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-2017-7955

April 16, 2018

Ryan T. Larson, P.E.
Chief, Flood Protection and Navigation Section
Sacramento District
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response and Fish and Wildlife Coordination Act Recommendations for the City of Sacramento's Stormwater Discharge System Project, in Sacramento on the bank of the Sacramento River

Dear Mr. Larson:

Thank you for your letter of January 18, 2017, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for City of Sacramento Stormwater Discharge System Project.

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 (MSA)(16 U.S.C. 1855(b)) for this action.

This biological opinion (opinion) is based on the biological assessment (ES Associates 2016) received by NMFS on January 25, 2017, and subsequent information received in May 2017. Based on the best available scientific and commercial information, the opinion concludes that the project is not likely to jeopardize the continued existence of the federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley (CV) spring-run Chinook salmon (*O. tshawytscha*), threatened California Central Valley (CCV) steelhead (*O. mykiss*), and threatened southern distinct population segment of North American green sturgeon (*Acipenser medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. NMFS has also included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project. The U.S. Army Corps of Engineers (Corps) serves as the lead Federal Action Agency for the proposed action.

This letter also transmits NMFS's review of potential effects of the proposed action on EFH for Pacific Coast Salmon, designated under the MSA, including conservation recommendations. This review was conducted pursuant to section 305(b) of the MSA, implementing regulations at

50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. The document concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the Action Area and has included recommendations.

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

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 Gary Sprague, in NMFS' California Central Valley Office, at (916) 930-3615, or via email at Gary.Sprague@NOAA.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

for Barry A. Thom
Regional Administrator

Enclosure

cc: To the file: 151422-WCR2017-SA00305
Brian Luke Corps Brian.J.Luke@usace.army.mil
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bcc. S. Brick, NOAA GC

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

City of Sacramento Stormwater Discharge System Project

National Marine Fisheries Service (NMFS) Consultation Number: WCR-2017-7955

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*)	Endangered	Yes	No	Yes	No
Central Valley spring-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
California Central Valley steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies 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: for Maria Rea

Barry A. Thom
Regional Administrator

Date: April 16, 2018

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1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion 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.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (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 NMFS' Central Valley Office.

1.2 Consultation History

On January 25, 2017, NMFS received the United States Army Corps of Engineers (Corps) letter of request for section 7 consultation and an accompanying biological assessment (BA).

May 15, 2017, NMFS received a phone call from Chris Fitzer (ES Associates) inquiring about the status of the consultation.

May 17, 2017, NMFS contacted Chris Fitzer.

On May 17, 2017, NMFS received clarifications and additional information from Chris Fitzer, via email.

NMFS initiated consultation for the proposed action on May 18, 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, 50 CFR 600.910). Or as defined for EFH, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The City of Sacramento is requesting authorization from the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act for the discharge of dredged or fill material associated with a construction project. The proposed action includes authorizing a new stormwater discharge as part of the Sacramento Railyards Specific Plan. The proposed action will include a riprap and concrete outfall structure on the riverbank, with seven 36-inch diameter and one 12-inch diameter pipes running up and over the east levee. The proposed action will also include a valve box, and steps on the waterside levee slope. The in-water construction activities will occur between August 1 and October 31. The project includes installation of a sheet pile cofferdam, to isolate the work area from the Sacramento River.

Conservations measures for the proposed action include:

- Development and implementation of a Storm Water Pollution Prevention Plan,
- Development and implementation of an Erosion Control Plan,
- Development and implementation of a Hazardous Materials Management Plan,
- Worker awareness training regarding sensitive fish and aquatic resources,
- In water construction limited to the period between August 1 and October 31,
- In water work will require a biologist or resource specialist on site,
- Protection and restoration measures for riparian vegetation, based on the Federal Interagency Restoration Working Group's Stream Corridor Restoration Handbook,
- Restoration of riparian vegetation, including the use of a 70:30 soil rock mixture,
- Use of a vibratory hammer to place the sheet pile cofferdam,
- Installation of sheet piles only during daylight hours,
- Directing fish out of the cofferdam will a seine net,
- Removal of fish from within the cofferdam, with seining, electrofishing, and dip nets,
- NMFS and the California Department of Fish and Wildlife (CDFW) will be notified at least 48 hours prior to fish removal,
- Riparian forest and scrub vegetation removal will be avoid and minimized where possible,
- To offset the permanent loss of 0.011 acres of shaded riverine aquatic habitat, mitigation bank credits will be purchased at a 3:1 ratio,
- To offset the permanent loss of 0.04 acres of riverine habitat, mitigation bank credits will be purchased at a 3:1 ratio, and
- Mitigation bank credits will be purchased at a mitigation bank approved by NMFS, U.S. Fish and Wildlife Service (USFWS), and CDFW with an applicable service area.

Operation measures to protect water quality will include:

- Meeting state water quality standards
- Measures to reduce sediment and pollutants in stormwater
- Water quality basins

- Street sweeping
- Soil protection and slope stabilization
- Fossil filters in drain inlets
- Ground infiltration areas

In addition, landward of the levee the proposed action includes a retaining wall, and a pump station with a wet well. The location of the proposed action is in the City of Sacramento, Sacramento County, at approximately Latitude 38.58915 N, Longitude -121.50497 W. The purpose of the project is to manage storm water for the Sacramento Railyards.

Under the FWCA, an action occurs whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license" (16 USC 662(a)).

"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). Operation of the stormwater outfall (i.e. discharges from it) would not occur 'but for' the proposed construction of the outfall. Thus, stormwater discharges are considered interrelated and interdependent. No other interrelated or interdependent actions have been identified associated with the proposed action. In particular, the development of the Sacramento Railyards is not interrelated or interdependent with the stormwater outfall. We understand that the development could proceed without the proposed action based on alternatives methods to address stormwater. In addition, due to the already disturbed nature of the existing railyards (located in upland areas), there are no anticipated impacts to NMFS listed species or designated critical habitat from further development of the railyards.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides a biological 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 opinion 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 opinion 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 opinion, 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:

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the Action Area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the Action Area.
- 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.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a RPA to the proposed action.

Conservation Banking in the Context of the ESA Environmental Baseline

Conservation banks present a unique factual situation, and this warrants a particular approach to how they are addressed. Specifically, 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 reading of "environmental baseline," might suggest that the overall ecological benefits of the conservation bank actions therefore belong in the environmental baseline. However, under this reading, all proposed actions, whether or not they included proposed credit purchases, would benefit from the environmental 'lift' of the entire conservation bank because it would be factored into the environmental baseline. In addition, where proposed actions did include credit purchases, it would not be possible to attribute their benefits to the proposed action, without double-counting. These consequences undermine the purposes of conservation banks and also do not reflect their unique circumstances. Specifically, conservation banks are established based on the expectation of future credit purchases. In addition, credit purchases as part of a proposed action will also be the subject of a future section 7 consultation.

It is therefore appropriate to treat the beneficial effects of the bank as accruing incrementally at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. Thus, for all projects within the service area of a conservation bank, only the benefits attributable to credits sold are relevant to the environmental baseline. Where a proposed action includes credit purchases, the benefits attributable *to those credit purchases* are considered effects of the action.

That approach is taken in this opinion.

2.2 Rangewide Status of the Species and Critical Habitat

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

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the 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.

The following Federally listed species evolutionarily significant units (ESU), distinct population segment (DPS) and designated critical habitat occur in the Action Area and have the potential to be affected by the action (Table 1):

Table 1. ESA Listing History.

Species	ESU or DPS	Original Final FR Listing	Current Final Listing Status	Critical Habitat Designated
Chinook salmon (*Oncorhynchus tshawytscha*)	Sacramento River winter-run Chinook salmon ESU	1/4/1994 59 FR 440 Endangered	6/28/2005 70 FR 37160 Endangered	6/16/1993 58 FR 33212
Chinook salmon (*O. tshawytscha*)	Central Valley spring-run ESU	9/16/1999 64 FR 50394 Threatened	6/28/2005 70 FR 37160 Threatened	9/2/2005 70 FR 52488
Steelhead (*O. mykiss*)	California Central Valley DPS	3/19/1998 63 FR 13347 Threatened	1/5/2006 71 FR 834 Threatened	9/2/2005 70 FR 52488
Green sturgeon (*Acipenser medirostris*)	Southern DPS	4/7/2006 71 FR 17757 Threatened	4/7/2006 71 FR 17757 Threatened	10/9/2009 74 FR 52300

2.2.1 Sacramento River Winter-run Chinook salmon

- First listed as threatened (54 FR 32085; August 4, 1989), reclassified as endangered (59 FR 440; January 4, 1994)
- Reaffirmed as endangered (70 FR 37160; June 28, 2005)
- Designated critical habitat (58 FR 33212; June 16, 1993)

The federally listed evolutionarily significant unit (ESU) of Sacramento River winter-run Chinook salmon (*O. tshawytscha*) and designated critical habitat occurs in the Action Area and may be affected by the proposed action.

The federally listed evolutionary significant unit (ESU) of Sacramento River winter-run Chinook salmon and designated critical habitat for this ESU occur in the Action Area and may be affected by the proposed action. 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 Appendix B: Rangewide Status of the Species and Critical Habitat.

Historically, Sacramento River winter-run Chinook salmon population estimates were as high as 120,000 fish in the 1960s, but declined to less than 200 fish by the 1990s (NMFS 2011b). In recent years, since carcass surveys began in 2001, the highest adult escapement occurred in 2005 and 2006 with 15,839 and 17,296, respectively (CDFG 2016). However, from 2007 to 2013, the

population has shown a precipitous decline, averaging 2,486 during this period, with a low of 827 adults in 2011 (CDFG 2016). This recent declining trend is likely due to a combination of factors such as poor ocean productivity (Lindley et al. 2009), drought conditions from 2007 to 2009, and low in-river survival rates (NMFS 2011b). In 2014 and 2015, the population was approximately 3,000 adults, slightly above the 2007 to 2012 average, but below the high (17,296) for the last 10 years (CDFW 2016).

The year 2014 was the third year of a drought that increased water temperatures in the upper Sacramento River, and egg-to-fry survival to the Red Bluff Diversion Dam (RBDD) was approximately 5 percent (NMFS 2016c). Due to the anticipated lower than average survival in 2014, hatchery production from Livingston Stone National Fish Hatchery (LSNFH) was tripled (i.e., 612,056 released) to offset the impact of the drought. In 2014, hatchery production represented 83 percent of the total in-river juvenile production. In 2015, egg-to-fry survival was the lowest on record (approximately 4 percent) due to the inability to release cold water from Shasta Dam in the fourth year of a drought. As expected, Sacramento River winter-run Chinook salmon returns in 2016 were a low, as they show the impact of 1,546 (CDFW 2017), due to drought impacts on juveniles from brood year 2013 (NMFS 2016c).

Although impacts from hatchery fish (i.e., reduced fitness, weaker genetics, smaller size, less ability to avoid predators) are often cited as having deleterious impacts on natural in-river populations (Matala et al. 2012), the Sacramento River winter-run Chinook salmon conservation program at LSNFH is strictly controlled by the USFWS to reduce such impacts. The average annual hatchery production at LSNFH is approximately 176,348 per year (2001 to 2010 average) compared to the estimated natural production that passes RBDD, which is 4.7 million per year based on the 2002 to 2010 average (Poytress and Carrillo 2011). Therefore, hatchery production typically represents approximately 3 to 4 percent of the total in-river juvenile Sacramento River winter-run production in any given year. However, the average over the last 12 years (about four generations) is 13 percent, with the most recent generation at 20 percent hatchery influence, making the population at a moderate risk of extinction.

The distribution of Sacramento River winter-run spawning and initial rearing historically was limited to the upper Sacramento River (upstream of Shasta Dam), McCloud River, Pitt River, and Battle Creek, where springs provided cold water throughout the summer, allowing for spawning, egg incubation, and rearing during the mid-summer period (Yoshiyama et al. 1998). The construction of Shasta Dam in 1943 blocked access to all of these waters except Battle Creek, which currently has its own impediments to upstream migration (i.e., a number of small hydroelectric dams situated upstream of the Coleman National Fish Hatchery (CNFH) weir). The Battle Creek Salmon and Steelhead Restoration Project (BCSSRP) is currently removing these impediments, restoring spawning and rearing habitat suitable for Sacramento River winter-run Chinook salmon in Battle Creek, which will be reintroduced to establish an additional population. Approximately 299 miles of former tributary spawning habitat above Shasta Dam are inaccessible to Sacramento River winter-run Chinook salmon. Yoshiyama et al. (2001) estimated that in 1938, the upper Sacramento River had a “potential spawning capacity” of approximately 14,000 redds equal to 28,000 spawners. Since 2001, the majority of Sacramento River winter-run Chinook salmon redds have occurred in the first 10 miles downstream of Keswick Dam. Most components of the Sacramento River winter-run Chinook salmon life history (e.g., spawning, incubation, freshwater rearing) have been compromised by the construction of Shasta Dam.

The greatest risk factor for Sacramento River winter-run Chinook salmon lies within its spatial structure (NMFS 2011b). The Sacramento River winter-run Chinook salmon ESU is comprised of only one population that spawns below Keswick Dam. The remnant and remaining population cannot access 95 percent of their historical spawning habitat and must therefore be artificially maintained in the upper Sacramento River by spawning gravel augmentation, hatchery supplementation, and regulation of the finite cold water pool behind Shasta Dam to reduce water temperatures.

Sacramento River winter-run Chinook salmon require cold water temperatures in the summer that simulate their upper basin habitat, and they are more likely to be exposed to the impacts of drought in a lower basin environment. Battle Creek is currently the most feasible opportunity for the ESU to expand its spatial structure, but restoration is not scheduled to be completed until 2020. The Central Valley Salmon and Steelhead Recovery Plan (Recovery Plan) includes criteria for recovering the winter-run Chinook salmon ESU, including re-establishing a population into historical habitats in Battle Creek as well as upstream of Shasta Dam (NMFS 2014).

Sacramento River winter-run Chinook salmon embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, which makes the species particularly at risk from climate warming. The only remaining population of Sacramento River winter-run Chinook salmon relies on the cold water pool in Shasta Reservoir, which buffers the effects of warm temperatures in most years. The exception occurs during drought years, which are predicted to occur more often with climate change (Yates et al. 2008). The long-term projection of how the CVP and SWP will operate incorporates the effects of climate change in three possible forms: less total precipitation; a shift to more precipitation in the form of rain rather than snow; or, earlier spring snow melt (Reclamation 2008). Additionally, air temperature appears to be increasing at a greater rate than what was previously analyzed (Lindley 2008, Beechie et al. 2012, and Dimacali 2013). These factors will compromise the quantity and/or quality of Sacramento River winter-run Chinook salmon habitat available downstream of Keswick Dam. It is imperative for additional populations of Sacramento River winter-run Chinook salmon to be re-established into historical habitat in Battle Creek and above Shasta Dam for long-term viability of the ESU (NMFS 2014).

Summary of the Sacramento River Winter-run Chinook Salmon Evolutionarily Significant Unit Viability

There are several criteria that would qualify the Sacramento River winter-run Chinook salmon population at moderate risk of extinction (continued low abundance, a negative growth rate over two complete generations, significant rate of decline since 2006, increased hatchery influence on the population, and increased risk of catastrophe), and because there is still only one population that spawns below Keswick Dam, the Sacramento River winter-run Chinook salmon ESU is at a high risk of extinction in the long term. The extinction risk for the Sacramento River winter-run Chinook salmon ESU has increased from moderate risk to high risk of extinction since 2005, and several listing factors have contributed to the recent decline, including drought, poor ocean conditions, and hatchery influence (NMFS 2016c). Thus, large-scale fish passage and habitat

restoration actions are necessary for improving the Sacramento River winter-run Chinook salmon ESU viability (NMFS 2016c).

Critical Habitat and Physical or Biological Features for Sacramento River Winter-run Chinook Salmon

The critical habitat designation for Sacramento River winter-run Chinook salmon lists the PBFs (58 FR 33212, 33216-33217; June 16, 1993), which are described in Appendix B. This designation includes the following waterways, bottom and water of the waterways, and adjacent riparian zones: the Sacramento River from Keswick Dam (river mile (RM) 302) to Chipps Island (RM 0) at the westward margin of the Delta; all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge (58 FR 33212; June 16, 1993). NMFS clarified that "adjacent riparian zones" are limited to only those areas above a stream bank that provide cover and shade to the nearshore aquatic areas (58 FR 33212, 33214; June 16, 1993). Although the bypasses (e.g., Yolo, Sutter, and Colusa) are not currently designated critical habitat for Sacramento River winter-run Chinook salmon, NMFS recognizes that they may be utilized when inundated with Sacramento River flood flows and are important rearing habitats for juvenile Sacramento River winter-run Chinook salmon. Also, juvenile Sacramento River winter-run Chinook salmon may use tributaries of the Sacramento River for non-natal rearing (Maslin et al. 1997, Pacific States Marine Fisheries Commission 2014).

Summary of Sacramento River Winter-run Chinook Salmon Critical Habitat

Currently, many of the PBFs of Sacramento River winter-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 diversions, altered flows in the Delta, and the lack of floodplain habitat. In addition, water operations that limit the extent of cold water below Shasta Dam have reduced the available spawning habitat (based on water temperature). Although the current conditions of Sacramento River winter-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 Central Valley Spring-run Chinook salmon

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

The Federally listed ESU of Central Valley (CV) spring-run Chinook salmon and designated critical habitat for this ESU occurs in the Action Area and may be affected by the proposed action. Detailed information regarding ESU listing and critical habitat designation history, designated critical habitat, ESU life history, and VSP (viable salmonid population) 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.

Historically, 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 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 spring-run Chinook salmon, suggested to be one of the largest runs of any Chinook salmon on the West Coast with estimates averaging 200,000-500,000 adults returning annually (CDFG 1990).

Monitoring of the Sacramento River mainstem during spring-run Chinook salmon spawning timing indicates some spawning occurs in the river (CDFW, unpublished data, 2014). Genetic introgression has likely occurred here due to lack of physical separation between spring-run and fall-run Chinook salmon populations (CDFG 1998). Sacramento River tributary populations in Mill, Deer, and Butte creeks are likely the best trend indicators for the CV spring-run Chinook salmon ESU. Generally, these streams have shown a positive escapement trend since 1991, displaying broad fluctuations in adult abundance (CDFW 2016). The Feather River Fish Hatchery (FRFH) 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 (June 28, 2005, 70 FR 37160).

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, or diversity groups (Lindley *et al.* 2004). Of these populations, only three independent populations currently exist (Mill, Deer, and Butte creeks tributary to the upper Sacramento River) and they represent only the northern Sierra Nevada diversity group. Additionally, smaller populations are currently persisting in Antelope and Big Chico creeks, and the Feather and Yuba rivers in the northern Sierra Nevada diversity group (CDFG 1998). In the San Joaquin River basin, observations in the last decade suggest that spring-running populations may currently occur in the Stanislaus and Tuolumne rivers (Franks 2013).

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 *et al.* 2008, Cavallo *et al.* 2011).

Because the populations in Butte, Deer and Mill creeks are the best trend indicators for ESU viability, we can evaluate risk of extinction based 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 recommended that the species status be reassessed in two to three years as opposed to waiting another five years, if the decreasing trend continued. In 2012 and 2013, most tributary populations increased in returning adults, averaging over 13,000. However, 2014 returns were lower again, just over 5,000 fish, indicating the ESU remains highly fluctuating. The most recent status review was conducted in 2015 (NMFS 2016b), which looked at promising increasing populations in 2012-2014; however, the 2015 returning fish were extremely low (1,488), with additional pre-spawn mortality reaching record lows. Since the effects of the 2012-2015 drought have not been fully realized, we anticipate at least several more years of very low returns, which may result in severe rates of decline (NMFS 2016b).

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).

Summary of the Central Valley spring-run Chinook salmon ESU viability

In summary, the recent 5-year Status Review described the extinction risk for the CV spring-run Chinook salmon ESU as remaining at moderate risk of extinction (NMFS 2016b). 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, 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).

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 (June 28, 2005, 70 FR 37160), which are described 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. 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 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 (June 28, 2005, 70 FR 37160).

Summary of the Value of CV Spring-run Chinook salmon Critical Habitat for the Conservation of the Species

Currently, many of the PBFs of CV spring-run Chinook salmon critical habitat are degraded, and provide limited high quality habitat. Features 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.

2.2.3 California Central Valley Steelhead

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

The Federally listed distinct population segment (DPS) of California Central Valley (CCV) steelhead and designated critical habitat for this DPS occurs in the Action Area and may be affected by the proposed action. Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, DPS life history, and VSP parameters can be found in the 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.

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 is limited to returns to hatcheries and redd surveys conducted on a few rivers. The hatchery data is 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 Coleman National Fish Hatchery (NFH) have increased over the last four years, 2011 to 2014. After hitting a low of only 790 fish in 2010, the last two years, 2013 and 2014, have averaged 2,895 fish. Wild adults counted at the hatchery each year represent a small fraction of overall returns, but their numbers have remained relatively steady, typically 200–300 fish each year. Numbers of wild adults returning each year have ranged from 252 to 610 from 2010 to 2014.

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 Feather River Hatchery experienced a sharp decrease from 2003 to 2010, with only 679, 312, and 86 fish returning in 2008, 2009 and 2010, respectively. In recent years, however, returns have experienced an increase with 830, 1797, and 1505 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.

An estimated 100,000 to 300,000 naturally produced juvenile CCV steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (Good *et al.* 2005). Nobriga and Cadrett (2001) used the ratio of adipose fin-clipped (hatchery) to unclipped (wild) CCV steelhead smolt catch ratios in the USFWS Chipps Island trawl from 1998 through 2000 to estimate that about 400,000 to 700,000 CCV steelhead smolts are produced naturally each year in the Central Valley. Trawl data indicate that the level of natural production of CCV steelhead has remained very low since the 2011 status review, suggesting a decline in natural production based on consistent hatchery releases. Catches of CCV steelhead at the fish collection facilities in the southern Delta are another source of information on the production of wild CCV steelhead relative to hatchery CCV steelhead (CDFW data: ftp.delta.dfg.ca.gov/salvage). The overall catch of CCV steelhead has declined dramatically since the early 2000s, with an overall average of 2,705 in the last 10 years. 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 anadromous *O. mykiss* 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. CCV steelhead are well-distributed throughout the Central Valley below the major rim dams (Good *et al.* 2005, NMFS 2016a). Most of the CCV steelhead populations in the Central Valley have a high hatchery component, including Battle Creek (adults intercepted at the Coleman NFH weir), the American River, Feather River, and Mokelumne River.

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). Recent reductions in population size are 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 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).

Although CCV steelhead will experience similar effects of climate change to Chinook salmon in the Central Valley, 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.

Summary of California Central Valley Steelhead DPS 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 foreseeable future throughout all or a significant portion of its range (NMFS 2016a).

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

The critical habitat designation for CCV steelhead lists the PBFs (June 28, 2005, 70 FR 37160), which are described 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. 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 Sacramento, Feather, and Yuba rivers, and 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.

Summary of the Value of California Central Valley Steelhead Critical Habitat for the Conservation of the species

Many of the PBFs of CCV steelhead critical habitat are currently 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 value for the conservation of the species of freshwater rearing and migration habitat and estuarine areas as riparian vegetation has been removed, reducing habitat complexity, food resources, and resulting in many other ecological effects. Contaminant loading and poor water quality in Central California waterways poses 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 effort.

2.2.4 Southern Distinct Population Segment (sDPS) of North American Green Sturgeon

- Listed as threatened (April 7, 2006, 71 FR 17757).
- Critical habitat designated (October 9, 2009, 74 FR 52300).

The federally listed southern distinct population segment (sDPS) of North American green sturgeon and designated critical habitat for this DPS occurs in the Action Area and may be affected by the proposed action. Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, and DPS life history can be found on the green sturgeon page of NMFS's website at http://www.westcoast.fisheries.noaa.gov/protected_species/green_sturgeon/green_sturgeon_pg.html.

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 (see below), and (2) by incidental catch of green sturgeon by the CDFW white sturgeon sampling/tagging program. 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 range-wide 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, and the Tracy Fish Collection Facility. This data should be interpreted with some caution. Operations and practices at the facilities have changed over the decades, which may affect salvage data. These data likely indicate a high production year vs. 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 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 (DIDSON) and 236 (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 individuals (NMFS 2010b). Other indicators of productivity such as data for cohort replacement ratios and spawner abundance trends are not currently available for sDPS green sturgeon.

Southern DPS green sturgeon spawn primarily in the Sacramento River in the spring and summer. 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 (NMFS 2016c) . 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.

Summary of Green Sturgeon sDPS 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 2010a). 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 2010a). Lindley *et al.* (2008), in discussing Sacramento River 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 barrier (NMFS 2015). Since many of the threats cited in the original listing still exist, the threatened status of the DPS is still applicable (NMFS 2015).

Critical Habitat and Physical or Biological Features for sDPS Green Sturgeon

The critical habitat designation for sDPS green sturgeon lists the PBFs (October 9, 2009, 74 FR 52300), which are described on the green sturgeon page of NMFS's website at http://www.westcoast.fisheries.noaa.gov/protected_species/green_sturgeon/green_sturgeon_pg.html. 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, for riverine systems, the designation includes substrate type or size. 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,
- Feather River from its confluence with the Sacramento River upstream to Fish Barrier Dam,
- Yuba River from its confluence with the Feather River upstream to Daguerre Point Dam, and
- the Sacramento-San Joaquin 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, and the
- Lower Columbia River estuary from the mouth to river kilometer 74.

In coastal marine waters, the geographical range includes all U.S. 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.

Summary of the Value of sDPS Green Sturgeon Critical Habitat for the Conservation of the Species

Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Additional features 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.

2.2.5 Global Climate Change

One factor affecting the range-wide status of CCV steelhead, Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and the Southern DPS of the North American green sturgeon, and aquatic habitat at large is climate change.

The world is about 1.3°F warmer today than a century ago and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century (IPCC 2007). Much of that increase likely will occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes *et al.* 1998). Using objectively analyzed data Liu and Huang (2000) estimated a warming of about 0.9°F per century in the Northern Pacific Ocean.

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

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

In light of the predicted impacts of global warming, the Central Valley has been modeled to have an increase of between 2 and 7 degrees Celsius by 2100, with a drier hydrology predominated by rainfall rather than snowfall (Dettinger 2004, Hayhoe *et al.* 2004, VanRheenen 2004, Stewart *et al.* 2005). This will alter river runoff patterns and transform the tributaries that feed the Central Valley from a spring and summer snowmelt dominated system to a winter rain dominated system. It can be hypothesized that summer temperatures and flow levels will become unsuitable for salmonid survival. The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff. This will truncate the period of time that suitable cold-water conditions exist downstream of existing reservoirs and dams due to the warmer inflow temperatures to the reservoir from rain runoff. Without the necessary cold water pool developed from melting snow pack filling reservoirs in the spring and early summer, late summer and fall temperatures downstream of reservoirs, such as Lake Shasta, could potentially rise above thermal tolerances for juvenile and adult salmonids that must hold and/or rear downstream of the dam over the summer and fall periods.

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). For the purpose of this consultation, the Action Area includes the Sacramento River from 200 feet upstream of the area to be dewatered, the area to be dewatered, 500 feet downstream from the area to be dewatered and 150 feet from the shore. This Action Area is based on the area potentially affected by increased turbidity and noise from the proposed action. Since the proposed action includes the purchase of mitigation credits from a conservation bank, the Action Area also includes the areas affected by the two mitigation banks that have service areas relevant to the project. 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).

Based on information discussed in *section 2.2.1 Sacramento River Winter Run Chinook Salmon,* increases of air temperatures will result in increases of water temperatures in the Feather River. Increases in the frequency and duration of droughts will also increase Feather River water temperatures. Due to water temperature increases associated with climate change, water temperatures in the Feather River are expected to be less favorable for CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon.

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. More detailed information can be found in the NMFS opinion for the Oroville Facilities (NMFS 2016d). In summary, 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 et al. 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 et al. 2004). Factors modeled by Vanrheenen et al. (2004) show that the melt season shifts to earlier in the year, leading to a large percent reduction of spring SWE (up to 100 percent in shallow snowpack areas). Additionally, an air temperature increase of 2.1°C (3.8°F) is expected to result in a loss of about half of the average April snowpack storage (Vanrheenen et al. 2004). The decrease in spring SWE (as a percentage) would be greatest in the region of the Sacramento River watershed, at the north end of the Central Valley, where snowpack is shallower than in the San Joaquin River watersheds to the south.

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 (9.0°F) 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.

Due to water temperature increases associated with climate change, water temperatures in the Sacramento River are expected to be less favorable for CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon.

The landscape within the Action Area has been highly altered. The Action Area is within the city limits of the City of Sacramento. The Action Area is adjacent to the Sacramento Railyards. The Sacramento Railyards is a 244 acre infill project to redevelop an area with mix uses. The area had been used for railroad maintenance since at least 1870, and other activities prior to that time. Due to flooding, city streets and buildings were elevated between 1868 and 1873. The river and river bank in the Action Area have been subject to many changes over the years. The Action Area includes an armored river bank, with a paved trail on top of the levee and a city street adjacent to the trail. This portion of the Sacramento River is primarily a rearing area and

migratory corridor for adult and juvenile anadromous fish listed under the ESA. In addition, the flows in this area are highly regulated by operation of upstream structures.

The flows in the Action Area are highly modified, through dams, and the export of water from upstream areas, and the delivery of water to downstream areas. The Sacramento River in the Action Area is primarily a migratory corridor and rearing area for salmonids and green sturgeon.

High flows in the winter of 2016-17, impacted survival of ESA listed salmonids, and adversely impacted the designated critical habitat upstream of the Action Area. The 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 Oroville Dam Spillway Emergency contributed to the high flows in the Action Area, and due to erosion associated with the spillway, high turbidity occurred. 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 Sacramento, Feather and Yuba rivers since the most recent status reviews for Sacramento River winter-run Chinook salmon, 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 Sacramento, Feather and Yuba rivers in 2017, in good numbers (25-30 in the Feather River at the Fish Barrier Dam).

The proposed construction occurs within the service areas of two conservation or mitigation banks approved by NMFS. 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. Additional transactions may be pending but given the uncertainty, associated benefits are not considered part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this opinion.

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. Additional transactions may be pending but given the

uncertainty, associated benefits are not considered part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this opinion.

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.

In NMFS' analysis of the proposed action, we identified the exposure and risk to ESA listed anadromous fish and their designated critical habitat, from all aspects of the proposed action. We identified several potential adverse effects of the proposed action on ESA listed anadromous fish species and designated critical habitat. These are:

- Dewatering work area and fish capture and relocation,
- Pile driving,
- Increased turbidity,
- Unintentional spills of hazardous substances, and
- Loss or degradation of riparian habitat function.

Species

2.5.1 Dewatering Work Area and Associated Fish Capture and Relocation

Because the work area where the outfall structure will be constructed, will first need to be dewatered, a sheet pile cofferdam will be put in place to isolate the work area. Fish that are in the area to be dewatered will initially be guided out of the work area using seine nets. Once the cofferdam is in place those fish that remain inside the cofferdam will be captured with a seine and/or electrofishing equipment. Captured fish will be released to the Sacramento River in the vicinity of the proposed action.

During the guiding and removal of fish from the instream work area, ESA listed anadromous adult and juvenile fish may be injured or die. If fish are present, elevated water temperatures along with herding or handling may result in stress that could result in injury or mortality of adult or juvenile Sacramento River ESA listed anadromous fish. If electrofishing is used to collect fish from inside the cofferdam, stunned fish may be injured. The proposed action includes maximizing the efficiency of the capture of fish from inside the cofferdam, and minimization of handling and stress of the fish. If necessary, fish will be held in live cars in the Sacramento River for a short time prior to release. Ice will be used to reduce the water temperature, if necessary. The instream work will occur between August 1 and October 31. The placement of the cofferdam is expected to be during the early part of the instream work.

Adult Sacramento River winter-run Chinook salmon are not expected to be present during construction of the cofferdam. A small proportion of adult CV spring-run Chinook salmon are

likely to be present in the Action Area, however they are expected to leave once construction activity begins. CV spring-run Chinook salmon spawning timing occurs during the instream work window, but the CV spring-run Chinook salmon spawning timing occurs during the end of the instream work window. The Action Area is not a known spawning area for CV spring-run Chinook salmon. Most adult CV spring-run Chinook salmon are expected to be upstream of the Action Area by July 1. A very small proportion of adult CV spring-run Chinook may migrate through the Action Area during the installation of the cofferdam. Adult CV spring-run Chinook salmon are expected to avoid the construction area.

Juvenile CV spring-run Chinook salmon migrate downstream from November through June and are not expected to be present in the Action Area. Juvenile Sacramento River winter-run Chinook salmon rear and migrate downstream from July through March and could be present in the Action Area during the construction of the cofferdam.

The timing of the construction of the cofferdam is at the beginning of the adult CCV steelhead upstream migration. Juvenile CCV steelhead and green sturgeon are likely to be present year around in the Action Area. A small proportion of the runs may be in the area prior to the work area being isolated with nets. A small number of adult green sturgeon may be present in the Action Area during construction of the cofferdam. The Action Area is not a known spawning area for either CCV steelhead or green sturgeon.

The ESA listed anadromous fish that may be present in the vicinity during construction of the cofferdam are expected to avoid the area due to the noise from placing the sheet piling for the cofferdam. Fish will initially be herded out of the cofferdam area, prior to any efforts to capture and relocated fish. The number of ESA listed anadromous fish that may become isolated within the construction area and require relocation is expected to be few.

It is impossible to precisely quantify the number of individuals of each fish species that are expected to be incidentally taken (injury, harm, death, etc.) as a result of the capture and relocation of fish from within the work area due to the variability and uncertainty associated with exposure and response of ESA listed species to the capture and relocation. This is due to the varying population size (annually and seasonally), annual variations in the timing of spawning and migration, variation in individual habitat use with the Action Area, and difficulty in making observations of 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 expect 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 associated with capture and relocation of fish from the work area, is an ecological surrogate of the temporary habitat disturbance due to the placement of the cofferdam. The riverine area to be isolated by the cofferdam (0.06 acres) is a very small proportion of the overall Sacramento River Basin accessible to ESA listed anadromous fish. The surface area to be isolated by the cofferdam relates proportionally to the number of fish that may need to be capture and relocated, and is easily measured. The area to be dewatered with the cofferdam has been identified in the biological assessment as 0.06 acres (page 6-5). This acreage is the ecological surrogate for take associated with capture and relocation of ESA listed anadromous fish species for the proposed action. The surrogate is 0.06 acres, so if the cofferdam footprint is larger than 0.06 acres the allowed take will have been exceeded.

2.5.2 Pile Driving

Noise associated with instream construction has the potential to injure or kill ESA listed anadromous fish. Direct effects associated with in-river construction work involve equipment and activities that produce pressure waves, creating underwater noise and vibration.

The use of a vibratory hammer (or other non-impact method) to install the sheet pile for the cofferdam will minimize the amount of in-water noise. Additionally, the pile driving will only be during daylight hours, with the initial impacts being of lower energy and reduced frequency. The remaining instream work will be isolated inside the cofferdam, in a dewatered condition and is not expected to transmit significant amounts of sound into the waters outside the cofferdam. With these measures the effects of sound on ESA listed anadromous fish is expected to be small and not expected to result in adverse effects.

Noise also has the potential to disrupt behavior, which could result in displacement from rearing habitat leading to reduced feeding, or increased predation. However, ESA listed anadromous fish are expected to avoid the work area. The effects from the noise from the pile driving is not expected to expand the width of the river, and will only be during daylight hours. The noise from pile driving will be minimized through the use of a vibratory hammer. The potential for noise from pile driving to reach the level of an adverse effect is expected to be unlikely.

2.5.3 Increased Turbidity

Construction activities of the proposed action are expected to result in increased turbidity in the Sacramento River during construction of the cofferdam. Increased turbidity has the potential to directly affect fish though injury and changes in behavior. Increase in turbidity can also affect PBFs for rearing and migration. The proposed action includes conservation measure that will minimize the increase in the turbidity in the Sacramento River.

Construction activities related to sheet pile installation will temporarily disturb soil and stream bed sediments, resulting in the potential for temporary increases in turbidity and suspended sediments in the Action Area. Turbidity plumes are expected to affect a portion of the channel width (about 150 feet) and extend up to 500 feet downstream of the site. Construction related increases in sedimentation and siltation above the background level could potentially affect fish species and their habitat by reducing egg and juvenile survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity. The magnitude of potential effects on fish depends on the timing and extent of sediment loading and flow in the river before, during, and immediately following construction.

High concentrations of suspended sediment can have both direct and indirect effects on salmonids. The severity of these effects depends on the sediment concentration, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat. Juvenile salmonids have been observed to avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler *et al.* 1984). Sigler *et al.*

(1984) found that prolonged exposure to turbidities between 25 and 50 nephelometric turbidity units (NTUs) resulted in reduced growth and increased emigration rates of juvenile coho salmon and steelhead compared to controls. These findings are generally attributed to reductions in the ability of salmon to see and capture prey in turbid water (Waters 1995). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Berg and Northcote (1985) observed changes in social and foraging behavior and increased gill flaring (an indicator of stress) in juvenile coho salmon at moderate turbidity (30-60 NTUs). In this study, behavior returned to normal quickly after turbidity was reduced to lower levels (0-20 NTU).

Any increase in turbidity associated with instream work is likely to be brief and occur only in the vicinity of the site, attenuating downstream as suspended sediment settles out of the water column. Temporary spikes in suspended sediment may result in behavioral avoidance of the site by fish; several studies have documented active avoidance of turbid areas by juvenile and adult salmonids (Bisson and Bilby 1982, Lloyd 1987, Servizi and Martens 1992, Sigler et al. 1984).

Individual fish that encounter increased turbidity or sediment concentrations will likely move away from affected areas into suitable surrounding habitat. In-water work will only occur during the beginning of the project's instream work, until the cofferdam has been installed, which will limit the duration of the turbidity effects.

ESA listed anadromous fish may be present during instream construction activities, and thus subject to the above effects. However, due to the isolation of the work area, the effects of increased turbidity are expected to be minor and are unlikely to result in injury, death, affect fish behavior, or impact fish feeding. Therefore, no adverse effects from increased turbidity are expected.

Sedimentation is known to have lethal and sublethal effects to incubating salmonids eggs by decreasing dissolved oxygen transport between spawning gravel. Sediment also blocks microspores on the surface of incubating eggs, inhibiting oxygen transport and creates an additional oxygen demand through the chemical and biological oxidation of organic material (Kemp *et al*. 2011, Greig *et al*. 2007, Suttle *et al*. 2004). Due to the location and timing of construction, ESA listed anadromous fish eggs will not be present. Spawning of ESA listed anadromous fish occurs upstream of the Action Area, and the instream work is prior to CCV steelhead and green sturgeon spawning. Thus adverse impacts to incubating eggs are not expected to occur.

During the dry season there is little precipitation that would cause runoff, which contributes to stream turbidity at construction sites. The work area will be isolated by a cofferdam. Installation of the cofferdam will be with a vibratory hammer, which will minimize any increase in turbidity.

Due to the measures included in the proposed action adverse effects to ESA listed anadromous fish are not expected as a result of increased turbidity. The level of increased turbidity is expected to be low, because there should not be much resulting from the pile driving, and the earth moving will occur in the dry behind the cofferdam. For these reasons the effect of

increased turbidity on ESA listed anadromous fish are expected to be small and not reach a level resulting in adverse effects.

2.5.4 Unintentional Spill of Hazardous Substances

Operation of power equipment, such as an excavator, in or near aquatic environments increases the potential for toxic substances to enter the aquatic environment and have negative effects on ESA listed anadromous fish species.

The proposed action includes the development of a hazardous materials spill prevention and countermeasures plan and will comply with the state National Pollutant Discharge Elimination System permit requirements. The proposed action includes daily inspections of all heavy equipment for leaks. With inclusion of these measures the potential effects from hazardous materials entering the aquatic environment and adversely affecting ESA listed anadromous fish are not expected to result in adverse effects to listed fish.

2.5.5 Loss or degradation of riparian habitat function

The temporary loss of 0.02 acres of riverine habitat, and permanent impact of 0.04 acres of riverine habitat and 0.011 acres of shaded riverine aquatic habitat could have adverse impacts on individual fish in the form of injury or possibly death by temporarily disrupting normal behavior patterns such as feeding or sheltering or rearing from localized reduction in benthic macroinvertebrates (resulting in reduced growth), and/or displacement (resulting in increased predation). Because the affected area is a small portion of the critical habitat in the Sacramento River, the affected area is only a small portion of the width of the Sacramento River, and the riparian area is a levee that is covered in large rock, the temporary loss of riparian habitat and streambed is not expected to result in adverse effects to ESA listed anadromous fish. With the very small area permanently impacted in relationship to the area of the Sacramento River, adverse effects to ESA listed anadromous fish are not expected.

Critical Habitat

2.5.6 Loss/Degradation of Riparian Habitat Functions

The proposed action will modify designated critical habitat for all of the ESA listed anadromous fish species in the Sacramento River. The proposed action will temporarily impact 0.02 acres of riverine habitat, permanently impact 0.04 acres of riverine habitat and 0.011 acres of shaded riverine aquatic habitat. These temporary and permanent modification to designated critical habitat have the potential to reduce the PBF for rearing (reduced quantity and quality of rearing habitat, increased predation, reduced cover, and reduced benthic invertebrate production) and may also adversely affect the PBF for migration. Potential adverse impacts to rearing PBFs include disturbed river bed (resulting in reduced benthic invertebrate production), and/or displacement (resulting in increased predation). The proposed action includes restoration of riparian habitat and the purchase of mitigation credits for permanent impacts. The purchase of mitigation credits will be at a ratio of 3:1 (credits purchased: area impacted) for impacts to ESA listed anadromous salmonids due to the loss of riverine and riparian habitat.

With these measures included in the proposed action, impacts to designated critical habitat for ESA listed anadromous fish species are expected to be small, and unavoidable permanent impacts will be offset through restoration and purchase of mitigation credits at a NMFS approved mitigation bank with an applicable service area. The action, through the purchase of compensatory mitigation credits, will restore and preserve in perpetuity designated critical habitat for all species analyzed in this opinion.

2.5.7 Increased Turbidity

Increased turbidity can affect the PBFs for rearing and migration. High turbidity can reduce the function of the habitat by making capture of prey less efficient. The functions of the habitat can be reduced, resulting in rearing and migrating fish avoiding habitat with increased turbidity.

With the conservation measures included in the proposed action, turbidity is not expected to reach levels that result in adverse effects to PBFs of designated critical habitat for ESA listed anadromous fish species in the Action Area.

2.5.8 Unintentional Spill of Hazardous Substances

Spills of hazardous substances can reduce the PBFs of designated critical habitat. Hazardous substances such as petroleum products used for fuel, lubrication, or hydraulic equipment can result in decreased function of the habitat for rearing and migration.

With the conservation measures included in the proposed action, spills of hazardous substances are not expected to reach levels that result in adverse effects to PBFs of designated critical habitat for ESA listed anadromous fish species in the Action Area.

2.5.9 Mitigation/Conservation Bank Credit Purchases

To address permanent impacts to riparian and aquatic habitats, the proposed action includes purchase of mitigation bank credits at a 3:1 ratio for permanent riparian impacts and a 3:1 ratio for permanent aquatic habitat impacts. Both the riparian and aquatic habitat impacts affect designated critical habitat as well as the listed species as described above. The purchase of mitigation credits will address the loss of ecosystem functions due to the modification of the river bank and streambed. These credit purchases are ecologically relevant to the impacts and the species affected because both banks include shaded riparian aquatic, riparian forest and floodplain credits with habitat values that are already established and meeting performance standards. Also, the banks are located in areas that will either benefit the ESUs/DPSs affected or in the case of the Fremont Landing Conservation Bank, the specific populations that are affected by the action.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase will be realized because each of the NMFS approved banks considered in this opinion have mechanisms in place to ensure credit values are met over time. Such mechanisms include legally binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage

and maintain the bank and habitat values in perpetuity, performance security requirements, a remedial action plan, and site inspections by NMFS. In addition, each bank has a detailed credit schedule and credit transactions and credit availability are tracked on the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the U.S. Army Corps of Engineers with support from the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Federal Highway Administration, and NOAA Fisheries to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas, as well information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation.

Interrelated and Interdependent

2.5.10 Degradation of Water Quality

The purpose of proposed action is to construct a facility that will allow the discharge of stormwater runoff from the Sacramento Railyards. The operation of the proposed stormwater outfall may affect ESA listed anadromous fish species. The operation of the proposed stormwater outfall is interrelated with the proposed action.

Development of the Sacramento Railyards may increase pollutant concentrations and sediment runoff. Extended periods of localized precipitation may result in high suspended sediment concentrations and increased pollution concentrations and turbidity. These conditions could result in reduction of feeding opportunities for sight feeding fish, increased predation, reduced growth rates, and may cause direct mortality of fish or their prey.

Studies in Washington State have identified mortalities of coho salmon (*O. kisutch)* from exposure to stormwater. While mortalities were not identified for Chinook salmon or steelhead exposed to stormwater, there may be sublethal effects. Those studies have also identified that treatment of stormwater with bio filters can counteract the lethal effects of stormwater.

The Federal Clean Water Act mandates permits for municipal stormwater discharges. The City of Sacramento is covered under a municipal separate storm sewer system (MS4) permit (CVRWQCB Order No. R5-2015-0023, NPDES Permit No. CAS082597). Part of the compliance with the MS4 permit is the development of a Stormwater Quality Improvement Plan which includes measures to control pollutants in stormwater discharge. All new development in the Sacramento Railyards will be required to follow the guidance in the Stormwater Quality Improvement Plan and implement the Water Quality Master Plan for the Sacramento Railyards. The expectation is that stormwater will be managed largely at each parcel, including installation of water quality basins, infiltration areas, deceleration of runoff flows in order to collect pollutants and suspended sediments, erosion control, soil protection, fossil filters, and with street sweeping.

The outflow of stormwater could result in attraction of salmonids to the outfall. Salmonids attracted to an outflow, may become injured from trying to swim upstream into the stormwater outfall. Adult salmonids returning to freshwater primarily use olfactory cues to home back to

their natal streams to spawn. They can be attracted other water flowing into a river, or areas of turbulence. Because the salmonids should be imprinted on olfactory cues of their natal streams, the probability of adults being attracted to this particular outflow is low. Without an olfactory cue, it would be unlikely that adult salmonids would be attracted to this new water source. Additionally, when stormwater flows are high, the flows at this location in the Sacramento River would usually be elevated. Under most weather circumstances, the stormwater outflow would be expected to be a very small percentage of the flows in the Sacramento River at this location. This would make it unlikely that ESA listed salmonids, or green sturgeon would be likely to try to access the stormwater outfall. Therefore the physical addition of this new water source is not expected to adversely affect adult ESA listed salmonids, or green sturgeon.

Poor stormwater water quality parameters can have an adverse on the receiving stream's water quality and result in adverse effects to ESA listed anadromous fish and designated critical habitat. Based on available information, outflow of stormwater is expected to be at its highest levels during winter months, when flows in the Sacramento River are high. The peak capacity of the proposed stormwater pumping facility would be 600 cfs. The 100 year peak pumping flow is expected to be 450 cfs. Flows in the Sacramento River during storm events is expected to be much higher. For example, flows from October 2016 through September 2017, ranged from 2,600 cfs (affected by tides, daily range 2,600 to 14,000) to 97,000 cfs at the Freeport gauge. After the first storm of that year (mid-December) through May, flows were only less than 35,000 cfs during one period in late December and early January. If the facility were pumping at 450 cfs and the flows in the Sacramento River were at 35,000 cfs, the stormwater outfall would represent 1.3 percent of the flow in the Sacramento River. Under most conditions, the flow of stormwater from the facility would likely be less than one percent of the flow in the Sacramento River. Additionally, peak stormwater outflows from the facility would occur during the winter when water temperatures are cooler. Cooler temperatures would result in less likelihood of the operation of the proposed stormwater outfall affecting water quality parameters such water temperature, and dissolved oxygen. Similarly, when stormwater is likely to be pumped, turbidity in the Sacramento River is usually elevated. For these reasons, the operation of the proposed stormwater facility is not expected to result in adverse water quality effects to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, or green sturgeon.

Critical habitat for Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the southern DPS of North American green sturgeon is designated within the Action Area for the proposed action. The operation of the proposed stormwater outfall has the potential to adversely affect the PBFs of salmonid rearing and juvenile downstream migration. The proposed action has the potential to adversely affect the PBFs of green sturgeon food resources, by affecting the production of benthic prey. Due to the small amount of the stormwater outflow compared to the flows in the Sacramento River, operation of the proposed stormwater facility are not expected to result in degraded water quality that would result in adverse effects to PBFs of designated critical habitat for ESA listed anadromous fish species in the Action Area.

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 the environmental baseline (Section 2.4).

NMFS staff are unaware of any future activities that are both within the Action Area and do not involve Federal activities.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's 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.

ESA listed anadromous fish species in the Sacramento River watershed have experienced significant declines in abundance and available habitat in the California Central Valley relative to historic conditions. The status of the species and critical habitat and environmental baseline sections of this opinion (2.2 and 2.4) detail the current range-wide status of the listed species and critical habitat, including climate change predictions for the California Central Valley. In light of the predicted impacts of global warming, it has been hypothesized that summer temperatures and flows levels will become unsuitable for salmonid survival in many parts of the Central Valley.

Population viability is determined by four parameters: spatial structure, diversity, abundance, and productivity (growth rate). Both population spatial structure and diversity (behavioral and genetic) provide the foundation for populations to achieve abundance levels at or near potential carrying capacity and to achieve stable or increasing growth rates. Spatial structure on a watershed scale is determined by the availability, diversity, and utilization of properly functioning habitats and the connections between such habitats.

Past and present impacts within the Sacramento River basin have caused significant loss of habitat. Anadromous fish populations have declined drastically over the last century, and many subpopulations have been extirpated. The construction of dams has limited access to a large and significant portion of historical spawning and rearing habitats. Dam operations have changed downstream flow patterns, affecting stream dynamics (*i.e.*, geomorphology, habitat configuration, *etc*.), and affected available habitat through changes in water temperature characteristics, limiting gravel recruitment to available spawning reaches and limiting the

introduction of LWM which contributes to habitat diversity. Gold mining has occurred in the Feather, American, and Yuba rivers, and there are many dams, water diversions, and levees.

The operation of hatcheries in the Sacramento River basin, including the Feather River hatchery have affected the diversity and abundance of wild spawning CV spring-run Chinook salmon and CCV steelhead. Hatchery fish spawning in the wild have affected the genetics of the wild fish, and this has impacted the diversity and abundance of ESA listed anadromous fish. Hatchery fall-run Chinook salmon spawning in the wild, have also impacted CV spring-run Chinook salmon through genetic introgression and redd superimposition.

There are a number of measures that are being implemented to improve spatial structure, diversity, abundance and productivity of ESA listed anadromous fish in the Sacramento River basin. This includes measures that are being implemented in the Sacramento, Feather, American, and Yuba rivers. Some of these measures include improved flow and water temperature management, habitat enhancements, improved fish passage, better hatchery management, and spatial separation of spawning fall-run Chinook salmon and CV spring-run Chinook salmon.

No cumulative effects were identified in the Action Area of the proposed action.

2.7.1 Effects of the Proposed Action to Listed Species

The proposed action is expected to adversely affect ESA listed anadromous fish species. These adverse effects include capture and relocation of ESA listed anadromous fish species from the area in which the cofferdam will be constructed and from within the cofferdam. The life stages and species expected to be affected are juvenile Sacramento River winter-run Chinook salmon, juvenile CCV steelhead, juvenile CV spring-run Chinook salmon, and juvenile green sturgeon. Adult green sturgeon, adult CCV steelhead, adult CV spring-run Chinook salmon are also be expected to be affected, but in smaller numbers as they have a lower risk of exposure. While the proposed action is expected to result in the capture, injury, or death of CV spring-run Chinook salmon, CCV steelhead, and green sturgeon, with the measures included in the proposed action the number of ESA listed fish species affected by the proposed action is expected to be small. Most of the captured ESA anadromous fish are expected be returned to the river without injury.

Adverse effects to ESA listed anadromous fish species may occur due to noise, instream construction, increased turbidity, and spills of hazardous substances. Adverse effects from noise associated with construction other than pile driving, are not expected to occur because the work will be isolated from the water. Adverse effects due to sound associated with pile driving are not expected to occur due to measures to minimize the sound to which fish are exposed. These measures include using a vibratory hammer, pile driving only during daylight hours, and each day starting the pile driving at a lower energy level. Similarly, fish are not expected to be exposed to increased turbidity at levels which will result in adverse effects. Measures included in the proposed action to minimize the risk of exposure of fish to hazardous substances, to a level where adverse effects are not expected to occur.

ESA listed anadromous fish species are not expected to directly interact with either the heavy equipment, or the sheet piling as they come into contact with the river bottom. Therefore, injuries and mortalities of fish from these construction activities are not expected. With the measures to

control turbidity, and the measures to control and address spills of hazardous substances, adverse effects to ESA listed anadromous fish species are not expected to occur.

Adverse effect to ESA listed anadromous fish individuals may occur due to temporary and permanent changes to aquatic and riparian habitat. This could occur due to loss of cover, shade, or changes in behavior (such as feeding). Because the habitat that will be modified is a urban levee that has been heavily rip-rapped and because it is a very small proportion of the Sacramento River, adverse effects to ESA listed anadromous fish species are not expected to occur.

2.7.2 Effects of the Proposed Action to Designated Critical Habitat

Critical habitat for Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the southern DPS of North American green sturgeon is designated within the Action Area for the proposed action. The proposed action has the potential to adversely affect the PBFs of salmonid rearing and juvenile downstream migration. The proposed action has the potential to adversely affect the PBFs of green sturgeon food resources, by affecting the production of benthic prey. The proposed action will modify a levee bank. The levee bank is heavily armored with large rock. The proposed action includes on site restoration of riparian vegetation. The proposed action is not expected to appreciable diminish the value of designated critical habitat for juvenile salmonid downstream migration or rearing. Disruption of the production of benthic organisms upon which green sturgeon feed is expected to be small and not appreciably diminish the value of critical habitat for the conservation of green sturgeon.

2.7.3 Mitigation/Conservation Bank Credit Purchases

The proposed action includes on-site restoration of riparian vegetation. The proposed action also includes off-site mitigation for permanent impacts to streambed designated critical habitat of ESA listed anadromous salmonids at a ratio of 3:1. As mitigation for permanent impacts to riparian designated critical habitat, the proposed action includes the purchase of credits from a NMFS approved conservation bank at a 3:1 ratio. Two conservation banks' applicable service areas are located upstream of the proposed action and benefit the same juvenile Sacramento River winter-run, 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). Disruption of the production of benthic organisms upon which green sturgeon feed is expected to be small and not appreciably diminish the value of critical habitat for the conservation of green sturgeon.

The proposed action also includes off-site mitigation for effects to ESA listed anadromous salmonid species and designated critical habitat at a ratio of 3:1. The proposed action, through the habitat restoration and purchase of compensatory mitigation credits, will restore and preserve in perpetuity designated critical habitat for all species analyzed in this opinion, with associated benefits for those species. The on-site habitat restoration will not be able to restore the area

permanently impacted by the construction of the new outfall structure. To address the permanent impacts the proposed action includes purchase of mitigation credits to address the effects from the permanent structure. The mitigation credits will provide off channel habitat for anadromous salmonids that otherwise would not exist. Off channel habitat provides rearing habitat for juvenile salmonids and includes floodplain riparian habitat, riparian floodplain forest habitat, and shaded riverine aquatic habitat. These types of habitats will provide ecosystem functions such as stream shading, providing cooler water temperatures; providing leaf debris to the stream, providing food for aquatic invertebrates; providing sources of bugs, providing food for fish; and providing woody material, which provides structure and diversity to stream habitat. The mitigation credits will address the permanent effects of the new outfall structure.

2.7.4 Summary

The Sacramento River winter-run Chinook salmon; Feather River, Battle Creek, Clear Creek, Butte Creek, Deer Creek, and Mill Creek spring-run Chinook; and Battle Creek, Clear Creek, Deer Creek, Mill Creek, Antelope Creek, steelhead populations, are considered to be "Core 1" populations for species recovery (NMFS 2014). Individuals from all of these populations, and other ESA listed anadromous fish populations, may be present in the Action Area. The number of individual fish that are expected to be exposed to adverse effects is expected to be a small number, and a very small proportion of the ESA listed anadromous fish populations that utilize Sacramento River watershed. Based on our analysis of available evidence, the adverse effects that are anticipated to result from the proposed action are not the type or magnitude that are expected to appreciably reduce the likelihood of both the survival and recovery of the Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon ESU, the CCV steelhead DPS, nor the southern DPS of North American green sturgeon. To mitigate the effects of the project the proposed action includes riparian plantings. The proposed action includes purchase of mitigation bank credits at a 3:1 ratio for permanent impacts to stream and riparian habitats. With the measures included in the proposed action to protect fish and designated critical habitat, restore designated critical habitat, and purchase mitigation credits, the adverse effects to individuals, populations, and designated critical habitat are 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' opinion that the proposed action is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the southern DPS of North American green sturgeon or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is

defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

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

NMFS anticipates incidental take of ESA listed anadromous fish with this proposed action. Specifically, NMFS anticipates that ESA listed anadromous fish may be harassed, captured, injured, or killed as a result of project implementation due to presence in the Action Area during the scheduled work period. Incidental take of ESA listed anadromous fish is expected to occur due to construction of the cofferdam, including capture, and relocation. Incidental take has been estimated based on the project description. 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 varying population size (annually and seasonally), annual variations in the timing of spawning and migration, variation in individual habitat use with the Action Area, and difficulty in making observations of injured or dead fish. However, it is possible to estimate the extent of incidental take here by designating an ecological surrogate, an element of the project that is expected to be representative of anticipated incidental take. The surrogate is predictable and measurable, and provides for the ability to monitor, to determine the extent of take that is occurring. The ecological surrogate for incidental take associated with construction of the cofferdam, including capture and relocation of ESA listed anadromous fish species for this proposed action, is the temporary habitat disturbance associated with the placement of the cofferdam. The area to be isolated by the cofferdam is 0.06 acres. If the footprint of the cofferdam is larger than 0.06 acres, the identified level of incidental take will have been exceeded.

2.9.2 Effect of Take

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

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are 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 by the Corps and the applicant to minimize incidental take associated with capturing and relocating ESA listed anadromous fish.
(2) Measures shall be taken by the Corps and applicant to minimize impacts to designated critical habitat and to mitigate for unavoidable impacts.
(3) The Corps and the applicant shall prepare and provide NMFS with a report detailing 1) any incidental take of listed fish species associated with the proposed action, 2) monitoring of replanted riparian vegetation, and 3) mitigation credits purchased.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

(1) The following terms and conditions implement reasonable and prudent measure 1:
    a. The Corps and applicant shall, as practicable, when placing the exclusion nets prior to the construction of the cofferdam, move the nets from the shore outward to encourage fish to leave the area.
    b. The Corps and applicant shall, as practicable, when placing the exclusion nets prior to the construction of the cofferdam, move the nets from the shore outward to encourage fish to leave the area.
    c. The Corps and applicant shall, as practicable, when removing fish from inside the cofferdam, leave an opening though which fish can be encouraged to leave volitionally. The seine net shall be moved through the inside of the cofferdam toward the opening. Place a barrier to prevent fish from entering the area inside of the cofferdam, then close the opening, and remove any remaining fish as described in the proposed action description.
    d. Handling of fish shall be conducted during the time of day that water temperatures are the coolest, to reduce the chance of fish mortalities.

(2) The following terms and conditions implement reasonable and prudent measure 2:
    a. The Corps shall include as a permit condition the proposed purchase of 0.153 acres of mitigation bank credits to address the 0.051 acres (0.04 + 0.011 acres) of Sacramento winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead permanent habitat impacts (i.e. a 3:1 ratio). The permit condition shall reflect the proposal to purchase such credits from a NMFS approved mitigation or conservation bank with a service area applicable to the construction project. Purchase of the mitigation credits shall occur prior to initiation of the project.
    b. The Corps shall include as a permit condition for revegetation of the river bank with native vegetation, where vegetation is removed and not part of the area to be permanently impacted.

(3) The following terms and conditions implement reasonable and prudent measure 3:

a. The Corps shall require the applicant to submit to NMFS a report describing the capture, relocation, injury, and mortalities of ESA listed anadromous fish, the mitigation measures implemented, and mitigation credits purchased associated with the proposed action. The report shall be submitted to NMFS within 60 days of project completion. The report should be submitted to the following address:

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

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 Corps should require the applicant to provide a NMFS-approved Worker Environmental Awareness Training Program for construction personnel to be conducted by a NMFS-approved biologist for all construction workers prior to the commencement of construction activities. The program should 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 under the ESA, and an explanation of terms and conditions identified in this opinion. Written documentation of the training should be submitted to NMFS.

(2) A report should be submitted to NMFS within 30 days of the completion of training. Completion of this training is consistent with agency requirements set forth in section 7(a)(1).

2.11 Reinitiation of Consultation

This concludes formal consultation for City of Sacramento Stormwater Discharge System Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the 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 opinion, (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 opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

If the project does not conform to the assumptions identified in this opinion, reinitiation of consultation would likely be triggered under the regulatory criteria (2) or (3) above.

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 Corps and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans (FMP) developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The FMP for Pacific Coast Salmon identifies the Sacramento River as EFH for all runs of Chinook salmon, which consists of four major components: spawning and incubation habitat; juvenile rearing habitat; juvenile migration corridors; adult migration corridors; and adult holding habitat (PFMC 2014). Additionally, the Action Area contains the following designated Habitat Areas of Particular Concern (HAPCs) likely to be either directly or indirectly adversely affected, they include **(1)** complex channels and floodplain habitats, and **(2)** thermal refugia.

3.2 Adverse Effects on Essential Fish Habitat

Effects to the HAPCs listed in section 3.1 above are likely to occur through construction activities.

Below is a list of expected adverse effects to EFH HAPCs associated with the proposed action. Specific affected HAPCs are indicated by the parenthetical number, corresponding to the list in section 3.1:

Sedimentation and turbidity

- Reduced habitat complexity **(1)**

Removal of riparian vegetation

- Degraded water quality **(1)**
- Reduced shading **(2)**
- Reduction in large woody material recruitment **(1)**
- Reduced shelter from predators **(1)**
- Reduction in aquatic macroinvertebrate production **(1)**

Spills of hazardous substances

- Degraded water quality (**1**)

Due to the placement of the stormwater outfall structure, it is expected that increase in sediment and turbidity will be minimal. The proposed action includes the replanting of some of the riparian and floodplain vegetation removed, and the purchase of mitigation banking credits. With inclusion of these conservation measures and implementation of best management practices included in the proposed action, adverse effects to EFH will be minimized.

3.3 Essential Fish Habitat Conservation Recommendations

The following are EFH conservation recommendations for the proposed action:

(1) The applicant should implement Conservation Recommendations (1) and (2) (section 2.10). Implementing these recommendations will address protection of complex channels, floodplain habitats, and thermal refugia.
(2) If trees are removed, from the bank of the Sacramento River, at the end of the project the removed trees should be place in the river, along the river bank to add complexity for rearing fish. Any trees removed should be retained as intact as possible, including the root structure.
(3) A sign should be placed along the trail that identifies the project, and measures to protect fish and fish habitat.

Fully implementing these EFH conservation recommendation would protect, by avoiding or minimizing the adverse effects described in section 3.2, designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps 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, minimizing, mitigating, or otherwise 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 Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. FISH AND WILDLIFE COORDINATION ACT

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

The following recommendations apply to the proposed action:

(1) If trees are removed, from the bank of the Sacramento River, at the end of the project the removed trees should be place either in the river, along the river bank, or the in the floodplain to add complexity for rearing fish. Any trees removed should be retained as intact as possible, including the root structure.

    Retention of large woody material in the stream and along the stream bank provides cover for rearing fish, refugia from high stream velocities, and increases productivity by providing areas for invertebrates to live. Retention of large woody material in the floodplain provides cover and refugia from high stream flows.

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

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include City of Sacramento. Individual copies of this opinion were provided to the Corps. This opinion 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.

5.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in 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.

5.3 Objectivity

Information Product Category: Natural Resource Plan

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

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