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

June 4, 2020 **Refer to NMFS No:** WCRO-2020-00090

James Mazza
Regulatory Division Chief
San Francisco District Corps of Engineers
450 Golden Gate Avenue, 4th Floor
San Francisco, California 94102-3406

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Marin County Flood Control and Water Conservation District's Novato Creek 2020 Maintenance Sediment Removal and Wetland Enhancement Project (Corps File No. 2004-28601N)

Dear Mr. Mazza:

Thank you for your letter of January 13, 2020, 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 USC Section 1531 et seq.), for the Novato Creek 2020 Maintenance Sediment Removal and Wetland Enhancement Project (Project). This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of federally managed fish species under the Pacific Salmon, Coastal Pelagic, and Groundfish Fishery Management Plans. Therefore, we have included the results of that review in Section 3 of this document.

The enclosed biological opinion is based on our review of the proposed Project and describes NMFS' analysis of potential effects on threated Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*), the Southern Distinct Population Segment (DPS) of North American green sturgeon (*Acipenser medirostris*), and designated critical habitat for those species, in accordance with section 7 of the ESA.

In the enclosed biological opinion, NMFS concludes the Project is not likely to jeopardize the continued existence of threatened CCC steelhead, nor is it likely to adversely modify its critical habitat. However, NMFS anticipates take of CCC steelhead will occur during Project construction as juvenile steelhead are likely to be present during dewatering of the work site for Project implementation. An incidental take statement which applies to this Project with non-discretionary terms and conditions is included with the enclosed biological opinion.

Regarding the threatened Southern DPS of North American green sturgeon, NMFS concurs with the Corps' determination that the Project is not likely to adversely affect this species, nor their designated critical habitat.

Please contact Nicholas Van Vleet at 707-575-6077 or by email at nicholas.vanvleet@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

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Copy to ARN File # 151422WCR2020SR00024

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

2020 Novato Creek Sediment Removal and Wetland Enhancement Project
NMFS Consultation Number: WCRO-2020-00090
Action Agency: U.S Department of the Army, Corps of Engineers, San Francisco District

Table 1. 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?
Central California Coast steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Southern Distinct Population Segment of North American green sturgeon (*Acipenser medirostris*)	Threatened	No*	No	No	No

*Please refer to section 2.12 for the analysis of species or critical habitat that are not likely to be adversely affected.

Table 2. Essential Fish Habitat and NMFS' Determinations:

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	No
Groundfish	Yes	No
Coastal Pelagics	Yes	No

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

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: June 4, 2020

List of Abbreviations Used

Abbreviation	Definition
BMPs	Best Management Practices
C°	Degrees Celsius
CCC	Central California Coast
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulation
Corps	U.S. Army Corps of Engineers
CY	Cubic Yards
District	Marin County Flood Control and Water Conservation District
DPS	Distinct Population Segment
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
ESA	Endangered Species Act
et seq.	[Latin *et sequens*] and the following one
etc.	[Latin *et cetera*] and others especially of the same kind: and so forth
FMP	Fishery Management Plan
i.e.	[Latin *id est*] that is
ITS	Incidental Take Statement
JARPA	Joint Aquatic Resource Permit Application
LWD	Large Woody Debris
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAVD 88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
Project	Novato Creek 2020 Maintenance Sediment Removal and Wetland Enhancement Project
RPMs	Reasonable and Prudent Measures
SMART	Sonoma-Marin Area Rail Transit
USC	United States Code

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1. INTRODUCTION

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

1.1 Background

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

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.

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

1.2 Consultation History

By letter dated January 13, 2020, the U.S. Army Corps of Engineers (Corps) requested initiation of formal consultation with NMFS pursuant to section 7 of the Federal Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 et seq.), regarding the proposed Novato Creek 2020 Maintenance Sediment Removal and Wetland Enhancement Project (Project) in the City of Novato, Marin County, California (Corps File Number 2004-28601N). The Corps determined the Project may adversely affect threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) due to dewatering portions of lower Novato Creek and its tributaries for equipment access and channel maintenance activities. A Dewatering and Aquatic Species Capture and Relocation Plan was provided with the Corps' January 13, 2020 letter.

Representatives from NMFS, the Corps, Marin County Flood Control and Water Conservation District (District), and the San Francisco Bay Regional Water Quality Control Board participated in a site visit on March 4, 2020.

In January 2020, NMFS reviewed the Project's Joint Aquatic Resource Permit Application (JARPA) (Marin County 2019a) and determined there was inadequate information regarding the Project's plans to create a muted tidal marsh in Heron's Beak Pond. Noting that there was no mention of creating a muted tidal pond in the Corps' January 13, 2020, initiation package, NMFS requested the Corps convene a telephone conference call with NMFS and the District. A conference call with representatives from NMFS, the Corps and the District was held on March 31, 2020, to discuss the Heron's Beak Pond component of the proposed Project. During the call,

the District agreed to develop a description and biological assessment of the proposed actions at Heron's Beak Pond. During the call, the group discussed the potential placement of a fish screen on the culvert that connects Heron's Beak Pond with Novato Creek.

The District provided a Biological Evaluation for the Heron's Beak Pond project element on April 9, 2020 (Marin County 2020). Additional information and photographs of the intake culvert were provided by the District to NMFS and the Corps on April 13, 2020.

After review of the Biological Evaluation, NMFS requested by email the District install a fish screen on the pond's intake to protect steelhead and sturgeon in lower Novato Creek from entrainment into the muted tidal pond. The District acknowledged in an April 16, 2020 email to the Corps and NMFS that they would install a fish screen before completing the Heron's Beak Pond project element.

On April 16, 2020, sufficient information regarding the Project was provided to NMFS for initiation of formal consultation.

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). For EFH consultation, 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 Corps proposes to issue a permit to the District under Section 404 of the Clean Water Act (33 U.S.C.1344) and Section 10 of the Rivers and Harbors Act of 1899, as amended (33 U.S.C. § 403 *et seq*.), for the Novato Creek 2020 Maintenance Sediment Removal and Wetland Enhancement Project. The purpose of the proposed Project is to minimize the risk of flooding in areas surrounding lower Novato Creek by removing accumulated sediment. To achieve this purpose, sediment in portions of Novato Creek and two of its tributaries will be removed and repurposed using heavy equipment. Additionally, the stream bank will be stabilized within the project area to prevent further erosion directly downstream of the Sonoma-Marin Area Rail Transit (SMART) rail bridge. Project construction will be limited to one summer/fall dry season and will occur between June 15 and October 15 of 2020. Excavated sediment will be placed primarily within Heron's Beak Pond for the purpose of raising the elevation of subsided portions of the pond. Following placement of the sediment in Heron's Beak Pond, a fish screen will be installed on the pond's intake in Novato Creek and the culvert will be operated to create a muted tidal wetland within Heron's Beak Pond.

1.3.1 Dewatering and Fish Relocation

Prior to sediment removal and bank stabilization activities, dewatering of work sites and aquatic species relocation will occur in Novato Creek and Heron's Beak Pond. Cofferdams will be built on the upstream and downstream extent of the sediment removal reaches in Novato Creek. The District will ensure that the tide gate on Heron's Beak Pond is closed, and that sand bags are placed along the outfall culvert to minimize existing leaks. Qualified fisheries biologists following both California Department of Fish and Wildlife (CDFW) and NMFS guidelines will lead fish relocation activities. Prior to fish relocation, field gear will be decontaminated to

prevent the spread of aquatic invasive species. Fish will be captured using dip and seine nets. Upon capture, fish will be segregated into size-classes and held temporarily in insulated containers. Waterlogged vegetation may be added to the containers to potentially minimize stress. Dotted smartweed (*Persicaria punctate)*, which was suspected to have caused mortality during the 2008 sediment removal project, will not be placed in holding containers.

Captured fish will be relocated to areas of species-specific suitable habitat in Novato Creek, as determined by a qualified biologist. Freshwater species will be relocated upstream, and marine species will be moved downstream of the project area. Fish capture and relocation efforts will take place when water temperatures are below 68°F, and is expected to take up to five working days. Pumps will be used to dewater the action area, and screens will have a mesh size of 3/32 inches to exclude fish as small as salmonid fry. During dewatering, water from Novato Creek and tributaries will be routed through Baccaglio Basin, Scottsdale Marsh, Scottsdale Pond, and eventually into Lynwood Basin. Additional aquatic species relocation information can be found in the Dewatering & Aquatic Species Capture and Relocation Plan (2019b) provided by the District/Corps.

1.3.2 Sediment Removal and Placement

Accumulated sediment will be removed from the creek beds of Novato, Warner, and Arroyo Avichi creeks. The extent of removal consists of 5,630 linear feet of channel from Diablo Avenue to 500 feet downstream of the SMART rail bridge in Novato Creek; 1,780 linear feet of channel from Diablo Avenue to the confluence with Novato Creek in Warner Creek; and 680 linear feet of channel from South Novato Boulevard to its confluence with Novato Creek in Arroyo Avichi Creek.

To reduce turbidity during excavation, sediment removal will not occur until work areas have been isolated by cofferdams and the channel is dewatered, as described above. Sediment excavation will be conducted with drag lines, excavators, dozers and dump trucks. Existing access ramps in the upper Project reaches of Novato and Warner creeks will be used for equipment access to work areas.

Removed sediment is anticipated to be placed at two primary locations. Up to 29,700 cubic yards (CY) of the removed sediment will be placed in Heron's Beak Pond. Additionally, up to 4,600 CY of removed sediment will be repurposed to promote the creation of an ecotone levee at the West Basin Cross Levee. Any sediment not used in Heron's Beak Pond or the West Basin Cross Levee, will be placed on Lynwood Levee.

1.3.3 Heron's Beak Pond Wetland Enhancement

Heron's Beak Pond is located along lower Novato Creek approximately 500 feet downstream of the SMART rail bridge. The pond is separated from Novato Creek by the existing Heron's Beak Levee on the right bank of Novato Creek. The elevation within Heron's Beak Pond has subsided over time, leaving the bed of the pond approximately two feet lower than the adjacent thalweg within Novato Creek. Using sediment to raise the bottom of the pond will allow vegetation to establish within the pond once tidal influence is restored to the site.

Following placement of sediment in Heron's Beak Pond, the tide gate connecting the pond to Novato Creek will be removed to promote the creation of a muted tidal wetland. The District is developing a long-term restoration plan to restore former tidal baylands in the Deer Island Basin, and the creation of a muted tidal wetland in Heron's Beak Pond will contribute to the larger long-term restoration plan.

During consultation, NMFS determined a potential for fish entrainment at Heron's Beak Pond and requested the District install a fish screen at the culvert connecting the pond with Novato Creek. The District has proposed to modify the original Project designs to include installation of a fish screen on the inlet/outlet of Heron's Beak Pond. The fish screen will have a mesh size of 3/32 inches, and will be designed to meet NMFS fish screening criteria for anadromous salmonids. The fish screen will exclude fish from entering Heron's Beak Pond, thus avoiding potentially unfavorable conditions within the pond.

1.3.4 Bank Stabilization

Ninety-five linear feet of streambank will be stabilized on the right bank roughly 90 feet downstream of the SMART rail bridge. Bank stabilization will occur following dewatering and fish relocation operations within Novato Creek, and will occur within the footprint of the sediment removal portion of this Project. Existing native vegetation will be removed and stored to be replanted following stabilization. Following removal of vegetation, the bank will be smoothed to create a 2:1 slope. The bottom half (below 6 NAVD 88) will be excavated at a minimum of 2 feet deep and have geotextile placed on the sloped bank. Approximately 126 CY of rock fill will be placed on the geotextile fabric. Previously excavated soil and vegetation will be used to fill in voids in the rock riprap. An erosion control blanket will be placed on top to protect the slope from erosion and allow plants to take root. Salvaged native plants will also be used in the upper slope area. Hydroseed, or other seeding methods, will be used if salvaged native plants do not cover enough of the newly stabilized area. Approximately 98 CY of earthen fill will be used for the entire bank stabilization structure.

1.3.5 Additional Conservation Measures

The District will use best management practices (BMP) to control sediment and other potential pollutants from entering the Novato Creek and its tributaries during Project activities. These include the following measures:

- Some riparian vegetation will be removed during the Project; however, no riparian trees will be removed.
- Any disturbed areas (access ramps and spoils areas) will be seeded with native grasses.
- A low flow channel will be recreated in the channel bottom once sediments are removed.
- Cofferdams will be installed during low tide, and will be removed upon Project completion.
- Maintenance and refuel of heavy equipment will occur in designated areas that are a minimum of 100 feet beyond the top of bank.
- Hazardous materials will not be stored within 100 feet of a drainage or water body. Pumps will be secured in place over fuel absorbent mats or drip pans and will be refueled outside of the stream channel. Spill control kits will be kept at the Project site at all times and construction personnel will be trained in proper spill control procedures.

Heavy equipment staging and storage areas will be outside of the creek channel and banks. Equipment will be checked daily for leaks. Refueling will take place outside of the stream channel (at least 100 feet from any water body or drain) and on top of tarps or similar materials.

Additional BMPs can be found in the JARPA application (Marin County 2019a).

We considered whether or not the proposed action would cause any other activities and determined that it would not.

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

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

The Corps determined the proposed action is not likely to adversely affect the Southern DPS of North American green sturgeon, nor its critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (2.13) of this opinion. This opinion discusses the potential adverse effects to the threatened CCC steelhead and its designated critical habitat.

2.1 Analytical Approach

This biological 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 biological 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 as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation of critical habitat for CCC steelhead uses the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this

term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ‘‘destruction or adverse modification’’ analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term “consequences” (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms “effects” and “consequences” interchangeably.

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

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

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the Project’s actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources, and the following:

> Marin County. Biological Evaluation and Essential Fish Habitat Assessment, Heron’s Beak Pond Muted Tidal Wetlands Restoration. Prepared for the Army Corps of Engineers by Marin County Flood Control and Water Conservation District. April 2020.

Information was also provided in electronic mail messages and telephone conversations between February 2020 and May 2020 with NMFS, the Corps, and the District. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

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 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.

2.2.1 Listed Species

This biological opinion analyzes the effects of the District's proposed sediment maintenance and wetland enhancement activities on the CCC steelhead DPS. CCC steelhead are listed as threatened under the ESA (71 FR 834, January 5, 2006). The CCC steelhead DPS includes steelhead in coastal California streams from the Russian River to Aptos Creek, and the drainages of Suisun Bay, San Pablo Bay, and San Francisco Bay. CCC steelhead occur in Novato Creek and its tributaries and are expected to be present at the site during Project implementation.

The non-tidally influenced reaches of Novato Creek are not designated habitat for any listed species under NMFS' jurisdiction. However, a large portion of the action area includes tidally-influenced portions of Novato Creek and its tributaries. The tidal portions of Novato Creek and its tributaries are designated critical habitat for CCC steelhead.

2.2.2 Species Description and Life History

Steelhead General Life History

Steelhead are anadromous forms of *O. mykiss*, spending some time in both fresh- and saltwater. The older juvenile and adult life stages reside in the ocean, until the adults ascend freshwater streams to spawn. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). Although one-time spawners are the great majority, Shapovalov and Taft (1954) reported that repeat spawners are relatively numerous (17.2 percent) in California streams. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults.

General reviews for steelhead in California document much variation in life history (Barnhart 1986; Busby et al. 1996; Moyle et al. 2017; Shapovalov and Taft 1954). Although variation occurs, in coastal California steelhead usually live in freshwater for 1 to 2 years before immigrating to the ocean. Juvenile steelhead emigration from San Francisco Bay natal streams occurs episodically during winter and spring months, and generally occurs during high flow events. Barnhart (1986) reports that peak smolt migration occurs in March and April, and steelhead smolts in California typically range in size from 140 to 210 millimeter (mm) (fork length). Steelhead of this size can withstand higher salinities than smaller fish, and are more

likely to occur for longer periods in tidally influenced estuaries, such as San Francisco Bay. Steelhead smolts in most river systems must pass through estuaries prior to seawater entry. Once they leave their natal streams, steelhead will spend 1 to 3 years in the ocean before returning to spawn.

Based on the timing of adult migration from the ocean to freshwater, CCC steelhead are classified as winter-run steelhead. Adult CCC steelhead typically enter freshwater between December and April, peaking in January and February (Fukushima and Lesh). Steelhead females build redds to bury eggs for a several month-long incubation period. Redds are generally located in areas where the hydraulic conditions are such that fine sediments, for the most part, are sorted out and streamflow is constant. This is because, during the incubation period, the intragravel environment must permit a constant flow of water to deliver dissolved oxygen and to remove metabolic wastes. Other intragravel parameters such as the gravel permeability, water temperature, substrate composition, and organic material in the substrate effect the survival of eggs to fry emergence (Chapman 1988; Everest et al. 1987; Shapovalov and Taft 1954). Adult steelhead may spawn 1 to 4 times over their life span.

Steelhead fry rear in freshwater edgewater habitats and move gradually into pools and riffles as they grow larger. Cover, water temperature, sediment, and food items are important habitat components for juvenile steelhead. Cover in the form of woody debris, rocks, overhanging banks, and other in-water structures provide velocity refuge and a means of avoiding predation (Bjornn et al. 1991; Shirvell 1990). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. In winter, juvenile steelhead become less active and hide in available cover, including gravel or woody debris. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Water temperature can influence the metabolic rate, distribution, abundance, and swimming ability of rearing juvenile steelhead (Barnhart 1986; Bjornn and Reiser 1991; Myrick and Cech Jr 2005). Optimal temperatures for steelhead growth range between 10 and 20 degrees (°) Celsius (C) (Hokanson et al. 1977; Myrick and Cech Jr 2005; Wurtsbaugh and Davis 1977). Fluctuating diurnal water temperatures are also important for the survival and growth of salmonids (Busby et al. 1996).

Turbidity (*i.e.*, water clarity) also can influence the behavior, distribution, and growth of steelhead (Cordone and Kelley 1961; Newcombe and Jensen 1996; Newcombe and MacDonald 1991; Redding et al. 1987; Sigler et al. 1984). The impacts of turbidity on juvenile salmonids are largely linked to factors such as background turbidity levels and the duration of turbid conditions. Bisson and Bilby (1982) found that juvenile coho salmon that were acclimated to clear water did not exhibit significant sediment avoidance until the turbidity reached 70 NTUs. Sigler *et al.* (1984) observed avoidance of turbid water by juvenile steelhead and coho when exposed to turbidities as low as 38 NTUs and 22 NTUs, respectively, for a period of 15-17 days. Sigler *et al.* (1984) also observed that fish kept in these turbid conditions had lower growth rates than fish kept in clear water for the same amount of time.

2.2.3 Status of Species

2.2.3.1 Status of CCC Steelhead and Their Critical Habitat

Historically, approximately 70 populations[1] of steelhead existed in the CCC steelhead DPS (Spence et al. 2008; Spence et al. 2012). Many of these populations (about 37) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts (Bjorkstedt et al. 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (Bjorkstedt et al. 2005; McElhany et al. 2000).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby et al. 1996). Near the end of the 20th century the population of wild CCC steelhead in the Russian River was estimated to be between 1,700-7,000 fish (Busby et al. 1996; Good et al. 2005). Recent estimates for the Russian River population are unavailable since monitoring data is limited. Abundance estimates for smaller coastal streams in the DPS indicate low population levels that are slowly declining, with recent estimates (2011/2012) for several streams (Redwood [Marin County], Waddell, San Vicente, Soquel, and Aptos creeks) of individual run sizes of 50 fish or less.[2] Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt et al. 2005). Similar losses in genetic diversity in the Napa River may have resulted from out-of-basin and out-of-DPS releases of steelhead in the Napa River basin in the 1970s and 80s. These transfers included fish from the South Fork Eel River, San Lorenzo River, Mad River, Russian River, and the Sacramento River. In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these populations. For more detailed information on trends in CCC steelhead abundance, see: (Busby et al. 1996; Good et al. 2005; Spence et al. 2008; Williams et al. 2011).

CCC steelhead have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead remain present in most streams throughout the DPS, roughly approximating the known historical range, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid DPSs or ESUs in worse condition. In 2005, a status review concluded that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good et al. 2005). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834).

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[1] Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

[2] Nature Conservancy. 2013. California Salmon Snapshots. Date Accessed: May 30, 2014. http://www.casalmon.org/.

In the San Francisco Bay region (both Interior San Francisco Bay and Coastal San Francisco Bay strata) data for steelhead remain limited. Many of the populations in the Coastal San Francisco Bay and Interior San Francisco Bay diversity strata including Walnut Creek, San Pablo Creek, San Lorenzo Creek, Alameda Creek, and San Mateo Creek are likely at high risk of extinction due to the loss of the majority of the historical spawning habitat behind impassible barriers, and the heavily urbanized nature of most of these watersheds downstream of barriers. More detailed information on trends in CCC steelhead abundance, can be found in: Busby et al. 1996, NMFS 1997, Good et al. 2005, Spence et al. 2008, Williams et al. 2011, Spence et al. 2012, and Williams et al. 2016.

A 2008 viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and that the limited information available did not indicate that any other CCC steelhead populations could be demonstrated to be viable (Spence et al. 2008). Monitoring data from the last ten years of adult CCC steelhead returns in Lagunitas and Scott creeks show steep declines in adults in 2008/2009. The 2011 status update found that the status of the CCC steelhead DPS remains "likely to become endangered in the foreseeable future" (Williams et al. 2011), as new and additional information available since Good et al. (2005), does not appear to suggest a change in extinction risk. On December 7, 2011, NMFS chose to maintain the threatened status of the CCC steelhead (76 FR 76386). In the most recent status review, Williams et al. (2016) found that there is little evidence to suggest that the extinction risk for this DPS has changed appreciably in either direction since the publication of the last viability assessment (Williams et al. 2011). After reviewing the status reviews. NMFS made no change in the listing of CCC steelhead as a threatened species (81 FR 33468).

Critical habitat was designated for CCC steelhead on September 2, 2005 (70 FR 52488). This designation of critical uses the term primary constituent element 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 primary constituent elements, physical or biological features, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

For CCC steelhead, PBFs include estuarine areas free of obstruction and excessive predation with the following essential features: (1) water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (3) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (70 FR 52488).

The condition of CCC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the

following human-induced factors affecting critical habitat[3]: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of streambank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased streambank erosion, loss of shade (higher water temperatures) and loss of nutrient inputs (70 FR 52488; Busby et al. 1996). Water development has drastically altered natural hydrologic cycles in many of the streams in the DPS. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids. Overall, current condition of CCC steelhead critical habitat is degraded, and does not provide the full extent of conservation value necessary for the recovery of the species.

A final recovery plan for CCC steelhead was prepared by NMFS in October 2016 (NMFS 2016). The plan describes key threats, actions needed to achieve recovery, and measurable criteria by which NMFS will determine when recovery has been reached. Recovery plan actions are primarily designed to restore ecological processes that support healthy steelhead populations, and address the various activities that harm these processes and threaten the species' survival. The recovery plan calls for a range of actions including the restoration of floodplains and channel structure, restoring riparian conditions, improving streamflows, restoring fish passage, protecting and restoring estuarine habitat, among other actions.

2.2.3.2 Factors Affecting the Rangewide Status of CCC Steelhead and Critical Habitat

NMFS cites many reasons (primarily anthropogenic) for the decline of steelhead (Adams et al. 2002; Busby et al. 1996). The foremost reason for the decline in these anadromous populations is the degradation and/or destruction of freshwater and estuarine habitat. Additional factors contributing to the decline of these populations include: commercial and recreational harvest, artificial propagation, natural stochastic events, marine mammal predation, and reduced marine-derived nutrient transport. The following section details the general factors affecting the CCC steelhead and their critical habitat.

Habitat Degradation and Destruction

The best scientific information presently available demonstrates a multitude of factors, past and present, have contributed to the decline of west coast salmonids by reducing and degrading habitat by adversely affecting essential habitat features. Most of this habitat loss and degradation has resulted from anthropogenic watershed disturbances caused by urban development, agriculture, poor water quality, water resource development, dams, gravel mining, forestry (Adams et al. 2002; Busby et al. 1996; Good et al. 2005), and lagoon management (Bond 2006; Smith 1990).

[3] Other factors, such as over fishing and artificial propagation have also contributed to the current population status of steelhead. All these human induced factors have exacerbated the adverse effects of natural factors such as drought and poor ocean conditions.

Commercial and Recreational Harvest
Ocean salmon fisheries off California are managed to meet the conservation objectives for certain stocks of salmon listed in the Pacific Coast Salmon FMP, including any stock that is listed as threatened or endangered under the ESA. Early records did not contain quantitative data by species until the early 1950s. In addition, the confounding effects of habitat deterioration, drought, and poor ocean conditions on salmonids make it difficult to assess the degree to which recreational and commercial harvest have contributed to the overall decline of salmonids in West Coast rivers.

Artificial Propagation
Releasing large numbers of hatchery fish can pose a threat to wild steelhead stocks through genetic impacts, competition for food and other resources, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991).

Natural Stochastic Events
Natural events such as droughts, landslides, floods, and other catastrophes have adversely affected steelhead and steelhead habitat throughout their evolutionary history. The effects of these events are exacerbated by anthropogenic changes to watersheds and estuaries such as logging, roads, water diversions, and diking and draining of coastal marshes. These anthropogenic changes have limited the ability of steelhead and habitat to rebound from natural stochastic events and further depressed populations to critically low levels.

Marine Mammal Predation
Although predation by these mammals is not believed to be a major factor in overall population decline, there may be substantial localized impacts on steelhead particularly during the migration season (Hanson 1993). Steller and California sea lion abundance has increased in recent decades (NMFS 2013).

Ocean Conditions
Recent evidence suggests poor ocean conditions played a significant role in the low number of returning adult fall run Chinook salmon to the Sacramento River in 2007 and 2008 (Lindley et al. 2009). The decline in ocean conditions likely affected ocean survival of all west coast salmonid populations (Good et al. 2005; Spence et al. 2008).

Climate Change
Another factor affecting the rangewide status of listed salmonids and critical habitat for these species is climate change. Impacts from global climate change are currently occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Milanes et al. 2018). Snow melt from the Sierra Nevada has declined, with an increasing amount of the precipitation falling as rain rather than snow (Milanes et al. 2018). California precipitation patterns have become more variable in recent decades, with increasingly drier conditions, and multiple years of severe to extreme drought (Milanes et al. 2018). Listed steelhead and steelhead critical habitat may have already experienced some detrimental impacts from climate change. NMFS believes the impacts to date

are likely fairly minor because natural, and local, climate factors likely still drive most of the climatic conditions these fish experience, and many of these factors have much less influence on steelhead abundance and distribution, and steelhead habitat, than human disturbance across the landscape.

The threat to CCC steelhead from global climate change will increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley et al. 2007; Moser et al. 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004; Moser et al. 2012). Total precipitation in California may decline; critically dry years may increase (Hayhoe et al. 2004; Lindley et al. 2007; Moser et al. 2012; Schneider 2007). Wildfires are expected to increase in frequency and magnitude (Moser et al. 2012; Westerling et al. 2011). In the San Francisco Bay region, warm temperatures generally occur in July and August, but as climate change takes hold, the occurrences of these events will likely begin in June and could continue to occur in September (Cayan et al. 2012). Interior portions of San Francisco Bay are projected to experience a threefold increase in the frequency of hot daytime and nighttime temperatures (heat waves) from the historical period (Cayan et al. 2012). Climate simulation models also project that the San Francisco region will maintain its Mediterranean climate regime, but experience a higher degree of variability of annual precipitation during the next 50 years and years that are drier than the historical annual average during the middle and end of the twenty-first century. The greatest reduction in precipitation is projected to occur in March and April, with the core winter months remaining relatively unchanged (Cayan et al. 2012).

For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts.[4] Estimates show that snowmelt contribution to runoff in the Sacramento/San Joaquin Delta may decrease by about 20 percent per decade over the next century (Cloern et al. 2011). Many of these changes are likely to further degrade steelhead habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Increasing water temperatures has recently been shown to increase the prevalence of blackspot infections in steelhead in Northern California (Schaaf et al. 2017). Estuaries may also experience changes detrimental to salmonids. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Cloern et al. 2011; Ruggiero et al. 2010; Scavia et al. 2002). Cloern et al. (2011) estimated that the salinity in San Francisco Bay could increase by 0.30-0.45 practical salinity unit per decade due to the confounding effects of decreasing freshwater inflow and sea level rise. In marine environments, ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Abdul-Aziz et al. 2011; Brewer and Barry 2008; Doney et al. 2011; Feely et al. 2004; Osgood 2008; Turley 2008). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007; Santer et al. 2011).

[4] https://water.ca.gov/Water-Basics/Climate-Change-Basics

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this Project includes 5,630 linear feet of Novato Creek extending downstream of the Diablo Avenue crossing to 500 feet downstream of the SMART bridge (Figure 1). The action area also includes lower portions of two tributaries: Warner Creek and Arroyo Avichi. In Warner Creek the Project area extends along 1,780 linear feet of channel from near the Diablo Avenue crossing to the stream's confluence with Novato Creek. The action area for Arroyo Avichi extends from near the South Novato Boulevard crossing of Arroyo Avichi to the stream's confluence with Novato Creek and is 680 linear feet. The linear extent of action area includes the amount of channel to be dewatered, reaches subject to sediment excavation, and the bank stabilization site. The action area also extends an additional 500 feet upstream and downstream of areas dewatered in each stream to allow for fish relocations and potential effects to water quality during construction activities. Laterally, the action area extends to encompass the riparian corridor to the top of bank of all three streams. The action area also includes Heron's Beak Pond and the West Basin Cross Levee, as sediment will be repurposed at these locations. In addition to the sediment placement sites at Heron's Beak Pond, the action area includes the site where a manually operated tide gate will be removed and a fish screen installed at the connection between lower Novato Creek and Heron's Beak Pond. If excess sediment remains after placement on the West Basin Cross Levee and Heron's Beak Pond, it will be placed on the Lynwood Levee, and will thus be included as part of the action area. The action area is sufficiently large enough to include any area downstream of the action area in which measurable turbidity may occur. The action area is within the City of Novato, Marin County, California. Novato Creek is a tributary to San Pablo Bay.

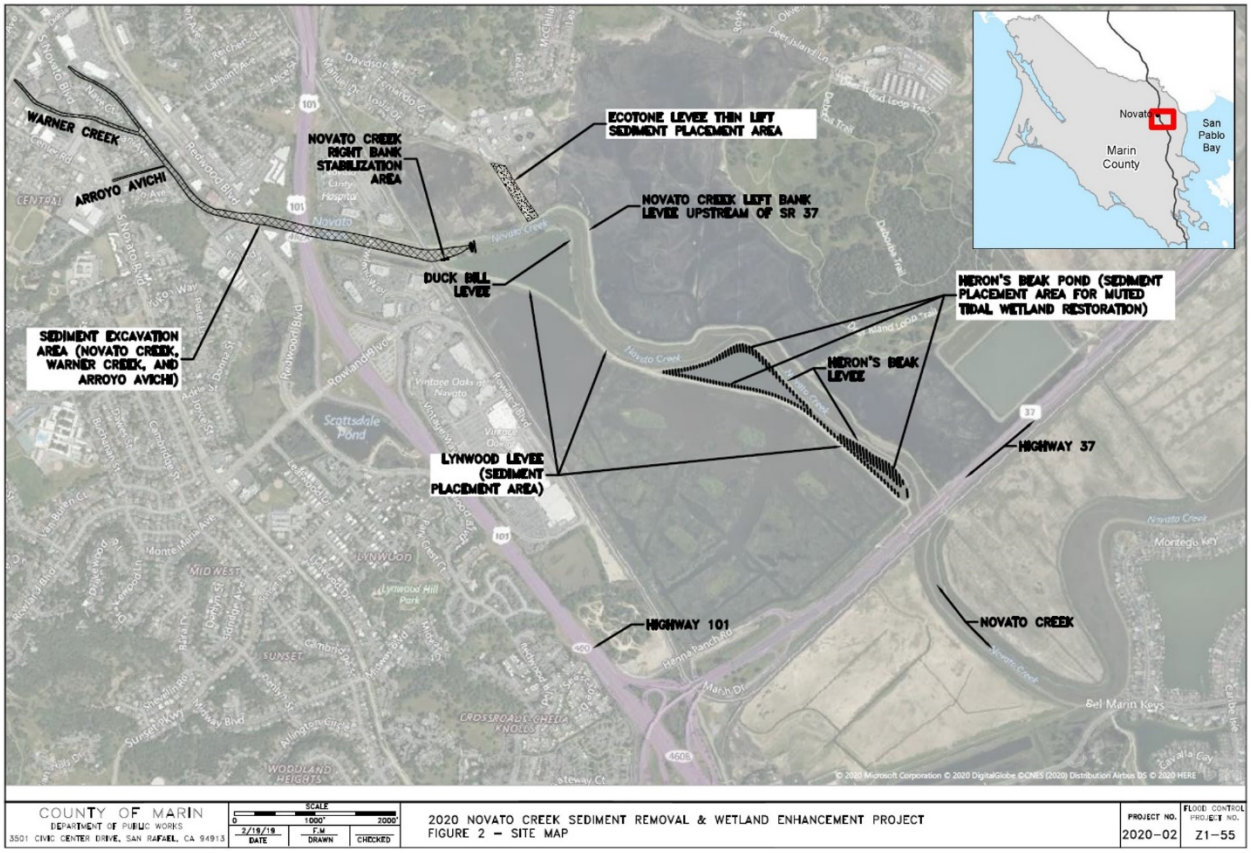

Figure 1. Action area with locations for sediment removal and subsequent placement.

2.4 Environmental Baseline

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

The Project area is dominated by urban development from the City of Novato. Novato was the fastest growing municipality in Marin County in 2005, and further population growth is expected.[5] All of the stream channels in the action area have been straightened and channelized to become trapezoidal in shape. Streamflow throughout most of the action area is tidally influenced. Freshwater input from upstream areas is expected to be low (i.e., likely 1-5 cfs) during the summer and early fall period of 2020. Currently Heron's Beak Pond is not

[5] https://www.marinwatersheds.org/novato-creek-watershed-history-and-habitat

significantly tidally influenced. A manually controlled gate is on the outfall of the culvert separating the Heron's Beak Pond from Novato Creek. A portion of the culvert on the Novato Creek side has degraded over time and allows a small amount of water to pass from Novato Creek to Heron's Beak Pond. Residential and commercial development has encroached on all stream banks where sediment removal will take place. The area surrounding Heron's Beak Pond is currently undeveloped. Highway 101 and SMART train tracks cross Novato Creek within the action area.

2.4.1 Status of CCC Steelhead and Their Critical Habitat in the Action Area

The NMFS recovery plan for CCC steelhead considers Novato Creek to be an independent population (i.e., self-sustaining), that is essential in the recovery of the Coastal San Francisco Bay Diversity Stratum (NMFS 2016). The Novato Creek population would need to support a minimum of 1,100 spawning adults annually to be considered recovered (NMFS 2016). Although current spawner abundance is unknown, it likely sustains low numbers due to habitat loss and degradation within the watershed. The Coastal San Francisco Bay Diversity Stratum, including Novato Creek, is considered the most impaired stratum in the DPS (NMFS 2016). Although estuary habitat within Novato Creek is considered better than other streams within this diversity stratum, it is only rated as fair (NMFS 2016).

CCC steelhead within the action area will likely be subjected to the effects of climate change as was described in section 2.2.3.2. The action area for this project is either in the estuary or in close proximity. With projected sea level rise, it is expected that the action area will be subjected to more marine-like conditions through time with further saltwater intrusion. Increased variability in annual precipitation, resulting in more extreme events such as droughts and floods will affect the amount of streamflow in Novato Creek. Increases in average air temperatures and prolonged heat waves could increase stream temperatures in the action area.

NMFS' search of fisheries data for salmon and steelhead recovery planning indicates that estimates of steelhead abundance for Novato Creek have not been done. However, there have been several limited fish sampling performed in Novato Creek in recent decades (Fawcett Environmental Consulting 2009; Fawcett Environmental Consulting 2012; Fawcett Environmental Consulting 2000; Fawcett Environmental Consulting 2006; Leidy et al. 2005; WRA Environmental Consultants 2016). Most of these surveys were conducted during fish relocation efforts for previous sediment removal projects (2006, 2008, 2012, 2016), and were wholly within the proposed sediment removal area for 2020. In these surveys biologists collected 100 juvenile steelhead (2006), 69 juvenile steelhead (2008), 3 juvenile steelhead (2012), and 2 juvenile steelhead (2016). NMFS assumes that the population of steelhead in the action area is small given the number of fish captured during previous relocation efforts and the quality of habitat in Novato Creek within the action area.

The stream channels in the action area are generally trapezoidal flood control channels that range in width from 15 to 75 feet. A thin strip of riparian trees occurs along the banks of channels in the upstream third of the action area. Beginning at the confluence of Warner Creek and Novato Creek and continuing downstream, most of the riparian trees have been removed from the action area. Throughout the action area, the riparian undergrowth is regularly removed from the stream banks during vegetation maintenance for flood water conveyance. Some stream banks consist of concrete walls.

Streamflow in Novato Creek, including the action area, is perennial and typically ranges from 1 to 5 cubic feet per second (cfs) during the summer months. Streamflow is less in Warner Creek during the summer months. In many years, surface flow is not present in the lower portions of Arroyo Avichi during the summer months. Water surface elevation in the action area is influenced by tidal action and releases from North Marin Water District facilities upstream of the action area. Water temperatures measured in Novato Creek, Warner Creek, and Arroyo Avichi in May and June 1996 ranged from 15.6 to 22.8 °C. Although water temperatures have not been recorded in the period of July through September, Rich (1997) estimates water temperatures are considerably higher than optimal for steelhead during its rearing life stage.

The stream channels in the action area are dominated by low gradient areas that are tidally influenced. The streambed is primarily composed of sand and silt and does not provide suitable substrate for steelhead spawning. In general, instream cover for steelhead is lacking. Some instream cover is provided by undercut banks and walls, concrete, and small amounts of emergent vegetation. Large instream woody debris, boulders, and other features for structural complexity are lacking in the action area. Overwinter habitat conditions are poor because the channel lacks habitat complexity and velocity refuge. Oversummering conditions are poor due to the lack of habitat complexity and high water temperatures (Rich 1997). Although aquatic habitat in the action area is currently in poor condition, this habitat is seasonally important to CCC steelhead because lower Novato Creek and the lower reaches of Warner Creek and Arroyo Avichi provide migration connectivity between spawning and rearing habitat upstream, and estuarine and marine habitats downstream.

2.4.2 Previous Section 7 Consultations in the Action Area

Pursuant to section 7 of the ESA, NMFS has conducted several previous interagency consultations that affected the action area of this Project.

In June 2005, NMFS and Corps completed an informal consultation on an outfall repair at the Lynwood and Cheda Pump Stations (NMFS ARN #151422SWR2005SR00278). These pump station projects had discountable and insignificant effects to water quality associated with construction and no long-term adverse effects were anticipated. NMFS concurred with the Corps' finding that the Lynwood and Cheda Pump Stations project was not likely to adversely affect CCC steelhead or their critical habitat.

In February 2014, NMFS completed an informal consultation with the Corps on a railroad bridge renovation project associated with the SMART rail project (NMFS ARN # 151422SWR2011SR00556). This bridge project had discountable and insignificant effects to water quality and no long-term effects were anticipated. NMFS concurred with the Corps that the SMART rail bridge project was not likely to adversely affect CCC steelhead, Southern DPS green sturgeon or their critical habitat.

Regarding previous sediment removal actions by the District in Novato Creek, NMFS has completed two informal consultations (NMFS ARN # 151422SWR2000SR405 in 2000 and NMFS ARN # 151422SWR2004SR9235 in 2004), and three formal consultations (NMFS ARN # 151422SWR2008SR00180 in 2008, NMFS ARN # 151422SWR2012SR00021 in 2012, and NMFS ARN # 151422WCR2016SR00112 in 2016) with the Corps. Sediment removal during

those previous projects had discountable and insignificant effects to water quality (minor and temporary increases in turbidity), and resulted in temporary changes to channel substrate and benthic fauna. Fish relocation from the 2008 sediment removal project resulted in significant mortality of juvenile steelhead due to exposure to dotted smartweed (*Polygonum punctatum*), a common riparian plant. The plant was placed in the buckets used for transporting steelhead to provide cover for the fish. Fish relocation in 2012 and 2016 resulted in no fish injuries or mortality. NMFS concluded that these past sediment removal activities by the District were not likely to jeopardize the continued existence of CCC steelhead, Southern DPS green sturgeon, or result in the destruction or adverse modification of designated critical habitat.

2.5 Effects of the Action

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

The Project activities that are expected to affect steelhead include fish relocation, dewatering of stream reaches, and potential contamination of water by chemical and sediment toxins. Sediment removal is designed to not change the width of the channels or the substrate composition within the action area, though the channel will be deeper. Only juvenile steelhead are expected to be in the action area during the June 15 through October 15 Project period. The potential effects of project activities on juvenile steelhead are presented in following subsections.

2.5.1 Fish Relocation Activities

Before and during dewatering the construction sites, the District proposes to capture and relocate fish away from the work site to avoid direct mortality and minimize the possible stranding of fish in isolated pools. Fish in the Project sites will be captured by seine and/or dip nets, and then transported and released to a suitable habitat. Data to precisely quantify the amount of steelhead that will be relocated prior to construction are not available. Using fish relocation data from the four most-recent sediment removal actions undertaken by the District in Novato Creek (2004, 2008, 2012, and 2016), NMFS anticipates between 0.2 to 11.6 steelhead per 1000 feet of the dewatered area. However, inter-annual variation in juvenile fish abundance and distribution occurs in response to variations in cohort strength, variations in precipitation and temperature, variations in predator or prey abundance, restoration actions, water year type, and other factors. In consideration of this potential variation, NMFS will assume that in some years 25 percent more juvenile steelhead may be present in the area to be dewatered. Since the dewatered area is 8,090 feet long (5,630 feet in Novato Creek, 1,780 feet in Warner Creek, and 680 in Arroyo Avichi) , NMFS expects up to 120 juvenile steelhead (rounded) could be within the area subject to fish collections.

Fish will also be relocated from Heron's Beak Pond during dewatering. Fish could potentially enter Heron's Beak Pond during spillover at the Heron's Beck Levee during high streamflow events in Novato Creek, and may be able to enter through the deteriorated culvert. Although

there are no known fish surveys for the pond, NMFS anticipates there will be no steelhead present in Heron's Beak Pond. However, fish rescue in Heron's Beak Pond will be performed as a precautionary measure, as there is no fish demographic data for the pond.

All steelhead present in the areas to be dewatered will need to be relocated or they will perish when the work sites are dewatered. Steelhead relocation activities will occur during the summer low-flow period after smolts have emigrated and before adults have immigrated into Novato Creek for spawning. Therefore, NMFS expects that only juvenile steelhead will be present in the action area and subject to relocation activities. Given typical steelhead life history and previous fish surveys from Novato Creek, impacts to steelhead will be expressed onto two year classes, but only for one season of sediment excavation authorized by the Corps permit.

Fish relocation activities pose a risk of injury or mortality to rearing juvenile steelhead. Any fish collecting gear, whether passive (Hubert et al. 1996) or active (Hayes et al. 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following both the CDFW and NMFS guidelines, direct effects to and mortality of juvenile steelhead during capture are expected to be minimized. Data from two years of similar salmonid relocation activities in Humboldt County indicate that average mortality rate is below one percent (Collins 2004). However, examination of longer term data set indicates fish relocation efforts are generally below three percent for steelhead (CDFG 2005, 2006, 2007, 2008, 2009, 2010a, 2010b). Based on information from several similar fish relocation efforts, NMFS estimates injury and mortalities would not exceed three percent of those juvenile steelhead that are relocated.

During most of the previous sediment removal activities undertaken by the District on Novato Creek, no fish injuries or mortalities were observed. However, during the 2008 sediment removal activities 69 steelhead were captured from Novato Creek and 27 died (≈ 39% mortality) (Fawcett Environmental Consulting 2009). The fish died from exposure to dotted smartweed (*Polygonum punctatum*) a common riparian plant. The plant was placed in the buckets used for transporting steelhead to provide cover for the fish. Subsequent research using threespine stickleback (*Gasterosteus aculeatus*), a more durable species, documented the potential toxicity of dotted smartweed.[6] Fish relocation efforts continued in 2008 immediately following the fish mortalities, as the cofferdams were in place, water was receding, and water temperatures were rising. Even though the water temperature was high (29° C), no additional mortalities were observed once dotted smartweed was no longer used in the buckets. NMFS believes that the fish mortality observed in 2008 is not typical of efforts during fish relocations and the District is now aware of the problems associated with dotted smartweed.

Fish relocations in Novato Creek during 2012 and 2016 resulted in no mortalities. Since NMFS expects up to 120 juvenile steelhead to be relocated during this Project and injury/mortality rates may be as high as three percent, no more than four juvenile steelhead are likely to be injured or

[6] Potential Lethal Effects of Common Streamside Plants on Native Fish. A poster presented at the 2009 annual meeting of the California-Nevada Chapter of the American Fisheries Society, by Michael Fawcett, Daniel Logan, and Amanda Morrison.

killed during fish relocation by this Project. Those fish that avoid capture may be exposed to risks described in the following section on dewatering.

Although sites selected for relocating fish should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat (Keeley 2003). Some of the fish released at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and a lower density of fish. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. Furthermore, with access to San Francisco Bay blocked by the cofferdams, fish will not be able to outmigrate from Novato Creek for the duration of this Project. However, downstream migratory behavior for steelhead is low during this time of year as juvenile rearing typically occurs in freshwater. NMFS cannot accurately estimate the number of fish affected by competition, but does not believe this impact will be large enough to affect the survival chances of individual fish. For example, the use of multiple release sites will help facilitate fish dispersion, limiting competition. Once sediment removal activities are completed in the late summer/early fall, juvenile steelhead will have the ability to return to the previously dewatered reaches of the action area.

2.5.2 Dewatering

NMFS anticipates temporary changes in streamflow within and downstream of Project sites during dewatering activities. These fluctuations in flow are anticipated to be small, gradual, and short-term. Streamflow in the vicinity of the Project sites should be the same as free-flowing conditions except during dewatering and in the dewatered reach where streamflow is bypassed through Baccaglio Basin, Scottsdale Marsh, Scottsdale Pond, and eventually into Lynwood Basin. Streamflow diversion and Project site dewatering are expected to cause temporary loss and alteration of aquatic habitat, as well as temporary loss of connectivity to San Francisco Bay.

Streamflow diversions could harm individual rearing juvenile steelhead by concentrating or stranding them in residual wetted areas before they are relocated (Cushman 1985). Rearing steelhead could be killed or injured if crushed during diversion activities, though direct mortality is expected to be minimal due to relocation efforts prior to installation of the diversion. Juvenile steelhead that avoid capture in the Project sites will die during dewatering activities. Few juvenile steelhead are likely to avoid capture due to the limited amount of hiding cover in the action area. Thus, NMFS expects that the number of juvenile steelhead in the action area that will be killed as a result of stranding during dewatering activities will be similar to the number of steelhead injured or killed during relocation (no more than four juvenile steelhead). Another manner by which steelhead may be harmed or killed during dewatering or stream bypass activities is to be entrained into the pumps or discharge line. NMFS expects juvenile steelhead will not be harmed or killed by entrainment because the District will screen all pumps drawing water from Novato Creek.

Benthic (*i.e.*, substrate dwelling) aquatic macroinvertebrates within the Project site may be killed or their abundance reduced when creek habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from streamflow diversions and dewatering will be temporary because construction activities will be relatively short-lived. However, larger scale

effects to the benthic community are expected from the Project's excavation of approximately 34,300 CY of sediment. Section 2.5.5 below discuss effects to the benthic community including macroinvertebrates associated with sediment removal.

2.5.3 Toxic Chemicals

Sediment removal activities in Novato Creek and its tributaries will involve the use of heavy machinery in close proximity to the channel or in the dry channel bed. The use of heavy machinery in creek channels creates the potential for toxic materials associated with mechanical equipment, such as fuels, motor oils, and antifreeze to enter the stream or channel. Oils and similar substances from construction equipment can contain a wide variety of polynuclear aromatic hydrocarbons (PAHs), and metals. Both can result in adverse impacts to salmonids. PAHs can alter salmonid egg hatching rates and reduce egg survival as well as harm the benthic organisms that are a salmonid food source (Eisler 2000). Some of the effects that metals can have on salmonids are: immobilization and impaired locomotion, reduced growth, reduced reproduction, genetic damage, tumors and lesions, developmental abnormalities, behavior changes (avoidance), and impairment of olfactory and brain functions (Eisler 2000).

The Project has included several measures which reduce the chances of toxins entering streams. These measures ensure that instream construction work only occurs during the dry season (June 15 - October 15). The District and its contractors propose to maintain any and all fuel storage and refueling site in an upland location well away from the stream channel; that vehicles and construction equipment be in good working condition, showing no signs of fuel or oil leaks, and that any and all servicing of equipment be conducted in an upland location.

For instream activities, NMFS does not anticipate any localized or appreciable water quality degradation from toxic chemicals, as the stream will be dewatered, giving the District and its contractors ample opportunity to attend to any spill prior to toxic chemicals reaching the waters of Novato Creek or its tributaries. NMFS anticipates that proposed BMPs and responses by the District and its contractors to any accidental spill of toxic materials should be sufficient to restrict the effects to the immediate area and not enter the waterway. Due to these measures, NMFS expects that accidents will be minimized and toxic chemical contamination of the action area will be prevented.

2.5.4 Increased Mobilization of Sediment within the Stream Channel

NMFS anticipates that short-term increases in turbidity will occur during proposed dewatering activities, sediment removal, construction and removal of cofferdams, removal of the tide gate on Heron's Beak Pond, and installation of the new fish screen at Heron's Beak Pond. In-stream and near-stream construction activities may cause temporary increases in turbidity (reviewed in Furniss et al. 1991, Reeves et al. 1991, and Spence et al. 1996). Sediment may affect salmonids feeding behavior and efficiency, resulting in reduced growth rates. High turbidity concentrations can reduce dissolved oxygen in the water column, effecting respiratory function. Also, because of turbidity, salmonids disperse from established territories, which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival.

The District has included BMPs to reduce the likelihood of sediments from entering the streams. NMFS assumes that these actions will be effective at reducing sedimentation rates. In the action

area, Novato Creek is shallow, influenced by tidal action, and exposed to high-levels of turbidity due to storm flow runoff events, wind and wave action, and benthic foraging activities of other aquatic organisms. Also, given that steelhead use of the action area during the summer months is low and that any steelhead encountered during this Project will be relocated upstream of the upstream cofferdams, no steelhead are anticipated in the downstream areas when the cofferdams are removed. Therefore, any effects associated with short-term increases in turbidity during implementation of this Project are expected to be discountable for steelhead.

2.5.5 Changes to Substrate Following Sediment Removal

Implementation of the District's Project will lower the channel bottom in the action area by as much as three feet by removing sediment. The channel bottom substrate within the Novato Creek portion of the action area is dominated by sand and silt. Based on previous sediment maintenance episodes, sediment removal activities are not expected to change the composition of the substrate within Novato Creek. Similarly, placement of excavated sediments in Heron's Beak Pond is not expected to significantly alter the substrate within this portion of the action area since the pond bottom is also comprised of fine sediment and sand. Placement of sediment at the West Basin Cross Levee and Lynwood Levee will occur in upland areas, and will have no effect on tidal waters in lower Novato Creek.

PBFs associated with critical habitat in the action area are degraded. The stream channels have been straightened and configured into trapezoidal channels managed for flood conveyance. Sediment removal is unlikely to affect steelhead migration through the action area because the Project will construct a low flow channel. The presence of a low flow channel is anticipated to facilitate maintenance of adequate water depths in the action area for steelhead migration at winter and spring base flows.

Removal of up to three feet of substrate will disturb benthic habitat within the channel and result in the removal of benthic macroinvertebrates. Benthic habitat provides foraging opportunities for fish, providing a substrate for infaunal and bottom-dwelling organisms, such as polychaete worms, crustaceans, and other potential prey items. Due to the relatively large scale of this Project (>8,000 linear feet of channel) and the removal of approximately 34,300 CY of sediment, recolonization of disturbed areas by benthic macroinvertebrates is expected to follow in several months to a few years (Oliver et al. 1977). The Project's impacts upon the benthic community could affect PBFs of critical habitat associated with steelhead foraging. However, the effect of benthic macroinvertebrate loss on steelhead is likely to be negligible because the number of rearing juveniles in this reach is very low and juvenile steelhead primarily feed on aquatic and terrestrial insects. Benthic organisms living within soft sediment and sand in lower Novato Creek likely composed a very small portion of the diet of juvenile steelhead. Based on the foregoing, the disturbance of benthic habitat and the associated loss of the macroinvertebrate community as a result of sediment removal are expected to have minor and temporary adverse effects on the foraging prey base for threatened CCC steelhead and their critical habitat.

2.5.6 Disruption of Fluvial and Geomorphic Processes

The District proposes to stabilize 95 linear feet of streambank in Novato Creek with 126 CY of riprap. This action is designed to prevent further erosion of the right bank downstream of the

SMART rail bridge. Natural fluvial and geomorphic processes in the action area have been previously compromised from channelization in the form of levees and altered by previous sediment removal projects. Streams transport water and sediment from upland sources to the ocean and, generally speaking, the faster the streamflow, the greater the erosive force. A stream channel naturally meanders, eroding laterally to create a sinuous longitudinal course. Stream meandering efficiently regulates the erosive forces by lengthening the channel and reducing stream gradient, thus controlling the ability of the stream to entrain and transport available sediment. Meandering streams also create and maintain both hydraulic and physical instream habitat used by fish and other aquatic species. For instance, specific to salmon and steelhead, a meandering, unconstrained stream channel sorts and deposits gravel and other substrate necessary for optimal food production and spawning success, maintains a healthy corridor, and allows floodplain engagement during appropriate winter flows (Spence and Hughes 1996).

By design, streambank stabilization projects prevent lateral channel migration, effectively forcing streams into a straight, linear simplified configuration that, without the ability to move laterally instead erodes and deepens vertically (Dunne and Leopold 1978; Leopold 1968). The resulting incised channel may fail to create and maintain aquatic and riparian habitat through lateral migration, but instead disconnects flow, natural processes and channel function from adjacent floodplain and riparian habitat, creating a simplified stream reach with poor food production and little functional habitat for summer and winter rearing salmonids (Florsheim et al. 2008; Pollock et al. 2007b). In the action area, existing bank stabilization structures have inhabited natural channel function and evolution, preventing creating and maintenance of natural habitat features which can provide complex fish habitat (*e.g.*, undercut banks, submerged rootwads, *etc.*). Thus, the bank stabilization component of the Project will continue to maintain the currently compromised condition of geomorphic and natural stream functions in the action area. The Project's 95 linear feet of bank stabilization will also further contribute to the degradation of PBFs in the action area associated with natural cover and forage for steelhead critical habitat.

2.5.7 Heron's Beak Pond Wetland Enhancement

Following the placement of excavated sediments in Heron's Beak Pond, the District proposes to remove the existing tide gate structure and install a fish screen that meets NMFS guideline for protection of anadromous salmonids. Removal of the tide gate without modification of the existing Heron's Beak Levee, will create a muted tidal exchange through the pond's opening to Novato Creek.

Based on research conduct by Hobbs (2017) in South San Francisco Bay, muted tidal ponds can have significantly lower dissolved oxygen (DO) conditions relative to adjacent tidal sloughs, particularly during the summer months. Some muted tidal ponds are susceptible to fish kills in summer, especially during warmer periods with a lack of wind that results in stronger eutrophication process and lower DO. Extreme variability of DO conditions can be stressful to aquatic organisms, from both periods of anoxia and hyperoxia (Lushchak and Bagnyukova 2006; Pollock et al. 2007a; Ross et al. 2001). Shallow waters and poor tidal circulation in muted tidal ponds can also create conditions of high water temperature in relation to adjacent tidal sloughs, especially during daytime hours in the summer and fall months. Similar water quality conditions are likely to occur in Heron's Beak Pond following the Project's removal of the tide gate.

The Project's installation of a fish screen at the opening with Novato Creek will effectively prevent steelhead from entering Heron's Beak Pond where degraded water quality conditions are expected during the summer and fall months. Additionally, the fish screen will prevent steelhead from entering the ponded area behind Heron's Beak Levee where they may have difficulty returning to Novato Creek or be subject to predation by birds or non-native striped bass (*Morone saxatillis*). With a design that conforms with NMFS criteria, the fish screen is anticipated to effectively prevent steelhead from entrainment and impingement.

2.6 Cumulative Effects

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

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

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

CCC steelhead are listed as threatened. Based on the extensive loss of historic habitat due to dams and the degraded condition of remaining spawning and rearing areas, CCC steelhead populations in watersheds that drain to San Francisco Bay, including Novato Creek, have experienced severe declines. Due to habitat degradation associated with urbanization and water development that has altered the streamflow regime, steelhead occur in Novato Creek in densities and abundance lower than historic levels. Juvenile CCC steelhead are expected to be present within the Novato Creek portion of action area during sediment removal activities; however, the number of individuals that are present is expected to be low due to the poor quality of rearing habitat and low summer streamflows. Those present likely make up a very small proportion of steelhead in Novato Creek. Due to the timing of the proposed action, no adult steelhead or migrating steelhead smolts would be adversely affected by the Project.

As described in the *Effects of the Action* (Section 2.5), NMFS identified dewatering and fish relocation as the adverse effects on CCC steelhead in the action area that would result from the proposed Project. Prior to dewatering approximately 8,000 linear feet of creek for sediment removal, fish would be collected and relocated from work areas. Fish that elude capture and remain in the Project area during construction activities would likely die during construction operations. However, based on the low mortality rates for similar capture and relocation efforts, NMFS anticipates few juvenile steelhead would be injured or killed by fish relocation and construction activities during implementation of this Project. Anticipated mortality from capture and relocation is expected to be less than three percent of the fish relocated, and mortality expected from dewatering is also expected to be less than three percent of the fish in the area prior to dewatering.

Steelhead present in the action area during the construction period will be limited to the juvenile life stage. If the maximum estimated number of juvenile steelhead are within the action area during dewatering, up to four juvenile steelhead may be killed during fish relocation activities and an additional four juvenile steelhead may be killed during the dewatering of work sites. These low numbers are due to effective relocation efforts and the low injury and mortality rates expected from the Project's use of experienced fish biologists to perform the collections.

The number of steelhead likely affected by the proposed Project make up a small proportion of steelhead in Novato Creek watershed since higher quality summer rearing habitat exists upstream of the action area. Consequently, the number of steelhead likely affected by the proposed Project make up an even smaller proportion of the CCC steelhead DPS. It is unlikely that the small potential loss of juveniles during the proposed action will impact future adult returns. Due to the relatively large number of juveniles produced by each spawning pair, steelhead spawning in the Novato Creek watershed in future years are likely to produce enough juveniles to replace the few that may be lost to effects at the Project site.

NMFS anticipates that short-term increases in turbidity will occur during proposed dewatering activities, construction and removal of cofferdams, sediment removal activities, removal of the Heron's Beak pond tide gate and installation of the fish screen. These impacts will be temporary, and NMFS anticipates that proposed BMPs will control sediment satisfactorily to avoid adverse effects to CCC steelhead or their critical habitat. Also, during the proposed action, NMFS does not anticipate steelhead being present downstream of the dewatered work area – the area in which increases in turbidity may occur. Therefore, NMFS believes that effects of degraded water quality to steelhead downstream of dewatered work area are discountable.

The effects of degraded water quality to designated critical habitat for steelhead will be negligible because of the Project design and BMPs incorporated by the District to avoid the discharge of pollutants into the waters of Novato Creek. NMFS expects the measures incorporated by the District will avoid or minimize the likelihood of accidental discharges of turbidity and other pollutants to Novato Creek to levels which are insignificant to steelhead and their critical habitat.

The disturbance of benthic habitat and loss of macroinvertebrates will occur during dewatering and sediment removal actions. Although this impact will be temporary, the loss of benthic organisms could affect PBFs of critical habitat associated with steelhead foraging. However, the effect of benthic macroinvertebrate loss on steelhead is likely to be minor because the number of rearing juveniles in this reach is very low and juvenile steelhead primarily feed on aquatic and terrestrial insects.

The Project's bank stabilization of 95 linear feet of channel will affect fluvial and geomorphic processes in Novato Creek. It is not expected to significantly degrade existing conditions, but further bank stabilization will continue to maintain the currently compromised condition of geomorphic and natural stream functions in the action area.

Wetland enhancement at Heron's Beak Pond will increase the tidal exchange of water between Novato Creek and the pond. The resulting muted tidal pond condition would allow steelhead and other fish access into an area of seasonal poor water quality and increased predation rates. The Project's installation of a fish screen at the Novato Creek opening will effectively block steelhead from access into the pond and avoid these potential adverse effects.

Regarding future climate change effects in the action area, California could be subject to higher average summer air temperatures and lower total precipitation levels. Reductions in the amount of precipitation would reduce streamflow levels in Northern and Central Coastal rivers. Estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this project, construction would be completed in one year during 2020 and the above effects of climate change are unlikely to be detected within this time frame. If the effects of climate change are detected over the short term, they will likely materialize as moderate changes to the current climate conditions within the action area. These changes may place further stress on CCC steelhead populations. The effects of the proposed action combined with moderate climate change effects may result in conditions similar to those produced by natural ocean-atmospheric variations as described in the Environmental Baseline section of this opinion (Section 2.4) and annual variations. CCC steelhead are expected to persist throughout these phenomena, as they have in the past, even when concurrently exposed to the effects of similar projects.

2.8 Conclusion

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

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant

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

2.9.1 Amount or Extent of Take

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

NMFS anticipates that take of juvenile CCC steelhead during sediment removal activities will be associated with fish collection relocation efforts during dewatering of the work sites.

The number of threatened steelhead that may be incidentally taken during Project activities is expected to be small, and limited to the pre-smolt juvenile life history stage. Take is anticipated to occur during the dewatering of approximately 8,000 linear feet of channel between June 15 and October 15. Up to 120 juvenile steelhead are likely to be collected and relocated during project implementation. NMFS anticipates no more than four juvenile steelhead present in the area to be dewatered will be harmed or killed during relocation efforts and no more than an additional four may be killed during dewatering activities.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

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

1. Undertake measures to ensure that harm and mortality to steelhead resulting from fish relocation and dewatering activities is low.

2. Undertake measures to minimize harm to steelhead resulting during and after construction of the project.

3. Prepare and submit a report to document the effects of construction and relocation activities and performance.

4. Ensure the fish screen at the intake to Heron's Beak Pond effectively protects juvenile steelhead and is properly maintained.

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 measures 1:

    a. Fish rescue and relocation efforts must take place in all areas where dewatering will occur in Novato, Warner and Arroyo Avichi creeks.

    b. The District must retain a qualified biologist with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. The Corps must ensure that all biologists working on this project be qualified to conduct fish collections in a manner which minimizes all potential risks to ESA-listed salmonids.

    c. The biologist must monitor the construction site during placement and removal of channel diversions and cofferdams to ensure that any adverse effects to salmonids are minimized. The biologist must be on site during all dewatering events to capture, handle, and safely relocate ESA-listed salmonids.

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

    e. If any salmonids are found dead or injured, the biologist must contact NMFS biologist Nicholas Van Vleet by email at nicholas.vanvleet@noaa.gov or the NMFS Santa Rosa Area Office at 707-575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities must be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples must be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS

Santa Rosa Area Office without obtaining prior written approval from the NMFS Santa Rosa Area Office. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

   a. The Corps or District must notify the NMFS Santa Rosa Area Office, by email at least 7 days prior to implementation of fish relocation and sediment removal activities. Notification shall be provided to NMFS biologist Nicholas Van Vleet at nicholas.vanvleet@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.

   b. The Corps and District must allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the project site during activities described in this opinion.

   c. A qualified biologist must monitor in-channel activities and performance of sediment control or detention devices for the purpose of identifying and reconciling any condition that could adversely affect salmonids or their habitat. The biologist must report immediately to the District, the Corps, and NMFS any condition that could adversely affect steelhead or their habitat beyond the conditions described in the preceding biological opinion.

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

   a. The Corps and District must provide a written report to NMFS by January 15 of the year following construction. The report must be submitted to NMFS Santa Rosa Area Office Attention: Supervisor of San Francisco Bay Branch, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report must contain, at a minimum, the following information:

      i. **Construction related activities --** The report must include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any effect on ESA-listed fish; the number of salmonids killed or injured during the project action; and photographs taken before, during, and after the activity from photo reference points.

      ii. **Fish Relocation --** The report must include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish

injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

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

    a. The District must submit draft design plans for the fish screen to NMFS for review and approval at least 120 days prior to installation. Draft plans to be provided to NMFS Santa Rosa Area Office Attention: Supervisor of San Francisco Bay Branch, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528

    b. The District must conduct monthly inspections of the fish screen to determine the status and condition of the facility. Required maintenance and repairs must be performed promptly.

2.10 Conservation Recommendations

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

NMFS offers the following conservation recommendations:

1. The District should work with NMFS and the Corps to identify and remedy fish passage impediments and barriers within the watershed. Prioritization of these barriers should also be conducted to guide future restoration projects. For example, a culvert on Arroyo Avichi, roughly ¼ mile upstream of the confluence with Novato Creek, has been identified as a likely barrier preventing adult steelhead from accessing spawning habitat (NMFS 2016).

2.11 Reinitiation of Consultation

This concludes formal consultation for the Novato Creek 2020 Maintenance Sediment Removal and Wetland Enhancement Project.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect"' Determinations

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b). When evaluating whether the proposed action is not likely to adversely affect listed species or critical habitat, NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

NMFS does not anticipate the proposed action will adversely affect:

North American green sturgeon southern DPS (*Acipenser medirostris*)
threatened (71 FR 17757; April 7, 2006)
critical habitat (74 FR 52300; October 9, 2009).

Green sturgeon is an anadromous, long-lived, and bottom-oriented fish species in the family Acipenseridae. Adult green sturgeons may exceed 2 meters in length and 100 kilograms in weight (Moyle 2002). Southern DPS green sturgeon spawn over cobbles and large gravels in a small portion of Sacramento River during the spring and early summer months. Juvenile green sturgeon spend their first few years in the Delta and San Francisco estuary before entering the marine environment as subadults. Green sturgeon feed on benthic invertebrates and fish (Adams et al. 2002).

The effects of the proposed action includes collection and relocation of fish associated with dewatering, degradation of water quality, and disturbance of benthic habitat. Although the tidal portion of the action area is accessible to adult and juvenile green sturgeon year-round, no green sturgeon have been observed during previous dewatering events for sediment removal in lower Novato Creek (Fawcett Environmental Consulting 2009; Fawcett Environmental Consulting 2012; Fawcett Environmental Consulting 2000; Fawcett Environmental Consulting 2006; WRA Environmental Consultants 2016; WRA Environmental Consultants 2015). Additionally, a portion of the project area was dewatered in 2014 to compete a renovation of a railroad trestle crossing Novato Creek. During that trestle project, about 650 feet of the Novato Creek channel was dewatered and all fish present in that area were captured and relocated; no green sturgeon were observed (Area West Environmental 2014). The Project's installation of cofferdams during low tide further reduce the likelihood of encountering green sturgeon because shallow water depths during low tide are unlike to support green sturgeon. Thus, green sturgeon are not likely to be present in the action area during project implementation.

The Project's potential effects on water quality are described in Sections 2.5.3 and 2.5.4. Short-term increases in turbidity are expected in lower Novato Creek during proposed dewatering activities, sediment removal, construction and removal of cofferdams, removal of the

tide gate on Heron's Beak Pond, and installation of the fish screen at Heron's Beak Pond. In consideration of the life history of green sturgeon, this benthic species is well adapted to living in estuaries with a fine sediment bottom and is tolerant of high levels of turbidity. Furthermore, increased levels of suspended sediment and turbidity during Project activities are anticipated to be minor, localized, and short-term. With tidal circulation in the action area, any elevated levels of suspended sediment or turbidity outside of the cofferdams are anticipated to rapidly return to background levels after work ceases. Green sturgeon are tolerant of levels of turbidity that exceed levels expected to result from this Project's construction activities. Regarding the potential discharge of contaminants, proposed BMPs and responses by the District are anticipated to be sufficient to prevent or contain accidental spills to levels which are not likely to adversely affect green sturgeon or their critical habitat. Based on the above, effects to green sturgeon associated with impacts on water quality from sediment excavation and other Project activities are expected to be insignificant or discountable.

The action area is located within designated critical habitat for the Southern DPS of green sturgeon. The PBFs essential for the conservation of green sturgeon in estuarine areas include food resources, water flow, water quality, migratory corridor, water depth, and sediment quality. As described above in the biological opinion, dewatering and removal of up to three feet of substrate would result in the disturbance of existing benthic habitat and loss of macroinvertebrates within the channel. Benthic habitat in the action area may provide foraging opportunities for green sturgeon, providing a substrate for infaunal and bottom-dwelling organisms, such as polychaete worms, crustaceans, and other potential prey items. However, this loss of benthic habitat will be temporary. Layers of mud and silt will become deposited during subsequent tide cycles and organisms from neighboring substrate will recolonize the project area, returning it to its previous condition. Additionally, green sturgeon are not likely to forage in the area in high numbers due to modified trapezoidal channel and degraded habitat conditions in lower Novato Creek. Thus, the potential effects of benthic habitat disturbance by this project on green sturgeon critical habitat are considered insignificant.

At the Heron's Beak Pond connection with Novato Creek, the Project's removal of the existing tide gate would allow green sturgeon to enter the pond where poor water quality conditions are expected during the summer and fall period. The Project's placement of a fish screen at the pond's intake will prevent green sturgeon from entering the pond and avoid these potential effects. Based on the above, the potential effects of the Project are expected to be insignificant on designated critical habitat for green sturgeon.

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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. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Lower Novato Creek and its estuary at the confluence with San Francisco Bay contains EFH for Pacific Coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), Pacific Coast salmon (PFMC 2014), and will be adversely affected by the 2020 Novato Creek Sediment Removal Project. Furthermore, estuaries are considered Habitat Areas of Particular Concern for Pacific Coast groundfish and Pacific Coast salmon.

3.2 Adverse Effects on Essential Fish Habitat

The following actions are expected to adversely affect EFH for Pacific Coast ground fish, Coastal pelagic species, and Pacific Coast salmon:

1. Dewatering in the estuary will result in a temporary loss of habitat, and could strand and kill any fish not relocated during dewatering. See section 2.5.2 for a detailed description of the effects of dewatering.

2. Decreased water quality in the estuary could result as a consequence of increased mobilization of sediment and the potential introduction of toxic chemicals. See sections 2.5.3 and 2.5.4 for further detail.

3. Removal and changes to substrate in the lower Novato Creek will remove benthic macroinvertebrate organisms within the project area; thus disrupting the prey base for EFH species. See section 2.5.5 for further detail.

3.3 Essential Fish Habitat Conservation Recommendations

Given the minimal adverse effects to EFH anticipated, NMFS has no practical EFH conservation recommendations to provide to avoid or reduce the magnitude of these effects.

3.4 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 effects the basis for NMFS' EFH Conservation Recommendations (50 CFR600.920(1)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include the District and the City of Novato. Individual copies of this opinion were provided to the Corps and the District. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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