UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

DEC 21 2016

Refer to NMFS No: WCR-2016-6015

Nancy A. Haley
Chief, California North Branch
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations for the Antelope Creek Flood Control Project (SPK-2014-0080)

Dear Ms. Haley:

Thank you for your letter of December 22, 2015, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for the Antelope Creek Flood Control Project (SPK-2014-0080).

This letter also transmits NMFS' essential fish habitat (EFH) conservation recommendations for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq.*).

Based on the best available scientific and commercial information, the Biological Opinion (Opinion) concludes that the Antelope Creek Flood Control Project is not likely to jeopardize the continued existence of the federally listed threatened California Central Valley (CCV) steelhead distinct population segment (*Oncorhynchus mykiss*). For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project. The action area is not designated critical habitat for CCV steelhead.

The EFH consultation concludes that the proposed action would adversely affect the EFH of Pacific salmon in the Action Area. The EFH consultation adopts the ESA reasonable and prudent measures and associated terms and conditions from the Opinion and includes additional conservation recommendations specific to the adverse effects to EFH.

The United State Army Corps of Engineers (Corps) has a statutory requirement under Section 305(b)(4)(B) of the MSA to submit a detailed written response to NMFS within 30 days of receipt of these conservation recommendations, and 10 days in advance of any action, that includes a description of measures adopted by the Corps for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR § 600.920(j)). If unable to complete a final response within 30 days, the Corps should provide an interim written response within 30 days before submitting its final response. In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the Antelope Creek Flood Control Project and the measures needed to avoid, minimize, or mitigate (also referred to as "compensate" by NMFS) such effects.

Please contact Jahnava Duryea at the NMFS California Central Valley Office, Sacramento, California, (916) 930-3725, or by email at Jahnava.Duryea@noaa.gov, should you have any questions concerning this consultation, or if you require additional information.

Sincerely,

for Barry A. Thom
Regional Administrator

Enclosure

cc: File 151422-WCR2015-SA-00021

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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation and Fish and Wildlife Coordination Act Recommendations

Antelope Creek Flood Control Project
NMFS Consultation Number: WCR-2016-6015
Action Agency: U. S. Army Corps of Engineers

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 Destroy or Adversely Modify Critical Habitat?
California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	NA

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

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

Issued By: Maria Rea
for Barry A. Thom
Regional Administrator

Date:

LIST OF ACRONYMS AND ABBREVIATIONS

BA – biological assessment
BMPs – best management practices
°C – degrees Celsius
CCV – California Central Valley
CCVAO – California Central Valley Area Office
CDFG – California Department of Fish and Game
CDFW – California Department of Fish and Wildlife
CFR – Code of Federal Register
CFS – cubic feet per second
CMP – corrugated metal pile
Coleman – Coleman National Fish Hatchery
CORPS – United States Army Corps of Engineers
CV – Central Valley
CVP – Central Valley Project
DBH – diameter at breast height
District – Placer County Flood Control and Water Conservation District
DO – dissolved oxygen
DPS – distinct population segment
DQA – Data Quality Act
DWR – Department of Water Resources
EBMUD – East Bay Municipal Utilities District
EFH – essential fish habitat
ESA – Endangered Species Act
ESM – engineered streambed material
ESU – evolutionarily significant unit
°F – degrees Fahrenheit
FL – fork length
FT/S– feet per second
FR – Federal Register
FWCA – Fish and Wildlife Coordination Act
HAPC – habitat area of particular concern
IPCC – Intergovernmental Panel on Climate Change
ITS – Incidental Take Statement
IWM – instream woody material
LWM – large woody material
MGD – million gallons per day
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NA – not applicable
NEMDC – Natomas East Main Drainage Canal
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
OHWL – ordinary high water line
OHWM – ordinary high water mark

Opinion – biological opinion
PBF – physical or biological features
PCE – primary constituent elements
RBDD – Red Bluff Diversion Dam
RWQCB – Regional Water Quality Control Board
SAM – Species Assessment Model (not to be confused with Standard Assessment Methodology)
SJRRP – San Joaquin River Restoration Program
SRA – shaded riverine aquatic
SSC – suspended sediment concentration
SWE – snow water equivalent
SWP – State Water Project
SWPPP – stormwater pollution prevention plan
UPRR – Union Pacific Railway Bridge
USACE – United States Army Corps of Engineers
USFWS – United States Fish and Wildlife Service
VSP – viable salmonid population
WWTP – Wastewater Treatment Plant

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1. INTRODUCTION

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

1.1 Background

The 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 50 CFR § 402. at

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U. S.C. 1801 *et seq.*) and implementing regulations at 50 CFR § 600.

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661 *et seq.*).

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 (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System (https://pcts.nmfs.noaa.gov/). A complete record of this consultation is on file at NMFS' California Central Valley Area Office (CCVAO).

1.2 Consultation History

- **24 October 2012 –** NMFS received a technical assistance letter requesting an official species list.

- **27 October 2014** – NMFS received a letter from the Corps (SPK-2014-00080) requesting initiation of informal consultation and concurrence that the Project may affect, but is not likely to adversely affect California Central Valley (CCV) steelhead. The Corps also determined that the Project may adversely affect EFH for Pacific Salmon. The request included a biological assessment (BA) and drawings.

- **31 December 2014** – NMFS CCVAO staff, Julie Wolford, contacted Steve Thomas, P. E., a Hydraulic Engineer at the NMFS Santa Rosa Office, via email for technical support requesting assistance with reviewing the engineering drawings for the proposed construction of the primary and secondary weirs and replacement culvert. Steve Thomas was unable to provide his assistance in determining if the Project has the potential for introducing fish passage barriers from the engineering drawings provided from the Corps

in the consultation package. Further detail pertaining to the engineering designs and hydraulic modeling was requested.

- **20 January 2015** – NMFS sent a letter of non-concurrence to the Corps, and requested additional information. NMFS also provided Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response Recommendations for the proposed Action to the Corps (Nancy Haley).

- **11 February 2015** – Steve Thomas, a NMFS Hydraulic Engineer, reviewed the Proposed Action based on the 100% design drawings and output from the HEC_RAS 1-D flow model for compliance with NMFS fish passage criteria for stream crossings.

- **1 June 2015** – NMFS staff, Julie Wolford, received an email from Linda Fisher (HDR Environmental Project Manager) relaying that they received confirmation from the Department of Water Resources (DWR) that the project will need to provide slope protection (*i.e.*, rip-rap) in two additional areas within the limits of the landfill, therefore, the project footprint would be expanded.

- **11 June 2015** – Conference call held with the Corps, NMFS, USFWS, Placer County Flood Control and Water Conservation District (District), and HDR to reinitiate consultation and to provide project updates.

- **15 June 2015** – NMFS staff, Julie Wolford, received an email from Linda Fisher summarizing water temperature, fish survey results, and site photographs.

- **23 June 2015** – NMFS staff, Julie Wolford, received an email from Jelica Arsenijevic (HDR Environmental Planner) with additional water temperature data collected during 17 June 2015 site visit.

- **10 September 2015** – During a Corps site visit, Robert Chase observed and identified five juvenile *O. mykiss* and 15 juvenile Chinook salmon in a pool approximately 20 feet upstream of the existing culverts in the vicinity of the proposed action. Additional information was provided to NMFS about the project.

- **11 September 2015** – HDR's fish biologists performed a formal follow-up snorkel survey in the area where the steelhead and salmon juveniles were seen and no such species were present, only common warm water species including pikeminnow, suckers, green sunfish and mosquito fish.

- **2 December 2015 –** NMFS staff, Gary Sprague, received an email from Linda Fisher with HDR's responses to NMFS questions and comments that were submitted to the District on 17 November 2015.

- **22 December 2015 –** NMFS received a letter from the Corps (SPK-2014-00080) requesting initiation of formal consultation for the Antelope Creek Flood Control Project. The Corps determined that the Project may affect and is likely to adversely affect CCV

steelhead and the EFH for Pacific Salmon. The request included a revised biological assessment (BA) dated December 2015.

- **7 January 2016 –** Linda Fisher provided NMFS with a revised essential fish habitat checklist via email.

- **4 April 2016 –** NMFS CCVAO initiated formal ESA Section 7 consultation for the Antelope Creek Flood Control Project.

- **21 November 2016 –** NMFS staff, Jahnava Duryea, met with HDR and Corps staff for a field visit at the project site.

A complete administrative record is on file at the NMFS CCVAO.

1.3 Proposed Action

"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).

The Placer County Flood Control and Water Conservation District proposes to replace existing culverts under a recreational urban trail with a new low-flow culvert and the construction of a primary weir and a secondary, overflow weir. The purpose of the proposed action is to detain additional flood volume along the Antelope Creek corridor in order to reduce peak discharges downstream on Dry Creek in downtown Roseville. The new culvert will be larger than the existing culverts, and will be approximately 20' wide and 140' long. A boulder weir will be constructed downstream of the culvert, to prevent development of an impassable plunge pool below the culvert. The new culvert will be placed in a manner to allow fish passage and will have sills in the bottom to retain sediment and thereby mimic a natural streambed. The first weir is designed to detain peak flows, while allowing for fish passage at all flows. The second weir will be for passing very high flows (100-year flood events).

The weir is designed to pass low flows without restriction and to preserve available storage for peak flood conditions, restricting discharge during the peak of a storm. It will increase upstream 100-year flood levels by less than five feet, and is designed to overtop at 100-year flood conditions. The proposed weir will detain flood flows for a short duration (*i.e.*, a few hours) to delay the local peak discharge by approximately an hour. Designing the weir to detain flood flows for even a short duration will significantly reduce the contribution of Antelope Creek discharges to the downstream peak flows on Dry Creek at Vernon Street in Roseville by as much as 800 cubic feet per second (cfs).

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No interrelated or interdependent actions were identified.

1.3.1 Project Location

The Project is located along Antelope Creek in Roseville, California, Section 36, Township 11 North, Range 6 East, Mount Diablo Meridian, Latitude 38.76284°, Longitude -121.26109° (Figure 1) in Placer County. The project is situated along Antelope Creek between the State Route 65/Roseville Bypass and Atlantic Street, just south of East Roseville Parkway.

Figure 1. Project location and vicinity map.

1.3.2 Project Description

The District will engage the engineering firm HDR, Inc. to construct the flood control weirs and new culvert in the Action Area. Construction of the flood control features will be accomplished in sequential phases: (1) establishing staging areas, site access, and securing borrow materials; (2) stream water diversion and dewatering of weir construction area; (3) removal of two existing corrugated metal pile (CMP) culverts and bike path; (4) weir construction and installation of a larger culvert and culvert outlet structure; and (5) rebuilding of the embankments and bike path.

Construction is planned for completion over the course of one season (May-October) with an in-water work window of June 15 – October 15. Estimated work hours are from 7:30am to 4:00pm, Monday through Friday.

1. Establishing staging areas, site access, and securing borrow materials.

The first phase will establish staging areas and access for the weir structure site. Prior to commencing construction, a staging area would be established to the west of creek to facilitate distribution of materials and equipment. Vegetation in the staging areas and construction footprint would be cleared and grubbed, and the construction contractor will install silt fencing around the staging areas to control sediment. The staging area would contain contractor's trailers, parking, fencing, and storage of equipment and materials. Heavy construction equipment likely to be utilized by the contractor over the duration of the Project is given in Table 1. Equipment and personnel would access the sites via public roads including Interstate 80, State Route 65, Atlantic Street, Galleria Boulevard, and Berry Street. Access to the weir site would be via Berry Street from Galleria Boulevard on the downstream end of the Action Area. Berry Street ends at a private gravel and/or paved road that leads to the proposed weir structure site.

Table 1. Construction Equipment

Equipment	Construction Purpose
Backhoe/Front-end Loader	Soil Manipulation and Drainage Work
Bobcat	Fill Distribution
Dozer	Soil Manipulation and Earthwork Construction
Scraper	Soil Manipulation and Earthwork Construction
Compactor	Soil Manipulation and Earthwork Construction
Concrete Truck	Delivering and Pouring Concrete
Haul Truck	Earthwork Construction and Clearing/Grubbing
Hydraulic Excavator	Deep Excavations
Hydraulic Crane	Place Precast Concrete Span/Box Culverts
Water Truck	Watering of the construction site for dust control

Approximately 1,718 cubic yards of fill (borrow material) would be required for the construction of the weir. Fill material used for the weir structure will be placed in the creek and along the banks for stabilization. Excavated material from the weir site would be reused as much as possible and additional material would only be imported as necessary. Borrow materials would be obtained from an onsite borrow site or purchased from local offsite locations and delivered.

2. Stream water diversion and dewatering of weir construction area.

The Proposed Action would require dewatering an approximately 312 foot long section of Antelope Creek from bank to bank, and diverting flow during construction. Dewatering would be

achieved by installing two sandbag cofferdams, upstream and downstream of the construction site. Flow in Antelope Creek would be diverted through a polyliner gravity pipe running along the west side of the immediate construction area. Following water diversion and fish exclusion from the coffered area, a sump pump may be used to complete the dewatering. The cofferdams would restrict upstream and downstream movement of native and non-native fish species during the in-channel construction window of June 15 through October 15.
To decrease the likelihood of fishes being stranded in the dewatered area, a qualified fish biologist will visually survey the work area for salmonids and any other native/non-native fish species, prior to the installation of the temporary stream diversion structure. Once the biologist confirms that fishes are not present, the first stream diversion structure will be installed beginning at the upstream end of the work area while leaving the downstream end open to the main channel of Antelope Creek. The first cofferdam will be installed approximately 174 feet upstream of the existing culvert crossing, near the City of Roseville's stream level and precipitation gage station on the western creek bank.

A second visual survey of the instream work area will be conducted by the biologist prior to installation of the second cofferdam downstream. If fishes are found within the area of water diversion, they will be guided with seine nets downstream of the reach of Antelope Creek to be dewatered. Guiding fishes from the work area via seining and dip netting, will be repeated as necessary, as flow is incrementally diverted, to ensure that all fishes are successfully cleared out of the construction area.

3. Removal of existing corrugated metal pile (CMP) culverts and bike path.

Once the in-channel construction area has been dewatered, the bicycle trail crossing and two existing CMP culverts will be removed to make room for the weir structure embankment. The entire area would require clearing in preparation for fill to be placed and for the installation of the new weir structure and culvert.

4. Weir construction and installation of a larger culvert and culvert outlet structure.

Following dewatering and clearing, new fill will be placed in the creek and along the floodplain for construction of the weir structure embankment. The weir embankment and some upstream and downstream slopes are proposed to be armored with erosion control mat and riprap to resist scour forces and ensure stability. Riprap will be used for streambank stabilization and will not be placed within the thalwag of the stream channel. Turf reinforced mat will be used along the banks, but will not be placed below the ordinary high water mark (OHWM) of Antelope Creek.

The new culvert has dimensions of approximately 20' wide and 140' long and will run through the bottom of the flood control weir. The culvert outlet structure would be cast-in-place or delivered in pre-cast sections and placed by crane into the channel. The culvert would span the creek channel (which is approximately 50 feet wide) and would be embedded into the channel bottom. The culvert was designed to more closely maintain the natural channel slope and profile to improve fish passage. The culvert will have retention sills in the bottom to retain sediment and thereby mimic a natural streambed.

The stream bottom approaching the culvert is designed with engineered streambed materials (ESM), composed of sands, gravels, cobbles, and boulders over larger rock to provide as natural of a condition as possible while also balancing scour resistance needs that occur at flood flows. ESM Type 1 consists of a well-graded mixture of diversified particle sizes designed to be immobile up to a stable bed design flow. More specifically, ESM Type 1 is a mixture of two parts by volume streambed sediment to three parts by volume streambed cobbles. Streambed sediment is a well-graded mix of rounded river rock and sediment with a maximum particle size of 3 inches, which drains freely and is free of excess moisture, muck, roots, sod, or other deleterious materials. Streambed cobbles are a well-graded mix of soil, gravel, and rounded river cobbles to simulate a natural streambed. Gradation requirements for streambed cobbles are as follows: all streambed cobbles will be less than 10-inch diameter, with 50 percent of cobbles smaller than 4-inch diameter and 10 percent of cobbles less than 1-inch diameter. The ESM is not considered armored substrate in that it allows for localized movement of material and substrate flexibility to mimic natural conditions and provide low flow channel formation and connectivity along with hydraulic diversity for fish and other aquatic organisms. The primary intent of designing the culvert with ESM was to simulate a natural streambed and provide for improved fish passage.

A boulder weir will be constructed approximately 40 feet downstream of the primary weir structure and culvert, to prevent development of an impassable plunge pool downstream of the culvert. The area immediately downstream of the boulder weir will be excavated and lined with ESM Type 2 to create a pool. ESM Type 2 shall consist of a well- graded mixture of diversified particle sizes designed to be immobile up to a stable bed design flow. Installation of ESM Type 2 will require the initial placement of streambed boulders followed by two parts by volume streambed sediment and three parts by volume streambed cobbles. Streambed sediment and streambed cobbles shall conform to the descriptions given above. Streambed boulders shall be hard, durable, rounded boulders free from cracks with a minimum specific gravity of 2.6 and a length to intermediate width ratio less than 3. The gradation shall conform to the following specifications: a mass of 700 – 2,000 lbs. and approximate dimensions of 28 – 36 cubic inches. The cross slope of the boulder weir would be 5 percent or less and the weir end would be extended into the banks to minimize risk of flanking. The boulder weir would require the addition of approximately 342 cubic yards (0.4 acres) of boulders and would be designed per the CDFW's California Salmonid Stream Habitat Restoration Manual guidelines for rock weirs (Flosi *et al.* 2002). The boulder weir will match the existing grade and there will be very little water surface drop over the rock weir, allowing for both juvenile and adult fish passage over the range of anticipated flows.

5. Rebuilding of the embankments and bike path.

Once the weirs are constructed and the new culvert has been installed, it will be necessary to rebuild the bike path on top of the engineered embankment. The rebuild will meet the City of Roseville Design Standards for bikeways. The asphalt pavement width would be 14 feet wide and profile grades would be less than 5 percent. Fencing would be installed adjacent to the bike path. The adjacent nearby side slopes of the creek would be protected with erosion control mat and/or hard armoring (riprap and articulating concrete block), if needed.

1.3.3 Conservation Measures

The following conservation measures will be implemented to avoid or minimize potential adverse effects on federally listed fish and wildlife species (measures 3-8 have features aimed at reducing impacts to federally listed fish species that are described in further detail):

1) *Protective barrier fencing around sensitive biological resources*

2) *Invasive plant species protection measures*

3) *Stormwater Pollution Prevention Plan (SWPPP) and Erosion Control Plan*

The District's construction contractor shall prepare an *Erosion Control Plan* for any grading for the project. Best management practices (BMPs) will be incorporated into the erosion and sediment control plan. The *SWPPP* will be site-specific and implemented in accordance with the California Regional Water Quality Control Board (RWQCB) Field Manual. Construction activities will be conducted during the typical construction season to avoid ground disturbance during the rainy season and equipment and materials will be staged in areas that have already been disturbed.

Designated staging areas, ingress and egress corridors, and equipment exclusion zones will be established to minimize soil and vegetation disturbance. Erosion control fencing shall be placed at the edges of construction where the construction activities are upslope of aquatic habitats to prevent washing of sediments into these features. All fencing shall be installed prior to the start of construction activities and shall be maintained throughout the construction period. Grading spoils generated during construction will be stabilized and surrounded by silt fences, fiber rolls, or geotextile coverings as necessary to protect and intercept runoff of sediment from wind and water erosion. Removable protective erosion control devices will be put into place anytime the 24-hour rain forecast exceeds 40 percent.

4) *Spill Prevention and Response Plan*

A *Spill Prevention and Response Plan* is intended to prevent any discharge of oil into navigable waters or adjoining shorelines. Spill prevention measures shall be included in the District's contractor's plan before onset of construction activities and the construction area will be routinely inspected to verify that the measures specified in the plan are properly implemented and maintained. The plan would describe spill sources and spill pathways in addition to the actions that would be taken in the event of a spill (*e.g.*, an oil spill from engine refueling would be immediately cleaned up with oil absorbents). The plan would outline descriptions of containment facilities and practices such as doubled-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures, and spill response kits. The plan will be implemented during construction to minimize the potential for and effects from spills of hazardous, toxic, or petroleum substances. NMFS would be contacted immediately and construction would cease if any spills occur in Antelope Creek.

5) Dewatering/Diversion Plan

The District's contractor shall implement a *Dewatering/Diversion Plan* during any dewatering activities. The plan includes utilizing a qualified biologist to exclude all fishes utilizing areas to be dewatered. The plan shall be provided to NMFS for review and approval prior to the onset of construction activities. Additionally, the contractor is to submit a *Bypass Design and Operation Plan* for review prior to installation.

6) Streambed Monitoring Plan

The District will implement a 10-year *Streambed Monitoring Plan* to identify and document potential scour and incision areas that could affect streambed conditions in the Action Area that are attributable to the Proposed Action. Standardized methods will be used during the collection of geospatial data to document annual and long-term (10-year) sediment and streambed conditions in Antelope Creek. Elevation data will be collected at four cross sections to monitor geomorphic conditions during the streambed program. At each cross section, approximately 15 to 25 points on the streambed will be surveyed to the nearest 0.01 foot. Representative points at each cross section shall include channel thawleg, breaks in slope, and at the active channel and bankfull channel location. Cross sections shall start (station 0.00N) on the left bank looking in the downstream direction.

Monitoring will provide a means to evaluate the efficacy of erosion control structures implemented as part of the Proposed Action. Data collected may also provide a means to evaluate hydraulic controls and passage of juvenile and adult salmonids at the stream crossing. Ultimately, based on streambed changes identified during the monitoring program, District staff will be able to identify corrective measures that may need to be applied.

7) Riparian Restoration: Mitigation and Monitoring Plan

A *Riparian Restoration and Mitigation and Monitoring Plan* has been prepared for the Proposed Action that identifies areas along Antelope Creek for restoration (*i.e.*, riparian planting). The District plans to conduct replant of any areas of riparian or SRA habitat affected by the project onsite with native riparian vegetation at a minimum 1:1 ratio. Plant species will include riparian trees and shrubs that are native to the foothills of the Sacramento Valley. Monitoring will be conducted annually for five years, with a goal of 80 percent survival. If less than 80 percent of the replacement trees and vegetation have survived at the end of the five-year monitoring period, replanting and an additional five years of monitoring will be conducted. Planting density goals will be to obtain between 65 and 90 percent ground and canopy cover by the end of the fifth year.

Additionally, to mitigate for impacts to mature oaks trees in accordance with the City of Roseville Tree Preservation Ordinance, the Proposed Action will replace oak trees based upon an inch-for-inch replacement as determined by the diameter at breast height (DBH) of the removed tree(s); a 15-inch box tree will replace a removed tree with a one inch

DBH; a 24-inch box tree will replace a removed tree with two inches DBH; and a 36-inch box tree will replace a tree with three inches DBH.

8) Offsite Mitigation Measures

The District proposes to implement off-site mitigation measures to compensate for long-term impacts to riparian and riverine habitat. Specific to the Antelope Creek Flood Control Project, the District will compensate for the permanent loss of 0.73 acres of riparian and SRA habitat by purchasing mitigation credits at a 3:1 ratio to fulfill the requirements of Section 7 consultation. This compensation ratio is based on site-specific information and determined through coordination with NMFS during the permitting process. Mitigation credits will be purchased from a NMFS-approved conservation bank prior to construction.

1.4 Action Area

"Action Area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The Action Area is not the same as the project boundary area because the Action Area must delineate all areas where federally listed species may be affected by the implementation of the proposed action.

The Proposed Action lies within the Dry Creek watershed that covers approximately 101 square miles, ranging from just west of Auburn (Placer County) west to Steelhead Creek (north of Sacramento, Sacramento County), and south to Folsom (Sacramento County). In addition to Antelope Creek, major tributaries in the watershed include Secrete Ravine, Miners Ravine, Strap Ravine Creek, Linda Creek, and Cirby Creek. The proposed action is located on Antelope Creek in the City of Roseville, CA.

For the purposes of addressing potential direct and indirect effects of the proposed action on listed fish species and their designated critical habitat, the Action Area for the Antelope Creek Flood Control Project is defined as the creek bed 500 feet upstream of where the multipurpose trail crosses Antelope Creek (Latitude 38.762559, Longitude -121.260491) to 1,500 feet downstream from the trail crossing that may be affected by temporary increases in turbidity, sedimentation, changes in water elevation, and noise during in-water construction activities. The Action Area includes the full width of the stream and all construction areas including the weir locations, staging areas, borrow areas, restoration areas, and construction access routes.

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, Federal agencies must ensure that their 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 provides an opinion stating

how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, Section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This Opinion consists of a jeopardy analysis that relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that 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.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species:

1) Identify the rangewide status of the species likely to be adversely affected by the proposed action.
2) Describe the environmental baseline in the Action Area.
3) Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
4) Describe any cumulative effects in the Action Area.
5) Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and habitat.
6) Reach jeopardy and adverse modification conclusions.
7) If necessary, define a reasonable and prudent alternative to the proposed action.

2.1.1 Use of Analytical Surrogates

The effects of the Antelope Creek Flood Control Project on federally listed fish species are primarily analyzed by using habitat disturbance as an ecological surrogate for take. Descriptions of the habitat disturbance anticipated during the dewatering of the Antelope Creek channel, construction of the weirs, installation of the new culvert, SRA riparian habitat loss, and project site operations and maintenance were provided in the biological assessment.

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 the Central Valley Recovery Plan (NMFS 2014), status reviews (NMFS 2016), 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' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

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 current function of the physical and biological features that help to form that conservation value. This section analyzes the status of those federally-listed anadromous fish species found within the Dry Creek watershed and greater Sacramento River basin, focusing on broader geographical scales, representing the entire range of the distinct population segment (DPS) of California Central Valley (CCV) steelhead, or perhaps slightly more narrowly focused upon habitat within California's Central Valley (CV).

The designation of critical habitat for species uses the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7214) replace 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 Opinion, we use the term PBF to mean primary constituent or essential features, as appropriate for the specific critical habitat.

2.2.1 Endangered Species Act Listing Status

The descriptions of the status of species and conditions of the designated critical habitats in this Opinion are a synopsis of the detailed information available on NMFS' West Coast Regional website. The following federally listed species DPS occurs in the Action Area and may be affected by the proposed action:

California Central Valley steelhead DPS (*O. mykiss*)

- Originally listed as threatened on 19 March 1998 (63 FR 13347)
- Reaffirmed as threatened on 15 August 2011 (76 FR 157)
- Critical habitat designated on 2 September 2005 (70 FR 52488)

http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/steelhead/california_central_valley/california_central_valley_steelhead.html

The Federally listed DPS of CCV steelhead occurs in the action area and may be affected by the proposed Project. While designated critical habitat does not occur in the Action Area, it does occur just downstream at the confluence with Dry Creek, therefore is included for discussion purposes in this Opinion.

NMFS has recently completed an updated status review of five Pacific salmon ESUs and one steelhead DPS, including CCV steelhead, and concluded that the species' status should remain as previously listed (76 FR 50447; August 15, 2011). In summary**,** the most recent biological information suggests that the extinction risk of this DPS has not improved since the last status review and that several of the listing factors have contributed to the decline, including recent years of drought and poor ocean conditions. There continue to be ongoing threats to the genetic integrity of natural or wild steelhead from hatchery steelhead programs in the Central Valley, but it is

unclear if or how this factor has influenced the overall viability of the DPS. The best available information on the biological status of the DPS and continuing and new threats indicate that its ESA status as a threatened species is appropriate. Long term recovery of this DPS will require improved freshwater habitat conditions, abatement of a wide range of threats including genetic threats from hatchery populations, and the reintroduction of steelhead to some of its historic habitat.

2.2.2 California Central Valley Steelhead DPS

Species Listing and Critical Habitat Designation History

CCV steelhead were originally listed as threatened on March 19, 1998 (63 FR 13347). Following a new status review (Good *et al.* 2005) and after application of the agency's hatchery listing policy, NMFS reaffirmed its status as threatened and also listed the Feather River Hatchery and Coleman National Fish Hatchery stocks as part of the DPS in 2006 (71 FR 834). In June 2004, after a complete status review of 27 west coast salmonid ESUs and DPSs, NMFS proposed that CCV steelhead remain listed as threatened (69 FR 33102). On January 5, 2006, NMFS reaffirmed the threatened status of the CCV steelhead and applied the DPS policy to the species because the resident and anadromous life forms of *O. mykiss* remain "markedly separated" as a consequence of physical, ecological and behavioral factors, and therefore warranted delineation as a separate DPS (71 FR 834). On February 2, 2016, NMFS completed another 5-year status review of CCV steelhead and recommended that the CCV steelhead DPS remain classified as a threatened species (NMFS 2016). Critical habitat was designated for CCV steelhead on September 2, 2005 (70 FR 52488) and is shown in

California Central Valley Steelhead Critical Habitat and Distribution
City
Critical Habitat & Steelhead Distribution
Steelhead Distribution
County Boundary
Streams
Map Date June 2006
Miles
Critical Habitat and Distribution information taken from "Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California" National Marine Fisheries Service, 2005
Area of Detail
California
California Central Valley Steelhead DPS
SHASTA
TEHAMA
GLENN
BUTTE
COLUSA
SUTTER
YUBA
NEVADA
PLACER
YOLO
SACRAMENTO
AMADOR
SOLANO
CALAVERAS
CONTRA COSTA
SAN JOAQUIN
STANISLAUS
MERCED
Redding
Anderson
Red Bluff
Corning
Chico
Oroville
Maxwell
Colusa
Yuba City
Knights Landing
Roseville
Sacramento
Vacaville
Fairfield
Ione
Antioch
Discovery Bay
Stockton
Modesto
Turlock
Lake Shasta
Whiskeytown Lake
Black Butte Reservoir
Lake Oroville
Butte Sink
Marie Collins Reservoir
Englebright Lake
Lake Wildwood
Camp Far West Reservoir
Folsom Lake
Lake Berryessa
Lake Amador
Pardee Reservoir
Comanche Reservoir
New Hogan Lake
New Melones Reservoir
Tulloch Reservoir
Don Pedro Reservoir
Lake McClure

Figure **2**.

California Central Valley Steelhead Critical Habitat and Distribution
City
Critical Habitat & Steelhead Distribution
Steelhead Distribution
County Boundary
Streams
Map Date June 2006
N
0 5 10 15 20
Miles
Critical Habitat and Distribution information taken from "Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California" National Marine Fisheries Service, 2005
Area of Detail
California
California Central Valley Steelhead DPS
SHASTA
TEHAMA
GLENN
BUTTE
COLUSA
SUTTER
YUBA
NEVADA
PLACER
YOLO
SACRAMENTO
AMADOR
SOLANO
CALAVERAS
CONTRA COSTA
SAN JOAQUIN
STANISLAUS
MERCED
Lake Shasta
Whiskeytown Lake
Redding
Anderson
Red Bluff
Corning
Black Butte Reservoir
Chico
Lake Oroville
Oroville
Marle Collins Reservoir
Englebright Lake
Lake Wildwood
Maxwell
Colusa
Butte Sink
Yuba City
Camp Far West Reservoir
Folsom Lake
Knights Landing
Roseville
Lake Berryessa
Sacramento
Vacaville
Fairfield
Ione
Lake Amador
Pardee Reservoir
Camanche Reservoir
New Hogan Lake
Stockton
Antioch
Discovery Bay
New Melones Reservoir
Tulloch Reservoir
Don Pedro Reservoir
Lake McClure
Modesto
Turlock

Figure 2. Map of CCV steelhead critical habitat and distribution

Summary of CCV Steelhead DPS Viability

All indications suggest that natural CCV steelhead have continued to decrease in abundance over the past 25 years (Good *et al.* 2005; NMFS 2011: NMFS 2016). Hatchery production and returns are dominant over natural fish. Continued decline in the ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts has steadily increased over the past several years.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show a decline, an overall low abundance, and fluctuating return rates. Lindley *et al.* (2007) developed viability criteria for CV salmonids using data through 2005, found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The widespread distribution of wild steelhead in the CV provides the spatial distribution necessary for the DPS to survive and avoid localized catastrophes. However, these populations are frequently very small, and lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2016). The most recent status review of the CCV steelhead DPS (NMFS 2016) found that the status of the population appears not to have improved since the 2011 status review, when it was considered to be in danger of extinction.

Critical Habitat: Physical and Biological Features for CCV Steelhead

Critical habitat for CCV steelhead includes stream reaches such as those of the Sacramento, Feather, and Yuba Rivers, and Deer, Mill, Battle, and Antelope creeks in the Sacramento River basin; the San Joaquin River, including its tributaries, and the waterways of the Delta (

Figure 2). Currently the CCV steelhead DPS and critical habitat extends up the San Joaquin River

up to the confluence with the Merced River. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high water line (OHWL). In areas where the OHWL has not been defined, the lateral extent will be defined by the bankfull elevation (defined as the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series) (Bain & Stevenson 1999; 70 FR 52488). Critical habitat for CCV steelhead is defined as specific areas that contain the PBFs and physical habitat elements essential to the conservation of the species. Inland habitat types used as PBFs for CCV steelhead include the following:

1. Freshwater Spawning Habitat

Freshwater spawning sites are those with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development. Most of the available spawning habitat for steelhead in the CV is located in areas directly downstream of dams due to inaccessibility to historical spawning areas upstream and the fact that dams are typically built at high gradient locations. These reaches are often impacted by the upstream impoundments, particularly over the summer months, when high temperatures can have adverse effects upon salmonids spawning and rearing downstream of the dams. Even in degraded reaches, spawning habitat has a high conservation value as its function directly affects the spawning success and reproductive potential of listed salmonids.

2. Freshwater Rearing Habitat

Freshwater rearing sites are those with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and survival; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large woody material (LWM), log jams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Non-natal, intermittent tributaries also may be used for juvenile rearing. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. Some complex, productive habitats with floodplains remain in the system (*e.g.*, the lower Cosumnes River, Sacramento River reaches with setback levees [*i.e.*, primarily located upstream of the City of Colusa]) and flood bypasses [*i.e.*, Yolo and Sutter bypasses]). However, the channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from either fish or avian predators. Freshwater rearing habitat also has a high conservation value even if the current conditions are significantly degraded from their natural state. Juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment.

3. Freshwater Migration Corridors

Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. They contain natural cover such as riparian

canopy structure, submerged and overhanging large woody objects, aquatic vegetation, large rocks and boulders, side channels, and undercut banks which augment juvenile and adult mobility, survival, and food supply. Migratory corridors are downstream of the spawning areas and include the lower mainstems of the Sacramento and San Joaquin rivers and the Delta. These corridors allow the upstream and downstream passage of adults, and the emigration of smolts. Migratory habitat condition is strongly affected by the presence of barriers, which can include dams (*i.e.*, hydropower, flood control, and irrigation flashboard dams), unscreened or poorly screened diversions, degraded water quality, or behavioral impediments to migration. For successful survival and recruitment of salmonids, freshwater migration corridors must function sufficiently to provide adequate passage. For this reason, freshwater migration corridors are considered to have a high conservation value even if the migration corridors are significantly degraded compared to their natural state.

4. Estuarine Areas

Estuarine areas free of migratory obstructions with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and salt water are included as a PBF. Natural cover such as submerged and overhanging LWM, aquatic vegetation, and side channels, are suitable for juvenile and adult foraging. Estuarine areas are considered to have a high conservation value as they provide factors which function to provide predator avoidance and as a transitional zone to the ocean environment.

Life History of CCV Steelhead

1. Egg to Parr

The length of time it takes for eggs to hatch depends mostly on water temperature. Steelhead eggs hatch in three to four weeks at 10°C (50°F) to 15°C (59°F) (Moyle 2002). After hatching, alevins remain in the gravel for an additional two to five weeks while absorbing their yolk sacs, and emerge in spring or early summer (Barnhart 1986). Fry emerge from the gravel usually about four to six weeks after hatching, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov & Taft 1954). Upon emergence, fry inhale air at the stream surface to fill their air bladders, absorb the remains of their yolks in the course of a few days, and start to feed actively, often in schools (Barnhart 1986; NMFS 1996).

The newly emerged juveniles move to shallow, protected areas associated within the stream margin (McEwan & Jackson 1996). As steelhead parr increase in size and their swimming abilities improve, they increasingly exhibit a preference for higher velocity and deeper mid-channel areas (Hartman 1965; Everest & Chapman 1972; Fontaine 1988).

Productive juvenile rearing habitat is characterized by complexity, primarily in the form of cover, which can be deep pools, woody debris, aquatic vegetation, or boulders. Cover is an important habitat component for juvenile steelhead both as velocity refugia and as a means of avoiding predation (Meehan & Bjornn 1991). Optimal water temperatures for growth range from 15°C (59°F) to 20°C (68°F) (McCullough *et al.* 2001; Spina 2006). Cherry *et al.* (1975) found preferred temperatures for rainbow trout ranged from 11°C (51.8°F) to 21°C (69.8°F) depending on

acclimation temperatures (cited in Myrick & Cech 2001).

2. Smolt Migration

Juvenile steelhead will often migrate downstream as parr in the summer or fall of their first year of life, but this is not a true smolt migration (Loch *et al.* 1988). Smolt migrations occur in the late winter through spring, when juveniles have undergone a physiological transformation to survive in the ocean, and become slender in shape, bright silvery in coloration, with no visible parr marks. Emigrating steelhead smolts use the lower reaches of the Sacramento River and the Delta primarily as a migration corridor to the ocean. Some rearing behavior is thought to occur in tidal marshes, non-tidal freshwater marshes, and other shallow water habitats in the Delta prior to entering the ocean (NMFS 2014).

3. Ocean Behavior

Unlike Pacific salmon, steelhead do not appear to form schools in the ocean (Behnke 1992). Steelhead in the southern part of their range appear to migrate close to the continental shelf, while more northern populations may migrate throughout the northern Pacific Ocean (Barnhart 1986). It is possible that California steelhead may not migrate to the Gulf of Alaska region of the north Pacific as commonly as more northern populations such as those in Washington and British Colombia. Burgner (1993) reported that no coded-wire tagged steelhead from California hatcheries were recovered from the open ocean surveys or fisheries that were sampled for steelhead between 1980 and 1988. Only a small number of disk-tagged fish from California were captured. This behavior might explain the small average size of Central Valley steelhead relative to populations in the Pacific Northwest, as food abundance in the nearshore coastal zone may not be as high as in the Gulf of Alaska.

Pearcy *et al.* (1990) found that the diets of juvenile steelhead caught in coastal waters of Oregon and Washington were highly diverse and included many species of insects, copepods, and amphipods, but by biomass the dominant prey items were small fishes (including rockfish and greenling) and euphausids.

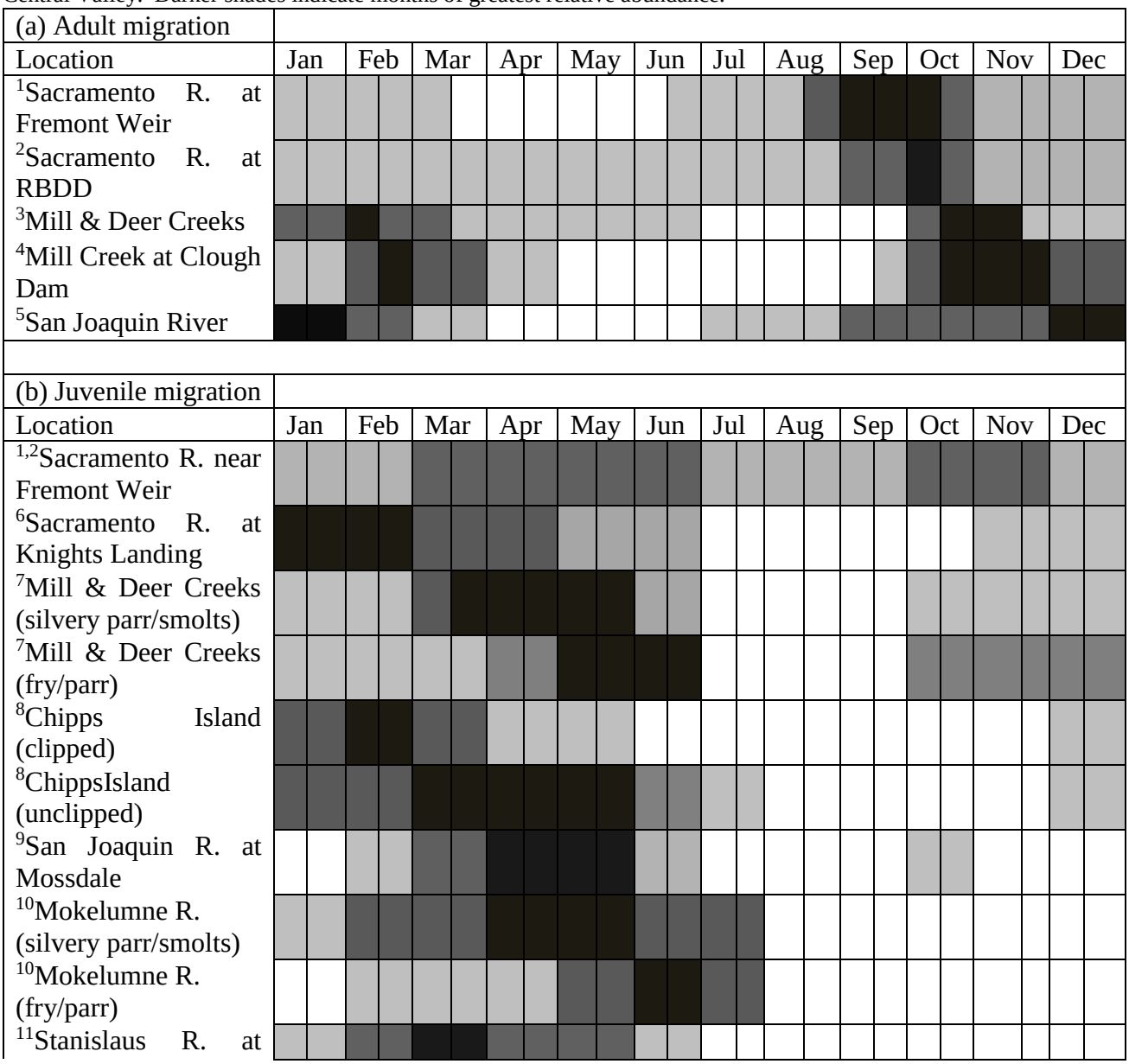
There are no commercial fisheries for steelhead in California, Oregon, or Washington, with the exception of some tribal fisheries in Washington waters.

4. Spawning

CCV steelhead generally enter freshwater from August to November, with a peak in September (Hallock *et al.* 1961). They spawn from December to April, with a peak in January through March, in rivers and streams where cold, well oxygenated water is available (Table 2; Williams 2006; Hallock *et al.* 1961; McEwan & Jackson 1996). The timing of upstream migration is correlated with high flow events, such as freshets, and the associated change in water temperatures (Workman *et al.* 2002). Adults typically spend a few months in freshwater before spawning (Williams 2006), but very little is known about where they hold between entering freshwater and spawning in rivers and streams. The threshold of a 56°F maximum water temperature that is commonly used for Chinook salmon is often extended to steelhead, but temperatures for spawning steelhead are not

usually a concern as this activity occurs in the late fall and winter months when water temperatures are low. Female steelhead construct redds in suitable gravel and cobble substrate, primarily in pool tailouts and heads of riffles.

Table 2. Temporal occurrence of (a) adult and (b) juvenile California Central Valley steelhead at locations in the Central Valley. Darker shades indicate months of greatest relative abundance.



Sources: [1](Hallock 1957); [2](McEwan 2001); [3](Harvey 1995); [4]CDFW unpublished data; [5]CDFG Steelhead Report Card Data 2007; [6]NMFS analysis of 1998-2011 CDFW data; [7](Johnson and Merrick 2012); [8]NMFS analysis of 1998-2011 USFWS data; [9]NMFS analysis of 2003-2011 USFWS data; [10]unpublished EBMUD RST data for 2008-2013; [11]Oakdale RST data (collected by FishBio) summarized by John Hannon (Reclamation); [12](Schaffter 1980).

Few direct counts of fecundity are available for CCV steelhead populations, but since the number of eggs laid per female is highly correlated with adult size, adult size can be used to estimate fecundity with reasonable precision. Adult steelhead size depends on the duration of and growth rate during their ocean residency (Meehan & Bjornn 1991). CCV steelhead generally return to freshwater after one or two years at sea (Hallock *et al.* 1961), and adults typically range in size from two to twelve pounds (Reynolds *et al.* 1993). Steelhead about 55 cm fork length (FL) may have fewer than 2,000 eggs, whereas steelhead 85 cm (FL) long can have 5,000 to 10,000 eggs, depending on the stock (Meehan & Bjornn 1991). The average for Coleman National Fish Hatchery (Coleman) since 1999 is about 3,900 eggs per female (USFWS 2011).

Unlike Pacific salmon, steelhead are iteroparous, meaning they are capable of spawning multiple times before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; and repeat spawners tend to be biased towards females (Busby *et al.* 1996). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Although one-time spawners are the great majority, Shapolov and Taft (1954) reported that repeat spawners were relatively numerous (17.2 percent) in Waddell Creek. Null *et al.* (2013) found between 36 percent and 48 percent of kelts released from Coleman National Fish Hatchery in 2005 and 2006 survived to spawn the following spring, which is in sharp contrast to what Hallock (1989) reported for Coleman in the 1971 season, where only 1.1 percent of adults were fish that had been tagged the previous year. Most populations have never been studied to determine the percentage of repeat spawners. Hatchery steelhead are typically less likely than wild fish to survive to spawn a second time (Leider *et al.* 1986).

5. Kelts

Post-spawning steelhead (kelts) may migrate downstream to the ocean immediately after spawning, or they may spend several weeks holding in pools before outmigrating (Shapovalov & Taft 1954). Recent studies have shown that kelts may remain in freshwater for an entire year after spawning (Teo *et al.* 2011), but that most return to the ocean (Null *et al.* 2013).

Description of Viable Salmonid Population (VSP) Parameters

As an approach to determining the conservation status of salmonids, NMFS has developed a framework for identifying attributes of a viable salmonid population (VSP). The intent of this framework is to provide parties with the ability to assess the effects of management and

conservation actions and ensure their actions promote the listed species' survival and recovery. This framework is known as the VSP concept (McElhany *et al.* 2000). The VSP concept measures population performance in term of four key parameters: abundance, population growth rate, spatial structure, and diversity.

1. Abundance

Historic CCV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s the steelhead run size had declined to about 40,000 adults (McEwan 2001). Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River upstream of the Feather River. Steelhead counts at the Red Bluff Diversion Dam (RBDD) declined from an average of 11,187 for the period from 1967 to 1977, to an average of approximately 2,000 through the early 1990s, with an estimated total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults (McEwan & Jackson 1996, McEwan 2001). Steelhead escapement surveys at RBDD ended in 1993 due to changes in dam operations, and comprehensive steelhead population monitoring has not taken place in the Central Valley since then, despite 100 percent marking of hatchery steelhead smolts since 1998. Efforts are underway to improve this deficiency, and a long term adult escapement monitoring plan is being planned (Eilers *et al.* 2010).

Current abundance data is limited to returns to hatcheries and redd surveys conducted on a few rivers. The hatchery data is the most reliable, as redd surveys for steelhead are often made difficult by high flows and turbid water usually present during the winter-spring spawning period.

Coleman operates a weir on Battle Creek, where all upstream fish movement is blocked August through February, during the hatchery spawning season. Counts of steelhead captured at and passed above this weir represent one of the better data sources for the Central Valley DPS. However, changes in hatchery policies and transfer of fish complicate the interpretation of these data. In 2005, per NMFS request, Coleman stopped transferring all adipose-fin clipped steelhead above the weir, resulting in a large decrease in the overall numbers of steelhead above the weir in recent years (Figure 3). In addition, in 2003, Coleman transferred about 1,000 clipped adult steelhead to Keswick Reservoir, and these fish are not included in the data. The result is that the only unbiased time series for Battle Creek is the number of unclipped (wild) steelhead since 2001, which have declined slightly since that time, mostly because of the high returns observed in 2002 and 2003.

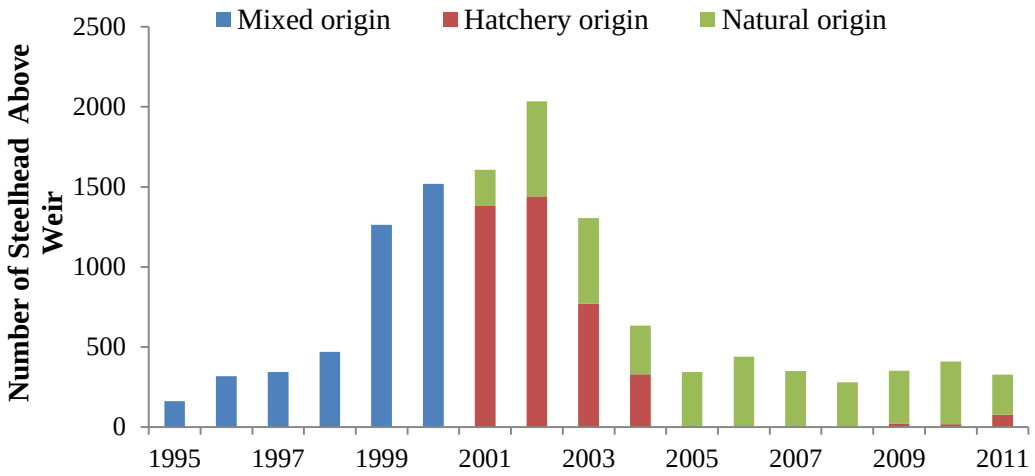


Figure 3. Steelhead returns to Battle Creek from 1995-2011. Starting in 2001, *O. mykiss* were classified as either wild (unclipped) or hatchery produced (clipped). Includes fish passed above the weir during broodstock collection and fish passing through the fish ladder March 1 to August 31. Data are from USFWS.

Prior to 2002, hatchery and natural-origin steelhead in Battle Creek were not differentiable, and all steelhead were managed as a single, homogeneous stock, although USFWS believes the majority of returning fish in years prior to 2002 were hatchery-origin. Abundance estimates of natural-origin steelhead in Battle Creek began in 2001. These estimates of steelhead abundance include all *O. mykiss*, including resident and anadromous fish (Figure 3).

Steelhead returns to Coleman have fluctuated greatly over the years. From 2003 to 2012, the number of hatchery origin adults has ranged from 624 to 2,968. Since 2003, adults returning to the hatchery have been classified as wild (unclipped) or hatchery produced (adipose clipped). Wild adults counted at the hatchery each year represent a small fraction of overall returns, but their numbers have remained relatively steady, typically 200-500 fish each year (Figure 4).

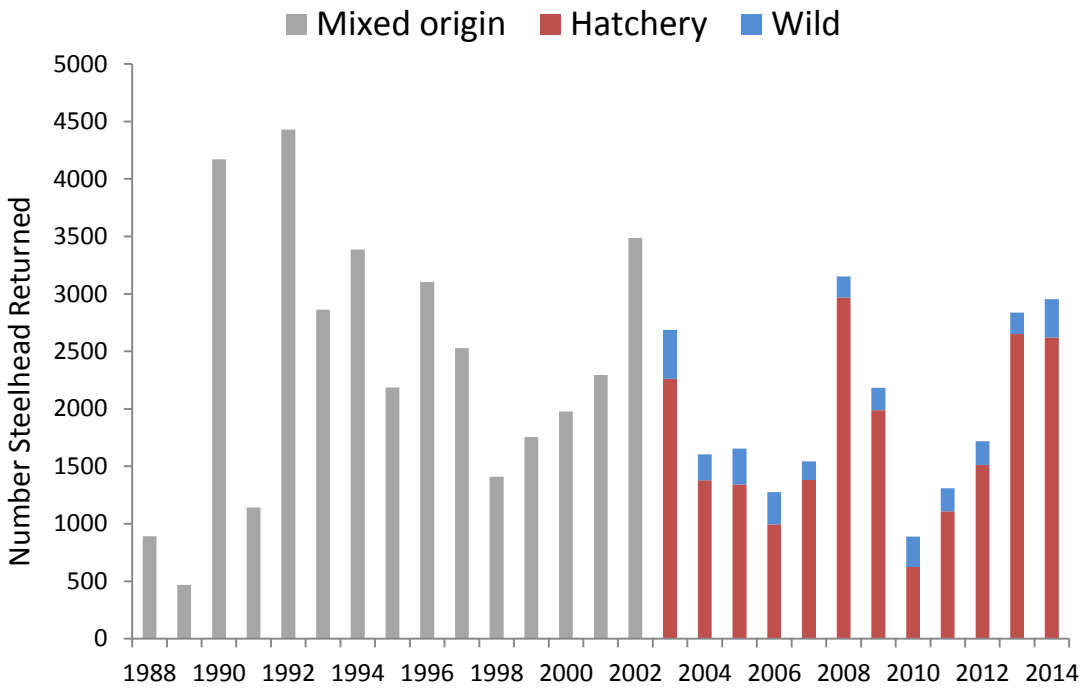


Figure 4. Annual steelhead returns to Coleman National Fish Hatchery from 1988-2014. Adipose fin-clipping of hatchery smolts started in 1998 and since 2003 all returns have been categorized either natural or hatchery origin.

Redd counts are conducted in the American River (Sacramento County) and in Clear Creek (Shasta County). An average of 143 redds have been counted on the American River from 2002-2015 (Error! eference source not found.**; data from Hannon & Deason 2008; Hannon et al. 2003; Chase 2010). Surveys were not conducted in some years on the American River due to high flows and low visibility. An average of 178 redds have been counted in Clear Creek from 2001 to 2015 (**

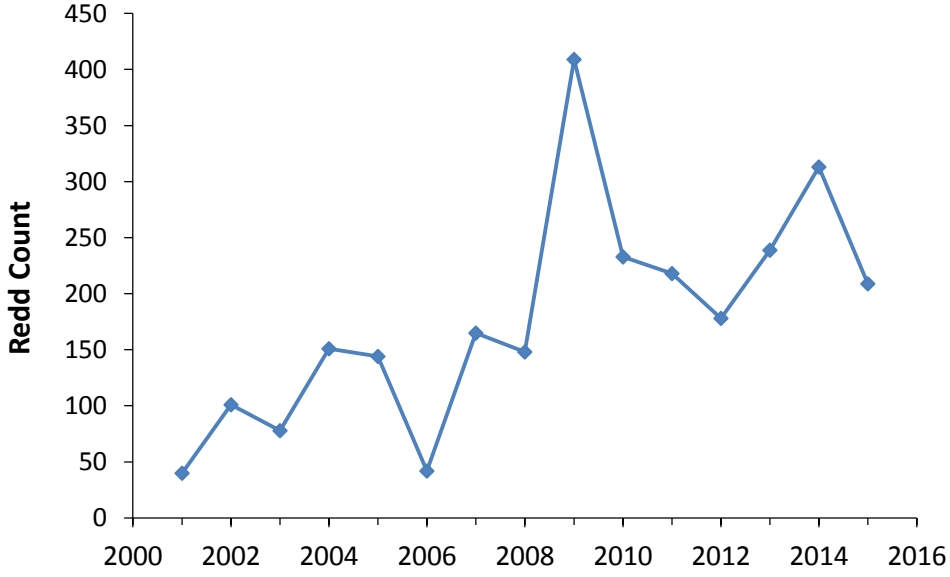


Figure 6; data from USFW). The Clear Creek steelhead population appears to have increased in abundance since Saeltzer Dam was removed in 2000, as the number of redds observed in surveys

conducted by the USFWS has steadily increased since 2001. The average redd index from 2001 to 2011 is 178, representing a range of approximately 100 - 1023 spawning adult steelhead on average each year, based on an approximate observed adult to redd ratio in Clear Creek (U. S. Fish and Wildlife Service 2015). The vast majority of these steelhead are wild fish, as no hatchery steelhead are stocked in Clear Creek.

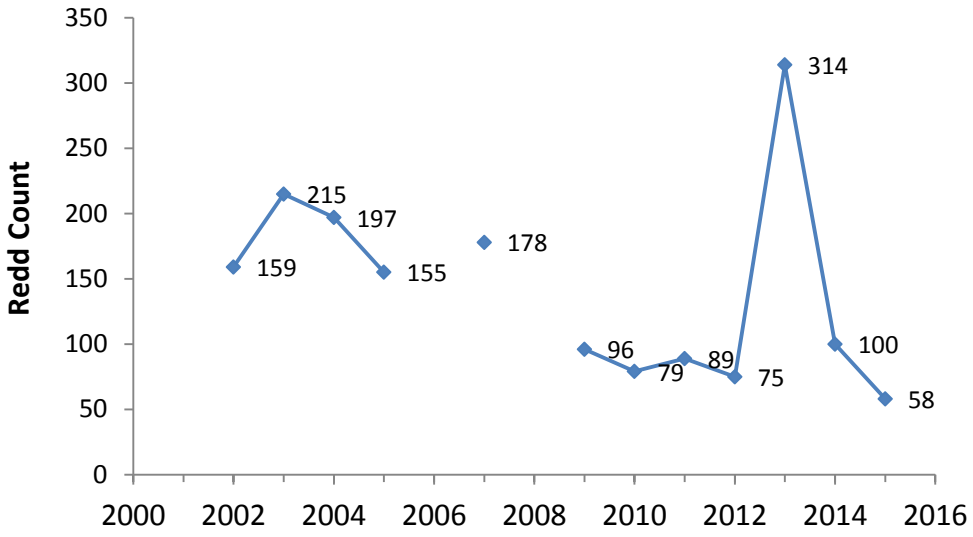


Figure 5. Steelhead redd counts from surveys on the American River from 2002-2015. Surveys could not be conducted in some years due to high flows and low visibility.

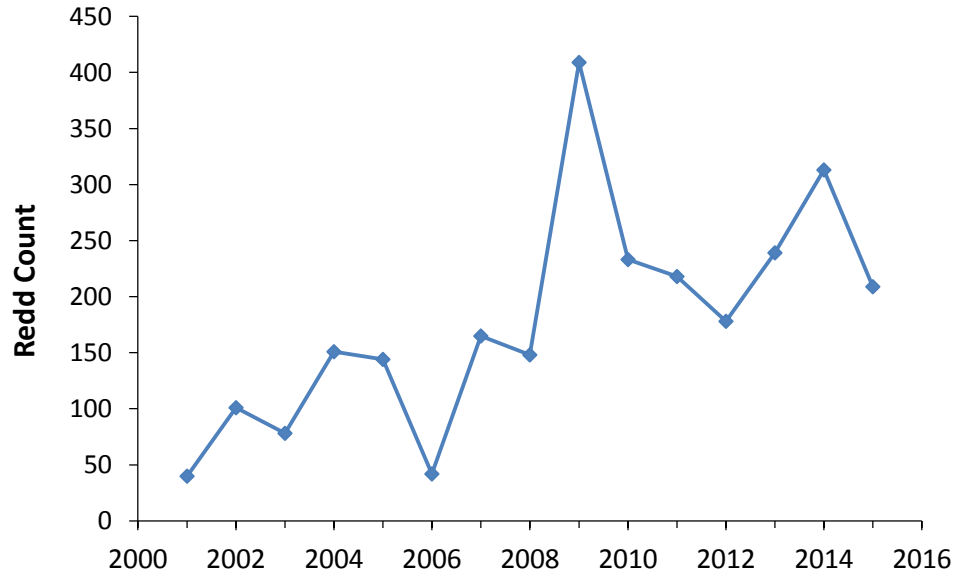


Figure 6. Clear Creek steelhead redd counts from USFWS surveys 2001–2011.

The East Bay Municipal Utilities District (EBMUD) has included steelhead in their redd surveys

on the Lower Mokelumne River since the 1999-2000 spawning season, and the overall trend is a slight increase. However, it is generally believed that most of the *O. mykiss* spawning in the Mokelumne River are resident fish (Satterthwaite *et al.* 2010), which are not part of the CCV steelhead DPS. In the most recent 5-year status review, NMFS upheld its decision not to include this population in the DPS (NMFS 2016).

The returns of steelhead to the Feather River Hatchery experienced a sharp decrease from 2003 to 2010, with only 679, 312, and 86 fish returning in 2008, 2009 and 2010, respectively (**Figure 7**). In recent years however, returns have experienced an increase with 830, 1797, and 1505 fish returning in 2012, 2013 and 2014 respectively. Almost all of these fish are hatchery fish and stocking levels have remained fairly constant, suggesting that smolt and/or ocean survival was poor for age classes that showed poor returns in the late 2000's.

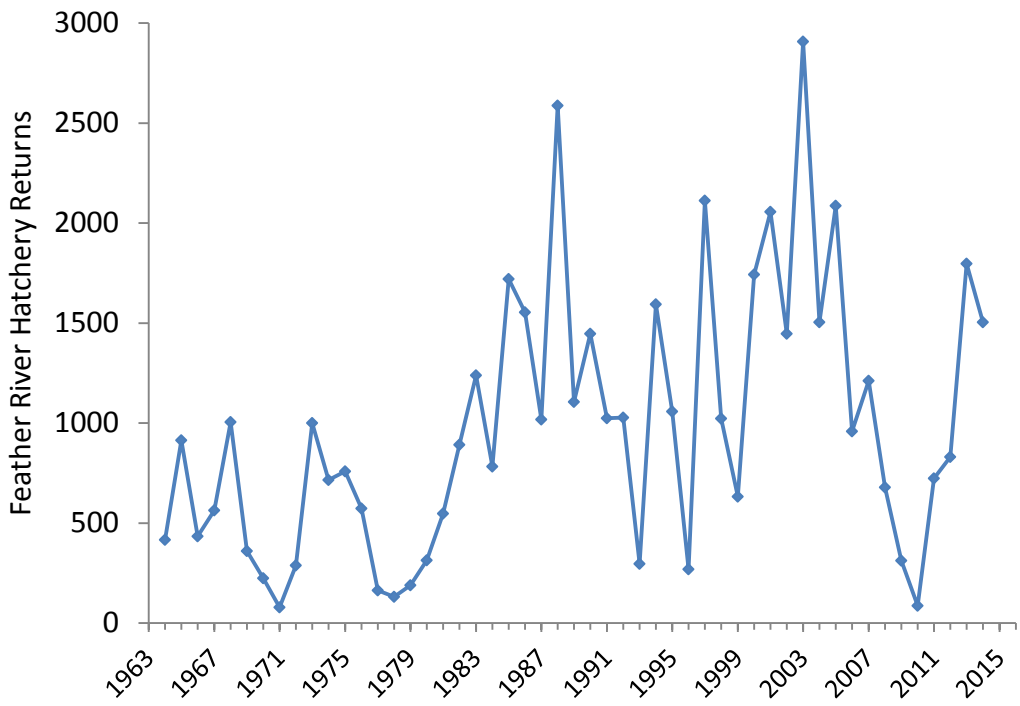


Figure 7. Steelhead returns to the Feather River Hatchery from 1964-2015.

The Clear Creek steelhead population appears to have increased in abundance since Saeltzer Dam was removed in 2000, as the number of redds observed in surveys conducted by the USFWS has steadily increased since 2001 (

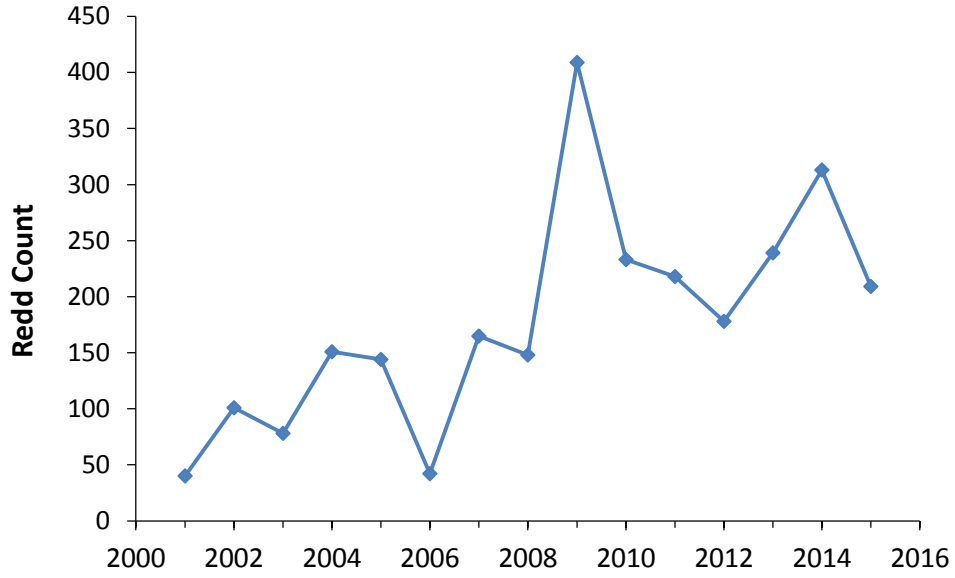


Figure 6). The average redd index from 2001 to 2011 is 157, representing somewhere between 128 and 255 spawning adult steelhead on average each year. The vast majority of these steelhead are wild fish, as no hatchery steelhead are stocked in Clear Creek.

Catches of steelhead at the fish collection facilities in the southern Delta are another source of information on the relative abundance of the CCV steelhead DPS, as well as the proportion of wild steelhead relative to hatchery steelhead (CDFG; ftp.delta.dfg.ca.gov/salvage). The overall catch of steelhead at these facilities has been highly variable since 1993 (Figure 8). Variability in catch is likely due to differences in water year types as Delta exports fluctuate. The percentage of unclipped steelhead in salvage has also fluctuated, but has generally declined since 100 percent clipping started in 1998. The number of stocked hatchery steelhead has remained relatively constant overall since 1998, even though the number stocked in any individual hatchery has fluctuated.

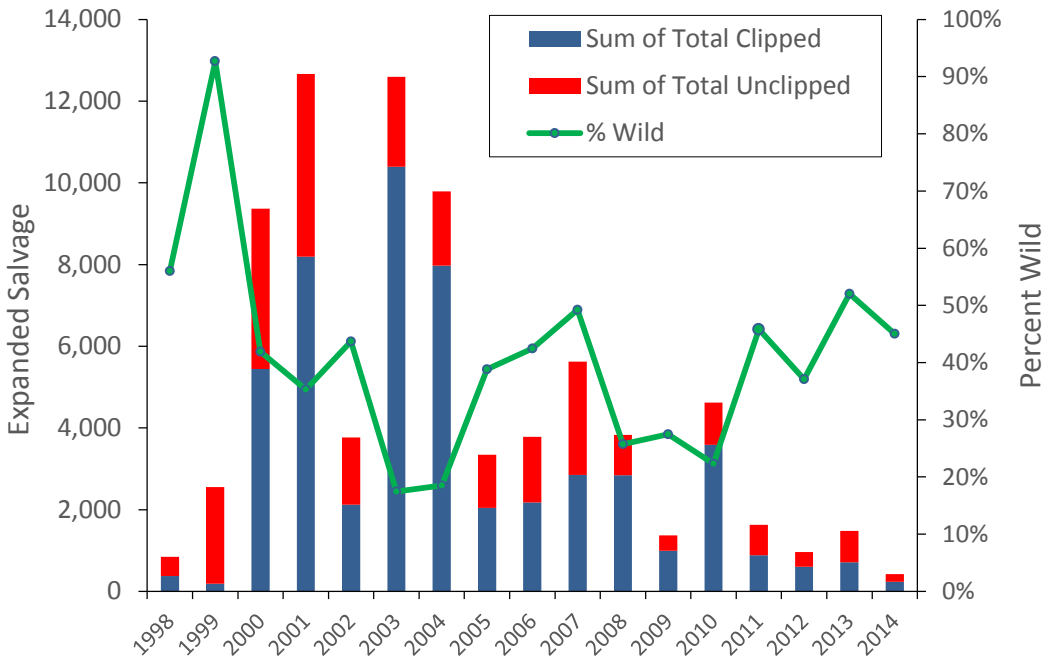


Figure 8. Steelhead salvaged in the Delta fish collection facilities from 1993 to 2014. All hatchery steelhead have been adipose fin-clipped since 1998. Data are from CDFW, at: ftp.delta.dfg.ca.gov/salvage.

The years 2009 and 2010 showed poor returns of steelhead to the Feather River Hatchery and Coleman, probably due to three consecutive drought years from 2007-2009, which would have impacted parr and smolt growth and survival in the rivers. Poor coastal upwelling conditions in 2005 and 2006, which strongly impacted fall-run Chinook salmon post-smolt survival (Lindley *et al.* 2009) may had a similar negative impact on steelhead as well. Wild (unclipped) adult counts appear not to have decreased as greatly in those same years, based on returns to the hatcheries and redd counts conducted on Clear Creek, and the American and Mokelumne rivers. This may reflect greater fitness of naturally produced steelhead relative to hatchery fish, and certainly merits further study.

Overall, steelhead returns to hatcheries have fluctuated so much from 2001 to 2011 that no clear trend is present, other than the fact that the numbers are still far below those seen in the 1960s and 1970s, and only a tiny fraction of the historical estimate. Returns of natural origin fish are very poorly monitored, but the little data available suggest that the numbers are very small, though perhaps not as variable from year to year as the hatchery returns.

2. Productivity

An estimated 100,000 to 300,000 naturally produced juvenile steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (Good *et al.* 2005). The Mossdale trawls on the San Joaquin River conducted annually by CDFW and USFWS capture steelhead smolts, although usually in very small numbers. These steelhead recoveries, which represent migrants from the Stanislaus, Tuolumne, and Merced rivers, suggest

that the productivity of CCV steelhead in these tributaries is very low. In addition, the Chipps Island midwater trawl dataset from the USFWS provides information on the trend (Williams *et al.* 2011).

Nobriga and Cadrett (2001) used the ratio of adipose fin-clipped (hatchery) to unclipped (wild) steelhead smolt catch ratios in the Chipps Island trawl from 1998 through 2000 to estimate that about 400,000 to 700,000 steelhead smolts are produced naturally each year in the Central Valley. Good *et al.* (2005) made the following conclusion based on the Chipps Island data:

"If we make the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1 percent of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire Central Valley. This can be compared with McEwan's (2001) estimate of 1 million to 2 million spawners before 1850, and 40,000 spawners in the 1960s."

The Chipps Island midwater trawl dataset maintained by the USFWS provides information on the trend in abundance for the CCV steelhead DPS as a whole. Updated through 2014, the trawl data indicate that the level of natural production of steelhead has remained very low since the 2011 status review (**Figure 9**). Catch per unit effort (CPUE) has fluctuated but remained level over the past decade, but the proportion of the catch that is adipose-clipped (100% of hatchery steelhead production have been adipose fin-clipped starting in 1998) has risen, exceeding 90 percent in some years and reaching a high of 95 percent in 2010 (Williams *et al.* 2011). Because hatchery releases have been fairly constant, this implies that natural production of juvenile steelhead has been declining in the Central Valley.

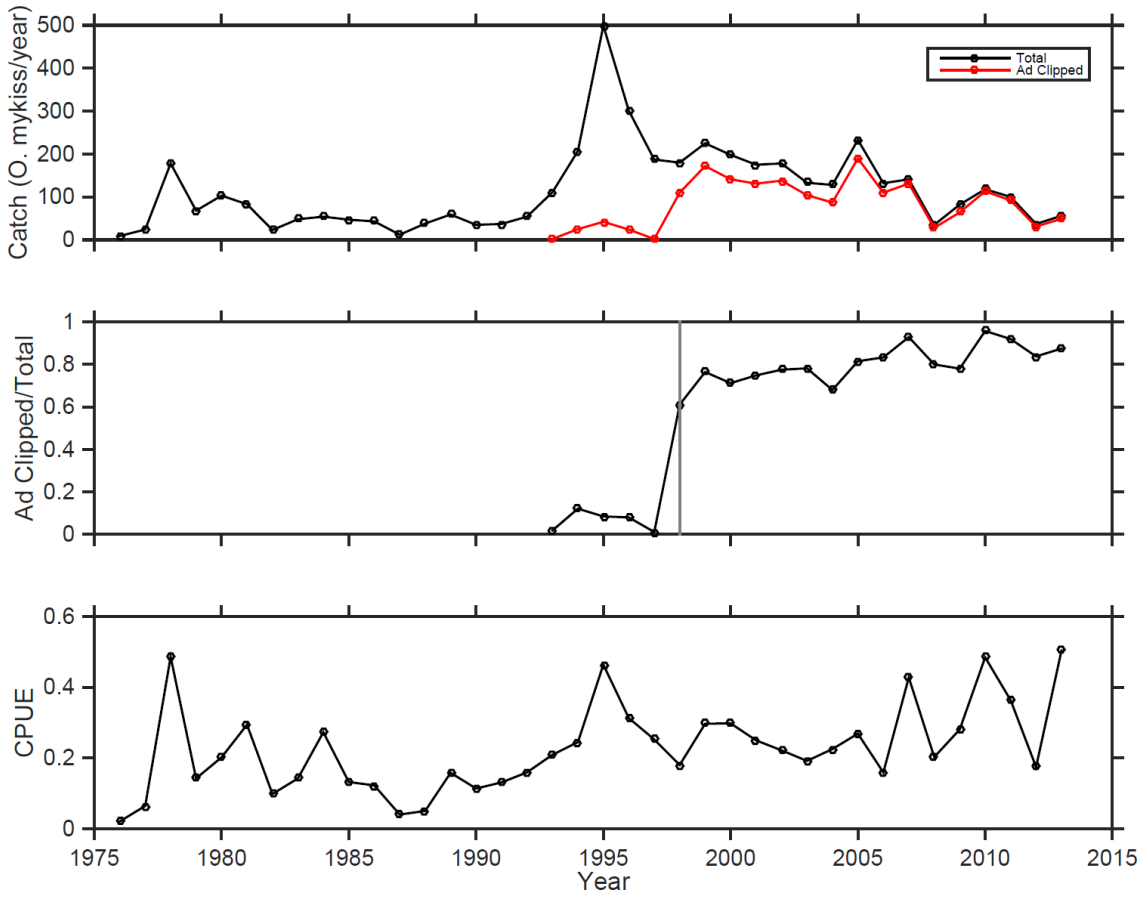


Figure 9. Top: Catch of steelhead at Chipps Island by the USFWS midwater trawl survey. **Middle:** Fraction of the catch bearing an adipose fin clip. 100% of steelhead production has been marked starting in 1998, denoted with the vertical gray line. **Bottom:** CPUE in fish per million m-3 swept volume. CPUE is not easily comparable across the entire period of record, as over time, sampling has occurred over more of the year and catches of juvenile steelhead are expected to be low outside of the primary migratory season.

In the Mokelumne River, EBMUD has included steelhead in their redd surveys on the Lower Mokelumne River since the 1999-2000 spawning season (NMFS 2011). Based on data from these surveys, the overall trend suggests that redd numbers have slightly increased over the years (2000-2010). However, according to Satterthwaite *et al.* (2010), it is likely that most of the *O. mykiss* spawning in the Mokelumne River are non-anadromous (or resident) fish rather than steelhead. The Mokelumne River steelhead population is supplemented by Mokelumne River Hatchery production. In the past, this hatchery received fish imported from the Feather River and Nimbus hatcheries (Merz 2002). However, this practice was discontinued for Nimbus stock after 1991, and discontinued for Feather River stock after 2008. Recent genetic studies show that the Mokelumne River Hatchery steelhead are closely related to Feather River fish, suggesting that there has been little carry-over of genes from the Nimbus stock.

Additionally, on the Mokelumne River, it appears that many fish can reach a size large enough to smolt at age 1, but the slower-growing fish are better served to mature as young-of-year (YOY) and spawn at age 1 rather than risk the extra freshwater mortality associated with waiting to smolt at age 2 (since much less time must elapse before the age 1 spawning opportunity compared to age 2 emigration). However, once the first spawning opportunity has passed and even slow growing fish are large enough to have a moderate chance of survival in the ocean, it takes too long and exposes fish to too much risk of freshwater mortality to grow to a large enough size to spawn with much success as a resident female at an even older age.

These results suggests that restoration activities for CCV steelhead should focus on habitat improvements that both increase parr survival and growth in natal rivers, especially in the summer and fall period, and improve smolt survival in the lower river reaches, the Delta, and Bays.

Catches of steelhead at the fish collection facilities in the southern Delta are another source of information on the relative abundance of the CCV steelhead DPS, as well as the production of wild steelhead relative to hatchery steelhead (ftp.delta.dfg.ca.gov/salvage). The overall catch of steelhead has declined dramatically since the early 2000's, with an overall average of 2,705 in the last ten years, as measured by expanded salvage (Figure 8). The percentage of wild (unclipped) fish in salvage has fluctuated, but has leveled off to an average of 36 percent since a high of 93 percent in 1999. The number of stocked hatchery steelhead has remained relatively constant overall since 1998, even though the number stocked in any individual hatchery has fluctuated. This relatively constant hatchery production, coupled with the dramatic decline in hatchery-origin steelhead catch at the south Delta fish collection facilities suggests that either stocked hatchery fish from the Sacramento basin are utilizing a more natural outmigration path and not being pulled into the south Delta fish facilities, or the immediate survival of those stocked fish has decreased. With respect to wild steelhead, the data indicates that over the last few years fewer adults are spawning (less eggs deposited), survival of early life stages has decreased, and/or wild steelhead are experiencing reduced exposure to the south Delta fish facilities.

Since 2003, fish returning to the Coleman National Fish Hatchery have been identified as wild (adipose fin intact) or hatchery produced (ad-clipped). Returns of wild fish to the hatchery have remained fairly steady at 200-300 fish per year, but represent a small fraction of the overall hatchery returns. Numbers of hatchery origin fish returning to the hatchery have fluctuated much more widely; ranging from 624 to 2,968 fish per year.

3. Spatial Structure

About 80 percent of the historical spawning and rearing habitat once used by anadromous *O. mykiss* in the Central Valley is now upstream of impassible dams (Lindley *et al.* 2006). The extent of habitat loss for steelhead most likely was much higher than that for salmon because steelhead were undoubtedly more extensively distributed. Due to their superior jumping ability, the timing of their upstream migration which coincided with the winter rainy season, and their less restrictive preferences for spawning gravels, steelhead could have utilized at least hundreds of miles of smaller tributaries not accessible to the earlier-spawning salmon (Yoshiyama *et al.* 1996). Many historical populations of CCV steelhead are entirely above impassable barriers and may persist as

resident or adfluvial rainbow trout, although they are presently not considered part of the DPS. Steelhead were found as far south as the Kings River, and possibly Kern River systems in wet years (McEwan 2001). Native American groups such as the Chunut people have had accounts of steelhead in the Tulare Basin (Latta 1977).

Steelhead are well-distributed throughout the Central Valley below the major rim dams (Good *et al.* 2005; NMFS 2011). Zimmerman *et al.* (2009) used otolith microchemistry to show that *O. mykiss* of anadromous parentage occur in all three major San Joaquin River tributaries, but at low levels, and that these tributaries have a higher percentage of resident *O. mykiss* compared to the Sacramento River and its tributaries.

Monitoring has detected small numbers of steelhead in the Stanislaus, Mokelumne, and Calaveras rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (S. P. Cramer Fish Sciences 2000). A counting weir has been in place in the Stanislaus River since 2002 and in the Tuolumne River since 2009 to detect adult salmon; these weirs have also detected *O. mykiss* passage. In 2012, 15 adult *O. mykiss* were detected passing the Tuolumne River weir and 82 adult *O. mykiss* were detected at the Stanislaus River weir (FISHBIO 2012; FISHBIO 2013a). In addition, rotary screw trap sampling has occurred since 1995 in the Tuolumne River, but only one juvenile *O. mykiss* was caught during the 2012 season (FISHBIO 2013b). Rotary screw traps are well known to be very inefficient at catching steelhead smolts, so the actual numbers of smolts produced in these rivers could be much higher. Rotary screw trapping on the Merced River has occurred since 1999. A fish counting weir was installed on this river in 2012. Since installation, one adult *O. mykiss* has been reported passing the weir. Juvenile *O. mykiss* were not reported captured in the rotary screw traps on the Merced River until 2012, when a total of 381 were caught (FISHBIO 2013c). The unusually high number of *O. mykiss* captured may be attributed to a flashy storm event that rapidly increased flows over a 24 hour period. Annual Kodiak trawl surveys are conducted on the San Joaquin River at Mossdale by CDFW. A total of 17 *O. mykiss* were caught during the 2012 season (CDFW 2013).

Most of the steelhead populations in the Central Valley have a high hatchery component, including Battle Creek (adult intercepted at the Coleman NFH weir), the American River, Feather River, and Mokelumne River. This is confounded, of course, by the fact that most of the dedicated monitoring programs in the Central Valley occur on rivers that are annually stocked. Clear Creek and Mill Creek are the exceptions.

Implementation of CDFW's Steelhead Monitoring Program began during the fall of 2015. Important components of the program include a Mainstem Sacramento River Steelhead Mark-Recapture Program and an Upper Sacramento River Basin Adult Steelhead Video/DIDSON Monitoring Program. The monitoring program will use a temporally stratified mark-recapture survey design in the lower Sacramento River, employing wire fyke traps to capture, mark, and recapture upstream migrating adult steelhead to estimate adult steelhead escapement from the Sacramento-San Joaquin River Delta. Data collected from recaptured adult steelhead will provide additional information on tributary escapement, survival, population structure, population distribution, and spatial and temporal behavior of both hatchery- and natural-origin steelhead.

The low adult returns to the San Joaquin tributaries and the low numbers of juvenile emigrants typically captured suggest that existing populations of CCV steelhead on the Tuolumne, Merced, and lower San Joaquin rivers are severely depressed. The loss of these populations would severely impact CCV steelhead spatial structure and further challenge the viability of the CCV steelhead DPS.

Efforts to provide passage of salmonids over impassable dams have the potential to increase the spatial diversity of Central Valley steelhead populations if the passage programs are implemented for steelhead. In addition, the San Joaquin River Restoration Program (SJRRP) calls for a combination of channel and structural modifications along the San Joaquin River below Friant Dam, releases of water from Friant Dam to the confluence of the Merced River, and the reintroduction of spring-run and fall-run Chinook salmon. If the SJRRP is successful, habitat improved for spring-run Chinook salmon could also benefit CCV steelhead (NMFS 2016)

4. Diversity

a. Genetic Diversity

California Central Valley steelhead abundance and growth rates continue to decline, largely the result of a significant reduction in the amount and diversity of habitats available to these populations (Lindley *et al.* 2006). Recent reductions in population size are also supported by genetic analysis (Nielsen *et al.* 2003). Garza and Pearse (2008) analyzed the genetic relationships among Central Valley steelhead populations and found that unlike the situation in coastal California watersheds, fish below barriers in the Central Valley were often more closely related to below barrier fish from other watersheds than to *O. mykiss* above barriers in the same watershed. This pattern suggests the ancestral genetic structure is still relatively intact above barriers, but may have been altered below barriers by stock transfers.

The genetic diversity of CV steelhead is also compromised by hatchery origin fish, which likely comprise the majority of the annual spawning runs, placing the natural population at a high risk of extinction (Lindley *et al.* 2007). There are four hatcheries (Coleman National Fish Hatchery, Feather River Fish Hatchery, Nimbus Fish Hatchery, and Mokelumne River Fish Hatchery) in the Central Valley which combined release approximately 1.6 million yearling steelhead smolts each year. These programs are intended to mitigate for the loss of steelhead habitat caused by dam construction, but hatchery origin fish now appear to constitute a major proportion of the total abundance in the DPS. Two of these hatchery stocks (Nimbus and Mokelumne River hatcheries) originated from outside the DPS (primarily from the Eel and Mad rivers) and are not presently considered part of the DPS.

b. Life-History Diversity

Historically, steelhead in the Central Valley consisted of both summer-run and winter-run migratory forms, based on their state of sexual maturity at the time of river entry and the duration of their time in freshwater before spawning. Between 1944 and 1947, annual counts of summer-run steelhead passing through the Old Folsom Dam fish ladder during May, June, and July ranged from 400 to 1,246 fish. However, after 1950, when the fish ladder at Old Folsom Dam was

destroyed by flood flows, summer-run steelhead were no longer able to access their historic spawning areas, and perished in the warm water downstream of Old Folsom Dam (Gerstung 1971).

Only winter-run (ocean maturing) steelhead currently are found in California Central Valley rivers and streams (Moyle 2002; McEwan & Jackson 1996). Summer-run steelhead have been extirpated due to a lack of suitable holding and staging habitat, such as cold-water pools in the headwaters of CV streams, presently located above impassible dams (Lindley *et al.* 2006).

Juvenile steelhead (parr) rear in freshwater for one to three years before migrating to the ocean as smolts (Moyle 2002). The time that parr spend in freshwater is inversely related to their growth rate, with faster-growing members of a cohort smolting at an earlier age but a smaller size (Peven *et al.* 1994, Seelbach 1993). Hallock *et al.* (1961) aged 100 adult steelhead caught in the Sacramento River upstream of the Feather River confluence in 1954, and found that 70 had smolted at age 2, 29 at age 1, and one at age 3. Seventeen of the adults were repeat spawners, with three fish on their third spawning migration, and one on its fifth. Age at first maturity varies among populations. In the Central Valley, most steelhead return to their natal streams as adults at a total age of two to four years (Hallock *et al.* 1961, McEwan & Jackson 1996).

Deer and Mill creeks were monitored from 1994 to 2010 by the CDFW using rotary screw traps to capture emigrating juvenile steelhead (Johnson & Merrick 2012). Fish in the fry stage averaged 34 and 41 mm FL in Deer and Mill, respectively, while those in the parr stage averaged 115 mm FL in both streams. Silvery parr averaged 180 and 181 mm in Deer and Mill creeks, while smolts averaged 210 mm and 204 mm. Most silvery parr and smolts were caught in the spring months from March through May, while fry and parr peaked later in the spring (May and June) and were fairly common in the fall (October through December) as well.

In contrast to the upper Sacramento River tributaries, Lower American River juvenile steelhead have been shown to smolt at a very large size (270 to 350 mm FL), and nearly all smolt at age-1 (Sogard *et al.* 2012).

5. Summary of ESU Viability

All indications are that natural Central Valley steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (Good *et al.* 2005; NMFS 2016); the long-term trend remains negative. Hatchery production and returns are dominant over natural fish, and one of the four hatcheries is dominated by Eel/Mad River origin steelhead stock. The ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance has remained at a relatively steady state since the 2011 status review and remains much lower than percentages observed in previous decades. Hatchery releases (100 percent adipose fin-clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts has steadily increased over the past decade.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show an overall very low abundance, and fluctuating return rates. Lindley *et al.* (2007) developed viability criteria for Central Valley

salmonids. Using data through 2005, Lindley *et al.* (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

The widespread distribution of wild steelhead in the Central Valley provides the spatial structure necessary for the DPS to survive and avoid localized catastrophes. However, most wild CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2011). The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.

The most recent status review of the CCV steelhead DPS (NMFS 2016) found that the status of the population appears to have remained unchanged since the 2011 status review (Good *et al.* 2005), when it was considered to be in danger of extinction.

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley, and aquatic habitat at large, is climate change.

Warmer temperatures associated with climate change reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen *et al.* 2000). Central California has shown trends toward warmer winters since the 1940s (Dettinger & Cayan 1995). An altered seasonality results in runoff events occurring earlier in the year due to a shift in precipitation falling as rain rather than snow (Roos 1991, Dettinger *et al.* 2004). Specifically, the Sacramento River basin annual runoff amount for April-July has been decreasing since about 1950 (Roos 1987, 1991). Increased temperatures influence the timing and magnitude patterns of the hydrograph.

The magnitude of snowpack reductions is subject to annual variability in precipitation and air temperature. The large spring snow water equivalent (SWE) percentage changes, late in the snow season, are due to a variety of factors including reduction in winter precipitation and temperature increases that rapidly melt spring snowpack (VanRheenen *et al.* 2004). Factors modeled by VanRheenen *et al.* (2004) show that the melt season shifts to earlier in the year, leading to a large percent reduction of spring SWE (up to 100% in shallow snowpack areas). Additionally, an air temperature increase of 2.1°C (3.8°F) is expected to result in a loss of about half of the average April snowpack storage (VanRheenen *et al.* 2004). The decrease in spring SWE (as a percentage) would be greatest in the region of the Sacramento River watershed, at the north end of the Central Valley, where snowpack is shallower than in the San Joaquin River watersheds to the south.

As CCV steelhead are blocked from the vast majority of their historic spawning and rearing habitat, the effects of climate change may be even greater in some cases than for Chinook salmon, as juvenile CCV steelhead need to rear in the stream for one to two summers prior to emigrating as smolts. In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile CCV steelhead, which range from 14°C to 19°C (57°F to 66°F). Several studies have found that steelhead require

colder water temperatures for spawning and embryo incubation than salmon (McCullough *et al.* 2001). In fact, McCullough *et al.* (2001) recommended an optimal incubation temperature at or below 11°C to 13°C (52°F to 55°F). Successful smoltification in steelhead may be impaired by temperatures above 12°C (54°F), as reported by Richter and Kolmes (2005). As stream temperatures warm due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of decreased survival due to higher metabolic demands. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild CCV steelhead populations.

In summary, observed and predicted climate change effects are generally detrimental to the species (McClure 2011, Wade *et al.* 2013), so unless offset by improvements in other factors, the 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. While there is uncertainty associated with projections, which increases over time, the direction of change is relatively certain (McClure *et al.* 2013).

2.3 Environmental Baseline

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 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR § 402.02).

The environmental baseline describes the status of listed species and critical habitat in the Action Area, to which we add the effects of the proposed action within the context of other factors that impact the listed species. The effects of the proposed action are evaluated along with the aggregate effects of all factors that have contributed to the status of listed species and those actions that are likely to affect listed species in the future, to determine if implementation of the proposed action are likely to cause an appreciable reduction in the likelihood of both survival and recovery or result in destruction or adverse modification of critical habitat.

In this section we narrow our geographic scope further, applying the same analysis as was done in Section 2.2, but considering just the Dry Creek watershed of which Antelope Creek is a major tributary. The Dry Creek watershed is located in the American River South Basin in the central portion of the Sacramento Valley and Sierra Nevada foothills in Placer and Sacramento counties (Figure 10). The watershed encompasses approximately 101 square miles and includes six tributary watersheds: Antelope Creek, Cirby Creek, Linda Creek, Strap Ravine, Secret Ravine, and Miners Ravine. Water eventually drains to the Sacramento River through the Natomas East Main Drainage Canal (NEMDC), also referred to as Steelhead Creek. Dry Creek itself is approximately 17.6 miles long, extending from the confluence with NEMDC upstream to the mouth of Antelope Creek. The channel is well defined with sandy bottoms and bordering riparian vegetation. Most of the flow is from precipitation, with summer flow composed of urban runoff, releases from the City of Roseville's Wastewater Treatment Plant (WWTP), and groundwater accretion (Jones & Stokes 2005).

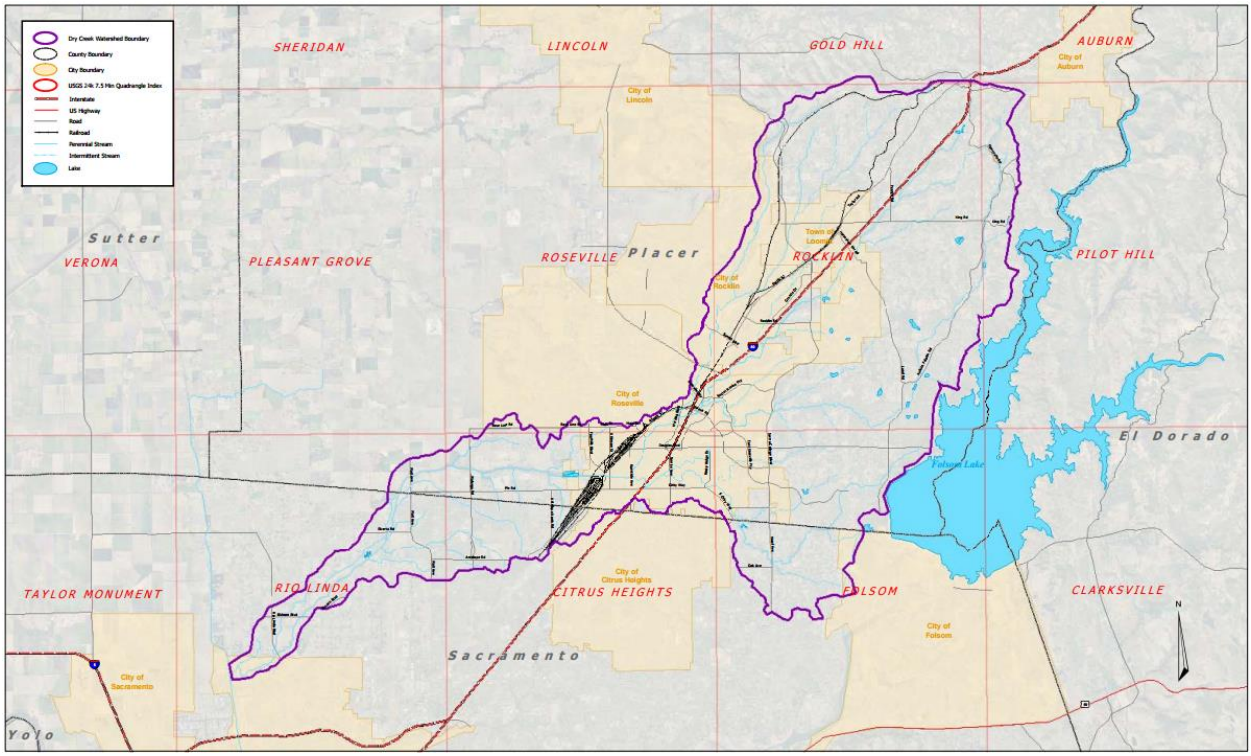


Figure 10. Map of the Dry Creek Watershed. Source: Hydrology - NHD/ECORP GPS Compilation 2003; Watershed Boundary - ECORP 2003.

The proposed action is located along Antelope Creek within the city limits of Roseville, CA, which is very urbanized. Antelope Creek is a perennial, slightly entrenched single-channel creek with three ephemeral tributaries and a watershed area of 12.4 miles. The mainstem of the creek flows 9.5 miles southwest to its confluence with Dry Creek. The landscape within the Action Area has been highly altered and the site is confined by adjacent land uses such as an old landfill, Interstate 80, a paved multi-use trail (bike path), an archery range, and residential and commercial developments. However, the Action Area has an open area with non-native annual grasses, oak woodland, valley foothill riparian, as well as emergent riparian and wetland species along the creek bank. The creek is culverted under the bike path near the proposed weir structure site and the banks surrounding the existing culverts are reinforced with rock riprap both upstream and downstream. There is a stormwater outfall structure located in the westernmost portion of the project footprint. It is likely that the course of Antelope Creek has been altered over the years to accommodate development activities.

The conservation condition and function of this habitat has been severely impaired through several factors discussed in the *Rangewide Status of the Species and Critical Habitat* section of this Opinion. The result has been the reduction in quantity and quality of several essential features of migration and rearing habitat required by CCV steelhead juveniles to grow and survive. In spite of the degraded condition of this habitat, there is intrinsic conservation value of the Action Area. During a site visit in September 2015, juvenile *O. mykiss* were identified by Corps fish biologists in the vicinity of the proposed action.

2.3.1 Status of California Central Valley Steelhead and Critical Habitat in the Action Area

The CCV steelhead DPS final listing determination was published on January 5, 2006 (71 FR 834) and included all naturally spawned populations of CCV steelhead (and their progeny) below natural and manmade barriers in the Sacramento and San Joaquin Rivers and their tributaries, including the Dry Creek watershed. The Dry Creek watershed supports resident native and introduced fish populations, as well as annual runs of Chinook salmon and steelhead. Critical habitat is not designated in Antelope Creek.

CDFW conducted periodic Chinook salmon spawning escapement surveys in the Dry Creek watershed, mostly upstream of the confluences with Miners and Secret ravines. In 1964, the estimated Chinook salmon population was over 1,000 fish (Jones & Stokes 2005). Historical accounts rarely mention CCV steelhead distribution and abundance in the Dry Creek watershed. Current estimates of steelhead in the Dry Creek watershed number a few hundred fish, with most occurring in Miners and Secret ravines (ECORP 2003). Usage of Dry Creek by anadromous salmonids prior to urbanization and development of the NEMDC is largely unknown (ECORP 2003).

2.3.1.1 Potential to Occur in the Action Area

The Dry Creek watershed has a low potential to support a viable population of steelhead due to the limited amount of suitable spawning habitat and year-round rearing habitats. Recent spawning surveys conducted by the Dry Creek Conservancy during winter months have only documented fall-/late-fall run Chinook salmon spawning. CCV steelhead have not been observed during these surveys. However, juvenile *O. mykiss* were reported to be seen at the project area by Corps personnel during a site visit in September 2015. Although much of Antelope Creek is degraded and characterized by low water levels, high temperatures, and fine sediment, these factors do not preclude its use for CCV steelhead juvenile rearing.

Jones & Stokes (2005) describes the use of the Species Assessment Model (SAM) for Chinook salmon and steelhead in western Placer County streams, including Antelope Creek. The condition of the streams was assessed based on available information, including field surveys. The SAM models attempted to evaluate effects of selected environmental conditions that are components of habitat for specific life stages of Chinook salmon and steelhead that may occur in these streams. However, insufficient data made it impossible to complete the SAM and determine the population performance for each stream (Jones & Stokes 2005).

2.3.1.2 Delineation of Critical Habitat for CCV Steelhead near the Action Area

Critical habitat for CCV steelhead was designated in September 2005 (70 FR 52488), and includes Dry Creek from its confluence with the NEMDC, upstream to Antelope Creek. There is no designated critical habitat for steelhead in the Action Area, designated critical habitat for CCV steelhead lies 3,000 feet downstream at the confluence with Dry Creek. The designated critical habitat is over 4,000 feet downstream from where the culvert will be replaced. The Action Area functions primarily as a rearing and migratory habitat for CCV steelhead. Due to the life history

timing of CCV steelhead, it is possible for one or more of the following life stages to be present within the Action Area throughout the year: adult migrants or rearing and emigrating juveniles.

The critical habitat designation also describes physical and biological PBFs that are essential for the conservation of CCV steelhead. Within Dry Creek and its tributaries, these PBFs include: 1) freshwater spawning areas; 2) freshwater rearing areas; and a 3) freshwater migration corridor. The essential features of these PBFs include adequate substrate, water quality, water quantity, water temperature, water velocity, shelter, food, riparian vegetation, space, and safe passage conditions. The intended conservation roles of these habitats are to provide appropriate freshwater rearing and migration conditions for juveniles and unimpeded freshwater migration conditions for adults.

Although habitat conditions within the Action Area are degraded, the importance of this area for the conservation of CCV steelhead is considered to be high. This is mainly due to the fact that there is very little suitable steelhead habitat remaining in the Central Valley and any habitat that is currently available is essential for sustaining the DPS.

2.3.2 Factors Affecting Species and Critical Habitat in the Dry Creek Watershed

2.3.2.1 Blocked Migratory Passage and Corridor Quality

Migratory access for adult CCV steelhead through Dry Creek and its main tributaries, Antelope Creek, Secret Ravine, and Miners Ravine may be restricted by beaver dams and infrastructure in combination with low flow in the fall (Jones & Stokes 2005). The migratory corridor along Antelope Creek has been reduced for adult and juvenile steelhead by barriers to upstream passage (Jones & Stokes 2005). In particular, an asphalt-bottomed culvert under Sunset Boulevard in Rocklin (approximately 1.8 river miles upstream of Action Area) is likely a barrier under low, and possibly moderate flows. A dam upstream of the Union Pacific Railway Bridge (UPRR) in Rocklin has formed a large wetlands complex that also may act as a barrier (Bailey 2003).

Recent surveys (2015) by HDR did not identify any man-made barriers to migration within the Action Area or downstream to the confluence with Dry Creek. At the time of this assessment, the existing culverts within the Action Area did not appear to pose as a hindrance to migration as it has a zero-percent gradient, an average velocity of 2.86 feet per second, and adequate depth for passage downstream of (0.8 meter) and within (0.9 feet) the culvert. Additionally, no beaver dams were observed. However, observed shallow water and an overall lack of instream cover could deter movements into and through Antelope Creek. Furthermore, the potential for large mats of non-native aquatic macrophytes to form barriers to migration was also observed in 2015.

During the April and May 2015 field verification surveys, average pool depth ranged from 1.51 to 2.38 feet. Average depth across all three creek transects ranged from a minimum of zero to 1.7 feet deep.

2.3.2.2 Limited Spawning Habitat and Fines

Dry Creek substrates are generally composed of a high percentage of fine sediment and spawning habitat appears to be limited (ECORP 2003). Dry Creek was not included in the spawning gravel surveys conducted by Jones & Stokes (2005), as CCV steelhead spawn primarily in its tributaries (ECORP 2003). However, the percentage of fine sediment in Antelope Creek would likely to result in relatively high mortality of eggs and larvae in all tributary streams.

Antelope Creek has two potential CCV steelhead spawning areas and one good resting pool near Antelope Creek's confluence with Dry Creek (Vanicek 1993 *as cited in* ECORP 2003), but further concludes these areas are degraded. Urban development and public access to Antelope Creek, especially in spawning habitat and at potential barriers, translates to a relatively high potential for harassment of spawning adults resulting in reduced fecundity (Jones & Stokes 2005).

During a 2004 assessment by Jones & Stokes (2005), Antelope Creek was characterized as having a mostly sandy bottom along the 1.82 kilometers (1.13 miles) of the survey reach. The spawning gravel area was 20 square meters (213 square feet), with the potential to support nine (9) steelhead redds and five (5) Chinook salmon redds. It was determined that approximately 7.32 km (4.55 mi) of potential spawning habitat is present throughout Antelope Creek, although only 25 percent were surveyed.

Surveys performed by HDR staff in 2015 also found the reach of Antelope Creek in the Action Area to be dominated by sand and silt substrate. The sub-dominant substrate observed in the Action Area reach was boulder-sized riprap, also not suitable for spawning. Among the three 100m transects surveyed in 2015, no spawning gravels were observed. Areas typically utilized for redd building, such as the heads of riffles and pool tailouts, were lacking due to an observed low diversity in habitat types. The vast majority of the area in the Action Area reach that was surveyed is low gradient, shallow, sandy run habitat with few pools and riffles.

The amount of fine materials measured during the spawning gravel surveys by Jones & Stokes (2005) was approximately 77 percent for Antelope Creek. Based on the survival relationship, eggs and larvae would not be expected to survive in Antelope Creek under such conditions. While HDR staff did not directly measure fines, they did observe that the stream banks are highly incised and that sloughing is common in the Action Area reach. These areas of active erosion have the potential to elevate sedimentation and thus fine percentages. Riprap has been employed in previous construction and maintenance activities throughout the Action Area for bank stability; however, the riprap has confined the channel thus disconnecting it from the flood plain and redirecting erosion elsewhere (*i.e.*, downstream).

2.3.2.3 Altered River Flow

Dry Creek receives effluent from the Roseville WWTP and Dry Creek WWTP. Maximum discharge capacity is 18 million gallons per day (mgd) but is typically below 15 mgd. The volume is a relatively small proportion of Dry Creek flow during winter flow conditions, but during low-flow periods, the treated effluent can make up as much as 50% of the streamflow (ECORP 2003).

Because this area is being rapidly developed, there is an anticipated increase over time of effluent discharge released to the stream.

Local winter rainfall and urban runoff is the primary source of flow in Antelope Creek.

2.3.2.4 Altered Stream Temperatures

Dry Creek serves as an important migratory corridor to upper tributaries, and water temperature is of concern during adult and juvenile migration. Water temperature ranges from ideal to suitable for migrating adult steelhead. Water temperatures in Dry and Antelope Creeks can reach unsuitable levels for juvenile steelhead during the late summer and may limit their rearing success and overall survival. From June through September in Dry Creek, water temperatures recorded above and below the effluent outfall for the Roseville WWTP have exceeded the water quality standards established for the effluent. Temperature cools downstream of the effluent discharge. In October through December, water temperatures warm downstream of the outfall and exceed the required water quality standards (ECORP 2003).

The Jones & Stokes (2005) assessment of Antelope Creek concluded that, based on the timeframe of the data recorded in Antelope Creek (May 30, 2003 to August 4, 2003), water temperatures were within the suitable range, but above ideal conditions for rearing steelhead and rearing and migrating juvenile Chinook salmon (Figure 11). Water temperature sub-lethal effects on salmonids, such as increased stress, altered feeding behavior, etc. would be expected.

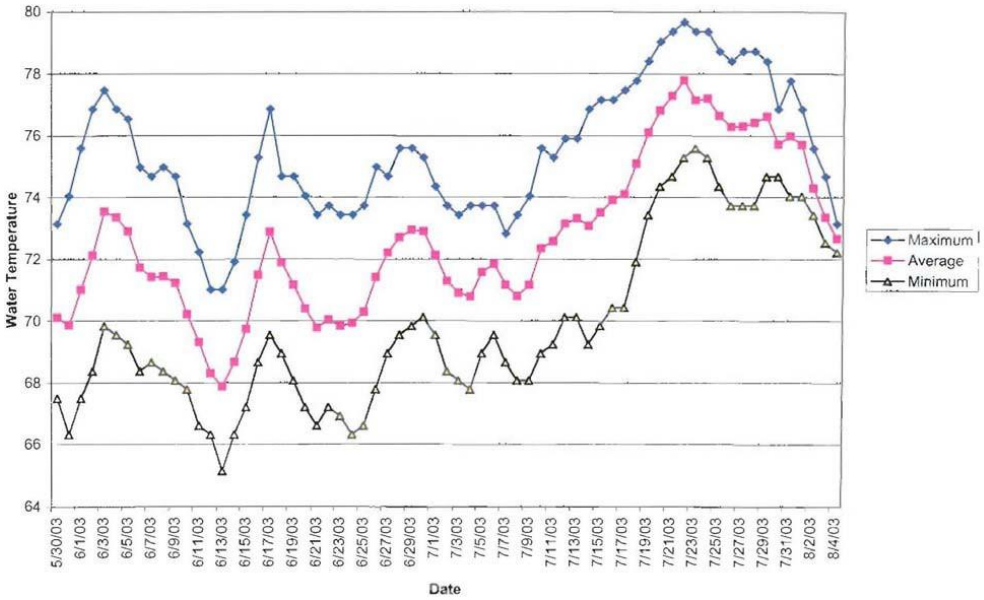


Figure 11. Water Temperatures Recorded at Antelope Creek in Summer 2003. Source: Placer County Planning Department (2005). Water temperature was recorded at three locations: 311 Sunset (38.47.193N, 121.14.998W), Antelope Creek Drive (38.46.200N, 121.15.520W), and the Myers Residence (38.47.976N, 121.14.064W).

In the 3.2-mile reach that was evaluated in 2003 (approximately 2,000 feet downstream of Hwy 65 [0.7 mi or 3,800 linear feet upstream of Action Area] and upstream approximately 3.2 mi), approximately 5 percent of the reach had no shade, 15 percent had low shade, 65 percent had moderate shade, and 15 percent had high shade. Less shade occurred in the downstream reaches. The levels of shade indicate that temperature levels in the creek may increase under low and moderate shade conditions (Placer County Planning Department 2005).

Real-time water temperatures were collected during HDR's 2015 surveys at three sites within the Action Area. In addition, water temperature data were collected in Dry Creek just upstream of the confluence with Antelope Creek, and in Antelope Creek just upstream of this confluence. Recorded water temperatures fell within the suitable range but not within ideal conditions for rearing steelhead and Chinook salmon. High temperatures that were recorded are likely contributable to long stretches of no canopy cover combined with shallow water conditions.

2.3.2.5 Water Quality

The Dry Creek watershed is located in one of the fastest-urbanizing areas in California. For the past two decades, the Sacramento and Roseville areas have experienced substantial development and growth. In the year 2000, Placer County had a population of 248,399, an increase of 43.8 percent over the 1990 population, and more than double the 117,247 residents in 1980. By 2020, the population is projected to grow by an additional 182,000. The resulting development has stressed the natural environment. Loss of riparian vegetation, stream bank erosion, and wastewater discharge into the streams have contributed to the decline of water quality in the Dry Creek watershed (Placer County 2016).

As previously mentioned, Dry Creek receives effluent from the Roseville WWTP and Dry Creek WWTP. Because this area is being rapidly developed, there is an anticipated increase over time of effluent discharge released to the stream. Dry Creek also receives inflow from a sewage disposal pond near Rio Linda Central Park and a sewage disposal area near Midtown Park. In addition, it also receives substantial urban runoff.

There is evidence that the Roseville WWTP affects Dry Creek's water quality. Dry Creek above Roseville WWTP has slightly elevated conductivities ranging from 141 to 221 microohms/cm, probably due to natural chemical weathering of minerals from the surrounding soil and rock (Jones & Stokes 2005). However, the conductivity almost doubles downstream of the WWTP, an inevitable result of current sewage treatment technologies. Excessive nutrient loads are due to the WWTP and urban and agricultural runoff (ECORP 2003). Along Dry Creek, contaminant inputs from multiple sources are likely, but have not been well documented, and the overall effects of pollutants on juvenile and adult salmonids survival are unknown. However, given the relatively high input of runoff from urban areas, adverse effects of contaminants could be expected.

Due to relatively high input of runoff from surrounding urban areas, contaminants probably affect the aquatic ecosystem of Antelope Creek. Antelope Creek receives treated effluent from one sewage disposal pond located north of the SR65 road crossing. Antelope Creek also receives urban runoff and other inputs of contaminants from multiple sources, although these inputs have not been well documented; consequently, effects of contaminants on juvenile and adult survival rates are

unknown (Jones & Stokes 2005). HDR's 2015 investigations of Antelope Creek did not include any water quality testing, but visible inputs of runoff from the surrounding urban areas were noted and these inputs likely add stressful contaminants and increase water temperatures.
Available data on the benthic macroinvertebrate community of Antelope Creek collected by the Dry Creek Conservancy during 2000 and 2001, are consistent with the expectation that contaminants are adversely affecting the aquatic ecosystem. In these samples, the dominant organisms catalogued in the benthic macroinvertebrate community were pollutant-tolerant forms (unpublished data, *summarized in* Bailey 2003).

2.3.2.6 Predation

The lower portions of Dry Creek are low grassland streams that are characterized by warmer temperatures and populated with temperature-tolerant native and nonnative fish populations. In Dry Creek, spotted bass (*Micropterus punctulatus*) and Sacramento pikeminnow (*Ptychocheilus grandis*), both of which prey on juvenile salmonids, are commonly found (ECORP 2003). Bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and smallmouth bass (*Micropterus dolomieu*) have also been observed in Dry Creek, and these species also prey on juvenile salmonids (Bailey 2003). However, along Dry Creek, steelhead benefit from cover that may minimize predation.

Limited data are available on Antelope Creek's predatory fish community. Species that have been observed in Antelope Creek include black bullhead catfish (*Ameiurus melas*), brown bullhead catfish (*A. nebulosus*), common carp (*Cyprinus carpio*), and green sunfish (Baily 2003, *as cited in* Jones & Stokes 2005). HDR snorkel surveys in 2015 also revealed the presence of bullfrogs (*Lithobates catesbeianus*) and crayfish (*Cambarus* spp.) along the creek. All of these species could potentially prey on juvenile steelhead. However, along Antelope Creek, steelhead benefit from a moderate amount of cover that may minimize predation.

2.3.2.7 Bank Modification and Riparian Habitat Loss

Bank modification (*i.e.*, construction embankments and bank armoring) changes the geomorphic processes affecting the Antelope Creek and the success of riparian vegetation. Riparian vegetation is important to aquatic habitats because it provides overhanging cover for rearing fish, stream side shading, and a source of terrestrial and aquatic invertebrate contributions to the fish food base (DWR 2007). Riparian vegetation is also an important source of future LWM contributions to the aquatic system.

2.3.2.8 Flood Control and Water Diversions

The percentage of stream flows removed by diversions along Dry or Antelope creeks have not been documented. However, there are three dams on Dry Creek and the associated diversions are probably active and unscreened (Jones & Stokes 2005). Additionally, there is a dam on Antelope Creek whose associated diversions may be active.

2.3.3 Conclusion: Survival and Mortality

The survival prospects for listed fish species in Antelope Creek and the Dry Creek watershed are poor to fair, with the above factors the main causes.

2.4 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR § 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

To evaluate the effects of the Antelope Creek Flood Control Project, NMFS examined the potential proposed actions in the designated Action Area. We analyzed construction-related impacts and the expected short- and long-term fish response to habitat modifications. We also reviewed and considered the District's proposed conservation measures. This assessment relied heavily on the information from the BA project description and review of the fish passage elements by a NMFS Hydraulic Engineer.

2.4.1 Construction Effects Analysis

NMFS expects that rearing or emigrating juvenile CCV steelhead may be present in the Action Area during construction activities. Juvenile CCV steelhead may be rearing in Antelope Creek year-round and may migrate downstream as parr in the summer or fall of their first year of life, but this is not a true smolt migration (Loch *et al.* 1988). Smolt migrations occur in the late winter through spring, but the tail end of the smolt migratory period could overlap slightly with the start of construction. The potential for negative impacts to migrating juvenile or adult CCV steelhead is relatively low, given the in-channel construction window of June 15 to October 15. If rearing juveniles are present, they are more likely to be negatively impacted by the Proposed Action.

Only those fish that are holding adjacent to or migrating past the construction site will be directly exposed or affected by construction activities. Those fish that are exposed to the effects of construction activities will encounter short-term (*i.e.*, minutes to hours) to longer term (*i.e.*, months) blockage of movement up- or downstream, construction-related noise, physical disturbance, and water quality changes that may cause injury or harm by increasing the susceptibility of some individuals to predation by temporarily disrupting normal behaviors and affecting sheltering abilities. In the unlikely event that an adult CCV were to enter the Action Area as the upstream cofferdam is being installed, they will likely exhibit avoidance behavior in response to construction and associated activities and move downstream or will be guided out of the Action Area via seine of dip nets.

Direct effects are defined as "the direct or immediate effects of the Proposed Action on the species or its habitat" (USFWS & NMFS 1998). Direct effects associated with in-river construction work involve equipment and activities that will produce turbidity, thereby temporarily altering in-river conditions. Any increases in turbidity will most likely disrupt feeding and migratory behavior activities of juvenile CCV steelhead. NMFS expects that actual physical damage or harassment to

listed fish species will be low relative to the overall population abundance during the months of construction.

2.4.1.1 Effects of Dewatering the Channel on CCV Steelhead

The Proposed Action would require dewatering a section of Antelope Creek and diverting flow around this section for up to four months during in-channel construction, from June 15 through October 15. Dewatering will have impacts on juvenile and adult CCV steelhead. Dewatering the project area with cofferdams has the potential for delaying or impeding juvenile and adult CCV steelhead movements during the four-month period in which in-channel work is proposed. Additionally, diverting stream flow through a bypass pipe may have the potential to harm or injure juvenile fishes if they become diverted through the pipe. Dewatering needs to occur slowly so that any fishes present have a chance to move out of the area. To decrease the likelihood of fishes being stranded in the dewatered area, a qualified, NMFS-approved fish biologist, would visually survey the work area for salmonids and any other native/non-native fish species, prior to the installation of the temporary stream diversion structure. If necessary, the biologist will guide any fishes present downstream and out of the work area via seine and/or dip nets. It is not anticipated that fishes shall be captured or handled in any manner during the dewatering and seining activities.

Prior to commencing in-channel work activities, fish presence shall be determined and a polyliner gravity pipe will be in place for water diversion. Dewatering will be accomplished by installing temporary sandbag cofferdams upstream and downstream of the weir construction site. Above the existing culverts, the upstream cofferdam will be installed first, leaving the downstream end open to the main channel of Antelope Creek. This will allow the area downstream to dewater naturally and slowly, so that any fishes present can move downstream of the construction area. If fishes are found within the area of water diversion, they would be guided with seine nets downstream.

The cofferdams will restrict upstream and downstream movement of steelhead within Antelope Creek. Any fishes present in the dewatered area would be subject to stranding and probable mortality resulting from suffocation, desiccation, or physical injury. To minimize this potential impact, a qualified fish biologist should ensure that fishes are successfully relocated out of the in-channel work site prior to the installation of the downstream cofferdam. Ideally, relocation would occur both naturally and with the guidance of beach seines as the area slowly dewaters. Once the downstream cofferdam is closed, a qualified biologist would be onsite to inspect the area and begin fish rescue and relocation activities if needed. Fish collections using dip nets would continue until all fish are removed. All captured fish would be held temporarily in buckets filled with clean stream water and released within the channel at least 1,000 feet downstream of the construction area where there are suitable habitat conditions.

Relocation of fish can cause stress, physical injury, and mortality from handling, time out of water, and crowding (including potential stress associated with crowding in the receiving area). To minimize this impact, handling and holding of fish should be minimized to the extent possible. Furthermore, water temperatures, DO, and fish densities in the buckets would be maintained within safe limits at all times, and relocated fish would be released in suitable habitat at least 1,000 feet from the construction site. The fish biologist on site would contact NMFS and CDFW immediately if any steelhead or Chinook salmon were found dead or injured. However, listed fish are not likely

to be present during the dewatering of the construction site, since summer water quality in Antelope Creek is typically extremely poor, with very high temperatures. For these reasons, effects due to dewatering are discountable, as they are extremely unlikely to occur.

2.4.1.2 Fish Passage

The proposed project will provide improved fish passage compared to the existing CMP culverts, which are smaller and steeper than the natural channel. Currently, the water surface drops at the inlets and outlets, and high velocities have been observed during normal flows. At the 2-year recurrence interval flood flow (approximately 400 cfs), the average velocity through the existing culverts is estimated at 12 feet per second (ft/s). By comparison, the average velocity in the proposed project culvert is less than 5 ft/s with lower localized velocities in the culvert attributed to the channel roughness provided by ESM and retention sills.

The proposed culvert will double the effective channel width and more than triples the cross-sectional area available compared to the existing CMP culverts, improving fish passage conditions during all anticipated fish migrations flows, including low flows. The Proposed Action would enhance fish access to approximately 8.4 miles of potential upstream fish habitat. Additionally, the rock weir and pool proposed downstream of the culvert are designed to enhance pool formation and provide a resting area for fish passage.

The weir will not permanently increase water levels upstream or permanently decrease the water levels downstream since the weir is designed only to detain the peaks of large flood flows for short durations (hours). Under normal low flow conditions and even small, more frequent storm events, the water levels will follow the natural channel slope through the large culvert in the weir providing similar hydraulic conditions in the natural channel. Potential upstream ponding during less frequent larger flood flow events will be temporary and will not adversely affect fish migration pathways in the stream channel. Typical fish migration flows are considered to be the longer duration, more frequent flows that occur, and generally less than the 2-year recurrence interval flood flow.

2.4.1.3 Stranding Potential in Borrow Sites

As indicated in the project description, the borrow site may become inundated during storm events during construction. The site will be excavated down from the creek land to an average of approximately four (4) feet deep throughout the borrow site. Positive drainage towards the creek would be maintained during construction at all times and the final grade of the borrow site will have a 0.2% slope toward the creek. Given that the entire borrow site will be graded in such a way as to prevent pooling of water, the potential for stranding is discountable, as it is extremely unlikely to occur.

2.4.1.4 Effects of Suspended Sediments and Turbidity on CCV Steelhead

Construction activities associated with the Proposed Action have the potential to contribute sediment and increase turbidity in Antelope Creek above those levels generally found under existing conditions. Although anadromous salmonids are highly migratory and would be capable

of moving freely throughout the Action Area, a sudden localized increase in turbidity could affect normal behaviors that are essential to growth and survival such as feeding, sheltering, and migrating (NMFS 2003). Increased levels of turbidity can affect listed species physiology through such physical mechanisms as gill-occlusion and/or through behavioral changes. Behavioral avoidance of turbid waters may be one of the most important effects of suspended sediments on salmonids (Birtwell *et al.* 1984; DeVore *et al.* 1980; Scannell 1988). Additional turbidity-related effects associated with behavioral alteration include disruption of feeding behaviors, which increases the likelihood that individual fish would face increased competition for food and space, and experience reduced growth rates, or possibly weight loss (NMFS 2003).

High levels of suspended sediments would cause the movement and redistribution of fish populations and could affect physical habitat. Once suspended sediment is deposited, it could reduce water depths in pools, decreasing the water's physical carrying capacity for juvenile and adult fishes (Waters 1995). Additionally, increased sediment loading could degrade food-producing habitat downstream of the Action Area. Sediment loading could interfere with photosynthesis of aquatic flora and displace aquatic fauna. Steelhead are sight feeders and turbid waters could reduce the ability to locate and feed on prey. Additionally, some individuals, particularly juveniles, could become disoriented and leave areas where their main food sources are located, ultimately reducing their growth rates.

The severity of the effects of suspended sediment pollution on fish increases as a function of suspended sediment concentration (SSC) and duration of exposure. For example, juvenile and adult salmonids, when exposed to 20 mg/L SSC for up to one week, would experience sublethal effects including short-term reduction in feeding rates and minor to moderate physiological stress (*e.g.*, increase in rate of coughing and increased respiration rate). Exposure to 150 mg/L SSC would have the following sublethal effects: moderate habitat degradation, impaired homing, major physiological stress, and long-term reduction in feeding rate and feeding success (Newcombe & Jensen 1996).

Construction activities that may increase SSC include the installation and removal of cofferdams, removal of the existing culverts, construction of the new weir and culvert, and placement of riprap. These activities may increase SSC to above 20 mg/L, which could result in sublethal effects. However, silt fences will be installed around the construction site to prevent suspended sediment from moving into the creek, and closure of the in-channel construction area via upstream and downstream cofferdams would prevent fish from coming in contact with a majority of construction activities. Furthermore, considering migration timing, poor water quality, and high water temperatures in Antelope Creek, listed species are not expected to be present in the localized impact area during most of the work window. Given the applicant's mitigation measures and the limited presence of steelhead during the work window, the effects on listed species due to suspended sediment are considered insignificant.

2.4.1.5 Effects of Potential Stream Incision on CCV Steelhead

Over time, the proposed project may cause incision of the stream channel downstream of the project and around the plunge pool. The extra energy from the high velocity water is designed to be dissipated in the culvert and in the rip-rap channel bottom downstream of the culvert. If channel incision does occur, the project may become perched, forcing upstream-migrating fishes to jump

into fast-moving, shallow water. Given the applicant's development and proposed implementation of a 10-year Streambed Monitoring Plan following completion of the Proposed Action, the effects on listed species due to stream incision are considered insignificant as they are unlikely to occur or will be remedied if incision begins to occur.

2.4.1.5 Effects of Aquatic Habitat Modification and Loss of Shaded Riverine Aquatic (SRA) Habitat

The Proposed Action would result in 0.092 acres (314 linear feet) of permanent impacts and 0.052 acres (251 linear feet) of temporary impacts. Construction of the proposed weir structure would require approximately 1,718 cubic yards of fill to be placed in the creek and along the banks. Fill materials would include soil, cobble, boulders, riprap, and concrete (Table 3). The installation of riprap or other streambed stabilization devices in smaller streams like Antelope Creek can result in a loss of shallow water rearing habitat, loss of riparian vegetation, loss of large woody debris, changes in food resources, loss of migratory corridors, and provides refuge for non-native predatory fishes.

Table 3. Amount of Fill to be placed within Antelope Creek

Type of Material	Amount (in cubic yards)
Soil	777.06
Riprap (rock)	178.03
Concrete	421.53
Boulder weir	341.79
TOTAL	**1,718.41**

In addition to fill, construction of the proposed Action would require the upstream and downstream slopes of the creek to be protected with erosion control mat and riprap to resist scour forces and to ensure embankment and stream bank stability. The effects of such actions result in continued fragmentation of existing habitat, and conversion of complex nearshore aquatic to simplified habitats that do not benefit salmonids. However, turf reinforced mat will not be placed below the OHWM of Antelope Creek and riprap will not be placed within the thalwag of the stream channel. The stream bottom will be designed with ESM, which is not considered armored substrate in that it allows for localized movement of material and substrate flexibility to mimic natural conditions.

Clearing, grubbing, and grading associated with the construction of the Proposed Action would result in the removal of riparian vegetation, resulting in the loss of shaded riverine aquatic (SRA) habitat which is critical to Central Valley steelhead. Construction of the Proposed Action would permanently remove approximately 0.60 acre of riparian or (SRA) habitat and 0.13 acre of creek habitat the Action Area. In addition, construction of borrow area excavation would temporarily affect 0.02 acre of SRA habitat. To mitigate these effects, the applicant has proposed to plant native riparian vegetation onsite at a 1:1 ratio and conduct monitoring annually for five years with a goal of 80% survival. In addition, riparian habitat credits at a ratio of 3:1 from a NMFS-approved conservation bank to compensate for overall and temporal SRA habitat loss by purchasing 2.19 acres of floodplain riparian habitat credits at a ratio of 3:1 from a NMFS-approved mitigation bank.

2.4.1.6 Hazardous Materials and Chemical Spills

Toxic substances used at construction sites, including gasoline, lubricants, and other petroleum-based products could enter the waterway as a result of spills or leakage from machinery and injure listed CCV steelhead. These substances can cause physiological stress and increased susceptibility of aquatic organisms to other sources of mortality such as predation through exposure to non-lethal levels, and kill aquatic organisms through exposure to lethal concentrations. Petroleum products also tend to form oily films on the water surface that can reduce dissolved oxygen (DO) levels available to aquatic organisms. Exposure of uncured concrete to surface water can cause localized increases in pH that can cause physiological stress in fish and other aquatic organisms.

NMFS expects that adherence to Best Management Practices (BMPs) that dictate the use, containment, and cleanup of contaminants will minimize the risk of introducing such products to the waterway. Implementation of the Spill Prevention and Response Plan prepared by the District's contractor and adherence to all preventative, contingency, and reporting measures in the approved plan will reduce the potential effects to listed fish species to discountable levels. Fishes near the construction site will be completely isolated from the channel and dewatered before any concrete is poured. All cured concrete will be washed and the wash water removed from the channel before channel flow is restored to the work areas. The concrete will be allowed to cure fully before being exposed to surface waters to avoid potential impacts to listed species. Therefore, the effect is discountable as it is extremely unlikely to occur.

2.4.1.7 Effects of Noise on CCV Steelhead

Noise may be induced from operating equipment in the dewatered construction area, construction of the weirs, and the placement of riprap. The effects of noise on fish include: (1) mortality if the noise level is greater than 228.9 dB relative to one micropascal reference for water (re 1 μPa); (2) damage to sensory hair cells if the noise level is greater than 180 dB (re 1 μPa); and (3) increased stress hormone levels if the noise level is greater than 153 dB (re 1 μPa) (Hempen *et al.* 2014).

The installation of the cofferdams and the diversion of the Antelope Creek flow around the work site during construction would preclude fish from moving past the construction area in the channel. As discussed in section 2.4.1.1, listed fish are unlikely to be present in the water adjacent to the dewatered construction area due to the construction window and fish's typical behavioral response to continued noise (avoidance). For these reasons, the effect is discountable as it is extremely unlikely to occur.

2.4.1.7 Effects on Food Supply

Channel dewatering will be required for a relatively small segment of Antelope Creek to allow construction to be performed in-the-dry during the June 15 to October 15 in-water work window. Channel dewatering can affect benthic macroinvertebrates, which are consumed by salmonids and may represent a substantial portion of their diet at various times of year. The effect of macroinvertebrate loss resulting from channel dewatering, grading, and other channel activities associated with the Proposed Action is difficult to quantify. The duration of in-channel activities and the macroinvertebrate species exposed to the dewatered condition are factors that influence

how those species of invertebrates are affected. However, assuming in-channel construction in-the-dry eliminates all macroinvertebrates in the immediate Action Area, after flow is returned; benthic macroinvertebrates that drift from unaffected areas upstream will begin to recolonize the affected portions of the creek channel. NMFS (2003 *as cited in* USBR 2011) reports that recolonization ranges from about 1 month to 45 days. Therefore, effects to the salmonid food supply are considered insignificant, as they are temporary in nature.

2.4.2 Indirect Effects

The indirect effects of the Proposed Action are intended to provide significant benefits to salmonids within Antelope Creek, with an objective of maintaining and enhancing access to upstream habitat during all anticipated fish migration flows, including low flow conditions. Indirect effects may also result for the duration of time it takes to replant the riparian vegetation in the footprint of the Proposed Action. Overall, the Proposed Action will not significantly modify the character of Antelope Creek.

2.4.3 Interrelated and Interdependent Effects

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification (i.e., this action would not occur "but for" a larger action) (USFWS and NMFS 1998). Interdependent actions are those that would have no significant utility apart from the action that is under consideration, *i.e.*, other actions would not occur "but for" this action (USFWS and NMFS 1998). No interrelated or interdependent actions have been identified for this Proposed Action.

2.5 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). 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.

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the Action Area. Future federal actions that are unrelated to the Proposed Action are not considered in this section because they would be subject to separate consultation pursuant to Section 7 of the ESA (USFWS & NMFS 1998). The Proposed Action is not anticipated to change conditions from existing as it is a reconstruction of an existing facility and will not add to the existing infrastructure. The effects associated with this project are short term and principally occur during the construction period.

2.5.1 Water Diversions and Usage

Non-Federal actions that may affect the Action Area include water diversions, municipal and industrial use, and release of wastewater effluent into Antelope Creek Action Area. Municipal and industrial practices in and upstream of the Antelope Creek may adversely affect riparian and

wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow in stream channels flowing into Antelope Creek or its tributaries.

Unscreened agricultural diversions throughout the channel entrain fish including juvenile salmonids and green sturgeon. Depending on the size, location, and season of operation, these unscreened diversions entrain and kill many life stages of aquatic species, including juvenile listed anadromous species. For example, as of 1997, 98.5 percent of the 3,356 diversions included in a CV database were either unscreened or screened insufficiently to prevent fish entrainment (Herren & Kawasaki 2001).

2.5.2 Aquaculture and Fish Hatcheries

More than 32-million fall-run Chinook salmon, 2-million spring-run Chinook salmon, 1-million late fall-run Chinook salmon, 0.25-million winter-run Chinook salmon, and 2-million steelhead are released annually from six hatcheries producing anadromous salmonids in the CV. All of these facilities are currently operated to mitigate for natural habitats that have already been permanently lost as a result of dam construction. The loss of historical habitat and spawning grounds upstream of dams results in dramatic reductions in natural population abundance which is mitigated for through the operation of hatcheries. Salmonid hatcheries can, however, have additional negative effects on ESA-listed salmonid populations.

The high level of hatchery production in the CV can result in high harvest-to-escapements ratios for natural stocks. California salmon fishing regulations are set according to the combined abundance of hatchery and natural stocks, which can lead to over-exploitation and reduction in the abundance of wild populations that are indistinguishable and exist in the same system as hatchery populations. Releasing large numbers of hatchery fish can also pose a threat to wild Chinook salmon and steelhead stocks through the spread of disease, genetic impacts, competition for food and other resources, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production.

Impacts of hatchery fish can occur in both freshwater and the marine ecosystems. Limited marine carrying capacity has implications for naturally produced fish experiencing competition with hatchery production. Increased salmonid abundance in the marine environment may also decrease growth and size at maturity, and reduce fecundity, egg size, age at maturity, and survival (Bigler *et al.* 1996). Ocean events cannot be predicted with a high degree of certainty at this time. Until good predictive models are developed, there will be years when hatchery production may be in excess of the marine carrying capacity, placing depressed natural fish at a disadvantage by directly inhibiting their opportunity to recover.

2.5.3 Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Urban stormwater runoff and suburban irrigation discharges contain numerous industrial

chemicals, pesticides, and herbicides that may adversely affect salmonid reproductive success and survival rates (Dubrovsky *et al.* 1998, 2000; Daughton 2003).

Increased urbanization also is expected to result in increased recreational activities in the region. Recreational activities can potentially disturb the current riparian vegetation and/or listed fish in the active channel. Some of these actions, particularly those which are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA Section 7 consultation process with NMFS.

2.5.4 Global Climate Change

Global climate change is a broad-scale cumulative effect that is likely to affect the Action Area. The world is about 1.3°F warmer today than a century ago and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century (IPCC 2001). Much of that increase likely will occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes 1998). Using objectively analyzed data Huang and Liu (2000) estimated a warming of about 0.9°F per century in the Northern Pacific Ocean.

Sea levels are expected to rise by 0.5 to 1.0 meters in the northeastern Pacific coasts in the next century, mainly due to warmer ocean temperatures, which lead to thermal expansion much the same way that hot air expands. This will cause increased sedimentation, erosion, coastal flooding, and permanent inundation of low-lying natural ecosystems (*e.g.*, salt marsh, riverine, mud flats) affecting listed salmonid and green sturgeon PBFs. Increased winter precipitation, decreased snow pack, permafrost degradation, and glacier retreat due to warmer temperatures will cause landslides in unstable mountainous regions, and destroy fish and wildlife habitat, including salmon-spawning streams. Glacier reduction could affect the flow and temperature of rivers and streams that depend on glacier water, with negative impacts on fish populations and the habitat that supports them.

Summer droughts along the South Coast and in the interior of the northwest Pacific coastlines will mean decreased stream flow in those areas, decreasing salmonid survival and reducing water supplies in the dry summer season when irrigation and domestic water use are greatest. Global warming may also change the chemical composition of the water that fish inhabit: the amount of oxygen in the water may decline, while pollution, acidity, and salinity levels may increase. This will allow for more invasive species to overtake native fish species and impact predator-prey relationships (Petersen & Kitchell 2001; Stachowicz *et al.* 2002).

In light of the predicted impacts of global warming, the CV has been modeled to have an increase of between $+2^{o}$ C and $+7^{o}$ C by 2100 (Dettinger *et al.* 2004; Hayhoe *et al.* 2004; Van Rheenen *et al.* 2004; Stewart 2005), with a drier hydrology predominated by rainfall rather than snowfall. On a larger scale, this will alter river runoff patterns and transform the tributaries that feed the local watersheds from a spring and summer snowmelt dominated system to a winter rain dominated system. A reduction in snowpack combined with increased ambient air temperatures is expected to result in earlier melting of snow and less run-off from the snowpack than that which occurs

today. It can be hypothesized that summer temperatures and flow levels will become unsuitable for salmonid survival.

The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff, possibly affecting the ability to meet downstream water temperature objectives to protect salmon, steelhead, and green sturgeon. This will truncate the period of time that suitable cold-water conditions exist downstream of existing reservoirs and dams due to the warmer inflow temperatures to the reservoir from rain runoff. Without the necessary cold water pool developed from melting snow pack filling reservoirs in the spring and early summer, late summer and fall temperatures downstream of reservoirs, such as Lake Shasta, could potentially rise above thermal tolerances for juvenile and adult salmonids (*i.e.*, Sacramento River winter-run Chinook salmon and CCV steelhead) that must hold and/or rear downstream of the dam over the summer and fall periods.

Currently, summer water temperatures often are close to the upper tolerance limits for salmon and steelhead and any increase in ambient air temperatures as a result of climate change is anticipated to make it more difficult at the very least, if not impossible, to meet established water temperature objectives. Reduced reservoir storage as a result of the anticipated change in run-off pattern may also affect the availability of a cold water supply necessary to maintain river temperatures downstream.

Within the context of the brief period over which the Proposed Action is scheduled to be operated, however, the near term effects of global climate change are unlikely to result in any perceptible declines to the overall health or distributions of the listed populations of anadromous fish within the Action Area that are the subject of this consultation.

2.6 Integration and Synthesis

The *Integration and Synthesis* section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the *Effects of the Action* (Section 2.4) to the *Environmental Baseline* (Section 2.3) and the *Cumulative Effects* (Section 2.5), 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) reduce the value of designated or proposed critical habitat for the conservation of the species.

The *Integration and Synthesis* section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of the proposed action. In this section, NMFS performs two evaluations: whether, given the environmental baseline and status of the species and critical habitat, as well as future cumulative effects, it is reasonable to expect the proposed action is not likely to: (1) reduce the likelihood of both survival and recovery of the species in the wild; and (2) result in the destruction or adverse modification of designated critical habitat (as determined by whether the critical habitat will remain functional to serve the intended conservation role for the listed anadromous species or retain its current ability to establish those features and functions essential to the conservation of the species).

The *Analytical Approach* described the analyses and tools we have used to complete this analysis. This section is based on analyses provided in the *Status of the Species*, the *Environmental Baseline*, and the *Effects of the Proposed Action*.

In our *Status of the Species* section, NMFS summarized the current likelihood of extinction of each of the listed species. We described the factors that have led to the current listing of each species under the ESA across their ranges. These factors include past and present human activities, climatological trends, and ocean conditions that have been identified as influential to the survival and recovery of the listed species. Beyond the continuation of the human activities affecting the species, we also expect that ocean condition cycles and climatic shifts will continue to have both positive and negative effects on the species' ability to survive and recover. The *Environmental Baseline* reviewed the status of the species and the factors that are affecting their survival and recovery in the Action Area. The *Effects of the Proposed Action* reviewed the exposure of the species and critical habitat to the proposed action, interrelated and interdependent actions, and cumulative effects. NMFS then evaluated the likely responses of individuals, populations, and critical habitat. The *Integration and Synthesis* will consider all of these factors to determine the proposed action's influence on the likelihood of both the survival and recovery of the species, and on the conservation value of designated critical habitat.

The criteria recommended for low risk of extinction for Pacific salmonids are intended to represent a species and populations that are able to respond to environmental changes and withstand adverse environmental conditions. Thus, when our assessments indicate that a species or population has a moderate or high likelihood of extinction, we also understand that future adverse environmental changes could have significant consequences on the ability of the species to survive and recover. Also, it is important to note that an assessment of a species having a moderate or high likelihood of extinction does not mean that the species has little or no chance to survive and recover, but that the species faces moderate to high risks from various processes that can drive a species to extinction. With this understanding of both the current likelihood of extinction of the species and the potential future consequences for species survival and recovery, NMFS will analyze whether the effects of the proposed action are likely to in some way increase the extinction risk each of the species faces.

In order to estimate the risk to CCV steelhead as a result of the proposed action, NMFS uses a hierarchical approach. The condition of the DPS is reiterated from the *Status of the Species* section of this Opinion. We then consider how the status of populations in the Action Area, as described in the *Environmental Baseline*, is affected by the proposed action. Effects on individuals are summarized and the consequence of those effects are applied to establish risk to the DPS as a whole.

2.6.1 Summary of the Status of the CCV Steelhead DPS

CV steelhead historically were well-distributed throughout the Sacramento and San Joaquin Rivers (Busby *et al.* 1996) and were found from the upper Sacramento and Pit River systems (now inaccessable due to Shasta and Keswick Dams) south to the Kings and possibly the Kern River systems, and in both east- and west-side Sacramento River tributaries (Yoshiyama *et al.* 1996).

Lindley *et al.* (2006) estimated that historically there were at least 81 independent CV steelhead populations distributed primarily throughout the eastern tributaries of the Sacramento and San Joaquin Rivers. This distribution has been greatly affected by dams (McEwan and Jackson 1996). Presently, impassable dams block access to 80 percent of historically available habitat, and block access to all historical spawning habitat for about 38 percent of historical populations (Lindley *et al.* 2006).

All indications are that natural Central Valley steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (Good *et al.* 2005; NMFS 2011); the long-term trend remains negative. Hatchery production and returns are dominant over natural fish, and one of the four hatcheries is dominated by Eel/Mad River origin steelhead stock.
Continued decline in the ratio between naturally produced juvenile steelhead to hatchery juvenile steelhead in fish monitoring efforts indicates that the wild population abundance is declining. Hatchery releases (100 percent adipose fin-clipped fish since 1998) have remained relatively constant over the past decade, yet the proportion of adipose fin-clipped hatchery smolts to unclipped naturally produced smolts has steadily increased over the past several years.

Existing wild steelhead stocks in the Central Valley are mostly confined to the upper Sacramento River and its tributaries, including Antelope (not the Antelope Creek in the Action Area), Deer, and Mill creeks and the Yuba River. Populations may exist in Big Chico and Butte creeks and a few wild steelhead are produced in the American and Feather Rivers (McEwan and Jackson 1996). Recent snorkel surveys (1999 to 2002) indicate that steelhead are present in Clear Creek (Newton 2002). Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

Existing wild steelhead stocks in the Central Valley are mostly confined to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill creeks and the Yuba River. Populations may exist in Big Chico and Butte creeks and a few wild steelhead are produced in the American and Feather Rivers (McEwan & Jackson 1996). Recent snorkel surveys (1999 to 2002) indicate that steelhead are present in Clear Creek (Newton 2002). Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin continue to show an overall very low abundance, and fluctuating return rates. Lindley *et al.* (2007) developed viability criteria for Central Valley salmonids. Using data through 2005, Lindley *et al.* (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

Spatial structure for steelhead is fragmented and reduced by elimination or significant reduction of the major core populations (*i.e.*, Sacramento, Feather, American rivers) that provided a source for the numerous smaller tributary and intermittent stream populations like Dry Creek, Auburn Ravine, Yuba River, and Deer, Mill, and Antelope creeks. Tributary populations can likely never achieve the size and variability of the core populations in the long-term, generally due to the size and available resources of the tributaries. The widespread distribution of wild steelhead in the

CCV provides the spatial structure necessary for the DPS to survive and avoid localized catastrophes. However, most wild CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change (NMFS 2016). The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.

The most recent viability assessment of CCV steelhead was conducted during NMFS' 2016 status review (NMFS 2016). Our review concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review when the Technical Recovery Team concluded that the DPS is at high risk of extinction. Further, there is still a general lack of data on the status of wild populations. There are some encouraging signs, as several hatcheries in the Central Valley have experienced increased returns of steelhead over the last few years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Delta fish facilities, and the percentage of wild fish in those data remains much higher than at Chipps Island. The new video counts at Ward Dam show that Mill Creek likely supports one of the best wild steelhead populations in the Central Valley, though at much reduced levels from the 1950s and 60s. Restoration and dam removal efforts in Clear Creek continue to benefit CCV steelhead. However, the catch of unmarked (wild) steelhead at Chipps Island is still less than 5 percent of the total smolt catch, which indicates that natural production of steelhead throughout the Central Valley remains at very low levels. Despite the positive trend on Clear Creek and encouraging signs from Mill Creek, all other concerns raised in the previous status review remain.

2.6.2 Status of the Environmental Baseline and Cumulative Effects in the Action Area

The Action Area is used by CCV steelhead as an upstream and downstream migration corridor and for rearing. Within the Action Area, the essential features of freshwater rearing and migration habitats for steelhead have been modified from a meandering waterway lined with a dense riparian vegetation, to a highly constrained and leveed system with limited riverine erosional processes and flooding. Dams, weirs, culverts, and other flood control structures have been constructed on Antelope Creek and most floodplains have been completely separated and isolated from it. The change in the ecosystem as a result of halting the lateral migration of the streambed channel, the loss of floodplains, the removal of riparian vegetation and instream woody material (IWM) have likely affected the functional ecological processes that are essential for growth and survival of CCV steelhead in the Action Area.

The *Cumulative Effects* section of this Opinion describe how continuing or future effects such as non-Federal water diversions, the discharge of point and non-point source chemical contaminant discharges, and climate change affect the species in the Action Area. These actions typically result in habitat fragmentation, and conversion of complex nearshore aquatic habitat to simplified habitats that incrementally reduces the carrying capacity of the rearing and migratory corridors.

2.6.3 Summary of Project Effects on CCV Steelhead Individuals

1. Construction Effects

The proposed work window for in-channel work on the Antelope Creek Flood Control Project is from June 15 to October 15. The potential negative effects of construction activities on listed species include elevated levels of noise, turbidity, contaminants, blockage or loss of habitat, and injury/morality related to potential fish relocation.

However, it is unlikely that these construction activities will result in adverse effects to the listed species for the following reasons; (1) potential negative impacts on listed species have been addressed and will be minimized through best management practices and conservation measures; (2) the work window avoids the primary migration windows of adult and juvenile CCV steelhead; (3) although adult and juvenile steelhead might occur in Antelope Creek, they would likely not be present in the Action Area due to the shallow water, poor water quality, and high water temperatures that occur in the Action Area during summer and early fall; (4) the work site would be dewatered during construction, preventing fish from migrating past the construction site and; (5) fish would move away from noisy environments with ongoing construction activities.

2. Long-term Effects Related to the Presence of Project Features

For juvenile and outmigrating steelhead, the proposed action will result in some long-term effects to individual steelhead that are exposed to the project features along Antelope Creek. Effects to migrating steelhead are considered to be beneficial because passage will be improved over existing conditions for both juvenile and adults following completion of the project. Furthermore, the project is not anticipated to cause an increase in predation or install any structural features that might impede adult migration.

Some long-term adverse effects to the growth and survival of CCV steelhead fry, rearing juveniles and smolts are anticipated due to the loss of instream structure, temporal loss of riparian habitat and overhanging shade, and simplification of benthic habitat. However, because of the relatively small size of the project, the retention of the natural thalwag of the stream channel, use of ESM in the culvert, onsite replanting, and the District's proposal to purchase compensatory credits at a NMFS-approved conservation bank, the action is not likely to appreciably reduce the survival or recovery of anadromous steelhead.

2.6.4 Summary

Although there are some short- and long-term impacts resulting from the project, the effects of these impacts, when added to the environmental baseline and cumulative effects in the Action Area are small. Beneficial and mitigative features like onsite 1:1 revegetation, use of ESM in the culvert, and the creation of a pool below the secondary boulder weir were developed during the planning phases of this project. Additionally, the District will purchase salmonid habitat credits at the NMFS approved conservation bank, prior to the start of construction to compensate for

adverse effects on habitat that will be impacted during the Proposed Action. The credit purchase shall be at a 3:1 ratio of the total acreage of habitat types lost onsite. This long-term conservation measure will serve to offset the impacts of the Antelope Creek Flood Control Project.

The project is not expected to increase the extinction risk of CCV steelhead.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the Action Area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence CCV steelhead. No critical habitat has been designated or proposed for this species within the Action Area; therefore, none was analyzed.

2.8 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). "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 incidental take statement (ITS).

The measures described below are non-discretionary, and must be undertaken by the District so that they become binding conditions of any grant, contract or permit, as appropriate, for the exemption in Section 7(o)(2) to apply. The District has a continuing duty to regulate the activity covered by this ITS. If the District: (1) fails to assume and implement the terms and conditions; or (2) fails to require the permittee, contractor, or grantee to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit, contract or grant document, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the District must report the progress of the action and its impact on the species to NMFS as specified in the ITS (50 CFR § §402.14(i)(3)).

2.8.1 Amount or Extent of Take

NMFS anticipates incidental take of adult and juvenile listed CCV steelhead in the Action Area through the implementation of the proposed action. NMFS cannot, using the best available information, quantify the anticipated incidental take of individual CCV steelhead because of the variability and uncertainty associated with the population size of the species, annual variations in the timing of migration, uncertainties regarding individual habitat use of the project area, and

response of CCV to the effects of the project. However, it is possible to designate as ecological surrogates, those measurable elements of the project that are expected to result in take and to monitor those surrogates to estimate the level of take that is occurring.

Accordingly, NMFS is quantifying take of CCV steelhead incidental to the action resulting from short-term construction impacts, as well as long-term impact to habitat of the Antelope Creek Flood Control Project. The most appropriate threshold for take, is an ecological surrogate of temporary habitat disturbance during the dewatering of the Antelope Creek channel, construction of the weirs, installation of the new culvert, SRA riparian habitat loss, and project site operations and maintenance.

The amount and extent of take described below is in the form of harm due to habitat impacts that will reduce the growth and survival of individuals from predation, or by causing fish to relocate and rear in other locations and reduce the carrying capacity of the existing habitat. There is not a stronger ecological surrogate based on the current information available. Due to a lack of site-specific fish data, the exact number of fish that will be affected is unknown. NMFS anticipates the following level of incidental take from program activities:

Incidental Take Associated with Construction and Habitat Loss:

(1) Take of juvenile and adult CCV steelhead in the form of injury and death is expected from the blockage and dewatering of a 312-foot section of Antelope Creek for a 4-month period, from June 15 to October 15. Blockage of Antelope Creek could lead to migratory delay for steelhead smolts and/or adults. Disruption of the migratory corridor may cause CCV steelhead smolt migration to be delayed or displaced, which may result in increased predation risk, decreased feeding, and increased competition. The temporary blockage and dewatering will affect the behavior of listed fish, prevent movement upstream and downstream of the dewatered section, increase predation risk, and decrease feeding, resulting in take of CCV steelhead over the period of in-channel construction. Drying out the channel will eliminate all of the macroinvertebrates in that section of the creek. After flow is reestablished, it may take benthic macroinvertebrates that drift from unaffected areas upstream 1 month to 45 days to recolonize the project area. Reduction in salmonid food supply is considered temporary in nature, but may result in reduced growth for those fish affected.

(2) Take of juvenile CCV steelhead in the form of injury and death is expected from predation caused by construction-related turbidity that extends up to 500 feet upstream of where the multipurpose trail crosses Antelope Creek (Latitude 38.762559, Longitude -121.260491) to 1,500 feet downstream of the trail crossing.

(3) Take of juvenile CCV steelhead is expected from habitat-related disturbances from the placement of up to 777.06 cubic yards of soil, 178 cubic yards of riprap, 422 cubic yards of concrete, and 342 cubic yards of boulders (secondary weir) in the creek channel and along the banks. Take will be in the form of harm to the species through modification or degradation of the PBFs for rearing and migration that reduces the carrying capacity of habitat. Additionally, the installation of riprap or other streambed stabilization devices in

smaller streams like Antelope Creek will result in a loss of riparian vegetation, loss of large woody debris, changes in food resources, and may provide refuge for non-native predatory fishes.

(4) Take of juvenile CCV steelhead in the form of injury and death is expected from the long-term loss of up to 0.73 acres of riparian and SRA habitat removed during project implementation. The loss of SRA habitat may cause behavior modification of juvenile fish avoiding the disturbed areas and experiencing reduced growth and survival. Reduction in SRA cover may lead to increased predation by predatory fishes, birds, or mammals. Loss of SRA may reduce food availability, which may result in increased competition and an increased susceptibility to predation.

2.8.2 Effect of the Take

In this 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 CCV steelhead.

2.8.3 Reasonable and Prudent Measures

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

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize the take of CCV steelhead.

(1) The District shall work with NMFS to establish agreed upon elements of an effective water diversion plan.

(2) The District shall maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed project to ensure their effectiveness.

(3) The District shall minimize the impacts of bank protection by implementing off-site conservation measures that provide beneficial growth and survival conditions for juvenile CCV steelhead.

(4) The District shall insure that contractors, construction workers, and all other parties involved with these projects implement the best management practices as detailed in the BA and this Opinion.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the District must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The District 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 incidental take statement (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 – The District shall work with NMFS to establish agreed upon elements of an effective water diversion plan:

a. Details regarding the specifications of the diversion pipe (*i.e.*, material, diameter, length, number of joints) to be used during dewatering activities will be provided to and approved by NMFS prior to the start of construction.

b. As stated in the BA, the action agency or the applicant will submit a *Bypass Design and Operation Plan* for NMFS to review and approve prior to installation and the onset of construction activities.

(2) The following terms and conditions implement reasonable and prudent measure 2 – The District shall maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed project to ensure their effectiveness:

a. The 10-year *Streambed Monitoring Plan* should include surveying approximately 300 feet upstream and downstream of the project. This document potential effects of ponding water at higher flows upstream of the project in addition to documenting potential cutting downstream of the project.

b. Boulder placement can shift over time and sedimentation may accumulate so as to no longer meet our fish passage criteria. If, at any point during the 10-year *Streambed Monitoring Plan*, a fish passage issue is identified, the District will notify NMFS immediately and remediate the issue as soon as possible.

c. The District shall replant of any areas of riparian or SRA habitat affected by the project onsite with native riparian vegetation at a minimum 1:1 ratio and continue to coordinate with the NMFS during the implementation and monitoring of this project as necessary by providing monitoring reports from the *Streambed Monitoring Plan* and the *Riparian Restoration and Mitigation and Monitoring Plan* as they become available.

(3) The following terms and conditions implement reasonable and prudent measure 3 – The District shall minimize the impacts of bank protection by implementing off-site conservation measures that provide beneficial growth and survival conditions for juvenile CCV steelhead:

a. The District shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable. Construction involving the placement of rock revetment below the OHWL will occur in accordance with BMPs and conservation measures described in this Opinion.

b. The District shall purchase salmon and steelhead credits from a NMFS-approved conservation bank prior to construction to fully compensate for the impacts to salmonids resulting from the project. The credit purchase shall be at a 3:1 ratio of the total acreage of all habitat types lost onsite (0.73 acres). After applying the mitigation ratio, a total of 2.19 acres of salmonid and steelhead restoration credits will be purchased. This compensation ratio is based on site-specific information and determined through coordination with NMFS during the permitting process. Mitigation credits will be purchased from a NMFS-approved conservation bank prior to construction.

(4) The following terms and conditions implement reasonable and prudent measure 4 – The District shall insure that contractors, construction workers, and all other parties involved with this project implement the project as proposed, adhering to the best management practices as detailed in the BA and this Opinion.

a. The District shall provide a copy of this Opinion to the prime contractor, making the prime contractor responsible for implementing all requirements and obligations included in these documents and to educate and inform all other contractors involved in the project as to the requirements of this Opinion. A notification that contractors have been supplied with this information will be provided to the reporting address below.

Updates and reports required by these terms and conditions shall be submitted to:

Maria Rea
California Central Valley Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento CA 95814
Phone: (916) 930-3600
FAX: (916) 930-3629

2.9 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).

(1) The District should minimize any potential take whenever possible, and implement practices that avoid or minimize negative impacts to salmon, steelhead, and sturgeon and their critical habitat.

(2) The District should support and promote aquatic and riparian habitat restoration within Antelope Creek and the Dry Creek watershed, especially where there are listed aquatic species and critical habitat. Practices that avoid or minimize negative impacts to listed species should be implemented.

(3) The District should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects. The Dry Creek Conservancy is one local example.

(4) The District should develop education and outreach programs to encourage river stewardship in Dry Creek.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

2.10 Reinitiation of Consultation

This concludes formal consultation for Antelope Creek Flood Control Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (Section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide

impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR § 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific coast salmon (PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

EFH designated under the Pacific Coast Salmon Fisheries Management Plan (FMP) may be affected by the proposed action. Additional species that utilize EFH designated under this FMP within the action area include fall-run/late fall-run Chinook salmon. EFH in the action area consists of adult migration habitat and juvenile rearing and migration habitat for three Chinook salmon runs (spring-, fall-, and late fall-run). Habitat Areas of Particular Concern (HAPCs) that may be either directly or indirectly adversely affected include (1) complex channels and floodplain habitats, and (2) thermal refugia.

3.2 Adverse Effects on Essential Fish Habitat

Construction activities would result in increased sedimentation, turbidity, and the potential for contaminants to enter the waterway. Installation of revetment would result in adverse effects to Pacific coast salmon EFH due to losses of riparian habitat and natural substrate. The net amount of riparian and SRA habitat that will be lost is 0.73 acres.

Effects to the HAPCs listed in *Section 3.1* are discussed in context of effects to critical habitat PBFs as designated under the ESA in *Section 2.2* and subsections. Effects to ESA-listed critical habitat and EFH HAPCs are appreciably similar, therefore no additional discussion is included. A list of temporary and permanent adverse effects to EFH HAPCs is included in this EFH consultation. Affected HAPCs are indicated by number, corresponding to the list in *Section 3.1*:

<u>Sedimentation and Turbidity</u>

- Reduced habitat complexity (1)
- Reduced size and connectivity of spawning patches (1)
- Degraded water quality (1, 2)
- Reduction in aquatic macroinvertebrate production (1)

<u>Contaminants and Pollution-related Effects</u>

- Degraded water quality (1, 2)
- Reduction in aquatic macroinvertebrate production (1)

<u>Installation of Revetment</u>

- Permanent loss of natural substrate at levee toe (1)

- Reduced habitat complexity (1)
- Increased bank substrate size (1)
- Increased predator habitat (1)
- Loss of IWM along site length (1)

Removal of Riparian Vegetation

- Reduced shade along site length (2)
- Reduced supply of terrestrial food resources (1)
- Reduced supply of IWM (1)

Fully implementing the measures described in *Section 1.3.3 Conservation Measures* and adhering to the *Terms and Conditions* (*Section 2.8.4*) would protect EFH for Pacific coast salmon by avoiding or minimizing the adverse effects described above.

3.3 Supplemental Consultation

The Corps and the District must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR § 600.920(l)).

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The following recommendations apply to the Proposed Action:

(1) The Corps should recommend that the project applicant install interpretive signs near the weir site along the multi-use trail to help identify and educate visitors about the ecological value of anadromous fish resources in Antelope Creek and the Dry Creek watershed.

The action agency must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of FWCA.

NMFS requests that your office provide a response to the FWCA recommendations. We make this request in order to foster greater communications with action agencies and to monitor the effectiveness of our recommendations. This concludes the FWCA portion of this consultation.

5. 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.

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The Corps, the District, and HDR, Inc. are the intended users of this Opinion. Other interested users could include USFWS, CDFW, or DWR. Individual copies of this BO were provided to all intended users. This Opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

5.2 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 3 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.

5.3 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*.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the *References* section. The analyses in this Opinion and EFH consultation 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 MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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