

Florsheim, J. L., E. A. Keller, and D. W. Best. 1991. Fluvial sediment transport in response to moderate storm flows following chaparral wildfire, Ventura County, southern California. Geological Society of America Bulletin 103(4):504-511.

French, B., D. Baldwin, J. Cameron, J. Prat, K. King, J. Davis, J. McIntyre, and N. Scholz. 2022. Urban Roadway Runoff Is Lethal to Juvenile Coho, Steelhead, and Chinook Salmonids, But Not Congeneric Sockeye. Environmental Science & Technology Letters.

Girman, D., and J. C. Garza. 2006. Population structure and ancestry of *O. mykiss* populations in South-Central California based on genetic analysis of microsatellite data. Final Report for California Department of Fish and Game Project No. P0350021 and Pacific States Marine Fisheries Contract No. AWIP-S-1.

Good, T. P., R. S. Waples, and P. B. Adams. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. NOAA Tech. Memo. NMFS-NWFSC-66:598 pages.

GPA Consulting. 2018. Project completion report for the Ventura state route 33 soil-nail wall project Ventura County, California, Report by S. Glowacki and J. Vu to California Department of Transportation, Los Angeles, CA.

Gregory, R. S., and 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(2):233-240.

Hanak, E., J. Lund, A. Dinar, B. Gray, R. Howitt, J. Mount, P. Moyle, and B. Thompson. 2001. Managing California's water: From conflict to reconciliation. Public Policy Institute of California, San Francisco, California.
Hansen, J. A., J. C. Marr, J. Lipton, D. Cacela, and H. L. Bergman. 1999a. Differences in neurobehavioral responses of chinook salmon (Oncorhynchus tshawytscha) and rainbow trout (Oncorhynchus mykiss) exposed to copper and cobalt: behavioral avoidance. Environmental Toxicology and Chemistry: An International Journal 18(9):1972-1978.
Hansen, J. A., J. D. Rose, R. A. Jenkins, K. G. Gerow, and H. L. Bergman. 1999b. Chinook salmon (Oncorhynchus tshawytscha) and rainbow trout (Oncorhynchus mykiss) exposed to copper: neurophysiological and histological effects on the olfactory system. Environmental Toxicology and Chemistry: An International Journal 18(9):1979-1991.
Harvey, B. C. 1986. Effects of Suction Gold Dredging on Fish and Invertebrates in Two California Streams. North American Journal of Fisheries Management 6(3):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, and E. E. Cleland. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the national academy of sciences 101(34):12422-12427.
Johannessen, C., P. Helm, B. Lashuk, V. Yargeau, and C. D. Metcalfe. 2022. The Tire Wear Compounds 6PPD-Quinone and 1,3-Diphenylguanidine in an Urban Watershed. Arch Environ Contam Toxicol 82(2):171-179.
Keeley, E. R. 2003. An experimental analysis of self-thinning in juvenile steelhead trout. Oikos 102(3):543-550.
Kelly, A. E., and M. L. Goulden. 2008. Rapid shifts in plant distribution with recent climate change. Proceedings of the national academy of sciences 105(33):11823-11826.
Kraft, M. E. 1972. Effects of controlled flow reduction on a trout stream. Journal of the Fisheries Research Board of Canada 29(10):1405-&.
Lowrance, R., R. Leonard, and J. Sheridan. 1985. Managing riparian ecosystems to control nonpoint pollution. Journal of Soil and Water Conservation 40(1):87-91.
Marcogliese, D. J. 2001. Implications of climate change for parasitism of animals in the aquatic environment. Canadian Journal of Zoology-Revue Canadienne De Zoologie 79(8):1331-1352.
Mastrandrea, M. D., and A. L. Luers. 2012. Climate change in California: scenarios and approaches for adaptation. Climatic Change 111(1):5-16.
McCarty, J. P. 2001. Ecological consequences of recent climate change. Conservation Biology 15(2):320-331.
McClure, M. M., E. E. Holmes, B. L. Sanderson, and C. E. Jordan. 2003. A large-scale, multispecies status, assessment: Anadromous salmonids in the Columbia River Basin. Ecological Applications 13(4):964-989.
McCullough, D. A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to chinook salmon. EPA 910-R-99-010, Seattle, Washington.
McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. NOAA Tech. Memo. NMFS-NWFSC-42.

McIntyre, J. K., D. H. Baldwin, D. A. Beauchamp, and N. L. Scholz. 2012. Low-level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators. Ecological Applications 22(5):1460-1471.

McIntyre, J. K., J. I. Lundin, J. R. Cameron, M. I. Chow, J. W. Davis, J. P. Incardona, and N. L. Scholz. 2018. Interspecies variation in the susceptibility of adult Pacific salmon to toxic urban stormwater runoff. Environmental Pollution 238:196-203.

Mitchell, S. 1999. A simple model for estimating mean monthly stream temperatures after riparian canopy removal. Environmental Management 24(1):77-83.

Mote, P. W., E. A. Parson, A. F. Hamlet, W. S. Keeton, D. Lettenmaier, N. Mantua, E. L. Miles, D. W. Peterson, D. L. Peterson, and R. Slaughter. 2003. Preparing for climatic change: the water, salmon, and forests of the Pacific Northwest. Climatic Change 61(1-2):45-88.

Myers, K., and N. Mantua. 2013. Climate change and ocean ecology of northwest steelhead. The Osprey: A Journal Published by the Steelhead Committee International Federation of Fly Fishers (75).

Nehlsen, W., J. E. Williams, and J. A. Lichatowich. 1991. Pacific salmon at the crossroads - stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16(2):4-21.

NMFS (National Marine Fisheries Service). 1997. Endangered and threatened species: listing of several evelutionary significant units (ESUs) of west coast steelhead. Federal Register 62:159(August 18, 1997):43937-43953.

NMFS (National Marine Fisheries Service). 2005. Endangered and threatened species: designated critical habitat for seven evolutionary significant units of Pacific salmon and steelhead in California. Federal Register 70:170(September 2, 2005):52488-52586.

NMFS (National Marine Fisheries Service). 2006. Endangered and threatened species: Final listing determinations for 10 distinct population segments of west coast steelhead. Federal Register 71:3(January 5, 2006):834-862.

NMFS (National Marine Fisheries Service). 2011. 5-Year review: summary and evaluation of Southern California Coast steelhead distinct population segment, National Marine Fisheries Service. Southwest Region. Long Beach, California.

NMFS (National Marine Fisheries Service). 2012. Southern California Steelhead Recovery Plan, Southwest Region, Protected Resources Division, Long Beach, California.

NMFS (National Marine Fisheries Service). 2016. 5-year review: Summary and evaluation of Southern California coast steelhead distinct population segment. National Marine Fisheries Service, California Coastal Office, Long Beach, California.

NMFS (National Marine Fisheries Service). 2017. Official correspondence to U.S. Marine Corps Base Camp Pendleton regarding August 17, 2017, incidental capture event of endangered steelhead in San Mateo Creek, December 5. Administrative file: 151422WCR2017CC00292.

NMFS (National Marine Fisheries Service). 2023. 2023 5-Year Review: Summary & Evaluation of Southern California Steelhead. National Marine Fisheries Service, West Coast Region. 226 pages.

Normandeau Associates Inc. 2015. Steelhead population and habitat assessment in the Ventura River/Matilija Creek basin 2006-2012 final report. 2015 Final Report by Mark Allen to Surfrider Foundation and California Department of Fish and Wildlife, Ventura, CA.

Opperman, J. J., and A. M. Merenlender. 2004. The effectiveness of riparian restoration for improving instream fish habitat in four hardwood-dominated California streams. North American Journal of Fisheries Management 24(3):822-834.

Peter, K. T., F. Hou, Z. Tian, C. Wu, M. Goehring, F. Liu, and E. P. Kolodziej. 2020. More than a first flush: Urban creek storm hydrographs demonstrate broad contaminant pollutographs. Environmental Science & Technology 54(10):6152-6165.

Peter, K. T., J. I. Lundin, C. Wu, B. E. Feist, Z. Tian, J. R. Cameron, N. L. Scholz, and E. P. Kolodziej. 2022. Characterizing the Chemical Profile of Biological Decline in Stormwater-Impacted Urban Watersheds. Environmental Science & Technology 56(5):3159-3169.

Sandahl, J. F., D. H. Baldwin, J. J. Jenkins, and N. L. Scholz. 2007. A sensory system at the interface between urban stormwater runoff and salmon survival. Environmental Science & Technology 41(8):2998-3004.

Santa Barbara Channelkeeper. 2008. Letter to Ventura County, Los Angeles Regional Water Quality Control Board, California Department of Fish and Game, U.S. Army Corp of Engineers, and Natinal Marine Fisheries Service, March 24. 2008.

Scavia, D., J. C. Field, D. F. Boesch, R. W. Buddemeier, V. Burkett, D. R. Cayan, M. Fogarty, M. A. Harwell, R. W. Howarth, C. Mason, D. J. Reed, T. C. Royer, A. H. Sallenger, and J. G. Titus. 2002. Climate change impacts on US coastal and marine ecosystems. Estuaries 25(2):149-164.

Scholz, N. L., M. S. Myers, S. G. McCarthy, J. S. Labenia, J. K. McIntyre, G. M. Ylitalo, L. D. Rhodes, C. A. Laetz, C. M. Stehr, B. L. French, B. McMillan, D. Wilson, L. Reed, K. D. Lynch, S. Damm, J. W. Davis, and T. K. Collier. 2011. Recurrent die-offs of adult coho salmon returning to spawn in Puget Sound lowland urban streams. PloS one 6(12):e28013.

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(7):1389-1395.

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(2):142-150.

Snyder, M. A., and L. C. Sloan. 2005. Transient future climate over the western United States using a regional climate model. Earth Interactions 9(11).

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 Corp., Corvallis, OR. (Available from the National Marine Fisheries Service, Portland, Oregon).

Spina, A. P. 2007. Thermal ecology of juvenile steelhead in a warm-water environment. Environmental Biology of Fishes 80(1):23-34.

Spina, A. P., M. A. Allen, and M. Clarke. 2005. Downstream migration, rearing abundance, and pool habitat associations of juvenile steelhead in the lower main stem of a south-central California stream. North American Journal of Fisheries Management 25(3):919-930.

Sutton, R., L.D. Sedlak, M. Box, C. Gilbreath, A. Holleman, R. Miller, L. Wong, A. Munno, K., Z. X, and C. Rochman. 2019. Understanding microplastic levels, pathways, and transport in the San Francisco Bay Region, SFEI-ASC Publication #950, October 2019.

Swift, C., and J. Mulder. 2008. Emergency road repair project on state highway 33, North Fork viatilija Creek at Wheeler Springs, Ventura County, California. Fish Rescue and Construction Monitoring Report. Entrix Inc., Ventura, CA.

Thomas, V. G. 1985. Experimentally determined impacts of a small, suction gold dredge on a Montana stream. North American Journal of Fisheries Management 5(3B):480-488.

Tian, Z., H. Zhao, K. T. Peter, M. Gonzalez, J. Wetzel, C. Wu, X. Hu, J. Prat, E. Mudrock, and R. Hettinger. 2021. A ubiquitous tire rubber–derived chemical induces acute mortality in coho salmon. Science 371(6525):185-189.

USFS (U. S. Forest Service). 2018. Fisheries Resource Report: Thomas Fire BAER Assessment – Santa Barbara and Ojai Ranger Districts, Los Padres National Forest. K. Klose, editor.

USGCRP (U.S. Global Change Research Program). 2009. Global climate change impacts in the United States: a state of knowledge report from the U.S. global change research program. Cambridge University Press, New York.

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, Bethesda, Maryland.

Welsch, D. J. 1991. Riparian forest buffers: function and design for protection and enhancement of water resources. USDA Forest Service, NA-PR-07-91, Radnor, Pennsylvania.

WERT (Watershed Emergency Response Team). 2018. Final Report: Thomas Fire CA-VNC-103156. Watershed Emergency Response Team, State of California.

Westerling, A. L., and B. P. Bryant. 2008. Climate change and wildfire in California. Climatic Change 87:S231-S249.

Westerling, A. L., D. R. Cayan, T. J. Brown, B. L. Hall, and L. G. Riddle. 2004. Climate, Santa Ana winds and autumn wildfires in southern California. Eos, Transactions American Geophysical Union 85(31):289-296.

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. NOAA's National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, CA.

Williams, T. H., B. C. Spence, D. A. Boughton, R. C. Johnson, E. G. R. Crozier, N. J. Mantua, M. R. O'Farrell, and S. T. Lindley. 2016. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-564.

Zimmerman, C. E., and G. H. Reeves. 2000. Population structure of sympatric anadromous and nonanadromous *Oncorhynchus mykiss*: evidence from spawning surveys and otolith microchemistry. Canadian Journal of Fisheries and Aquatic Sciences 57(10):2152-2162.