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

Refer to NMFS No: WCR-2017-7965

September 27, 2017

Mr. Mark Ziminske
Chief, Environmental Resources Branch
Department of the Army
United States Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Emergency Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Public Law 84-99 Feather River Emergency Levee Repair

Dear Mr. Ziminske:

Thank you for your letter received on August 29, 2017, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) for the emergency levee repair on the Feather River to be conducted under Public Law (PL) 84-99.

Thank you also for your request for consultation pursuant to the essential fish habitat (EFH) provisions in section 305 (b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action. NMFS' review concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the action area.

The enclosed biological opinion, based on the biological assessment, and best available scientific and commercial information, concludes that the project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley spring-run Chinook salmon Evolutionarily Significant Unit, (*Oncorhynchus tshawytscha*), the threatened California Central Valley steelhead Distinct Population Segment (DPS)(*O. mykiss*), and the threatened Southern DPS of the North American green sturgeon (*Acipencer medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. 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.

Because the proposed action will modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources under the Fish and Wildlife Coordination Act (16 U.S.C. 662(a)).

Please contact Tancy Moore in NMFS' West Coast Region, California Central Valley Office at (916) 930-3605 or via email at Tancy.Moore@noaa.gov, if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

for Barry A. Thom
Regional Administrator

Enclosure

Cc: To the File: 151522-WCR2017-SA00375

Ms. Robin Rosenau, Environmental Planning Section, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814

Mr. David Colby, Environmental Planning Section, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814

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

PL 84-99 Feather River Emergency Levee Repair

National Marine Fisheries Service Consultation (NMFS) Number: PCTS No. WCR-2017-7965

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?*	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
CV spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	No
California CCV steelhead DPS (*O. mykiss*)	Threatened	Yes	No	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	No

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: September 27, 2017

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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 this biological opinion (BO) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402.

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.

The following provides some background information regarding need for the proposed project: A series of storms struck Northern California from early January 2017 to March 2017. A Federal Disaster Declaration was issued by President Trump on April 1, 2017 for thirty-four California counties for the storms and resultant flooding, mudslides, and landslides. As a result of these storms, a number of levees in the Central Valley sustained significant damage. To repair these levees, several reclamation districts and other organizations responsible for levee maintenance requested assistance from the USACE, Sacramento District, through Public Law (PL) 84-99, Rehabilitation Assistance for Non-Federal Flood Control Projects. Under PL 84-99, the USACE Chief of Engineers, acting for the Secretary of the Army, is authorized to undertake activities including disaster preparedness, advance measures, emergency operations (flood response and post flood response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated source.

During the summer of 2017, the United States Army of Engineers (USACE) organized a series of site visits for USACE and resource agency staff to locations where the levees were damaged in the previous winter's storms. One of these sites was the subject of this consultation, visited on June 6, 2017. On June 21, 2017, a meeting was held with USFWS, NMFS, and the USACE to discuss the repairs for the aforementioned damage to Central Valley levees.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts. A complete record of this consultation is on file at the NMFS California Central Valley Office.

1.2 Consultation History

On August 29, 2017, NMFS received a request via mail for informal consultation from the USACE for project effects to Central Valley (CV) spring-run Chinook salmon, California Central Valley (CCV) steelhead, and the Southern DPS of the North American green sturgeon and the critical habitat for these species.

On August 31, 2017, NMFS received an email clarifying the request for informal consultation was a clerical error, and requesting formal consultation for the project's impacts to the above species and their critical habitat.

NMFS requested more information about the project regarding the onsite plantings via email on August 28th, 2017, and received this information on September 6, 2017.

NMFS initiated consultation on September 6, 2017.

1.3 Proposed Federal 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).

During the fall of 2017, the USACE plans to repair a damaged levee on the Feather River through the PL 84-99 program. This repair, which will be 82 feet in length, will occur on the right bank of the river, and is located at approximately the intersection of Bishop Avenue and Kent Avenue in Live Oak, California. The waterside of the levee experienced significant erosion and slope failure due to multiple discharge surges associated with the emergency response at Oroville Dam that occurred in the winter of 2017. To repair the levee, the USACE plans to place a mixture of quarry stone, soil-filled quarry stone, and willow plantings over the damaged slope. A total of 0.17 acres of bare quarry stone will be placed at the toe of the repair below the ordinary high water mark (OHWM), and 0.1 acres of a 70:30 quarry stone to soil mix will be placed just upslope above the OHWM.

The toe of the quarry stone and soil mixture will be covered with a 15 foot long (upslope to downslope) and 12 inch thick aggregate base layer, consisting of ¾ inch stones and sandy small fines The stones from the aggregate base layer are expected to move into the voids in the quarry stone below while the fines stay on the top, providing a medium for willow cuttings. Over time, the aggregate base and willows foster accretion of river born fines and sediments. As the willow cuttings take, the roots will find the soil-filled quarry stone below. The remaining quarry stone and soil section will be covered in a 12 inch layer of topsoil and seeded with native grass immediately during construction.

Between two and four orchard trees above the OHWM require removal for equipment access to the site. All other trees and large shrubs will be wrapped in burlap in order to prevent damage during construction activities. Upon completion of construction, the burlap will be removed. Where tree trimming or removal is required, it will be conducted under the direction of a

qualified arborist. Vegetation and roots for any grass or small shrubs present in the project footprint will be cleared to ground level before the placement of riprap.

The repair will be completed before November 1, 2017. During the following construction season in 2018, the aggregate base section will be planted with willow pole cuttings. Experienced contractors will perform the installation, and the vegetation plan will include proposed irrigation and vegetation monitoring schedules, as appropriate. Additionally, to fully compensate for impacts to salmonids resulting from the proposed repair, off-site mitigation credits for salmon and steelhead will be purchased from a NMFS-approved conservation bank. The credit purchase will be at a 2:1 ratio for impacts above the OHWM and 3:1 for impacts to habitat below the OHWM. Since the stone placed above and below the OHWM is estimated to impact 0.10 acres and 0.17 acres, respectively, the USACE will purchase 0.20 acres of mitigation for impacts above the OHWM and 0.51 acres of mitigation for impacts below the OHWM, for a total mitigation purchase of 0.71 acres. NMFS-approved mitigation banks with service areas that include the proposed action area include the Bullock Bend Mitigation Bank and the Fremont Landing Conservation Bank.

1.3.1 Construction Avoidance and Minimization Measures

The following measures are part of the proposed action:

1. The removal and disturbance of existing, native riparian vegetation will be minimized.
2. The placement of filter fabric will be kept to a minimum necessary to facilitate construction. The fabric will only be installed as a barrier between the quarry stone and the soil-filled quarry stone in order to prevent excessive sedimentation during construction. The filter fabric will be a natural fiber mesh that will biodegrade quickly; no plastics will be used.
3. The contractor will be responsible for providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations to ensure compliance with water quality standards. This will be accomplished by installing temporary and permanent erosion and sediment control best management practices (BMPs). These may include, but are not limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. Any temporary measures will be removed after the area has been stabilized.
4. A USACE representative will be identified as the point of contact for any contractor who might incidentally harm a listed fish, or find a dead, injured, or entrapped listed fish. This point of contact will be identified to all construction employees during an orientation regarding the potential effects on listed fish. The orientation will be conducted by a qualified fisheries biologist and cover specific information on measures to prevent injury to listed fish and what to do if any are found in the project area.
5. NMFS will be notified immediately if one or more listed fish are found dead or injured. Follow-up written notification would include the date, time, and location of the dead or injured specimen, a photograph, cause of injury or death, and name and agency affiliation of the individual who found the specimen.

6. If a water pump is necessary, all intakes will be screened according to NMFS fish screening specifications. No coffer dams are anticipated to be needed during construction.
7. Upon completion of construction, any disturbed banks will be restored to pre-project conditions.

1.3.2 Interrelated and Interdependent Actions

"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). There are no interdependent or interrelated activities associated with the proposed project.

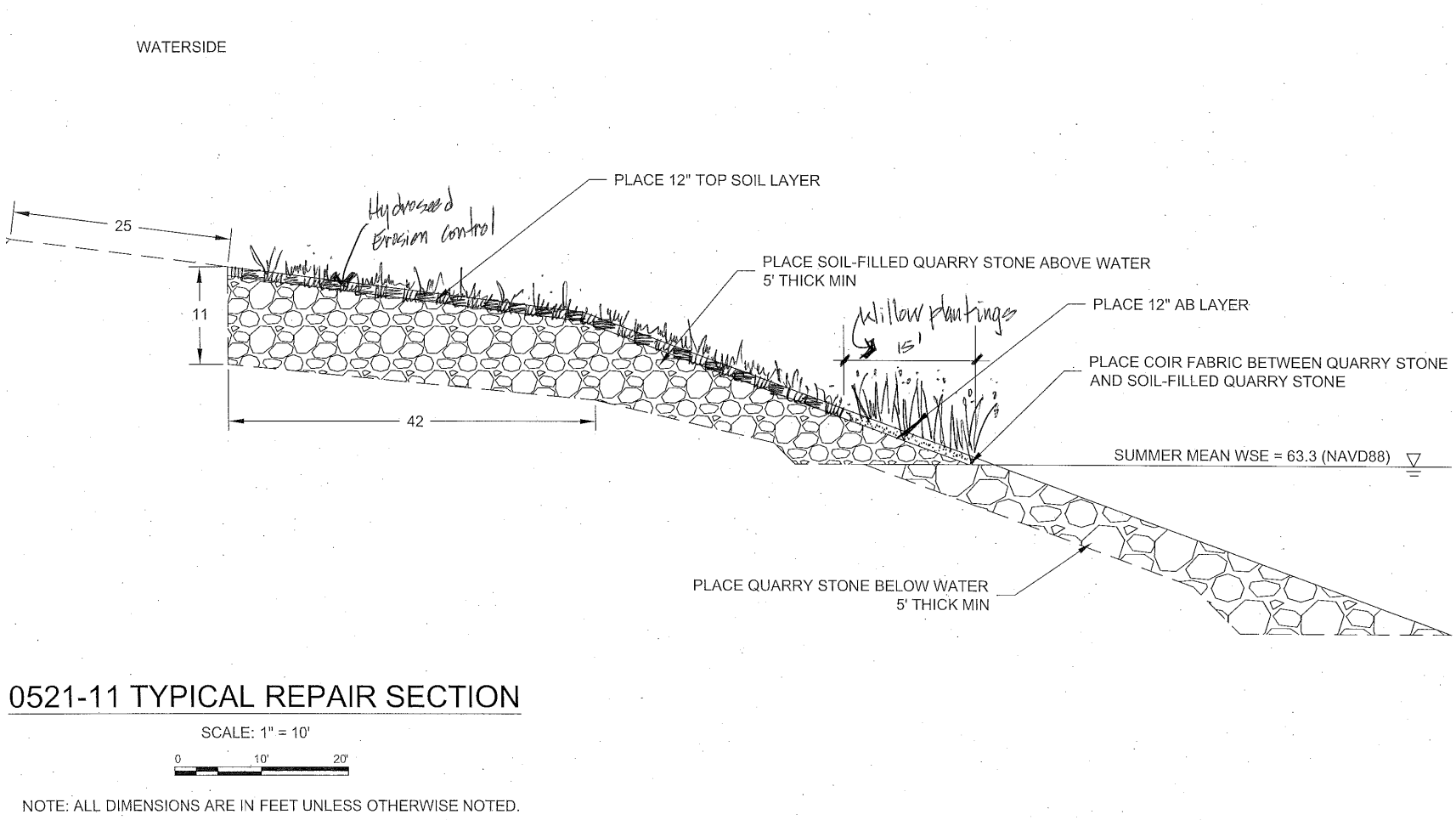

Figure 1. Cross section of the PL84-99 bank repair site on the Feather River

2. ENDANGERED SPECIES ACT: ANALYSIS OF EFFECTS AND INCIDENTAL TAKE STATEMENT

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

2.1 Analytical Approach

This BO includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis 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.

This BO relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) 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 BO, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

1. Identify the rangewide status of the species and critical habitat expected 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 by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the Proposed Action poses to species and critical habitat.
6. Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
7. If necessary, suggest a RPA to the Proposed Action.

2.1.1 Use of Analytical Surrogates

It is impossible to precisely quantify and track the amount or number of individuals that are expected to be incidentally taken (injure, harm, kill, etc.) per species as a result of the proposed action due to the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of spawning and migration, individual habitat use within the action area, and difficulty in observing injured or dead fish. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the project that are expected to result in incidental take, that are more predictable and/or measurable, with the ability to monitor those surrogates to determine the extent of take that is occurring.

The most appropriate threshold for take for this project, is an ecological surrogate of habitat disturbance. Descriptions of the habitat disturbance anticipated during the rehabilitation of the emergency levee repair site, including the loss of SRA (shaded riverine aquatic) cover and riparian habitat and placement of rock revetment, were provided in the biological assessment.

2.1.2 Conservation Banking in the Context of the ESA Environmental Baseline

Conservation (or mitigation) banks present a unique situation in terms of how they are used in the context of the *Effects Analysis* and the *Environmental Baseline* in ESA section 7 consultations.

When NMFS is consulting on a proposed action that includes conservation bank credit purchases, it is likely that physical restoration work at the bank site has already occurred and/or that a section 7 consultation occurred at the time of bank establishment. A traditional interpretation might suggest that the overall ecological benefits of the conservation bank actions belong in the *Environmental Baseline*. Under this interpretation, where proposed actions include credit purchases, it would not be possible to attribute their benefits to the proposed action, without double-counting. Such an interpretation does not reflect the unique circumstances that conservation banks serve. Specifically, conservation banks are established based on the expectation of future credit purchases. Conservation banks would not be created and their net beneficial effects would not occur in the absence of this expectation.

For these reasons, it is appropriate to treat the beneficial effects of the bank as accruing in connection with and at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. This means that, in formal consultations on projects within the service area of a conservation bank, the beneficial effects of a conservation

bank should be accounted for in the *Environmental Baseline* after a credit transaction has occurred. More specifically, the *Environmental Baseline* section should mention the bank establishment (and any consultation thereon) but, in terms of describing beneficial effects, it should discuss only the benefits attributable to credits already sold. In addition, in consultations that include credit purchases as part of the proposed action, the proportional benefits attributable to those credit purchase should be treated as effects of the action. Conversely, where a proposed action does not credit purchases, it will not receive any direct offset associated with the bank. This approach preserves the value of the bank for its intended purposes, both for the value of the credits to the bank proponent and the net conservation value of the bank to listed species and their critical habitat.

This BO will analyze the beneficial effects of the credit transaction associated with the proposed action and recognizes the beneficial effects associated with the remainder of the credits at the bank that have not been subject to a transaction (and their associated ecological benefits) will not be considered in the *Environmental Baseline*.

2.2 Rangewide Status of the Species and Critical Habitat

This BO examines the status of each species that would be adversely affected by the Proposed Action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The BO also examines the condition of critical habitat throughout the designated area, evaluates the value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that value for the conservation of the listed species.

2.2.1 Central Valley Spring-run Chinook Salmon

- Listed as threatened (64 FR 50394; September 16, 1999); reaffirmed (70 FR 37160; June 28, 2005)
- Designated critical habitat (70 FR 52488; September 2, 2005)

Detailed information regarding ESU listing and critical habitat designation history, designated critical habitat, ESU life history, and viable salmonid population (VSP) parameters can be found in NMFS 2014 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon, Central Valley Spring-Run Chinook salmon, and the Distinct Population Segment of California Central Valley steelhead (NMFS 2014), and in the recent 5-year Status Review (NMFS 2016b).

Historically, CV spring-run Chinook salmon were the second most abundant salmon run in the Central Valley and one of the largest on the west coast (CDFG 1990). These fish occupied the upper and middle elevation reaches (1,000 to 6,000 feet) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit rivers, with smaller populations in most tributaries with

sufficient habitat for over-summering adults (Stone 1872, Rutter 1904, Clark 1929). The Central Valley drainage as a whole is estimated to have supported CV spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). The San Joaquin River historically supported a large run of CV spring-run Chinook salmon, suggested to be one of the largest runs of any Chinook salmon on the West Coast, with estimates averaging 200,000 to 500,000 adults returning annually (CDFG 1990).

Monitoring of the Sacramento River mainstem during CV spring-run Chinook salmon spawning timing indicates some spawning occurs in the river (CDFW 2015) Genetic introgression has likely occurred here due to lack of physical separation between spring-run and fall-run Chinook salmon populations (CDFG 1998). Battle Creek and the upper Sacramento River represent persisting populations of CV spring-run Chinook salmon in the basalt and porous lava diversity group, though numbers remain low. Other Sacramento River tributary populations in Mill, Deer, and Butte creeks (northern Sierra Nevada diversity group) are likely the best trend indicators for the CV spring-run Chinook salmon ESU. Generally, these streams showed a positive escapement trend between 1991 and 2006, displaying broad fluctuations in adult abundance. The Feather River Fish Hatchery (FRFH) CV spring-run Chinook salmon population represents an evolutionary legacy of populations that once spawned above Oroville Dam. The FRFH population is included in the ESU based on its genetic linkage to the natural spawning population and the potential for development of a conservation strategy (70 FR 37160; June 28, 2005).

The Central Valley Technical Review Team (TRT) estimated that historically there were 18 or 19 independent populations of CV spring-run Chinook salmon, along with a number of dependent populations, all within four distinct geographic regions (i.e., diversity groups) (Lindley *et al.* 2004). Of these populations, only three independent populations currently exist (Mill, Deer, and Butte creeks). Additionally, smaller populations are currently persisting in Antelope and Big Chico creeks and the Feather and Yuba rivers, also in the northern Sierra Nevada diversity group (CDFG 1998). The northwestern California diversity group has two low abundance persisting populations of spring-run Chinook salmon in Clear and Beegum creeks. In the San Joaquin River basin, the southern Sierra Nevada diversity group, observations in the last decade suggest that spring-running populations may currently occur in the Stanislaus and Tuolumne rivers (Franks 2015).

The CV spring-run Chinook salmon ESU is comprised of two known genetic complexes. Analysis of natural and hatchery spring-run Chinook salmon stocks in the Central Valley indicates that the northern Sierra Nevada diversity group spring-run Chinook salmon populations in Mill, Deer, and Butte creeks retain genetic integrity as opposed to the genetic integrity of the Feather River population, which has been somewhat compromised by introgression with the fall-run ESU (Good et al. 2005a; Garza and Pearse 2008; Cavallo et al. 2011).

Because the populations in Butte, Deer and Mill creeks are the best trend indicators for ESU viability, NMFS can evaluate risk of extinction based on VSP in these watersheds. Over the long term, these three remaining populations are considered to be vulnerable to anthropomorphic and naturally occurring catastrophic events. The viability assessment of CV spring-run Chinook salmon, conducted during NMFS' 2010 status review (NMFS 2011a), found that the biological status of the ESU had worsened since the last status review (2005), and the status review

recommends that the species status be reassessed in 2 to 3 years as opposed to waiting another 5 years if the decreasing trend continued. In 2012 and 2013, most tributary populations increased in returning adults, averaging more than 13,000. However, 2014 returns were lower again—approximately 5,000 fish—indicating the ESU remains highly fluctuating. The most recent status review was conducted in 2015 (NMFS 2016b), and it looked at promising increasing populations in 2012 to 2014; however, the 2015 returning fish were extremely low (1,488), with additional pre-spawn mortality reaching record lows. Since the effects of the 2012 to 2015 drought have not been fully realized, NMFS anticipates at least several more years of very low returns, which may result in severe rates of decline (NMFS 2016b).

The Feather River spring-run Chinook population is considered to be a "Core 2" population by NMFS recovery plan for the species (NMFS 2014). Core 2 populations meet, or have the potential to meet, the biological recovery standard for moderate risk of extinction. These watersheds have lower potential to support viable populations, due to lower abundance, or amount and quality of habitat. These populations provide increased life history diversity to the ESU/DPS and are likely to provide a buffering effect against local catastrophic occurrences that could affect other nearby populations, especially in geographic areas where the number of Core 1 populations is lowest.

2.2.1.1 Summary of the Central Valley Spring-run Chinook Salmon Evolutionarily Significant Unit Viability

In summary, the extinction risk for the CV spring-run Chinook salmon ESU was evaluated for years 2012 – 2014, which remained at moderate risk of extinction (Williams *et al.* 2016). However, based on the severity of the drought and the low escapements, as well as increased pre-spawn mortality in Butte, Mill, and Deer creeks in 2015 and 2016 (CDFW 2017), there is concern that these CV spring-run Chinook salmon strongholds will deteriorate into high extinction risk in the coming years based on the population size or rate of decline criteria (NMFS 2016b).

2.2.1.2 Critical Habitat and Physical or Biological Features for Central Valley Spring-run Chinook Salmon

The critical habitat designation for CV spring-run Chinook salmon lists the PBFs (70 FR 52488; September 2, 2005). In summary, the PBFs include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine habitat. The geographical range of designated critical habitat includes stream reaches of the Sacramento, Feather, Yuba, and American rivers; Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks; and the Sacramento River as well as portions of the northern Delta (70 FR 52488; September 2, 2005).

2.2.1.3 Summary of Central Valley Spring-run Chinook Salmon Critical Habitat Status

Currently, many of the PBFs of CV spring-run Chinook salmon critical habitat are degraded and provide limited high quality habitat. Factors that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, scarcity of complex in-river cover, and the lack of floodplain habitat. Although the current conditions of CV spring-run Chinook salmon critical habitat are significantly degraded, the

spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

2.2.2 California Central Valley Steelhead

- Originally listed as threatened (63 FR 13347; March 19, 1998); reaffirmed (71 FR 834; January 5, 2006)
- Designated critical habitat (70 FR 52488; September 2, 2005)

Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, DPS life history, and VSP parameters can be found in NMFS 2014 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon, Central Valley Spring-Run Chinook salmon, and the Distinct Population Segment of California Central Valley steelhead (NMFS 2014), and in the recent 5-year Status Review (NMFS 2016a).

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 CCV steelhead run size had declined to about 40,000 adults (McEwan 2001). Current abundance data for CCV steelhead are limited to returns to hatcheries and redd surveys conducted on a few rivers. The hatchery data are the most reliable because redd surveys for steelhead are often made difficult by high flows and turbid water usually present during the winter-spring spawning period.

CCV steelhead returns to CNFH increased from 2011 to 2014. After hitting a low of only 790 fish in 2010, 2013 and 2014 have averaged 2,895 fish. Wild adults counted at the hatchery and in river each year represent a small fraction of overall returns, but their numbers have remained relatively steady, typically 200 to 300 fish each year. Numbers of wild adults returning each year ranged from 252 to 610 from 2010 to 2014, respectively.

Redd counts are conducted in the American River and in Clear Creek (Shasta County). An average of 143 redds have been counted on the American River from 2002–2015 [data from Hannon *et al.* (2003), Hannon and Deason (2008), Chase (2010)]. An average of 178 redds have been counted in Clear Creek from 2001 to 2015 following the removal of Saeltzer Dam, which allowed steelhead access to additional spawning habitat. The Clear Creek redd count data ranges from 100-1023 and indicates an upward trend in abundance since 2006 (USFWS 2015).

The returns of CCV steelhead to the FRFH experienced a sharp decrease from 2003 to 2010, with only 679, 312, and 86 fish returning in 2008, 2009 and 2010, respectively. In recent years, however, returns have experienced an increase, with 830, 1,797, and 1,505 fish returning in 2012, 2013, and 2014, respectively. Overall, steelhead returns to hatcheries have fluctuated so much from 2001 to 2015 that no clear trend is present.

Trawl data indicate that the level of natural production of steelhead has remained very low since the NMFS 2011 status review (NMFS 2016a), suggesting a decline in natural production based on consistent hatchery releases. Catches of steelhead at the fish collection facilities in the southern Delta are another source of information on the production of wild steelhead relative to

hatchery steelhead (CDFW 2017). 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.

About 80 percent of the historical spawning and rearing habitat once used by CCV steelhead in the Central Valley is now upstream of impassible dams (Lindley *et al.* 2006). 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 are well-distributed throughout the Central Valley below the major rim dams (NMFS 2016a). Most of the steelhead populations in the Central Valley have a high hatchery component, including Battle Creek (adults intercepted at the CNFH weir), the American River, Feather River, and Mokelumne River.

The CCV 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). Reductions in population size have been supported by genetic analysis (Nielsen *et al.* 2003). Garza and Pearse (2008) analyzed the genetic relationships among CCV 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 CCV steelhead is also compromised by hatchery origin fish, placing the natural population at a high risk of extinction (Lindley *et al.* 2007). Steelhead in the Central Valley historically consisted of both summer-run and winter-run Chinook salmon migratory forms. Only winter-run (ocean maturing) steelhead currently are found in California Central Valley rivers and streams as summer-run have been extirpated (McEwan and Jackson 1996, Moyle 2002).

The Feather River steelhead population is considered to be a "Core 2" population by NMFS recovery plan for the species (NMFS 2014). Core 2 populations meet, or have the potential to meet, the biological recovery standard for moderate risk of extinction. These watersheds have lower potential to support viable populations, due to lower abundance, or amount and quality of habitat. These populations provide increased life history diversity to the ESU/DPS and are likely to provide a buffering effect against local catastrophic occurrences that could affect other nearby populations, especially in geographic areas where the number of Core 1 populations is lowest.

2.2.2.1 Summary of California Central Valley Steelhead Distinct Population Segment Viability

All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (NMFS 2016a); the long-term trend remains negative. Hatchery production and returns are dominant. Most wild CCV populations are very small and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish.

In summary, the status of the CCV steelhead DPS appears to have remained unchanged since the 2011 status review, and the DPS is likely to become endangered within the near future throughout all or a significant portion of its range (NMFS 2016a).

2.2.2.2 Critical Habitat and Physical or Biological Features for California Central Valley Steelhead

The critical habitat designation for CCV steelhead lists the PBFs (70 FR 52488; September 2, 2005). In summary, the PBFs include freshwater spawning sites; freshwater rearing sites; freshwater migration corridors; and estuarine areas. The geographical extent of designated critical habitat includes the following: the Sacramento, Feather, and Yuba rivers and the Deer, Mill, Battle, and Antelope creeks in the Sacramento River basin; the San Joaquin River, including its tributaries but excluding the mainstem San Joaquin River above the Merced River confluence; and the waterways of the Delta.

2.2.2.3 Summary of California Central Valley Steelhead Critical Habitat Status

Many of the PBFs of CCV steelhead critical habitat are degraded and provide limited high quality habitat. Passage to historical spawning and juvenile rearing habitat has been largely reduced due to construction of dams throughout the Central Valley. Levee construction has also degraded the freshwater rearing and migration habitat and estuarine areas as riparian vegetation has been removed, reducing habitat complexity and food resources and resulting in many other ecological effects. Contaminant loading and poor water quality in central California waterways pose threats to lotic fish, their habitat, and food resources. Additionally, due to reduced access to historical habitats, genetic introgression is occurring because naturally produced fish are interacting with hatchery-produced fish, which has the potential to reduce the long-term fitness and survival of this species.

Although the current conditions of CCV steelhead critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento-San Joaquin River watersheds and the Delta are considered to have high intrinsic value for the conservation of the species as they are critical to ongoing recovery efforts.

2.2.3 Southern Distinct Population Segment of North American Green Sturgeon

- Listed as threatened (71 FR 17757; April 7, 2006)
- Designated critical habitat (74 FR 52300; October 9, 2009)

Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, and DPS life history can be found in the NMFS 2015 five-year status review for sDPS green sturgeon (NMFS 2015).

Green sturgeon are known to range from Baja California to the Bering Sea along the North American continental shelf. During late summer and early fall, subadults and non-spawning adult green sturgeon can frequently be found aggregating in estuaries along the Pacific coast (Emmett

et al. 1991, Moser and Lindley 2006). Using polyploid microsatellite data, Israel *et al.* (2009) found that green sturgeon within the Central Valley of California belong to the sDPS.

Additionally, acoustic tagging studies have found that green sturgeon found spawning within the Sacramento River are exclusively sDPS green sturgeon (Lindley *et al.* 2011). In waters inland from the Golden Gate Bridge in California, sDPS green sturgeon are known to range through the estuary and the Delta and up the Sacramento, Feather, and Yuba rivers (Israel *et al*. 2009, Bergman *et al.* 2011, Seesholtz *et al.* 2014). It is unlikely that green sturgeon utilize areas of the San Joaquin River upriver of the Delta with regularity, and spawning events are thought to be limited to the upper Sacramento River and its tributaries. There is no known modern usage of the upper San Joaquin River by green sturgeon, and adult spawning has not been documented there (Jackson and Van Eenennaam 2013).

Recent research indicates that the sDPS is composed of a single, independent population, which principally spawns in the mainstem Sacramento River and also breeds opportunistically in the Feather River and possibly even the Yuba River (Bergman *et al.* 2011, Seesholtz *et al.* 2014). Concentration of adults into a very few select spawning locations makes the species highly vulnerable to poaching and catastrophic events. The apparent, but unconfirmed, extirpation of spawning populations from the San Joaquin River narrows the available habitat within their range, offering fewer habitat alternatives. Whether sDPS green sturgeon display diverse phenotypic traits, such as ocean behavior, age at maturity, and fecundity, or if there is sufficient diversity to buffer against long-term extinction risk is not well understood. It is likely that the diversity of sDPS green sturgeon is low, given recent abundance estimates (NMFS 2015).

Trends in abundance of sDPS green sturgeon have been estimated from two long-term data sources: (1) salvage numbers at the state and Federal pumping facilities (CDFW 2017), and (2) by incidental catch of green sturgeon by the CDFW's white sturgeon sampling/tagging program (DuBois and Harris 2016). Historical estimates from these sources are likely unreliable because the sDPS was likely not taken into account in incidental catch data, and salvage does not capture rangewide abundance in all water year types. A decrease in sDPS green sturgeon abundance has been inferred from the amount of take observed at the south Delta pumping facilities, the Skinner Delta Fish Protection Facility (SDFPF), and the Tracy Fish Collection Facility (TFCF). This data should be interpreted with some caution. Operations and practices at the facilities have changed over the project lifetime, which may affect salvage data. These data likely indicate a high production year versus a low production year qualitatively, but cannot be used to rigorously quantify abundance.

Since 2010, more robust estimates of sDPS green sturgeon have been generated. As part of a doctoral thesis at the University of California at Davis (UC Davis), Ethan Mora has been using acoustic telemetry to locate green sturgeon in the Sacramento River and to derive an adult spawner abundance estimate (Mora *et al.* 2015). Preliminary results of these surveys estimate an average annual spawning run of 223 (using dual-frequency identification sonar (DIDSON) and 236 (using telemetry) fish. This estimate does not include the number of spawning adults in the lower Feather or Yuba rivers, where green sturgeon spawning was recently confirmed (Seesholtz *et al.* 2014).

The parameters of green sturgeon population growth rate and carrying capacity in the Sacramento Basin are poorly understood. Larval count data shows enormous variance among sampling years. In general, sDPS green sturgeon year class strength appears to be highly variable with overall abundance dependent upon a few successful spawning events (NMFS 2010) . Other indicators of productivity such as data for cohort replacement ratios and spawner abundance trends are not currently available for sDPS green sturgeon.

2.2.3.1 Summary of Green Sturgeon Southern Distinct Population Segment Viability

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate (NMFS 2010). Although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2010). Lindley *et al.* (2008), in discussing winter-run Chinook salmon, states that an ESU (or DPS) represented by a single population at moderate risk of extinction is at high risk of extinction over a large timescale; this would apply to the sDPS for green sturgeon. The most recent 5-year status review for sDPS green sturgeon found that some threats to the species have recently been eliminated such as take from commercial fisheries and removal of some passage barriers (NFMS 2015). Since many of the threats cited in the original listing still exist, the threatened status of the DPS is still applicable (NMFS 2015).

2.2.3.2 Critical Habitat and Physical or Biological Features for Southern Distinct Population Segment Green Sturgeon

The critical habitat designation for sDPS green sturgeon lists the PBFs (74 FR 52300; October 9, 2009). In summary, the PBFs include the following for both freshwater riverine systems and estuarine habitats: food resources, water flow, water quality, migratory corridor, depth, and sediment quality. Additionally, substrate type or size is also a PBF for freshwater riverine systems. In addition, the PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas. The geographical range of designated critical habitat includes the following:

- In freshwater, the geographical range includes:
    - The Sacramento River from the Sacramento I-Street bridge to Keswick Dam, including the Sutter and Yolo bypasses and the lower American River from the confluence with the mainstem Sacramento River upstream to the highway 160 bridge
    - The Feather River from its confluence with the Sacramento River upstream to Fish Barrier Dam
    - The Yuba River from its confluence with the Feather River upstream to Daguerre Point Dam
    - The Delta (as defined by California Water Code section 12220, except for listed excluded areas)

- In coastal bays and estuaries, the geographical range includes:
    - San Francisco, San Pablo, Suisun, and Humboldt bays in California
    - Coos, Winchester, Yaquina, and Nehalem bays in Oregon
    - Willapa Bay and Grays Harbor in Washington
    - the lower Columbia River estuary from the mouth to river kilometer (RK) 74

In coastal marine waters, the geographical range includes all United States coastal marine waters out to the 60-fathom-depth bathymetry line from Monterey Bay north and east to include waters in the Strait of Juan de Fuca, Washington.

2.2.3.3 Summary of Southern Distinct Population Segment Green Sturgeon Critical Habitat Status

Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Factors that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, and presence of contaminants in sediment. Although the current conditions of green sturgeon critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in both the Sacramento-San Joaquin River watersheds, the Delta, and nearshore coastal areas are considered to have high intrinsic value for the conservation of the species.

2.2.4 Global Climate Change

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 and 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 2004). Specifically, the Sacramento River basin annual runoff amount for April-July has been decreasing since about 1950 (Roos 1987, Roos 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 2004). Factors modeled by VanRheenen (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 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.

Projected warming is expected to affect Central Valley Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if climate warms by 5°C (9°F), it is questionable whether any Central Valley Chinook salmon populations can persist (Williams 2006). Based on an analysis of an ensemble of climate models and emission scenarios and a reference temperature from 1951- 1980, the most plausible projection for warming over Northern California is 2.5°C (4.5°F) by 2050 and 5°C by 2100, with a modest decrease in precipitation (Dettinger 2005). Chinook salmon in the Central Valley are at the southern limit of their range, and warming will shorten the period in which the low elevation habitats used by naturally-producing fall-run Chinook salmon are thermally acceptable. This would particularly affect fish that emigrate as fingerlings, mainly in May and June, and especially those in the San Joaquin River and its tributaries.

CV spring-run Chinook salmon adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson *et al.* 2011). CV spring-run Chinook salmon spawn primarily in the tributaries to the Sacramento River, and those tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. Even in tributaries with cool water springs, in years of extended drought and warming water temperatures, unsuitable conditions may occur. Additionally, juveniles often rear in the natal stream for one to two summers prior to emigrating, and would be susceptible to warming water temperatures. In Butte Creek, fish are limited to low elevation habitat that is currently thermally marginal, as demonstrated by high summer mortality of adults in 2002 and 2003, and will become intolerable within decades if the climate warms as expected. Ceasing water diversion for power production from the summer holding reach in Butte Creek resulted in cooler water temperatures, more adults surviving to spawn, and extended population survival time (Mosser *et al.* 2013).

Although steelhead will experience similar effects of climate change to Chinook salmon, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile 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 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 in 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 and greater presence and activity of predators. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild steelhead populations.

The sDPS green sturgeon spawn primarily in the Sacramento River in the spring and summer. The Anderson-Cottonwood Irrigation District Diversion Dam (ACID) is considered the upriver extent of green sturgeon passage in the Sacramento River (71 FR 17757; April 7, 2006). The

upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer (Heublein et al. in review). Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of green sturgeon, but temperatures at spawning locations lower in the river may be more affected. It is uncertain, however, if green sturgeon spawning habitat exists closer to ACID, which could allow spawning to shift upstream in response to climate change effects. Successful spawning of green sturgeon in other accessible habitats in the Central Valley (i.e., the Feather River) is limited, in part, by late spring and summer water temperatures (NMFS 2015). Similar to salmonids in the Central Valley, green sturgeon spawning in tributaries to the Sacramento River is likely to be further limited if water temperatures increase and higher elevation habitats remain inaccessible.

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 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 populations of salmon, steelhead, and green sturgeon may be affected by the implementation of the proposed action.

This repair, which will be 82 feet in length, will occur on the right bank of the Feather River, and is located at approximately the intersection of Bishop Avenue and Kent Avenue in Live Oak, California. For projects with in-water construction activities, such as installation of riprap, the downstream extent of the action area is defined by the distance of potential increased turbidity and sediment deposition. Based on turbidity measurements taken during construction for similar bank stabilization projects performed by the USACE, turbidity impacts for the proposed repair are expected to occur up to 100 feet from the shoreline and up to 400 feet downstream of any in-water construction activities. Therefore the action area includes an approximately 482 foot stretch of the Feather River.

Since the USACE plans to purchase mitigation credits from a conservation bank, the action area also includes the two mitigation banks that have service areas within the project area. These include the Fremont Landing Conservation Bank, which is a 100-acre floodplain site along the Sacramento River (Sacramento River Mile 106) and Bullock Bend Mitigation Bank, a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80).

2.4 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 Feather River has undergone many changes from its historical condition. These changes began in earnest with the California Gold Rush, and continued with the development of manmade dams and other structures to control the flow, storage, and transport of water, and the development of hydroelectric power. The Feather River flows approximately 60 miles north to south before entering the Sacramento River at Verona. The river is almost entirely contained within a series of levees as it flows through the agricultural lands of the Sacramento Valley. Flows are regulated for water supply and flood control through releases at Oroville Dam, and to a lesser extent flows are regulated to maximize production of hydroelectric power. The action area for this project is found in the lower Feather River, which is generally considered as that portion of the Feather River and its watershed that lies downstream of Oroville Dam, extending to the confluence with the Sacramento River at Verona.

The action area, which encompasses the Feather River and associated floodplains and riparian areas at and adjacent to the repair, functions primarily as a rearing and migratory habitat for CV spring-run Chinook salmon and CCV steelhead. The Southern DPS of North American green sturgeon uses the area as a migration corridor for juveniles and adults.

The action area is within designated critical habitat for CV spring-run Chinook salmon, and CCV steelhead. Habitat requirements for these species are similar. The PBFs of salmonid habitat within the action area include: freshwater rearing habitat and freshwater migration corridors. 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 habitat in the action area is to provide appropriate freshwater rearing and migration conditions for juveniles and unimpeded freshwater migration conditions for adults. The area is outside of spawning habitat for CV spring-run Chinook salmon and CCV steelhead. However, the conservation condition and function of this habitat in the action area and throughout the Feather River has been severely impaired through several factors, described below.

Dams have eliminated access to historic holding, spawning, and rearing habitat and have resulted in CV spring-run Chinook salmon and fall-run Chinook salmon spawning and rearing in the same areas, at the same times. This has resulted in increased competition, superimposition of redds, and interbreeding of the two populations. Other anthropogenic activities that have impacted CV spring-run Chinook salmon and CCV steelhead include modification of the hydrograph, loss of sediment and large wood transport, restriction of lateral movement of the river channel, mining, unscreened water diversions, and riparian vegetation removal. Changes in the hydrograph have reduced lateral movement of the river, and along with the loss of sediment

and large wood transport downstream of Oroville Dam, resulted in decreases in habitat value for salmonid spawning and rearing.

Mining, levee and dike construction, and removal of riparian vegetation have also resulted in adverse effects to habitat for spawning and rearing salmonids. Bank modification (the construction of levees and bank armoring) has changed the geomorphic processes affecting the lower Feather River. 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. Riparian vegetation is also an important source of future LWM contributions to the aquatic system. Removal of vegetation through bank modification has reduced habitat quality and the productivity of the lower Feather River. Also, unscreened water diversion may entrain salmonids and result in the loss of a significant number of CV spring-run Chinook salmon and CCV steelhead. The result of these changes has been the reduction in quantity and quality of several essential features of migration and rearing habitat required by juveniles to grow and survive. In spite of the degraded condition of this habitat, the intrinsic value of the action area for the conservation of the species is high as it is used by two federally listed salmonids in the Central Valley.

The Feather River population of CV spring-run Chinook continues to have high returns (1,000-20,000), but is heavily influenced by the Feather River Fish Hatchery (FRFH). The population spawning in-river is difficult to determine because they are not counted when entering, and monitoring during spawning results in difficulties distinguishing between races. The returns to the FRFH collected for propagation have remained fairly consistent, generally between 1,000 to 4,000 fish. The proportion of hatchery-origin spring- or fall-run Chinook salmon contributing to the natural spawning spring-run Chinook salmon population on the Feather River remains unknown due to overlap in the spawn timing of spring-run and fall-run Chinook salmon, and lack of physical separation. However, carcass surveys indicate a large percentage of these are likely of hatchery origin (NMFS 2016b).

Escapement of CCV steelhead at the FRFH seems to be quite variable over the years, generally averaging about 1,100 fish. Currently, nearly all the steelhead that return to the Feather River Hatchery are hatchery-origin fish, indicating that spawning and/or rearing habitat for steelhead in the Feather River is very poor and natural production is limited (NMFS 2016a).

The action area is also within designated critical habitat for Southern DPS of the North American green sturgeon. PBFs for sDPS green sturgeon within freshwater riverine systems include food resources, substrate type/size, flow, water quality, migration corridors free of passage impediments, depth (holding pools), and sediment quality. As is the case with salmonids, PBFs in the area been severely impaired through several anthropogenic factors. The loss of potential upstream habitat from Oroville Dam, altered hydrograph, altered temperature regime, other changed or degraded environmental or habitat conditions, overfishing, poaching, diversions of water, predation, ocean survival, and other factors have greatly impacted the sDPS green sturgeon in the Feather River.

A migratory corridor that is attractive to sDPS green sturgeon is necessary for sDPS green sturgeon to access spawning grounds and to access other tributaries such as the Yuba River.

Presently, a rock weir at Sunset Pumps is believed to impair upstream fish passage of sDPS green sturgeon at low flows. Additionally, habitat conditions necessary to support a healthy population of sDPS green sturgeon in the Feather River are influenced by a variety of other impacts such as sport fishing regulations, water diversions, contributions from tributaries such as the Yuba River, levee maintenance and construction. Despite the degraded condition of the habitat, green sturgeon have been observed spawning in the Feather River. DIDSON surveys from 2011-2013 documented variable numbers of green sturgeon present in the Feather River, but at least 3 were present each year, with one year confirming 21-28 sturgeon present. Green sturgeon have also been observed spawning in the Feather River (NMFS 2015). Utilization of the area by several green sturgeon life stages means the habitat is still of high value for the conservation of the species.

High flows occurred in the Feather River during the winter of 2016-17. These have impacted survival of ESA-listed salmonids, and adversely impacted designated critical habitat in the Feather River. These high flows resulted in juvenile salmonids being stranded, eggs being scoured out of the gravel, and juvenile fish prematurely being moved downstream. The high flows have resulted in large changes in the rivers, with erosion of the river banks and high loads of sediment being deposited into the rivers. The high flows have benefited critical habitat through the recruitment of large woody material. The adverse effects of the high flows in the winter of 2016-17, coupled with the drought conditions from 2012 through 2016, have likely impacted the recovery of ESA-listed salmonids. It is likely that the numbers of ESA-listed salmonids has declined, and the critical habitat has degraded in the Feather River since the most recent status reviews for CV spring-run Chinook salmon, and CCV steelhead. At this time, it unclear if there were adverse impacts to green sturgeon, due to the high flows. Adult green sturgeon were present in the Feather River in 2017, in good numbers (25-30 in the Feather River at the Fish Barrier Dam).

2.4.1 Mitigation Banks and the Environmental Baseline

There are several conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this BO. Both these banks occur within critical habitat for CV spring-run Chinook salmon and CCV steelhead. These include:

Fremont Landing Conservation Bank: Established in 2006, the Fremont Landing Conservation Bank is 100-acre floodplain site along the Sacramento River (Sacramento River Mile 106) and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead. There are off-channel shaded aquatic habitat credits, riverine shaded aquatic habitat credits and floodplain credits available. To date, there have been 15.6 of 100 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

Bullock Bend Mitigation Bank: Established in 2016, the Bullock Bend Mitigation Bank is a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80) and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV

steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement and salmonid riparian forest credits available. To date, there have been 12.5 of 119.65 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

2.5 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 this emergency levee repair, NMFS examined the potential effects of the proposed actions. We analyzed construction-related impacts and the fish response to habitat modifications. We also reviewed and considered the USACE's proposed conservation measures. This assessment relied heavily on the information from the USACE's biological assessment for this project.

Our assessment will consider the nature, duration, and extent of the proposed actions relative to the spawning, rearing, and migration timing, behavior, and habitat requirements of all life stages of federally listed fish in the action area. Effects of the levee repair on aquatic resources include both short- and long-term impacts. Short-term effects, which are related primarily to construction activities (*i.e.*, increased suspended sediment and turbidity), may last several hours to several weeks. Long-term impacts may last months or years and generally involve physical alteration of the river bank and riparian vegetation adjacent to the water's edge.

Construction activities may increase noise, turbidity, suspended sediment, and sediment deposition that may disrupt feeding or temporarily displace fish from preferred habitat or impair normal behavior. Construction activities will also introduce riprap material into the water column that may injure, harm, or kill listed fish. Some of these effects may occur downstream of the construction activities because noise and sediment may be propagated downstream. Substantial increases in suspended sediment could temporarily bury substrates and submerged aquatic vegetation that supports invertebrates for feeding juvenile fish.

The levee repair will also contribute to the continued confinement of the riverine system that in turn negatively impacts listed fish species and their designated critical habitat. This analysis also evaluates the long-term impacts of the levee repair on fish species and their critical habitat.

The purchase of 0.71 acres of mitigation credit from a NMFS approved bank creates beneficial effects that will restore and protect floodplain and riparian habitat and improve juvenile rearing habitat for all species analyzed in this BO. Although the banks technically do not include green sturgeon credits, we expect that individual Feather River green sturgeon will benefit from the purchase of these credits.

2.5.1 Construction Impact Analysis for Salmonids and Green Sturgeon

NMFS expects that adult and juvenile CCV steelhead, CV juvenile spring-run Chinook salmon, and adult and juvenile green sturgeon are likely to be present in the action area, (although in low numbers because the construction window avoids periods of peak abundance) during construction activities. No spawning habitat for CCV steelhead, spring-run Chinook salmon or green sturgeon is present in the action area, therefore no adverse effects to spawning adults or incubating eggs are expected. Direct effects associated with in-river construction work will involve equipment and activities that will produce pressure waves, and create underwater noise and vibration, thereby temporarily altering in-river conditions. Only those fish that are holding adjacent to or migrating past the levee repair 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) construction-related noise, physical disturbance, and water quality changes, mainly increased turbidity. These may cause injury or harm by increasing the susceptibility of some individuals to predation by temporarily disrupting normal sheltering behaviors. These changes may also impair feeding behaviors, which in turn impact their ability to grow and survive. Fish, especially adults, often respond to construction activities by quickly swimming away from the construction sites, resulting in the majority escaping injury. Any fish that do not relocate during construction may be crushed or injured by construction equipment or personnel.

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 salmonids and green sturgeon. Petroleum products also tend to form oily films on the water surface that can reduce DO available to aquatic organisms. The exposure to these substances can kill fish directly in high enough concentrations through acute toxicity or suffocation from lack of oxygen. These chemicals may also kill the prey of listed fish species, reducing their ability to feed and therefore grow and survive. However, due to adherence to BMPs that dictate the use, containment, and cleanup of contaminants, the use of toxic substances at the construction site is not likely to adversely affect listed fish species.

Turbidity and sedimentation events are not expected to affect visual feeding success of green sturgeon, as they are not believed to utilize visual cues (Sillman *et al.* 2005). Green sturgeon, which can occupy waters containing variable levels of suspended sediment and thus turbidity, are not expected to be impacted by the increases in the turbidity levels anticipated from the proposed project. Although increases in turbidity can disrupt feeding and migratory behavior activities of salmonids, NMFS anticipates adherence to the BMPs described above in the *Proposed Federal Action* section will greatly minimize the risk of injury or death caused by increases in turbidity.

NMFS expects that actual physical damage or harassment may occur to listed fish species, but will be low due to the timing of the construction. Impacts to adults due to construction are expected to be especially minor because their size, preference for deep water, and their crepuscular migratory behavior will enable them to avoid most temporary, nearshore disturbance that occurs during typical daylight construction hours.

2.5.2 Project Effects Estimated Using Loss of Riparian Habitat as an Analytical Surrogate

Complex natural banks are generally characterized by rich habitat diversity with variable water depths and velocities, including shallow, low-velocity areas used by juveniles as refuge from fast currents and predators. SRA cover is the nearshore aquatic area occurring at the interface between a river and adjacent woody riparian habitat. The principal attributes of SRA include natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water, and the water containing variable amounts of woody debris, such as leaves, logs, branches and roots. Instream woody material (IWM) provides important sources of cover and food for juvenile fishes and other aquatic organisms. In addition to cover and shelter for fish, riparian vegetation provides other important stream ecosystem functions, including channel and streambank stability; inputs of food (*e.g.*, terrestrial insects), organic material, and nutrients; and temperature moderation (Murphy and Meehan 1991).

Riparian habitat, especially the SRA component, is important for rearing and out-migrating juvenile salmon because it provides overhead and instream cover from predation and enhances food production. Terrestrial insects and IWM that fall from riparian plants into the river enhance the aquatic food webs and provide high-value feeding areas for juvenile salmonids. Once in the river channel, the stems, trunks, and branches become very important structural habitat components for aquatic life. Many of the aquatic invertebrates that are primary food sources for juvenile salmon and steelhead live on woody debris. In some cases, the reproductive cycles of macroinvertebrates are tied to IWM, as their eggs are laid and develop inside fallen logs and are eventually eaten by fishes.

Riparian shade can be critical in preventing diurnal thermal maxima from reaching dangerous levels, thereby extending the usable season for small streams (Maslin *et al.* 1997). Trees and shrubs growing along river banks providing microclimates of cooler water temperatures during the hot summer months where many fishes will congregate to feed and seek cover. In addition, the roots, branches and other submerged plant materials provide cover for young fishes, as well as nutrients and sources of invertebrates. Riparian trees and shrubs will eventually end up in the river channel as floods erode the bank or sweep them from the floodplain. IWM affects the hydraulics of flows around it, resulting in a more complex channel geomorphology and increasing the storage of spawning gravels.

The levee repair on the Feather River will require the removal of between two and four orchard trees above the OHWM (ordinary high water mark) in order for equipment access to the site. Prior to the placement of riprap, vegetation and roots would be cleared to ground level. The section of the repair with soil-filled riprap (0.10 acres) will be planted in 2018 with willow pole cuttings. However, 0.17 acres of habitat below the OHWM will be covered with riprap that will remain bare and unplanted, representing a permanent loss of riparian habitat. The temporary loss of riparian vegetation in the soil-filled riprap section and the permanent loss of habitat in the bare riprap section will likely reduce food production and feeding rates for juveniles, as well as increase rates of predation. Juveniles may also be negatively impacted by increases in temperature. However, given the size of the repair, only a very small proportion of each of these listed fish populations present in the Feather River are expected to be impacted. Migrating adult Chinook and steelhead residents (outmigrating post spawning adults) will likely not be impacted

because adult salmonids are unlikely to use the nearshore habitat that will be affected by this project, as they prefer deeper water instead.

2.5.3 Project Effects on Critical Habitat

The emergency levee repair is expected to cause a reduction in critical habitat by removing riparian vegetation and installing rock revetment. Revetment will be placed along a total of 82 linear feet of the Feather River. Approximately 0.17 acres of riprap will be placed below the OHWM, permanently creating an area of unproductive, low quality habitat along the interface of the channel bottom and the bank slope. Above the OHWM, the USACE will install 0.10 acres of soil-filled riprap, which will remain unplanted until next year. The effects of this project result in continued fragmentation of existing habitat, and conversion of nearshore aquatic to simplified habitats that have adverse effects on salmonids and green sturgeon.

This project is expected to adversely impact several of the essential features (PBFs) of critical habitat for CV spring-run Chinook salmon, and CCV steelhead, including freshwater rearing habitat and migration corridors for juvenile salmon and steelhead. Implementing the proposed repair may affect freshwater rearing sites due to the trimming and removal of riparian vegetation, which provides natural cover and supports juvenile growth and mobility. Willow pole cuttings will be installed in the section of the repair with soil-filled riprap in 2018. The lag time between the placement of the riprap and the installation of the plantings means that site will remain devoid of vegetation for at least a year. Furthermore, these plantings will take time to become established and grow, and replace the habitat value of vegetation that was lost. Vegetation removal may permanently impact habitat value at the toe of the repair where planting will not occur.

The PBF of migratory corridors for adults is not expected to be impacted, as migrating adult Chinook and steelhead will likely not be impacted because adult salmonids are unlikely to use the nearshore habitat that will be affected by this project, as they prefer deeper water instead. Furthermore, the site will not install any features that expected to block or impede juvenile or adult migration. No spawning habitat for CCV steelhead, spring-run Chinook salmon or green sturgeon is present in the action area, therefore no adverse effects to spawning adults or incubating eggs are expected.

The project is expected to adversely impact several of the essential features (PBFs) of critical habitat for sDPS green sturgeon, including food resources and substrate. The PBF of food resources, which refers to the availability of prey items for juvenile, sub-adult, and adult life stages, is expected be adversely affected by the installation of 82 linear feet of rock revetment at the bank repair site. The installation of rock revetment below ordinary high water will impair green sturgeon foraging habitat, thereby reducing the availability of prey. Similarly, the PBF of substrate type and size will also be adversely affected, as part of the natural river bed will be permanently covered with large rocks and will no longer be available as foraging habitat. The levee repair is not expected to permanently impact the PBFs of water flow or water quality, migration corridors (*i.e.*, pathways necessary for the safe and timely passage of all life stages), or depth (*i.e.*, availability of deep pools for use as holding habitat), since the site will not install any

features that are expected to block or impede juvenile or adult migration, alter any deep pools, or permanently alter water quality.

The action, through the purchase of compensatory mitigation credits, will restore and preserve in perpetuity, 0.71 acres of designated critical habitat for all species analyzed in this BO.

2.6 Cumulative Effects

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

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the Action Area. However, it is difficult if not impossible to distinguish between the Action Area's future environmental conditions caused by global climate change that are properly part of the *Environmental Baseline* vs. *Cumulative Effects*. Therefore, all relevant future climate-related environmental conditions in the Action Area are described in Section 2.2.4.

2.6.1 Agricultural Practices

Agricultural practices in the action area may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow. Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which then flow into the receiving waters of the associated watersheds. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect listed salmonid and sDPS green sturgeon reproductive success and survival rates (Dubrovsky 1998, Daughton 2002).

2.6.2 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 Feather River. All of these facilities are currently operated to mitigate for natural habits that have already been permanently lost as a result of dam construction. The loss of this available habitat 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 between hatchery and wild fish, 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 (NPCC 2003).

2.6.3 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. 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.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially will degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially suspending contaminated sediments and degrading areas of submerged vegetation. This in turn will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.4 Rock Revetment and Levee Repair Projects

Cumulative effects include non-Federal riprap projects. Depending on the scope of the action, some non-Federal riprap projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of riprap occur within the Feather River watershed. For example, most of the levees have roads on top of the levees which are either maintained by the county, reclamation district, owner, or by the state. Landowners may utilize roads at the top of the levees to access part of their agricultural land. The effects of such actions result in continued fragmentation of existing high-quality habitat, and conversion of complex nearshore aquatic to simplified habitats that affect salmonids in ways similar to the adverse effects associated with this project.

2.7 Integration and Synthesis

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

2.7.1 Status of the CV Spring-Run Chinook Salmon ESU

In the 2016 status review, NMFS found, with a few exceptions, CV spring-run Chinook salmon populations have increased through 2014 returns since the last status review (2010/2011), which moved the Mill and Deer creek populations from the high extinction risk category, to moderate, and Butte Creek remaining in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations continued to show stable or increasing numbers in that period, putting them at moderate risk of extinction based on abundance. Overall, the Southwest Fisheries Science Center concluded in their viability report that the status of CV spring-run Chinook salmon (through 2014) had probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased. However, the 2015 returning fish were extremely low (1,488), with additional pre-spawn mortality reaching record lows. Since the effects of the 2012 to 2015 drought have not been fully realized, NMFS anticipates at least several more years of very low returns, which may result in severe rates of decline (NMFS 2016b).

2.7.2 Status of the CCV Steelhead DPS

The 2016 status review (NMFS 2016a) 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 was in danger 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 1950's and 60's. Restoration 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.

2.7.3 Status of the Green Sturgeon Southern DPS

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate because, although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2010).

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley *et al.* (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (NMFS 2010).

There is a strong need for additional information about sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their micro- and macro-habitat ecology.

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

Salmon, steelhead and green sturgeon use the action area as an upstream and downstream migration corridor and for rearing. Within the action area, the essential features of freshwater rearing and migration habitats for salmon, steelhead and green sturgeon have been transformed from a meandering waterway lined with a dense riparian vegetation, to a highly leveed system under varying degrees of constraint of riverine erosional processes and flooding. Levees have been constructed near the edge of the river and most floodplains have been completely separated and isolated from the river. Severe long-term riparian vegetation losses have occurred in the Feather River, and there are large open gaps without the presence of riparian vegetation due to the high amount of riprap. The change in the ecosystem as a result of halting the lateral migration of the river channel, the loss of floodplains, the removal of riparian vegetation and IWM have likely affected the functional ecological processes that are essential for growth and survival of salmon, steelhead and green sturgeon in the action area.

The *Cumulative Effects* section of this BO describe how continuing or future effects such as the discharge of point and non-point source chemical contaminant discharges, aquaculture and hatcheries and increased urbanization 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.

2.7.5 Summary of Project Effects on CV Spring-run Chinook salmon, CCV steelhead and sDPS Green Sturgeon Individuals

1. Construction-related Effects

During construction, some injury or death to individual fish is likely to result from rock placement (crushing), or predation related to displacement of individuals away from the shoreline or at the margins or turbidity plumes. These construction type actions will occur during summer and early fall months, when the abundance of individual salmon, steelhead, and green sturgeon is low and should result in correspondingly low levels of injury or death.

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

For juvenile and outmigrating salmon and steelhead, the proposed action will result in some short-term and long-term adverse effects to individual salmon and steelhead that are exposed to the project features along the Feather River. Riparian vegetation is expect to be removed and replaced in the areas of the repair with soil-filled riprap, and not replaced at the toe of the repair, which will remain bare rock. This temporary loss of vegetation in some areas and permanent loss in others is expected to decrease food availability, reduce cover and increase temperatures in the action area, resulting in reduced growth and survival.

Migrating adult Chinook and steelhead residents (outmigrating post spawning adults) will likely not be impacted because adult salmonids are unlikely to use the nearshore habitat that will be affected by this project, as they prefer deeper water instead. Furthermore, the project is not anticipated to cause an increase in predation on adults or install any structural features that might impede adult migration.

For fry and juvenile rearing sDPS green sturgeon, shoreline habitat conditions are negatively impacted compared to the environmental baseline. The worsened conditions begins immediately after construction, but will gradually partially recover as the plantings on the waterside slope mature and soil accumulates on top of the riprap. The project will permanently cover some benthic substrate that provides food resources of juvenile and adult green sturgeon, although this area covered represents a very small fraction of the adjacent habitat available in the Feather River. The loss of benthic substrate is expected to reduce food availability to juvenile and adult green sturgeon, resulting in decreased growth and survival.

2.7.6 Summary of Project Effects on CV Spring-run Chinook salmon, CCV steelhead and sDPS Green Sturgeon Critical Habitat

Within the action area, the relevant PBFs of the designated critical habitat for listed salmonids are migratory corridors and rearing habitat, and for green sturgeon the six PBFs include food resources, substrate type/size, flow, water quality, migration corridor free of passage impediments, depth (holding pools), and sediment quality.

The PBFs of freshwater rearing habitat and migration corridors for juvenile salmon and steelhead is expected to be affected by the temporary removal of vegetation on the upper bank and the

permanent installation of bare riprap at the toe of the repair. These activities are expected to reduce the quality of this habitat for rearing and migrating juvenile salmonids. The PBF of migratory corridors for adults is not expected to be impacted, as migrating adult Chinook and steelhead are unlikely to use the nearshore habitat that will be affected by this project, as they prefer deeper water instead. Furthermore, the site will not install any features that expected to block or impede juvenile or adult migration.

Green sturgeon PBFs of substrate type/size and food resources are expected to both be adversely affected by the proposed project, as project features will cover the soft benthic substrate where green sturgeon forage for food with riprap, reducing food availability. However, the amount of benthic substrate lost is small compared to the amount of available habitat in the Feather River. Some of the riprap will be mixed with soil and planted with riparian vegetation, which is expected to lessen the impacts of the project in the long-term.

As mitigation for these some of these impacts, the USACE plans to purchase credits from a NMFS-approved conservation bank at a 3:1 ratio for habitat impacted below the OHWM and 2:1 for habitat above the OHWM, for a total 0.71 acres purchased. Although the two conservation banks within the service area are located downstream of the proposed project, they benefit the same juvenile CV spring-run and CCV steelhead that use the construction portion of the action area by providing suitable rearing habitat. Both the Fremont Landing Conservation Bank and Bullock Bend Mitigation Bank have adequate mechanisms in place to track credits and debits and ensure that more debits are not sold then credits that are available, and overall habitat improvement for CCV steelhead and CV spring-run Chinook is expected. A description of these tracking mechanisms can be found in the respective banking instruments for Bullock Bend (Westervelt Ecological Services 2016) and Fremont Landing (Wildlands Inc. 2006)

2.7.7 Summary

Although there are some short-term and permanent impacts from the proposed project, when added to the environmental baseline and cumulative effects, the impacts from the proposed project in the action area are small, and in some cases occur during seasons when fish abundance is low. To mitigate the effects of the project, the USACE plans to install riparian plantings on the waterside levee slope and purchase mitigation credits off-site at a 3:1 ratio below the OHWM and 2:1 above the OHWM. This is a substantially greater amount of restoration and preservation than the spatial footprint of the levee repair. In addition, the compensatory mitigation serves as a form of advanced mitigation because the habitat at the bank was restored between one year (Bullock Bend Mitigation Bank) and eleven years (Fremont Landing Conservation Bank) before the impact of the levee repair.

The Feather River spring-run Chinook and steelhead populations are both considered to be “Core 2” populations and are both in the Northern Sierra Diversity Groups of these species. Core 2 populations have a lower potential to support viable populations than Core 1 populations, but they still provide increased life history diversity to the ESU/DPS and are likely to provide a buffering effect against local catastrophic occurrences that can affect Core 1 populations. The proposed levee repair is likely to adversely impact individuals in these Core 2 populations, but the size of the project is very small relative to the amount of habitat available to these

populations. Therefore, the project is not expected to reduce appreciably the likelihood of either the survival and recovery of a listed species in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated or proposed critical habitat for the conservation of the species.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the Action Area, the effects of the Proposed Action, 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 of CCV steelhead, CV spring-run Chinook salmon, or the sDPS of the North American green sturgeon or destroy or adversely modify designated critical habitat of these species.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "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).

2.9.1 Amount or Extent of Take

NMFS anticipates incidental take of CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon in the action area through the implementation of the Proposed Action. Because of proposed project timing, actual numbers of fish adversely affected, are expected to be low. NMFS cannot, using the best available information, precisely quantify and track the amount or number of individuals that are expected to be incidentally taken (injure, harm, kill, etc.) per species as a result of the proposed action due to the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of spawning and migration, individual habitat use within the action area, and difficulty in observing injured or dead fish. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the project that are expected to result in incidental take, that are more predictable and/or measurable, with the ability to monitor those surrogates to determine the extent of take that is occurring.

The most appropriate threshold for incidental take, is an ecological surrogate of habitat disturbance, which includes the loss of SRA (shaded riverine aquatic) cover and riparian habitat through the placement of rock revetment. 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.

The behavioral modifications or fish responses that result from the habitat disturbance are described below. NMFS anticipates annual take will be limited to the following forms:

1. Harm to rearing juvenile CV spring-run Chinook salmon, and CCV steelhead, and adult and juvenile sDPS green sturgeon from the removal of 0.27 acres of SRA cover, which will be replaced with 0.10 acres of soil-filled rock revetment and 0.17 acres of bare rock revetment. This loss will affect juvenile CV spring-run Chinook, CCV steelhead, and juvenile and adult sDPS green sturgeon through displacement, increased predation, and loss of food, resulting in decreased growth and survival.
2. Harm to rearing juvenile spring-run CV Chinook salmon, CCV steelhead, and sDPS green sturgeon from construction activities, resulting in increased turbidity in the footprint of the proposed project, extending downstream 400 feet from the end of the site and 100 feet from the bank, for a total of 48,200 square feet. This disturbed habitat will affect the behavior of fish, including displacement which is reasonably certain to result in fish migration delay, leading to increased predation, decreased feeding, and increased competition.

Incidental take will be exceeded if the amount of habitat disturbance described in the surrogate is exceeded.

2.9.2 Effect of the Take

In the BO, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon or destruction or adverse modification of their critical habitat.

2.9.3 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).

1. Measures shall be taken to minimize the impacts of bank protection by implementing integrated onsite and off-site conservation measures that provide beneficial growth and survival conditions for juvenile salmonids and the sDPS of North American green sturgeon.
2. Measures shall be taken to ensure that contractors, construction workers, and all other parties involved with this project implement the project as proposed in the biological assessment and this BO.
3. Measures shall be taken to minimize the amount and duration of placement of rock revetment below ordinary high water (OHW).

4. Measures shall be taken to monitor incidental take of listed fish and the survival of on-site plantings.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USACE or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The USACE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this 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:

    a. The USACE shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable, and where appropriate, removed IWM will be anchored back into place. The trunks of trees left in place shall be protected from construction damage by wrapping them with coir fiber, jute fabric, 2X4s or other mechanisms that prevent trunk damage.
    b. In the section of the repair with soil-filled riprap, the USACE shall install native vegetation such as willows, trees, and/or shrubs no later than the 2018 construction season. The USACE shall replace any removed trees (both above and below the OHWM) at a 3:1 ratio. The vegetation plan will include proposed irrigation and vegetation monitoring schedules if necessary in order to ensure the survival of the plantings.
    c. The USACE shall only purchase salmon and steelhead credits from a conservation bank that is NMFS-approved. Credits shall be purchased prior to completing the repair.

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

    a. The USACE shall provide a copy of this BO 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 the BO. A notification that contractors have been supplied with this information will be provided to the reporting address below.
    b. A NMFS-approved Worker Environmental Awareness Training Program for construction personnel shall be conducted by the NMFS-approved biologist for all construction workers prior to the commencement of construction activities. The program shall provide workers with information on their responsibilities with regard to Federally-listed fish, their critical habitat, an overview of the life-history of all the species, information on take prohibitions, protections afforded these animals under the ESA, and an explanation of the relevant terms and conditions of this BO. Written documentation of the training must be submitted to NMFS within 30 days of the completion of training.

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

    a. Construction involving the placement of rock revetment below the OHW will occur in accordance with BMPs and conservation measures described in this BO.
    b. Updates and reports required by these terms and conditions shall be submitted to the address provided below.

4. The following terms and conditions implement reasonable and prudent measure 4:
    a. The USACE shall submit a riparian planting and monitoring plan for on-site plantings to NMFS no later than April 30, 2017. These plantings will be maintained for a minimum of five years, at which point they should achieve a minimum of 80% survivability. Remediation shall occur if the plantings do not meet the survivability requirements at the end of the five year period.
    b. The USACE shall submit a report to NMFS of any incidental take that occurs as part of the project. This report shall be submitted not later than December 31st 2017. All reports for NMFS shall be sent to:

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

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a Proposed Action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

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

2. The USACE should support and promote aquatic and riparian habitat restoration within the Feather River and other watersheds, especially those with listed aquatic species. Practices that avoid or minimize adverse effects to listed species should be encouraged.

3. The USACE 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.

4. The USACE should make set-back levees integral components of their authorized bank protection or ecosystem restoration efforts.

5. The USACE should conduct or fund studies to identify set-back levee opportunities, at locations where the existing levees are in need of repair or not, where set-back levees could be built now. Removal of the existing riprap from the abandoned levee should be investigated in restored sites and anywhere removal does not compromise flood safety.

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.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Feather River PL 84-99 Emergency Levee Repair.

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 ITS 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 BO, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this BO, 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 RESPONSE

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 USACE and descriptions of EFH for Pacific Coast Salmon (PFMC 2014) contained in the Fishery Management Plan (FMP) 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 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. 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

Consistent with the ESA portion of this document which determined that aspects of the proposed action will result in impacts to pacific coast salmon and critical habitat, we conclude that aspects of the proposed action would also adversely affect EFH for these species. Adverse effects to ESA-listed critical habitat and EFH HAPCs are appreciably similar, therefore no additional discussion is included. Listed below are the adverse effects on EFH reasonably certain to occur. Affected HAPCs are indicated by number, corresponding to the list in Section 3.1:

1. Sedimentation and Turbidity

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

2. Contaminants and Pollution-related Effects

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

3. Installation of Revetment

- Permanent loss of natural substrate at levee toe (1)
- Reduced habitat complexity (1)
- Increased bank substrate size (1)
- Increased predator habitat (1)

4. Removal of Riparian Vegetation

- Reduced shade (2)
- Reduced cover (1)
- Reduced supply of terrestrial food resources (1)
- Reduced supply of IWM (1)

3.3 Essential Fish Habitat Conservation Recommendations

The following four conservation recommendations are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH:

1. For effect 1 listed above (HAPC #1,#2), NMFS recommends that USACE adopt term and conditions (T&Cs) 2a and 3a above to minimize effects on juvenile rearing.
2. For effect 2 listed above (HAPC #1,#2), NMFS recommends that USACE adopt T&Cs 2a and 3a above to minimize effects on juvenile rearing.
3. For effect 3 listed above (HAPC #1), NMFS recommends that USACE adopt T&Cs 1b and 3a above to minimize effects on juvenile rearing.
4. For effect 4 listed above (HAPC #1,#2), NMFS recommends that USACE adopt T&Cs 1a and 1b above to minimize effects on juvenile rearing.

Fully implementing the above listed EFH conservation recommendations would avoid and minimize the adverse effects to designated EFH for Pacific Coast Salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, USACE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The USACE 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. 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 BO addresses these

DQA components, documents compliance with the DQA, and certifies that this BO has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this BO is the USACE. Other interested users could include the United States Fish and Wildlife Service, the California Department of Fish and Wildlife, and the California Department of Water Resources. Individual copies of this BO were provided to the USACE. This BO will be posted on the Public Consultation Tracking System website (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the *References* section. The analyses in this BO 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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