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

Refer to NMFS No: WCRO-2021-00509

April 30, 2021

Chandra Jenkins
Chief, CA Delta Section
Regulatory Division
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lower San Joaquin River Feasibility Study Smith Canal Gate re-initiation

Dear Ms. Jenkins:

Thank you for your letter of February 26, 2021, requesting re-initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Lower San Joaquin River Feasibility Study Smith Canal Gate. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR Part 402, as amended; 84 Fed. Reg. 44976, 45016 (August 27, 2019)).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA, 16 U.S.C. 1855(b)) for this action. Enclosed we provide NMFS's review of the potential effects of the proposed action on EFH for Pacific Coast Salmon in the project section, as designated under the MSA. The document concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the action area and has included EFH Conservation Recommendations.

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

Based on the best available scientific and commercial information, the biological opinion concludes that the proposed project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*), threatened California Central Valley steelhead distinct population segment (DPS) (*O. mykiss*), or the threatened southern DPS of North American green sturgeon (*Acipenser medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

Please contact Monica Gutierrez at (916) 930-3657, or via email at Monica.Gutierrez@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

A. Catherine Marcinkevage

Cathy Marcinkevage
Assistant Regional Administrator
California Central Valley Office

Enclosure

cc: Copy to File: 151422-WCR2021-SA00065

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

Lower San Joaquin River Feasibility Study – Smith Canal Gate

NMFS Consultation Number: ***WCRO-2021-00509***

Action Agency: U.S Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central Valley spring-run Chinook Salmon ESU (*O. tshawytscha*)	Threatened	Yes	No	N/A (Does not occur within the action area for this species)	N/A (Does not occur within the action area for this species)
California Central Valley steelhead Distinct Population Segment (DPS (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No

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

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

Issued By: A. Catherine Marcinkevage

Cathy Marcinkevage
Assistant Regional Administrator for California Central Valley Office

Date: **April 30, 2021**

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1. Introduction

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

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR Part 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 Part 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 California Central Valley Office.

1.2. Consultation History

On June 7, 2016, NMFS issued a biological opinion on the overall Lower San Joaquin River Feasibility Study (LSJRFS). NMFS concluded that the project was not likely to jeopardize the continued existence of the federally listed species and designated critical habitats. The Smith Canal Gate project is one component of the larger LSJRFS project, but a full detailed description and design for the Gate was not available at that time.

On November 6 and 7, 2018, NMFS and the U.S. Army Corps of Engineers (Corps) had discussions over the phone and via email regarding how to move forward with the Smith Canal Gate consultation, after new information was developed for the project description and Gate design.

On November 27, 2018, NMFS and the Corps had a conference call to go over a draft Biological Assessment (BA) of the Smith Canal Gate project.

On April 4, 2019, NMFS received an initiation package requesting formal section 7 consultation for the Smith Canal Gate project. Upon review of the biological assessment, NMFS provided the Corps with a list of questions needed to analyze the effects of the proposed action.

On May 9, 2019, upon review of the Corps' response email to the information requested by NMFS, NMFS initiated formal consultation.

On October 18, 2019, NMFS issued a biological opinion to the Corps, concluding the proposed action was not likely to jeopardize the continued existence of the federally listed species and not likely to destroy or adversely modify their designated critical habitats.

On October 13, 2020, the San Joaquin Area Flood Control Authority (SJAFCA) received technical assistance from NMFS via email to extend the Year 1 in-water work window from July 15 to November 15, 2020, to accommodate installation of all sixty-four foundation piles (2020 season). Based on the information received from SJAFCA, the proposed project related activities from pile driving (behind a cofferdam) and barge/boat traffic would remain unchanged from the 2019 NMFS opinion, therefore re-initiation was not warranted. In-water work was completed on November 9 and all equipment used for in-water work was demobilized on November 10, 2020, thereby completing all Year 1 in-water work activities within the extended in-water work window.

On February 5, 2021, Corps had a call with NMFS to go over some potential modifications of the in-water construction activities for Year 2.

On February 26, 2021, Corps requested re-initiation of formal consultation of Smith Canal Gate project, as a result of the changes to the proposed action described below in section 1.3.1, and consultation was initiated on this date.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under MSA, 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 is the lead Federal agency for this project. The Central Valley Flood Protection Board and SJAFCA are the non-Federal project sponsors partnering with the Corps on LSJRFS. The SJAFCA is requesting authorization to complete the Smith Canal Gate portion of the LSJRFS located in the San Joaquin River, City of Stockton, San Joaquin County, California (Figure 1).

The proposed action would implement flood risk-reduction measures in the vicinity of the Smith Canal and the San Joaquin River in and adjacent to the City of Stockton. The proposed action would consist primarily of a fixed wall, filled with granular material, that would extend approximately 800 feet from the north tip of Dad's Point to the right bank of the San Joaquin River at the Stockton Golf and Country Club and would feature a 50-foot-wide gate that would be closed during high flow events forecast to approach or exceed design operating water surface elevations (8.0 feet). During high flow and high tide events, the gate structure would isolate Smith Canal from the San Joaquin River and allow existing levees to function as a secondary flood risk-reduction measure. The gate would be closed only as needed for flood control to prevent high tide flows from entering Smith Canal, remaining open to allow for recreation, navigation, and tidal movement in and out of Smith Canal. To aid in navigation, U.S. Coast Guard-approved lighting will be installed along the fixed wall structure and at the gate opening.

The opening portion of the gate structure would consist of a miter (double-door gate structure), opening outwards towards the San Joaquin River. When open, the gate doors would recess into the gate structure, providing a 50-foot-wide opening. The structure would be opened and closed by electric motors located above water on top of each gate hinge. The gate panels would be attached to a concrete foundation using stainless steel anchor bolts. The gate panels would be gasket-sealed at their connection to the fixed wall structure and at the point where two panels come together.

The gate structure would be designed so it could be operated locally with programmable preset operating controls. Gate controls would be installed in a weatherproof enclosure on Dad's Point, adjacent to the fixed wall tie-in. A second set of controls may be located at the end of the sheet pile wall near the shore if safe gate operation is deemed possible from this location. A portable generator can be brought to the western end of Dad's Point to connect into the power distribution equipment in the event of a power outage.

Improvements to Dad's Point including the construction of continuous single sheet pile floodwall, placement of fill material, and new recreation amenities would also be completed. Approximately 1,660 linear feet of continuous single sheet pile floodwall would be constructed along Dad's Point. Most of the sheet pile wall would be entirely underground, but a concrete cap would be installed on top of the sheet pile wall in areas where it would be exposed. Fill material would be placed in some areas to raise the elevation of Dad's Point, and the crown would be graded to accommodate a 20-foot-wide all-purpose road. As Dad's Point is currently part of Louis Park, the site would be restored to its existing use and would have new recreation amenities. These amenities would include installation of fishing and wildlife viewing platforms accessible to people with disabilities; construction of a multi-use interpretive trail suitable for walking, running, and bicycling with kiosks and benches; removal of invasive vegetation and planting of native landscaping; and installation of bat boxes, if suitable.

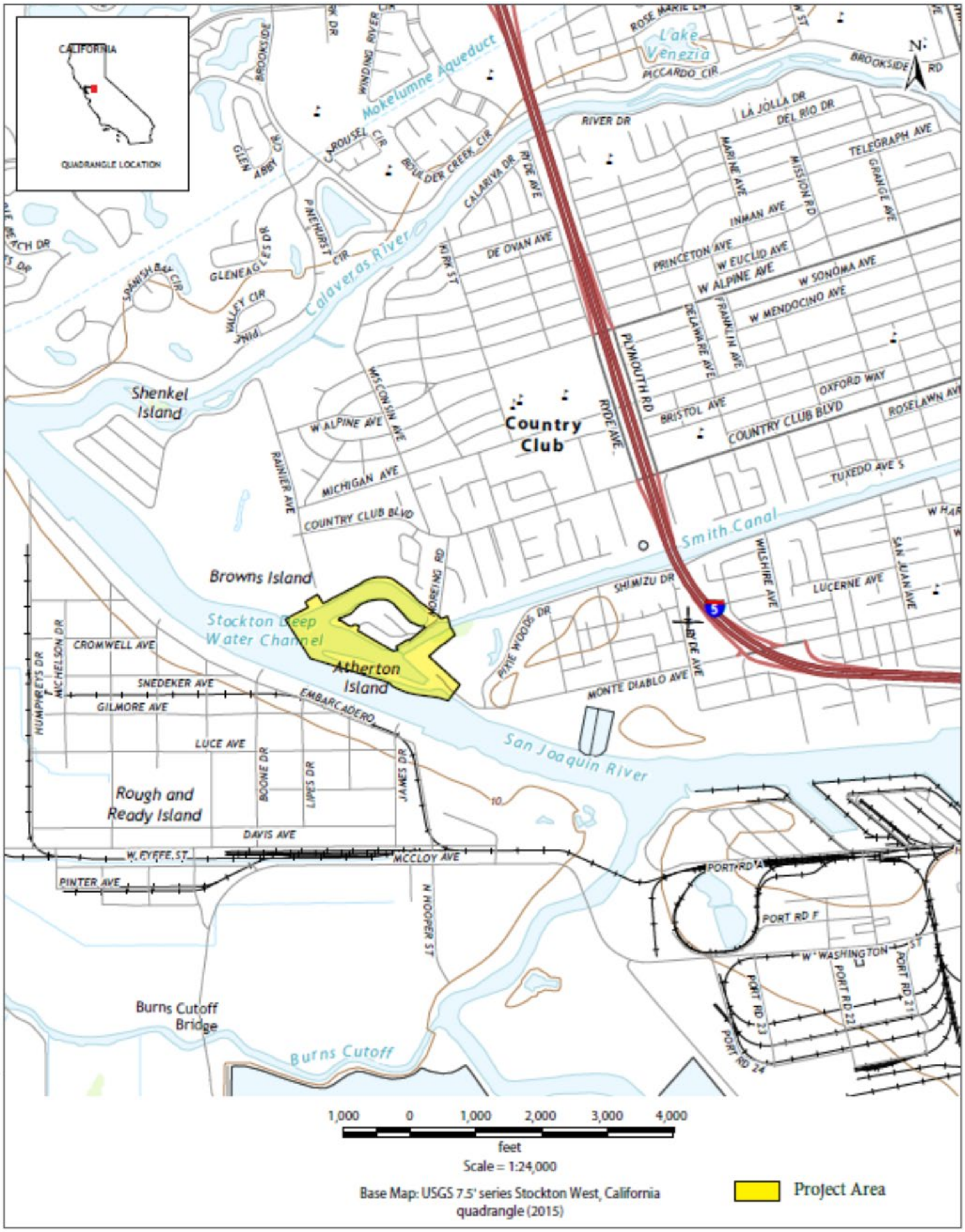

Figure 1. Proposed project area.

Construction Materials

The Louis Park parking area near the boat launch at the base of Dad's Point would be used as a staging area. Construction materials to be used in substantial quantities are steel sheet pilings for the fixed wall, concrete for the gate monolithic structure, riprap boulders for scour protection during flood events, and granular fill material for the fixed wall. Other materials imported to the site could include incidental construction support materials, aggregate base rock, asphalt, concrete, and hydroseed. Materials would be brought to the project site via truck or barge, depending on the location of the staging area, the size, or amount of the material being brought to the site. Barges or boats will be used to deliver materials and equipment via the San Joaquin River and the Stockton Deep Water Ship Channel (DWSC).

Debris from dredging, clearing, and grubbing between the connection of the gate structure and the shoreline would be hauled to one of two permitted disposal sites: the Lovelace Materials Recovery Facility in Manteca, approximately 12.5 miles from the project site, or the North County Recycling Center and Sanitary Landfill in Lodi, approximately 22 miles from the project site. Alternatively, dredged material could be disposed of at an upland site with no connectivity to waters of the United States. Any upland disposal site selected would be closer to the project site than the two facilities described above.

Cofferdam Installation

Construction and installation of the gate structure would begin by installing a metal sheet pile cofferdam, to dewater the work area and allow dry work on the foundation and walls for the gate structure. To form the cofferdam, sheet piles would be driven using a barge-mounted crane equipped with a vibratory hammer. The cofferdam sheet piles would be sized to form the foundation of the gate structure, approximately 71 by 71 feet, and would be the same height as the gate structure (elevation 15.0 feet), extending 10 feet above the mean water level at the entrance to Smith Canal.

The cofferdam would be constructed over a 1-month period during an in-water work window of July 15 to October 15. Construction of the cofferdam would limit access for boat traffic from both Smith Canal and Atherton Cove to an opening north of the cofferdam. The access would be limited until the gate structure would be operational, estimated to be 11 months after construction of the cofferdam.

Dewatering Procedures

Dewatering of the cofferdam area would begin once cofferdam installation was complete and would continue during the entire installation of the gate structure to ensure a dry work substrate. Initial dewatering would take place prior to placement of the foundation. Procedures would be put into place to manage the silt that would likely be removed during the initial dewatering activities. The silt would be allowed to settle within the cofferdam to limit silt discharged during dewatering. The cofferdam is assumed to have a low continuous inflow, resulting in a work area that is not water tight, so a sump pump and generator would be used to remove excess water periodically if it reaches a predetermined level. Should continuous dewatering be needed, bag filters would be used to contain and dispose of silt.

Dredging

Prior to construction of the gate structure and fixed wall, dredging of up to 8,650 cubic yards of the channel bottom may be needed along the length of the fixed wall alignment in order to provide a level surface, as well as dredging in an additional area to allow barge access for pile driving during periods when water surface elevations may be low. Dredging will occur prior to the construction of a cofferdam. Material would be dredged using a combination of a long arm excavator, a dragline excavator, and a clamshell excavator, and silt curtains will be used along the limits of dredging. A turbidity curtain will be used around the dredging area to minimize turbidity.

Gate Structure Construction and Installation

Construction and installation of the gate structure would start once the cofferdam is sufficiently dewatered. Construction of the gate structure would take approximately 6 months. Sixty-four concrete-filled steel pipe piles, approximately 36 inches in diameter, would be driven along the inside edge of the cofferdam to provide support for the concrete floor and walls. The steel pipe piles would be installed by using a barge-mounted crane equipped with a pile driving impact hammer.

Pile driving is likely to cause a small amount of heaving of mud as it is displaced by the piles, which would be removed to get the bottom surface to the correct elevation. The mud removal would be done with either a clamshell excavator or a long-arm track hoe and would be contained within the cofferdam walls.

Following installation of the steel pipe piles, a reinforced concrete floor and the gate structure walls would be formed and poured. Two sides of the cofferdam would be used as forms. The concrete floor would be 69 feet wide, 69 feet long, and 6 feet thick, while the concrete walls would be 71.25 feet long, 22 feet high, and 6 feet thick. The metal gate would be attached to the concrete floor and walls by a barge-mounted crane. The cofferdam sheet pile along the inlet and outlet sides of the gate would be cut down to the level of the gate structure floor by a diver using a torch. The remaining portion of the sheet pile would be kept in place to prevent seepage under the gate structure. Rock protection would be placed at the transitions from the gate structure to the fixed wall to provide scour protection.

The gate would be tested and put into service after construction of the gate structure controls and southern side of the fixed wall is completed. Construction of the northern side of the fixed wall would not take place until after the gate structure has been tested to confirm operability.

Fixed Wall Construction

Following installation of the gate structure cofferdam, work would begin on the fixed wall portion of the proposed action. The fixed wall would extend approximately 800 feet from the north tip of Dad’s Point Levee to the east bank of the San Joaquin River, at the Stockton Golf and Country Club. The fixed wall consists of two cellular web steel sheet pile walls driven into the riverbed by a vibratory hammer. The walls would be constructed to be between approximately 29 feet apart at the connection between cells and 34 feet apart at the widest part of each cell, and would have a top elevation of 15.0 feet, extending 10 feet above the mean water level at the entrance to Smith Canal. The silt in the water between the sheet walls would be allowed to settle before being dewatered.

The north end of the fixed wall would be integrated into the existing FEMA-accredited levee near the Stockton Golf and Country Club. This integration would be designed so that it would not affect the integrity of the existing levee system. Sheet pile wing walls would be driven along the levee perpendicular to the north end of the fixed wall, and the wing walls would be tied into the end of the fixed walls using interlocking sheet piles. Interlocking sheet piles would also be used at the Dad's Point tie-in, connecting the southern-most cell of the fixed wall to two parallel sheet pile walls driven into the end of Dad's Point.

Granular material would be installed between the walls using a front-end loader. The granular material would consist of a sand and gravel mixture. Steel cable cross-ties would subsequently be manually installed as the granular material is raised to an elevation within 3 feet of the top of the sheet piles. Upon completion of construction, a locked security gate would be installed at the south end of the fixed wall on Dad's Point and at the north end of the fixed wall at the Stockton Golf and Country Club. The gate would be 8 feet high and prevent public access to the fixed wall and gate structure. Access to the gate structure through the security gate would be limited to SJAFCA and authorized maintenance representatives.

Once construction of the fixed wall is complete, thirty-five 36-inch steel pipe pile dolphins would be installed on the San Joaquin River side of the wall to protect it from boats colliding into the wall, and two fender piles would be installed on both the San Joaquin River and Smith Canal sides of the gate structure. The pipe piles would be driven using a barge-mounted impact hammer. The dolphin piles would be spaced every 16 feet on each side of the gate structure and would be placed approximately 55 feet away from the centerline of the fixed wall. The fender piles would have a floating fender that would move up and down the pile with the tide, and all four fender piles would have a solar-powered light-emitting diode navigation light mounted on top.

Planter boxes would also be installed along the top edge of the Atherton Cove and Smith Canal side of the fixed wall. The planter boxes would be designed to allow vegetation to hang down over the top half of the wall, but would not extend below the water surface. Construction of the fixed wall would be staggered over 2 years in order to comply with the allowable in-water work period from mid-July to mid-October each year. The southern and northern portions of the fixed wall would be installed during the first and second years of construction, respectively. Construction of the northern side of the fixed wall would not take place until after the gate structure has been tested to confirm operability.

Similar to the construction of the gate structure, work to construct the fixed wall would be done using barge-mounted equipment. The granular material would be delivered to the construction site by a truck or barge using a crane equipped with a clamshell bucket.

Riprap Placement

Once the fixed wall is constructed, approximately 3,400 tons of riprap (approximately 200 linear feet) would be placed along the banks at the Stockton Golf and Country Club (approximately

100 linear feet on each side of the fixed wall). Additionally, 230 linear feet around the tip of Dad's point. Riprap to be placed would have a maximum diameter of 18 inches, and would be of a gradation that minimizes large voids. The wall tie-ins are designed to be stable, but the riprap would be needed for scour protection during flood events. At the tie-in with the Stockton Golf and Country Club, the riprap would extend along the bank from both the Smith Canal and San Joaquin River sides of the wall. The riprap would be placed using either an excavator or a clamshell bucket.

Floodwall and Fill Placement

Construction of the fixed wall and its use as a flood structure would contribute to a 200-year level of flood protection and meet the 200-year level of protection elevation (15.0 feet). The downstream banks adjacent to the Stockton Golf and Country Club meet this elevation requirement; however, several areas along Dad's Point do not, including most of its eastern half. To address the elevation deficiency, in addition to seismic stability and seepage concerns, a single sheet pile floodwall would be built, and fill would be placed in additional areas to bring the entirety of Dad's Point up to a minimum of 15.0 feet in elevation.

To accommodate the new single sheet pile floodwall and fill placement, the existing landscaping and concrete pathway along the middle of Dad's Point would be removed; however, most of the existing vegetation along the edges of Dad's Point would be preserved in place. A 1-foot-wide trench would then be excavated using a backhoe between Stations 22+50 and 30+13. Sheet piles would then be installed using a vibratory hammer, and a 1-foot-wide concrete cap would be constructed on top of the single sheet pile wall. The single sheet pile floodwall would be designed in accordance with the USACE Engineering and Construction Bulletin Number 2014-18 (Design and Evaluation of I-Walls Including Sheet Pile Walls) and USACE Engineering Circular Number 1110-2-6066 (Design of I- Walls). Dad's Point would also be regraded following construction of the floodwall to cover both sides of the floodwall wherever possible, which may require placement of fill material to form a 20-foot-wide levee crown. After grading, an 8-foot-wide all-purpose road would be constructed along the crown to provide access to the southern end of the fixed wall and gate structure. A 12-foot-wide section of concrete pavers would run parallel to the all-purpose road.

In addition, an abandoned 30-inch steel pipe runs through Dad's Point. The pipe would be removed where feasible and any pipe remnants would be capped at both ends and filled with a cement mix.

Recreation Improvements

Improvements on Dad's Point would be made to increase the recreation opportunities and overall experience for visitors. Recreation facilities developed on Dad's Point would be selected based on current uses of the space including fishing, wildlife viewing, walking, biking, and running. As part of recreation facility implementation, other improvements would be made, such as invasive species removal, revegetation of banks with native riparian species, and replacement of landscaping removed during construction.

Fishing and wildlife viewing from Dad's Point are popular recreation activities. Two fishing and wildlife viewing platforms would be constructed on the river side of the peninsula, spaced approximately 750 feet apart, to provide optimum spaces for engaging in these opportunities. The platforms would be constructed by driving 24-inch steel pipe piles with an impact hammer into the bank that would extend out from the peninsula to support the ramp and platform. The platforms would be 36 feet wide and 12 feet deep, with a ramp for access. The platforms would be Americans with Disabilities Act accessible and have railings for safety and benches for sitting. The platforms would help organize and direct use of the shoreline for recreation activities, and signage placed along the remainder of the shoreline would prohibit its use, where necessary, to help prevent erosion and keep wildlife habitat undisturbed. Construction of the platforms would involve the placement of steel piles within the mean high water mark of the San Joaquin River. In consultation with a qualified biologist, up to five bat boxes would be installed along Dad's Point, if suitable locations are found.

Because invasive plants displace native plants and wildlife, increase wildfire and flood danger, consume valuable water, and degrade recreational opportunities, invasive plants would be removed along the levee and replaced with native vegetation. Removal of invasive trees, shrubs, and herbaceous vegetation from the banks of Dad's Point would remove the source of seeds and additional invasive plants. Areas where invasive plants are removed would be revegetated with native riparian plants. Planting these areas with native riparian plants would increase habitat value, decrease wildfire and flood danger, increase recreation opportunities, and reduce maintenance costs. Herbicides will be used to eradicate non-natives in upland areas (such as glyphosate, 2,4-D, Imazamox, or Penoxsulam). Invasive trees will be cut and will have a stump painted with an herbicide. For other invasive plants, the operator will use a hand wand sprayer from a backpack or from an ATV-mounted tank.

A multi-use interpretive trail suitable for walking, running, and bicycling would be constructed on Dad's Point after the grade adjustment and floodwall construction are complete. Kiosks with interpretive signs would help educate the public on a variety of topics, including local wildlife and plants, the San Joaquin River watershed, the history of the Port of Stockton, the Sacramento-San Joaquin River Delta (Delta), or information about the proposed low water use demonstration plantings at Dad's Point. The signs would be developed with multiple languages presented to reach the widest audience possible. The replacement trail would be constructed as a Class I multiuse trail facility with a minimum 8-foot-wide concrete surface. A 12-foot-wide section of concrete pavers would run parallel to the all-purpose concrete road. Benches and kiosks would also be provided along the trail.

Construction Timing

Although initially SJAFCA anticipated that construction of the project would last approximately 2 years, through this reinitiated opinion they have split the construction into 3 years. As Year 1 construction has been completed under the original opinion (NMFS 2019), this opinion includes the proposed action components for Year 2 and Year 3.

There would be two primary periods for construction, depending on the type of work:

1) In-Water Work. All work in water would be conducted during an approximate 12-week period from mid-July to mid-October each year. This timeframe is the only time when work that may disturb aquatic habitat would be completed. During that time, work activities would be conducted 10 hours a day, from 7:00 a.m. to 5:00 p.m., up to 7 days per week.
2) Dry Land Work. Work on dry land, including dewatered portions of Smith Canal, would be conducted year-round, depending on weather. Work hours would be 9 hours per day, from 7:00 a.m. to 4:00 p.m., Monday through Friday.

Summary of the Vibratory and Impact Pile Driving Activities

For all pile driving (sheet and pipe), piles will be driven to the maximum depth possible using a vibratory hammer prior to using an impact hammer. It is anticipated that all sheet piles can be driven using only vibratory methods, but it is possible some impact hammering will be needed to reach required depths depending on geotechnical conditions.

Construction of the Smith Canal Gate and associated dolphins and flood walls will require the use of both vibratory and possibly impact pile driving to install the sheet piles for the permanent cofferdam and pipe pile foundations of the gate structure across the canal, the temporary construction support platforms, and the permanent fishing platforms and retaining walls. Steel pipe piles and sheet piles will be placed into the river channel first via vibratory pile driving, and then via impact pile driving for final setting and then load testing during the proposed in-water work window of July 15 to October 15. Most in-water pile driving will be accomplished with a barge-mounted crane, and once the sheet pile retaining wall of the gates form a cofferdam, the internal area will be dewatered so that foundation piles can be installed "in-the-dry." When construction is complete, vibratory pile driving will be used to remove all temporary support piles and cofferdam sheet piles and parts of an abandoned steel pipe running through Dad's Point.

The sides of the cofferdam around the gate structure that abut the fixed wall will stay in place. For the sides of the cofferdam on the inlet/outlet sides of the gate, a diver will cut the sheet piles to the level of the gate structure floor and the sheets will be removed using a crane. The contractor will excavate and remove the portion of the pipe that is within Dad's Point after installing a concrete plug on the Smith Canal side. A summary of pile driving activities is summarized in Table 1.

Table 1. Summary of pile driving activities.

Structure	Number of Piles	Pile Description	Type of Pile Driving	Environment	Estimated Duration
Floodgate Foundation	64	36-inch diameter steel pipe piles	Impact	Inside cofferdam surrounded by water	10 days
Dolphins	39	36-inch diameter steel pipe piles	Impact	In water	4-5 days
Floodgate Cofferdam	71 feet x 71 feet	PZ-40 sheet piles	Vibratory	In water	1 month
Fixed Cellular Sheet Pile Wall	~1,465 sheets	AS-500-12.7 sheet piles	Vibratory	In water	6 months
Fishing Platforms	24	24-inch diameter steel pipe piles	Impact	In water (16) and on land (8)	3-4 days
Dad's Point Flood Wall	770 sheets	NZ-26/AZ-26	Vibratory	On land	60 days

The pile driving assumptions for the Proposed Action have been revised (from 3200 strikes) to allow for up to 5,000 strikes per day during the limited in-water work window, in order to ensure that in-water work and pile driving activities can be completed within the in-water work windows, which would help minimize temporary impacts on special-status fish species. As set forth below, the associated hydroacoustic impacts resulting from pile driving activities were recalculated using up to 5,000 strikes per day, and the analysis was also updated to reflect that impact driving may be used for installation of the cellular sheet pile wall piles, if needed, once they have been vibrated in to the maximum depth possible. The analysis assumes that various combinations of pipe piles and sheet piles could be driven on the same day with the same pile driver, and up to 5,000 strikes per day for any given pile or combination of piles.

Operation and Maintenance

Once complete, the gate structure and the slide gates would be tested as needed, and testing would be scheduled to avoid times when boat traffic is expected to be heavy. During this testing, the gate would be closed and then reopened.

Once the gate structure is deemed fully operational, the gate will normally remain open to allow for tidal movement, navigation, and recreation. It would be closed only as needed for flood control purposes, testing, inspection, and maintenance. For flood control purposes, the gate would be closed only during high flow and high tide events forecasted to exceed the design operating water surface elevation (8.0 feet); events that typically occur between November and April. The gate would be operated as needed during these times to prevent high tides from entering Smith Canal. If a high tide event were anticipated, the gate would be closed at the lowest tide prior to the forecasted high tide. The gate would remain closed until the water level in the San Joaquin River drops down to the water level in Smith Canal, at which point the gate would open. Currently, an urban area of approximately 3,430 acres drains into Smith Canal via nine storm drain pump stations. In the event that rainfall occurs while the gate is closed and causes the water level in Smith Canal to be higher than the Delta, the pump stations that pump into Smith Canal from the surrounding developed areas would be shut off until the gate is opened.

Table 2 below presents the number of gate closures that would have occurred between 1983 and 2013 based on stage data from the Burns Cutoff Gage Station. The number of closures over this 30-year period would have ranged from 0 to 19 times per year, with no closures occurring in 23 of those years.

Table 2. Number of days with stage greater than 8 feet NAVD88.

Year	No. Days with Stage ≥ 8.0 Feet NAVD88	Year	No. Days with Stage ≥ 8.0 Feet NAVD88
1983	19	1998	13
1984	2	1999	0
1985	0	2000	0
1986	4	2001	0
1987	0	2002	0
1988	0	2003	0
1989	0	2004	0
1990	0	2005	0
1991	0	2006	8
1992	0	2007	0
1993	0	2008	0
1994	0	2009	0
1995	0	2010	0
1996	0	2011	1
1997	12	2013	0

Based on the information presented in Table 2, it is assumed that there would be two closures per year on average for flood control purposes. This is a conservative estimate, however, based on historical days that were above 8 feet NAVD88. In general, the gate would not need to be closed at a precise point in the tidal cycle. However, if a significant local rain event was predicted to occur at the same time as flood stage on the San Joaquin River near Stockton, timing of gate closure would need to be more precise to maximize storage space for local runoff behind the fixed wall. To be prepared for such an event, SJAFCA would develop a gate operation plan. The plan would include procedures for predicting when river stage would be high and when local rain events might be significant. For example, each year prior to November 1, SJAFCA would obtain tide prediction tables to determine the timing of peak tides. These high tides would be used to develop an “alert” table to help plan activities during the winter months. In addition, because rainfall and runoff affect water surface elevation, daily stage predictions generated by DWR would be monitored. This information would help determine when the gate would be closed for flood control purposes. The gate operation plan would consider that gate closure should occur earlier (at low tide potentially days before the flood flows are expected to arrive) if new storms were predicted for the region. The operation plan would consider scenarios of combined high stage on the San Joaquin River and significant local stormwater runoff.

Routine inspection and maintenance of the gate structure and associated equipment would be conducted on an annual basis to ensure that flood risk-reduction would be provided by the operation of the gate structure. This inspection and maintenance would be conducted on the gate's abutment seals, motors, hinges, and panels. Maintenance of the fixed wall structure corrosion protection system would take place every 2 years. The fill material in the fixed wall would be inspected annually, and additional fill material would be added as required.

Floating debris that has accumulated behind the fixed wall would be regularly removed. The frequency of debris removal would depend on the rate of accumulation, to be determined by regular visual monitoring of the site and collection of information from adjacent residents. Based on the information gathered, SJAFCA would schedule and implement a regular debris removal program, removing debris from the project site as frequently as needed to comply with the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins' direction that "[w]ater shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses."

Water hyacinth (*Eichhornia crassipes*) also would be regularly removed from the areas on the Atherton Cove and Smith Canal side of the fixed wall through development and implementation of a water hyacinth control program to ensure that the cover of water hyacinth in the project area does not increase beyond existing conditions. The frequency of water hyacinth removal would depend on the rate of vegetation growth and accumulation, to be determined by regular visual monitoring of the site. Based on the information gathered, SJAFCA would schedule and implement a regular removal program, removing hyacinth from the project site during the growing season, which is generally from March to early December. During the growing season, mechanical harvesting would be conducted using an aquatic weed harvester whenever cover of water hyacinth reaches 20 percent in the most affected areas behind the fixed wall. The percent cover would be visually estimated from the shoreline.

Conservation Measures

1) Prior to any construction activities onsite, a review of all required permits and notifications will be performed to ensure requirements for environmental compliance are fully understood, specific limits of activities and work are defined and understood, and all environmental clearances and access, encroachment agreements, and permissions have been obtained from the appropriate agencies and parties.

2) An approved biological monitor will be onsite during all construction activities that occur within the channel (i.e., cofferdam dewatering, pile driving). Biological monitors will be notified in advance of all work activities and locations, and scheduled to be onsite as required during vegetation clearing activities.

3) To clearly demarcate the project boundary and protect sensitive natural communities, SJAFCA or its contractor will install temporary exclusion fencing (i.e., minimum 4-foot tall high-visibility orange construction fencing) around sensitive biological resource areas 1 week prior to the start of construction activities.

4) Before any work occurs in the project site, a qualified biologist will conduct mandatory contractor/worker environmental awareness training to brief construction personnel on the need to avoid impacts on sensitive biological resources and the penalties for not complying with permit requirements.

5) Prior to construction activities, environmentally sensitive areas will be flagged or fenced in order to clearly delineate the extent of the construction. All crews will also have a set of environmental drawings showing the locations of the known environmental areas. The plans will also define the fencing installation procedure. The project's special provisions package will provide clear language regarding acceptable fencing material and prohibited construction- related activities, vehicle operation, material and equipment storage, and other surface- disturbing activities within sensitive areas.

6) Access routes and work areas will be limited to the minimum amount necessary to achieve the project goals. Unpaved routes and boundaries will be clearly marked prior to initiating construction.

7) All equipment will be maintained such that there will be no leaks of machine fluids such as gasoline, diesel, or oils. Containment pans will be placed under stationary equipment in the event of leaks.

8) Hazardous materials such as fuels and oils will be stored in sealable containers in a designated location that is at least 200 feet from any aquatic habitat.

9) The number of access routes, size of staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Project limits will be established and defined with physical markers to define access routes and maintenance areas to the minimum area necessary to complete the project; this includes locating access routes and maintenance areas outside of any drainages or creeks.

10) Construction access, staging, storage, and parking areas shall be located on ruderal or developed lands to the extent possible. Vehicle travel adjacent to wetlands and riparian areas shall be limited to existing roads and designated access paths. Sensitive natural communities (e.g., wetlands, water, riparian zones) shall be conspicuously marked in the field to minimize impacts on those communities, and work shall be limited to outside the marked areas.

11) Only tightly woven fiber netting or similar material may be used for erosion control. No plastic monofilament matting will be used for erosion control, as this material may ensnare wildlife or disperse into the environment, increasing the amount of plastic pollution.

12) SJAFCA or its contractor will inspect and clean all equipment being used for brush clearing to minimize the spread of invasive plant species into upland refugia and tidal marsh habitat.

13) Upon completion of the proposed action, all temporarily disturbed natural areas, including stream banks, will be returned to original contours to the extent feasible. Affected wetlands, stream banks or stream channels will be stabilized prior to the rainy season and/or prior to reestablishing flow. Native wetland vegetation will be reestablished as appropriate.

14) SJAFCA or its contractor will implement one or more of the following actions to avoid and minimize the spread or introduction of terrestrial invasive plant species. In addition, SJAFCA will coordinate with the San Joaquin County Agricultural Commissioner to ensure that the appropriate Best Management Practices (BMPs) are implemented for the duration of the construction of the proposed action.

    a. Educate construction supervisors and managers about the importance of controlling and preventing the spread of invasive plant infestations.
    b. Use eradication methods that have been approved by or developed in conjunction with the San Joaquin County Agricultural Commissioner during terrestrial invasive species removal to prevent dispersal of the species and/or destroy viable plant parts or seeds. Methods may include use of herbicides approved for use in and near waterways and seasonal removal (i.e., prior to flower and fruit production).
    c. Minimize surface disturbance to the greatest extent feasible to complete the work.
    d. Use native, noninvasive species or nonpersistent hybrids in erosion-control plantings to stabilize site conditions and prevent invasive plant species from colonizing.
    e. Use erosion-control materials that are weed-free or contain less than 1% weed seed.

15) Vegetation will be cleared only where necessary and will be cut approximately 4 inches above soil level. This will allow plants to regrow after construction. All clearing and grubbing of woody vegetation will be done using hand tools, small mechanical tools, or backhoes and excavators.

16) Prior to use of the proposed staging area adjacent to the San Joaquin River, or any other potential staging area that is not graded or paved, SJAFCA will retain a qualified wetland delineator to assess the staging area for the presence of any potential waters of the United States. This assessment does not need to be a complete delineation according to all USACE requirements, but will be adequate for the purposes of determining the approximate boundaries of any potential wetlands or other waters of the United States so that they can be avoided. If potential wetlands or other waters are found within the staging area, they will be shown on a map, fenced, and avoided during all construction activity, including a suitable buffer to avoid any long-term impacts.

17) All slopes or unpaved upland areas temporarily disturbed by construction activities will be revegetated at least 3 days prior to a forecasted rain event with an erosion control seed mix that consists of grasses and herbaceous species that are native or naturalized to the region. The temporarily disturbed areas will be restored to pre-project topography and hydrology to the greatest extent possible.

18) To prevent introduction and/or transport of aquatic invasive species into or from creeks, sloughs or other wetted channels in the Action Area, any equipment that comes into contact with the channel will be inspected and cleaned before and after contact, according to the most current Inspection Standards and Cleaning and Decontamination Procedures (DiVittorio et al. 2012).

Water Quality Measures

Subject to requirements of Section 402 of the Federal Clean Water Act, and the National Pollutant Discharge Elimination System (NPDES) permitting process, all construction projects that disturb more than one acre of land are required to prepare and implement a stormwater pollution prevention plan (SWPPP). The consulting firm selected to prepare detailed construction plans and will also be required to prepare a SWPPP for the project and include it in project plans and specifications. The construction contractor(s) will then be required to post a copy of the SWPPP at the project site, file a notice of intent to discharge stormwater with the Central Valley Regional Water Quality Control Board (Regional Water Board), and implement all measures required by the SWPPP. SJAFCA will be responsible for monitoring to ensure that the provisions of the SWPPP are effectively enforced. In the event of noncompliance, the Regional Water Board will have the authority to shut down the construction site or fine the responsible party or parties.

The SWPPP will include the following information and stipulations:

- A description of site characteristics, including runoff and drainage characteristics and soil erosion hazard.
- A description of proposed construction procedures and construction-site housekeeping practices, including prohibitions on discharging or washing potentially harmful materials into streets, shoulder areas, inlets, catch basins, gutters, or agricultural fields, associated drainage, or irrigation features.
- A description of measures that will be implemented for erosion and sediment control, including requirements for the following:
    - Conduct major construction activities involving excavation and spoils haulage during the dry season, to the extent possible;
    - Conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to storm drains and surface waters.
    - Grade and stabilize spoils sites to minimize erosion and sediment input to surface waters.
    - Implement erosion control measures as appropriate to prevent sediment from entering surface waters, agricultural water features, and storm drains to the extent

feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on exposed slopes.

- A Spill Prevention and Response Plan (SPRP) that identifies any hazardous materials to be used during construction; describes measures to prevent, control, and minimize the spillage of hazardous substances; describes transport, storage and disposal procedures for these substances; and outlines procedures to be followed in case of a spill of a hazardous material. The SPRP will require that hazardous and potentially hazardous substances stored onsite be kept in securely closed containers located away from drainage courses, agricultural areas, storm drains, and areas where stormwater is allowed to infiltrate. It will also stipulate procedures, such as the use of spill containment pans, to minimize hazards during onsite fueling and servicing of construction equipment. Finally, the SPRP will require that SJAFCA be notified immediately of any substantial spill or release.
- A stipulation that construction will be monitored by SJAFCA personnel to ensure that contractors are adhering to all provisions relevant to state and Federal stormwater discharge requirements, and that SJAFCA will shut down the construction site in the event of noncompliance.

Application of herbicides would be limited to the dry season to avoid potential runoff into adjacent waterways. Herbicides will not be applied during rain events or when winds exceed 10 miles per hour to prevent transport of the herbicide to off-target areas, such as surface waters. Sprayer nozzles will be calibrated to a spray density that avoids drift during application, or a surfactant will be used with the herbicide. Herbicides will be applied at a height no more than approximately four feet above plant canopy. Contractors will follow all herbicide label and requirements.

Turbidity curtains will be used around the cofferdam, and water from the dewatering process would be pumped over the top of the cofferdam and discharged in the area surrounded by the turbidity curtain to allow any silt or suspended sediments to settle back to the channel bottom.

In-Channel Work

In-channel work, including all channel and bank modifications, will be restricted to the dry season (July 15 to October 15). In-channel work will be restricted to low-flow periods between mid-July and mid-October unless otherwise approved by appropriate agencies. This window can be extended based on river conditions, if approved in writing by NMFS. Work from the banks can occur year-round. Work requiring stream dewatering, stream crossings, or work within the live stream will not begin before July 15. To the extent feasible, all in-channel work will be done by equipment operating from dry areas outside the channel.

Special Status Fish Conservation Measures

To avoid or minimize potential injury and mortality of special-status fish species, SJAFCA proposes to implement the following fish protection measures during cofferdam construction and dewatering.

- Silt fences, fiber rolls, silt curtains, and other appropriate sediment control measures will be used to minimize sediment input to the active channel, consistent with the project.
- Lighting at the gate and along the floodwalls will be directed away from the water surface as much as possible in order to decrease the attraction of juvenile salmonids and predatory fish to the area.
- SJAFCA and/or its contractor will ensure that a qualified fish biologist is on site during cofferdam construction and dewatering to supervise fish rescue activities and document any occurrences of stressed, injured, or dead fish. The biologist will be responsible for:

  (1) identifying the appropriate capture or exclusion measures;

  (2) overseeing the monitoring, handling, and release of all captured salmonids; and

  (3) maintaining detailed records of fish rescue activities, including species, numbers, life stages, and size classes of listed species observed, collected, relocated, injured, and killed, and environmental conditions (e.g., water temperature) under which fish rescue activities are conducted.

- Potential capture methods during fish salvage will include seines, dip nets, electrofishing, or other methods that minimize the risk of injury. If electrofishing is used, all techniques will be consistent with NMFS Electrofishing Guidelines (National Marine Fisheries Service 2000).
- SJAFCA will require the contractor to implement the following measures, developed in coordination with project design engineers, to minimize the exposure of listed fish species to potentially harmful underwater sounds.
  - If feasible, the contractor will vibrate all piles to the maximum depth possible before using an impact hammer.
  - The smallest pile driver and minimum force necessary will be used to complete the work.
  - During impact driving, SJAFCA will require the contractor to use a bubble ring or similar device to minimize the extent of the interim peak and cumulative SEL to below the noise thresholds (reference the Caltrans impact pile driving handbook: http://www.dot.ca.gov/hq/env/bio/files/bio_tech_guidance_hydroacoustic_effects_110215.pdf).
  - Pile driving of gate structure piles will occur inside a dewatered cofferdam.
  - No pile-driving activity will occur at night.
  - A sound attenuation device (pile cap cushion) will be used between the drive hammer strike face and the steel piling to avoid direct steel on steel impacts.
  - Construction activities will avoid submerged and emergent aquatic vegetation to the greatest extent possible.
  - SJAFCA and/or its contractor will develop and implement a hydroacoustic monitoring plan prior to pile driving commencement for resource agency approval. The monitoring plan will be submitted to the resource agencies (CDFW, NMFS, USFWS) for approval at least 60 days before the start of project activities. The plan will include the following requirements:

- SJAFCA and/or its contractor will monitor underwater noise levels during all impact pile driving activities on land and in water to ensure that that peak and cumulative SELs do not exceed fish injury or mortality thresholds.
- If the levels are exceeded, pile driving will cease and SJAFCA and/or its contractor will contact NMFS to determine whether work can resume.
- The monitoring plan will describe the methods and equipment that will be used to document the extent of underwater sounds produced by pile driving, including the number, location, distances, and depths of the hydrophones and associated monitoring equipment.
- A reporting schedule that includes provision of daily summaries of the hydroacoustic monitoring results to the resource agencies and more comprehensive reports on a monthly basis during the pile driving season.
- The final report will include the number of piles installed per day, the number of strikes per pile, the interval between strikes, the peak sound pressure level (Lpeak), SEL, RMS per strike, accumulated SEL per day at each monitoring station, and when these levels are exceeded, if ever.

Habitat Mitigation

All riparian trees along the edge of the proposed staging area adjacent to the San Joaquin River would be avoided during construction, and any loss of herbaceous riparian vegetation would be temporary and would be anticipated to reestablish after construction. Native vegetation to be replanted would include native grass species. Because the proposed project will permanently destroy some amount of CCV steelhead and southern Distinct Population Segment (sDPS) green sturgeon critical habitat, a purchase of compensatory mitigation credits is included as part of the proposed action to offset this impact to some degree. SJAFCA will purchase salmonid credits at a 3:1 ratio from a NMFS approved conservation bank. For the permanent destruction of 0.82 acres of tidal perennial habitat, the applicant will purchase 2.46 credits; and for the permanent destruction of 0.83 acres of riparian habitat, the applicant will purchase 2.49 credits.

1.3.1 New Proposed Action Construction Schedule for Year 2 and Year 3

Construction of the Project, as originally proposed, was anticipated to require two years of construction; however, additional assessments made by the SJAFCA in 2019 determined that the Project would likely require three years to complete. The critical element for completion of construction in a three-year period is construction of the southern wall extending from the gate structure to Dad's Point in Year 2. This section of the wall, which will be constructed in-water, is anticipated to take approximately 19 weeks. To facilitate this schedule, the in-water work window identified previously would need to be extended to allow for early mobilization, resulting in an earlier start and a later end to the in-water work window in Year 2 (2021). The anticipated Year 2 schedule consists of:

- May 1-31: Dad's Point demolition and vegetation management (land-based work);
- June 15-30: mobilization and staging of barge, pile-driving equipment, and materials at the staging yard and in-water construction site;
- July 1-13: dredge cofferdam and Dad's Point;
- July 16-31: install piles for Dad's Point fishing piers;

- July 1-November 30: build south wall;
- August 1-October 15: install Dad's Point cutoff/sheet pile walls;
- October 16-31: Dad's Point riprap placement, dewater and dredge the cofferdam, and install the Tremie plug;
- December 1-15: demobilize in-water work equipment and barges; and
- December 1-31: pour concrete for the gate foundation.

Year 2 (to occur in 2021) will include installation of the approximately 500-foot long southern cellular sheetpile wall structure between Dad's Point and the ring cofferdam, while Year 3 (2022) construction will largely focus on installation of the approximately 150-foot long northern wall structure between the gate structure and the golf course. The southern portion of the wall (to be constructed in 2021) consists of seventeen (17) cells extending approximately 500 feet from Dad's Point to the south end of the miter gate, while the northern portion of the wall (to be constructed in 2022) consists of seven (7) cells extending approximately 150 feet from the north end of the miter gate to the golf course. The fixed wall consists of two cellular web steel sheet pile walls that would be driven into the riverbed by a vibratory hammer. The walls would be constructed to be between approximately 29 feet apart at the connection between cells and 34 feet apart at the widest part of each cell, and would have a top elevation of 15.0 feet, extending 10 feet above the mean water level at the entrance to Smith Canal. Granular material would be installed between the walls using a front-end loader operating from the previously completed cells of the wall. The granular material would consist of a sand and gravel mixture. Steel cable cross-ties would subsequently be manually installed as the granular material is raised to an elevation within 3 feet of the top of the sheet piles. Construction is planned to begin with the first cell at the cofferdam (i.e., future gate location) and continue southward to Dad's Point as the in-water work window progresses. During the first two weeks of July (i.e., July 1-14), the contractor intends to install flat sheets used to form the cellular floodwall using only vibratory pile-driving methods. Because these sheets will be inter-joined to form the larger interconnected cells, attenuation (e.g., use of a bubble curtain or cofferdam) is not feasible.

Year 3 proposed in-water construction activities would be completed from July 15-October 15, and consisting of the following schedule:

- January 1-May 31: continue to pour concrete for the gate foundation in the dry cofferdam;
- June 1-July 31: assemble gate structure in the dry cofferdam;
- August 1-15: remove cofferdam;
- July 16-September 30: build the north wall;
- September 16-30: place riprap around the gate and install dolphin and fender piles;
- October 1-15: place riprap at the golf course end of the north wall.

There are no anticipated changes to the schedule for construction of the smaller wall structure in Year 3 (2022), which will occur July 15 through October 15.

1.3.2. Additional Updated Conservation Measures

In addition to the conservation measures provided in the 2018 BA (ICF 2018), and included in the NMFS 2019 biological opinion, SJAFCA is proposing conservation measures that are specifically included to minimize: 1) any potential impacts associated with the extended (i.e., July 1 to November 30) in-water work window; 2) an incremental increase in boat and barge traffic outside the July 15 -October 15 construction window; and 3) removal of the 1,000 impact hammer strikes per day condition. The additional conservation measures are as follows:

- A fisheries biologist will be on-site during all barge movements to monitor for erratically behaving fish within 500 feet of the tugboat; if any erratically behaving fish are observed, the biologist will temporarily halt the barge movement and contact NMFS to identify the appropriate corrective actions (e.g., reduce the tugboat motor RPMs, monitor underwater noise levels to ensure RMS values do not exceed 150 dB RMS beyond 100 m of the tugboat).
- All Project boats will obey the posted speed limit of 5 mph (4.3 knots) within Smith Canal;
- All Project boats will avoid rapid acceleration within the Action Area;
- All Project boat motors will be turned off when not in use; and
- Movement of the barge and use of the tugboat will be restricted to the minimum amount necessary to complete the intended work.

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

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

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion 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(s) of critical habitat for (species) use(s) 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.

2.1.1. Conservation Banking in the Context of the ESA Environmental Baseline

Conservation (or mitigation) banks present a unique situation in terms of how they are used in the context of the *Effects Analysis* (section 2.5) and the *Environmental Baseline* (section 2.4) in ESA Section 7 consultations.

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

For these reasons, it is appropriate to treat the beneficial effects of the bank as accruing in connection with and at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. This means that, in formal consultations on projects within the service area of a conservation bank, the beneficial effects of a conservation bank should be accounted for in the *Environmental Baseline* after a credit transaction has occurred. More specifically, the *Environmental Baseline* section should mention the bank establishment (and any consultation thereon) but, in terms of describing beneficial effects, it should discuss only the benefits attributable to credits already sold. In addition, in consultations that include credit purchases as part of the proposed action, the proportional benefits attributable to those credit purchases should be treated as effects of the action. Conversely, where a proposed action does not include credit purchases, it will not receive any direct offset associated with the bank. This approach preserves the value of the bank for its intended purposes, both for the value of the credits to the bank proponent and the conservation value of the bank to listed species and their critical habitat.

2.1.2 Completed Construction Components Informing Effects of the Action

The following activities completed under the original biological opinion (NMFS 2019) will be used to inform the anticipated effects of similar activities on the listed species for the remainder of the proposed action (Year 2 and Year 3).

Test Pile Driving Program and Monitoring Plan

SJAFCA conducted a test pile program (TPP) during the 2019 in-water work window, which involved vibratory and impact driving a single 20-inch steel flat web sheet pile and “H” pile in three separate locations along the alignment of the cellular sheet pile wall across the mouth of Atherton Cove. The purpose of the test pile program was to ascertain site-specific subsurface conditions and responses in order to:

1) Verify that piles could be installed to minimum tip elevation with the hammers selected;

2) Evaluate need for any driving aids to achieve the first objective;

3) Ensure that in-water work is limited to in-water work windows; and,

4) Evaluate peak and cumulative sound exposure levels (SELs) during pile driving operations with and without a bubble curtain.

Driving and removal of each test pile required the use of up to two barges, and up to 1,000 strikes with an impact hammer on each of the three days. Each test pile was vibrated to the maximum depth possible, and then driven to its design depth using an impact hammer (if and when needed). The piles were monitored for structural stresses during installation. Each pile was removed once it had reached its design elevation.

The test pile program also included conducting five cone penetration tests (CPTs) across the cellular sheet pile wall alignment. CPTs involved pressing a sensor mounted on a 2-inch-wide sectional pole into the channel bottom from a barge-mounted rig, with additional sections being added as the pole was pressed further into the channel bed. No impact or vibratory hammer was needed and the pole was removed once the desired depth was reached.

Year 1 Construction Activities

Year 1 activities for the Proposed Action consisted primarily of mobilization at the staging area and gate location at the mouth of Smith Canal, installation of a cofferdam to isolate the gate construction area, installation of foundation pipe piles for the gate structure, seepage cutoff wall, and seasonal demobilization of the in-water work area. The gate structure will be constructed in subsequent years within a sheet pile ring cofferdam that was constructed during the in-water work period in Year 1 (i.e., 2020) using a vibratory pile-driver. Upon completion of the cofferdam, installation of 64 foundation pipe piles was initiated in August 2020 using vibratory and impact pile driving methods within the cofferdam. Prior to installing the final Z-sheets to finalize and seal the cofferdam, fish exclusion and relocation efforts occurred to relocate fish from the 80 feet by 80 feet cofferdam used to isolate the construction area. The underwater sounds that were recorded during pile driving activities will help inform the construction activities for Year 2 and Year 3. During the fish removal effort, no ESA listed fish were observed or captured.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" 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 function of the PBFs that are essential for the conservation of the species.

The descriptions of the status of species and conditions of the designated critical habitats in this opinion are a synopsis of the detailed information available on NMFS' West Coast Regional website.

The following federally listed species Evolutionarily Significant Units (ESUs) or Distinct Population Segments (DPSs) and designated critical habitat occur in the action area and may be affected by the proposed action (Table 3):

Table 3. Listing for federally listed species.

Species	Scientific Name	Original Listing Status	Current Listing Status	Critical Habitat Designated
California Central Valley (CCV) steelhead DPS	*Oncorhynchus mykiss*	3/19/1998 63 FR 13347 Threatened	1/5/2006 71 FR 834 Threatened; confirmed 5/5/2016 Status review	9/2/2005 70 FR 52488
Central Valley (CV) spring-run Chinook salmon ESU	*Oncorhynchus tshawytscha*	9/16/1999 64 FR 50394 Threatened	6/28/2005 70 FR 37160 Threatened	N/A (Does not occur within the action area for this species)
Southern DPS of North American green sturgeon	*Acipenser medirostris*	4/7/2006 71 FR 17757 Threatened	4/7/2006 71 FR 17757 Threatened; confirmed 8/11/2015 Status review	10/9/2009 74 FR 52300

2.2.1. Species Listing and Critical Habitat Designation History

2.2.1.1. CCV Steelhead

The federally listed DPS of CCV steelhead and its designated critical habitat occur in the action area and may be affected by the proposed action. Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, DPS life history, and viable salmonid population (VSP) parameters can be found in the most recent 5-year status review (NMFS 2016).

Historical CCV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan, 2001). By the early 1960s, the CCV steelhead run size had declined to about 40,000 adults (McEwan, 2001). Current abundance data for CCV steelhead are limited to returns to hatcheries and redd surveys conducted on a few rivers. The hatchery data are the most reliable because redd surveys for steelhead are often made difficult by high flows and turbid water usually present during the winter-spring spawning period.

CCV steelhead returns to Coleman National Fish Hatchery increased from 2011 to 2014 (see the most recent 5-year status review (NMFS 2016) for further information). After hitting a low of only 790 fish in 2010, 2013 and 2014 averaged 2,895 fish. Wild adults counted at the hatchery each year represent a small fraction of overall returns. Numbers of wild adults returning ranged from 252 to 610 from 2010 to 2014, but their numbers have remained relatively steady, typically 200 to 300 fish each year.

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

An estimated 100,000 to 300,000 naturally produced juvenile CCV steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (Good et al. 2005). Nobriga and Cadrett (2001) used the ratio of adipose fin-clipped (hatchery) to unclipped (wild) steelhead smolt catch ratios in the U.S. Fish and Wildlife Service (USFWS) Chipps Island trawl from 1998 through 2000 to estimate that about 400,000 to 700,000 steelhead smolts are produced naturally each year in the Central Valley. Updated through 2014, trawl data indicate that the level of natural production of steelhead has remained very low since the 2011 status review, suggesting a decline in natural production based on consistent hatchery releases (NMFS 2016). Catches of steelhead at the fish collection facilities in the southern Delta are another source of information on the production of wild steelhead relative to hatchery steelhead (CDFW 2018). The overall catch of CCV steelhead has declined dramatically since the early 2000s, with an overall average of 2,705 in the last 10 years. The percentage of wild (unclipped) fish in salvage has fluctuated, but has leveled off to an average of 36 percent since a high of 93 percent in 1999.

About 80 percent of the historical spawning and rearing habitat once used by CCV steelhead in the Central Valley is now upstream of impassible dams (Lindley et al. 2006). Many historical populations of CCV steelhead are entirely above impassable barriers and may persist as resident or adfluvial rainbow trout, although they are presently not considered part of the DPS. Steelhead are well-distributed throughout the Central Valley below the major rim dams (Good et al. 2005, NMFS, 2016). Most steelhead populations in the Central Valley have a high hatchery component, including Battle Creek (adults intercepted at the Coleman National Fish Hatchery weir), the American River, Feather River, and Mokelumne River.

The CCV steelhead abundance and population growth rates continue to decline, largely the result of a significant reduction in the amount and diversity of habitats available to these populations (Lindley et al., 2006). Recent reductions in population size are supported by genetic analysis (Nielsen et al., 2003). Garza and Pearse (2008) analyzed the genetic relationships among CCV steelhead populations and found that, unlike coastal California watersheds, fish below barriers in the Central Valley were often more closely related to below barrier fish from other watersheds than to *O. mykiss* above barriers in the same watershed. This pattern suggests the ancestral genetic structure is still relatively intact above barriers, but may have been altered below barriers by stock transfers. Two hatchery stocks (Nimbus and Mokelumne River Hatcheries) originated from outside the DPS (primarily from the Eel and Mad rivers) and are not presently considered part of the DPS. However, during the recent NMFS 5-year status review for CCV steelhead, NMFS recommended including the Mokelumne River Hatchery steelhead population in the CCV Steelhead DPS due to the close genetic relationship with FRFH steelhead that are considered part of the native Central Valley stock (NMFS 2016). Steelhead in the Central Valley historically consisted of both summer and winter-run timing. Currently, only winter-run (ocean maturing) steelhead are found in California Central Valley rivers and streams as summer-run have been extirpated (McEwan & Jackson 1996, Moyle 2002).

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

Even though CCV steelhead will experience similar effects of climate change to Chinook salmon in the Central Valley, as they are also blocked from the vast majority of their historical spawning and rearing habitat, the effects may be even greater in some cases, as juvenile CCV steelhead need to rear in the stream for one to two summers prior to emigrating as smolts, leaving them more susceptible to warm water events. In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile CCV steelhead, which range from 57 degrees Fahrenheit (°F) to 66°F (14 degrees Celsius (°C) to 19°C). Several studies have found that steelhead require colder water temperatures for spawning and embryo incubation than salmon (McCullough et al., 2001). In fact, McCullough et al. (2001) recommended an optimal incubation temperature at or below 52°F to 55°F (11°C to 13°C). Successful smoltification in steelhead may be impaired by temperatures above 54°F (12°C), as reported by Richter and Kolmes (2005). As stream temperatures warm due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of decreased survival due to higher metabolic demands and greater presence and activity of predators. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild CCV steelhead populations.

In summary, the status of the CCV steelhead DPS in the 2016 status review appears to have remained unchanged since the 2011 status review. Therefore, we concluded that CCV steelhead should remain listed as threatened, as the DPS is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (NMFS 2016). All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of natural fish to hatchery fish over the past 25 years (Good et al. 2005, NMFS 2016); the long-term trend remains negative. Hatchery production and returns are dominant. Most wild CCV steelhead populations are very small and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish.

2.2.1.1.1 Critical habitat and PBFs for CCV steelhead

The critical habitat designation for CCV steelhead lists the PBFs (70 FR 52488; September 2, 2005), which are described in their recovery plan (NMFS 2014). In summary, the PBFs include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine areas. The geographical extent of designated critical habitat includes the following: the Sacramento, Feather, and Yuba rivers and the Deer, Mill, Battle, and Antelope creeks in the Sacramento River Basin; the San Joaquin River, including its tributaries but excluding the mainstem San Joaquin River above the Merced River confluence; and the waterways of the Delta.

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

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

2.2.1.2 CV spring-run Chinook salmon

The federally listed ESU of CV spring-run Chinook salmon may occur in the action area and may be affected by the proposed action. Its designated critical habitat does not occur within the action area. According to the most recent status review (NMFS 2016a), this ESU would not be expected to be affected by this proposed action. However, since 2015, the San Joaquin River Restoration Program (SJRRP) has been reintroducing CV spring-run Chinook salmon incrementally back into the San Joaquin River mainstem far upstream of the construction area. These actions are to meet a settlement goal that also fulfills a NMFS's recovery requirement regarding this ESU. According to a final rule under ESA Section 10(j), these reintroduced CV spring-run Chinook salmon are designated as a non-essential experimental population inside of the experimental population area, which is generally in the San Joaquin River from its confluence with the Merced River upstream to Friant Dam (78 FR 79622; December 31, 2013).

However, outside of the experimental population area, CV spring-run Chinook salmon are considered part of the CV spring-run Chinook salmon ESU, which is listed as a threatened species. Since the action area for this proposed action occurs outside of the experimental population area but includes the migration corridor the reintroduced fish must take to reach the ocean or return to the experimental population area, NMFS added analysis of the effects of the proposed action on the CV spring-run Chinook salmon ESU to this biological opinion. The number of CV spring-run Chinook salmon returning to the upper San Joaquin River in the experimental population area is expected to increase over time, as experimental hatchery release numbers, adult spawning returns, and the number of juveniles produced naturally in the restoration area increases. Detailed information regarding the ESU's life history, and viable salmonid population (VSP) parameters pertaining to the natural populations that occur in tributaries of the Sacramento River Basin can be found in the most recent 5-year status review (NMFS 2016a).

Since the independent populations in Butte, Deer and Mill creeks are the best trend indicators for ESU viability, NMFS can evaluate risk of extinction based on VSP parameters in these watersheds. Lindley et al. (2007) indicated that the CV spring-run Chinook salmon populations in the Central Valley had a low risk of extinction in Butte and Deer creeks, according to their population viability analysis (PVA) model and other population viability criteria (*i.e.*, population size, population decline, catastrophic events, and hatchery influence, which correlate with VSP parameters abundance, productivity, spatial structure, and diversity). The Mill Creek population of CV spring-run Chinook salmon was at moderate extinction risk according to the PVA model, but appeared to satisfy the other viability criteria for low-risk status. However, the CV spring-run Chinook salmon ESU failed to meet the "representation and redundancy rule" for the spatial structure parameter since these three populations are the only demonstrably viable populations from one diversity group (northern Sierra Nevada) out of the three diversity groups that historically supported the ESU, or out of the four diversity groups as described in the NMFS Central Valley Salmon and Steelhead Recovery Plan (NMFS 2014), which stated a recovery criteria of nine viable populations. Over the long term, these three remaining populations are considered to be vulnerable to catastrophic events, such as volcanic eruptions from Mount Lassen or large forest fires due to the close proximity of their headwaters to each other. Drought events are also considered to pose a significant threat to the viability of the CV spring-run Chinook salmon populations in these three watersheds due to their close proximity to each other. One large event could eliminate all three populations.

In the latest status review (NMFS 2016a), the authors found, with a few exceptions, CV spring-run Chinook salmon populations had increased through 2014 returns since the previous status review (2010/2011), which moved the Mill and Deer creek populations from the high extinction risk category to moderate, and Butte Creek remained in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations continued to show stable or increasing numbers the last five years, putting them at moderate risk of extinction based on abundance. Overall, the Southwest Fisheries Science Center concluded in their viability report (Williams et al. 2016) that the status of CV spring-run Chinook salmon (through 2014) has probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased; however, sharp declines were observed in 2015 and 2016 (CDFW 2017). Therefore, the ESU is still facing significant extinction risk, and that risk is likely to increase over at least the next few years as the full effects of the recent drought are realized (NMFS 2016a).

2.2.1.3 sDPS green sturgeon status

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

The federally listed sDPS of North American green sturgeon and its designated critical habitat occur in the action area and may be affected by the proposed action. Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, DPS life history, and viable population parameters can be found in the 2015 5-year status review (NMFS 2015).

Green sturgeon are known to range from Baja California to the Bering Sea along the North American continental shelf. During late summer and early fall, subadults and non-spawning adult green sturgeon can frequently be found aggregating in estuaries along the Pacific coast (Moser and Lindley 2007). Using polyploid microsatellite data, Israel et al. (2009) found that green sturgeon within the Central Valley of California belong to the sDPS.

Additionally, acoustic tagging studies have shown that sDPS green sturgeon found spawning within the Sacramento River are exclusively sDPS green sturgeon (Lindley et al. 2011). In waters inland from the Golden Gate Bridge in California, sDPS green sturgeon are known to range through the estuary and the Delta and up the Sacramento, Feather, and Yuba rivers (NMFS 2018). It is unlikely that green sturgeon utilize areas of the San Joaquin River upriver of the Delta with regularity, as spawning events are thought to be limited to the upper Sacramento River and its tributaries. There is no known modern usage of the upper San Joaquin River by green sturgeon for spawning (Jackson et al. 2016).

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

Trends in abundance of sDPS green sturgeon have been estimated from two long-term data sources: (1) salvage numbers at the state and Federal pumping facilities (CDFW 2018) and (2) by incidental catch of green sturgeon by the California Department of Fish and Wildlife (CDFW)'s white sturgeon sampling/tagging program (DuBois 2016). Historical estimates from these sources are likely unreliable because the sDPS was likely not taken into account in incidental catch data, and salvage does not capture rangewide abundance in all water year types. A decrease in sDPS green sturgeon abundance has been inferred from the amount of take observed at the south Delta pumping facilities (Skinner Delta Fish Protective Facility and the Tracy Fish Collection Facility). Operations and practices at the facilities have changed over the project lifetime, which may affect salvage data. These data likely indicate a high production year versus a low production year qualitatively, but cannot be used to accurately quantify abundance.

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

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

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate (NMFS 2010). Although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices (NMFS 2010). The most recent 5-year status review for sDPS green sturgeon found that some threats to the species have recently been eliminated such as take from commercial fisheries and removal of some passage barriers (NMFS 2015). Since many of the threats cited in the original listing still exist, the threatened status of the DPS is still applicable (NMFS 2015).

2.2.1.4 Critical habitat and PBFs for sDPS green sturgeon

The critical habitat designation for sDPS green sturgeon lists the PBFs (74 FR 52300; October 9, 2009), which are described in the sDPS green sturgeon recovery plan (NMFS 2018).

In summary, the PBFs include the following for both freshwater riverine systems and estuarine habitats: food resources, water flow, water quality, migratory corridor, depth, and sediment quality. Additionally, substrate type or size is also a PBF for freshwater riverine systems. In addition, the PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas.

In freshwater, the geographical range of designated critical habitat includes:

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

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

2.2.1.5 Climate change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley, and aquatic habitat is climate change. Lindley et al. (2007) summarized several studies (Hayhoe et al. 2004, Dettinger et al. 2004, Dettinger 2005, VanRheenen et al. 2004, Knowles and Cayan 2002) on how anthropogenic climate change is expected to alter the Central Valley, and based on these studies, described the possible effects to anadromous salmonids. Climate models for the Central Valley are broadly consistent in that temperatures in the future would warm significantly, total precipitation may decline, the variation in precipitation may substantially increase (i.e., more frequent flood flows and critically dry years), and snowfall would decline significantly (Lindley et al. 2007). Climate change is having, and would continue to have, an impact on salmonids throughout the Pacific Northwest and California (Battin et al. 2007).

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

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

Modeling indicates that stream habitat for cold water species declined with climate warming and remaining suitable habitat may only exist at higher elevations (Null et al. 2013). Climate warming is projected to cause average annual stream temperatures to exceed 24°C (75.2°F) slightly earlier in the spring, but notably later into August and September. The percentage of years that stream temperatures exceeded 24°C (for at least 1 week) is projected to increase, so that if air temperatures rise by 6°C, most Sierra Nevada rivers would exceed 24°C for a certain number of weeks every year.

Warming is already affecting CV Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if climate warms by 9°F (5°C), it is questionable whether any Central Valley Chinook salmon populations can persist (Williams 2006). In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 57°F to 66°F (14°C to 19°C). Several studies have found that steelhead require colder water temperatures for spawning and embryo incubation than salmon (McCullough et al. 2001). In fact, McCullough et al. (2001) recommended an optimal incubation temperature at or below 52°F to 55°F (11°C to 13°C). Successful smoltification in CCV steelhead may be impaired by temperatures above 54°F (12°C), as reported in Richter and Kolmes (2005). As stream temperatures warm due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of decreased survival due to higher metabolic demands and greater presence and activity of predators. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild steelhead populations. Based on an analysis of an ensemble of climate models and emission scenarios and a reference temperature from 1951 to 1980, the most plausible projection for warming over Northern California is 4.5°F (2.5°C) by 2050 and 9°F (5°C) by 2100, with a modest decrease in precipitation (Dettinger 2005). Chinook salmon in the Central Valley are at the southern limit of their range, and warming would shorten the period in which the low elevation habitats used by naturally producing Chinook salmon are thermally acceptable. This should particularly affect fish that emigrate as fingerlings, mainly in May and June, and especially those in the San Joaquin River and its tributaries.

Central Valley salmonids are highly vulnerable to drought conditions. The increased in-river water temperature resulting from drought conditions is likely to reduce the availability of suitable holding, spawning, and rearing conditions in Clear Creek and in the Sacramento, Feather, and Yuba rivers. During dry years, the availability of thermally suitable habitats in spring-run Chinook salmon river systems without major storage reservoirs (e.g., Mill, Deer, and Butte creeks) is also likely to be reduced. Multiple dry years in a row could potentially devastate Central Valley salmonids. Prolonged drought due to lower precipitation, shifts in snowmelt runoff, and greater climate extremes could easily render most existing spring-run Chinook salmon habitat unusable, either through temperature increases or lack of adequate flows. The droughts that occurred from 2007 to 2009, and from 2012 to 2015, were likely factors in the recent widespread decline of all Chinook salmon runs (including CV spring-run Chinook salmon) in the Central Valley (Williams et al. 2011, Michel et al. 2015).

The increase in the occurrence of critically dry years also would be expected to reduce abundance, as, in the Central Valley, low flows during juvenile rearing and outmigration are associated with poor survival (Kjelson and Brandes 1989, Baker and Morhardt 2001, Newman and Rice 2002). In addition to habitat effects, climate change may also impact Central Valley salmonids through ecosystem effects. For example, warmer water temperatures would likely increase the metabolism of predators, reducing the survival of juvenile salmonids (Vigg and Burley 1991). In summary, climate change is expected to exacerbate existing stressors and pose new threats to Central Valley salmonids, including CCV steelhead, by reducing the quantity and quality of inland habitat (Lindley et al. 2007).

Since 2005, there has been a period of widespread decline in all Central Valley Chinook salmon stocks. An analysis by Lindley et al. (2009) that examined fall-run Chinook salmon found that unusual oceanic conditions led to poor growth and survival for juvenile salmon entering the ocean from the Central Valley during the spring of 2005 and 2006 and most likely contributed to low returns in 2008 and 2009. This reduced survival was attributed to weak upwelling, warm sea surface temperatures, low prey densities, and poor feeding conditions in the ocean. When poor ocean conditions are combined with drought conditions in the freshwater environment, the productivity of salmonid populations can be significantly reduced. Although it is unclear how these unusual ocean conditions affected CCV steelhead, it is highly likely they were adversely impacted by a combination of poor ocean conditions and drought (NMFS 2011).

Although CCV steelhead would experience similar effects of climate change to Chinook salmon, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile CCV steelhead need to rear in the stream for one to two summers prior to emigrating as smolts.

In summary, observed and predicted climate change effects are generally detrimental to all of the species addressed in this biological opinion. Unless offset by improvements in other factors, the status of the species and critical habitat is likely to decline over time. The climate change projections referenced above cover the time period between the present and approximately 2100. While there is uncertainty associated with projections, which increases over time, the direction of change is relatively certain (McClure et al. 2013).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

Since the proposed action includes the purchase of mitigation credits from a conservation bank, the Action Area also includes the areas affected by mitigation banks that have service areas relevant to the project areas. These include the Fremont Landing Conservation Bank, which is a 100-acre site along the Sacramento River (Sacramento River Mile 78 through 80); the Bullock Bend Mitigation Bank, which is a 116.15-acre site along the Sacramento River (Sacramento River Mile 80); Cosumnes Floodplain Mitigation Bank, which is a 472-acre site at the confluence of the Cosumnes and Mokelumne rivers (Mokelumne River Mile 22); and Liberty Island Conservation Bank, which is a 186-acre site located at the south end of the Yolo Bypass on Liberty Island in the Delta.

The project is located in the City of Stockton and unincorporated San Joaquin County, California. The project area includes Atherton Island, Atherton Cove, Louis Park (including Dad's Point), the Stockton Golf and Country Club, and the portions of the San Joaquin River in the immediate vicinity. The area north of Smith Canal, Atherton Island, Atherton Cove and Stockton Golf and Country Club, is located in unincorporated San Joaquin County. Louis Park, including Dad's Point, is in the City of Stockton.

Atherton Island is at the west end of Smith Canal, and Louis Park is southeast of Atherton Island at the mouth of the Canal. Dad's Point, a land bar that is an extension of Louis Park, is southwest of the mouth of Smith Canal and separates the Louis Park boat launch area from the San Joaquin River (Figure 2).

Atherton Cove is a dead-end slough of the river that extends north and east around Atherton Island, and the Stockton Golf and Country Club is along the north bank of the river and southwest shore of Atherton Cove, to the northwest of Smith Canal.

The Action area includes waters of the San Joaquin River that are within 1,000 feet upstream and downstream of proposed in-water construction areas. This area represents the potential area of impacts from the proposed project, in addition to noise effects based on pile-driving noise during similar construction activities (Figure 2).

CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon have the potential to occur in the action area during the proposed action's period of construction and long-term operations. Designated critical habitats occur in the action area for CCV steelhead and the sDPS of North American green sturgeon. CV spring-run Chinook salmon critical habitat does not occur in the action area and will not be discussed further in this biological opinion.

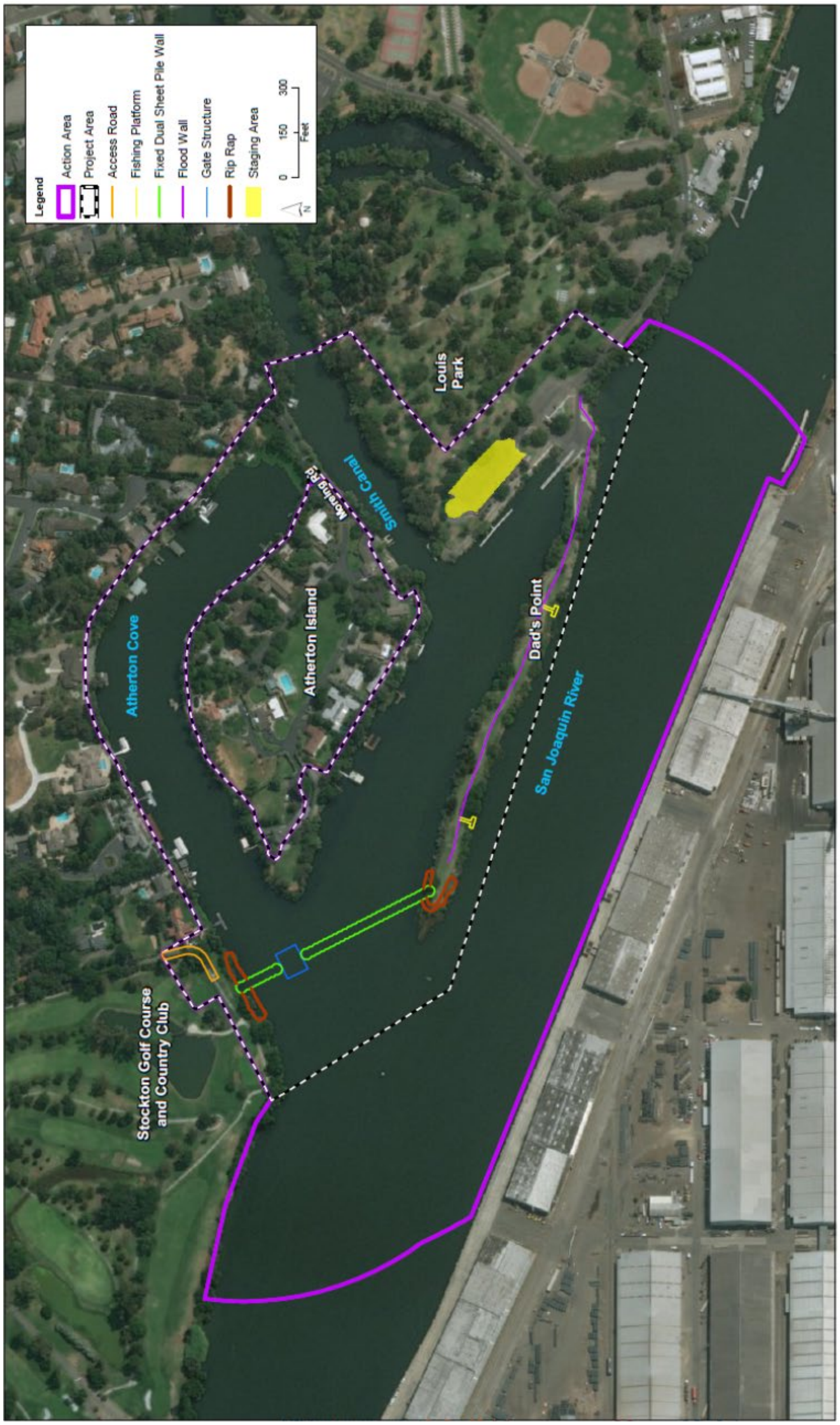

Figure 1. Proposed Action Area (BA 2018)

2.4. Environmental Baseline

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

2.4.1. Occurrence of Listed Species and Critical Habitat in the Action Area

The federally listed anadromous species that use and occupy the action area are migrating adult and juvenile CCV steelhead and CV spring-run Chinook salmon, and juvenile, subadult and adult sDPS green sturgeon. The action area is within designated critical habitat for CCV steelhead and green sturgeon. The San Joaquin River mainstem in the action area is the primary migration corridor for both adult and juvenile CV spring-run Chinook salmon and CCV steelhead life stages spawned in the San Joaquin River Basin to the Delta, which contains important rearing habitat for juveniles. All anadromous fish that utilize the San Joaquin River Basin must also pass by this location at least twice to successfully complete their life histories. Juvenile (including subadult) sDPS green sturgeon may be present throughout the Delta during every month of the year, whereas spawning and post-spawn adults are unlikely to migrate through the action area because their primary migratory route between the ocean and upstream spawning habitats lies predominantly in the Sacramento River and its tributaries.

2.4.1.1 CCV steelhead

The life history strategies of steelhead are extremely variable between individuals, and it is important to take into account that CCV steelhead are iteroparous (i.e., can spawn more than once in their lifetime) (Busby et al. 1996), and therefore may be expected to emigrate back down the system after spawning. As such, the determination of the presence or absence of CCV steelhead in the Delta accounted for both upstream and downstream migrating adult steelhead (kelts).

Adult CCV steelhead enter freshwater in August (Moyle, 2002) and peak migration of adults moving upriver occurs in August through September (Table 4, Hallock et al. 1957). Adult CCV steelhead will hold until flows are high enough in the tributaries to migrate upstream where they will spawn from December to April (Hallock et al. 1961). After spawning, most surviving steelhead kelts migrate back to the ocean and reach the Sacramento River during March and April, and have a high presence in the Delta in May. Migrating adult CCV steelhead through the San Joaquin River are present from July to March, with highest abundance between December and January (Table 4). Small, remnant populations of CCV steelhead are known to occur in the Stanislaus River and the Tuolumne River and their presence is assumed on the Merced River due to proximity, similar habitats, historical presence, and recent otolith chemistry studies verifying at least one steelhead in the limited samples collected from the river (Zimmerman et al. 2008). Outmigrating juveniles from these tributaries would have to pass through the action area during their emigration to the ocean. Juveniles would emigrate from February through June, with the core of their migration occurring March through May.

The proposed construction period for this proposed action in the mainstem San Joaquin portion of the action area is from mid-July through November for Year 2021 and through mid-October for Year 2022. This will overlap with the adult CCV steelhead migration period in the San Joaquin River Basin (i.e., the months of September, October, and November).

However, the long-term operations of the project's flood control gates in Smith Canal may overlap with both adult migration upstream, and juvenile migration downstream as this is likely to occur during the winter when river levels are expected to rise in response to high astronomical tides or flood events, which will also likely trigger fish movements. Likewise, the environmental effects of the long-term vegetation policies along the proposed action's levees will overlap with fish presence into the future. Because of the close proximity of the canal to San Joaquin River, a migratory corridor for fish, it is possible that fish can enter the canal through the cove.

Table 4. The temporal occurrence of (a) adult and (b) juvenile California Central Valley steelhead at locations in the Central Valley. Darker shades indicate months of greatest relative abundance.

(a) Adult migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Early Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
[1]Sacramento R. at Fremont Weir	L	L	L	L	L	N	N	N	N	N	N	L	L	L	L	M	H	H	H	M	L	L	L	L
[2]Sacramento R. at RBDD	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M	H	M	L	L	L	L
[3]Mill & Deer Creeks	M	M	H	M	M	L	L	L	L	L	L	L	N	N	N	N	N	N	M	H	H	L	L	L
[4]Mill Creek at Clough Dam	L	L	M	H	M	M	L	L	N	N	N	N	N	N	N	N	N	L	M	H	H	H	M	M
[5]San Joaquin River	H	H	M	M	L	L	N	N	N	N	N	N	L	L	L	L	M	M	M	M	M	M	H	H

(b) Juvenile migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Early Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
[1,2]Sacramento R. near Fremont Weir	L	L	L	L	M	M	M	M	M	M	M	M	L	L	L	L	L	L	M	M	M	M	L	L
[6]Sacramento R. at Knights Landing	H	H	H	H	M	M	M	M	L	L	L	L	N	N	N	N	N	N	N	N	L	L	L	L
[7]Mill & Deer Creeks (silvery parr/smolts)	L	L	L	L	M	H	H	H	H	H	L	L	N	N	N	N	N	N	L	L	L	L	L	L
[7]Mill & Deer Creeks (fry/parr)	L	L	L	L	L	L	M	M	H	H	H	H	N	N	N	N	N	N	M	M	M	M	M	M
[8]Chipps Island (clipped)	M	M	H	H	M	M	L	L	L	L	N	N	N	N	N	N	N	N	N	N	N	N	L	L
[8]Chipps Island (unclipped)	M	M	M	M	H	H	H	H	H	H	M	M	L	L	N	N	N	N	N	N	N	N	L	L
[9]San Joaquin R. at Mossdale	N	N	L	L	M	M	H	H	H	H	L	L	N	N	N	N	N	N	L	L	N	N	N	N
[10]Mokelumne R. (silvery parr/smolts)	L	L	M	M	M	M	H	H	H	H	M	M	M	M	N	N	N	N	N	N	N	N	N	N
[10]Mokelumne R. (fry/parr)	N	N	L	L	L	L	L	L	M	M	H	H	M	M	N	N	N	N	N	N	N	N	N	N
[11]Stanislaus R. at Caswell	L	L	M	M	H	H	M	M	M	M	L	L	N	N	N	N	N	N	N	N	N	N	N	N
[12]Sacramento R. at Hood	L	L	H	H	H	H	H	H	H	H	H	N	N	N	N	N	N	N	N	N	L	L	L	L

Sources: [1](Hallock 1957); [2](McEwan 2001); [3](Harvey 1995); [4]CDFW unpublished data; [5]CDFG Steelhead Report Card Data 2007; [6]NMFS analysis of 1998-2011 CDFW data; [7](Johnson & Merrick 2012); [8]NMFS analysis of 1998-2011 USFWS data; [9]NMFS analysis of 2003-2011 USFWS data; [10]unpublished EBMUD RST data for 2008-2013; [11]Oakdale RST data (collected by FishBio) summarized by John Hannon (Reclamation) ; [12](Schaffter 1980).
Darker shades indicate months of greatest relative abundance.
Relative Abundance Symbol Key: H = High M = Medium L = Low N = Not Present

2.4.1.1.1. CCV steelhead critical habitat

The PBFs for CCV steelhead critical habitat in the action area include freshwater migration corridors and rearing habitat. The freshwater migration utility in the action area is of fair quality, since flows of the lower San Joaquin River are typically of adequate magnitude, quality, and temperatures to support adult and juvenile migration. Most importantly, this section of CCV steelhead critical habitat serves as a migration corridor for all of the adults and juveniles produced and supported by the San Joaquin River and its major tributaries.

During the summer months, migration and rearing habitat is of poor quality due to unsuitable water temperatures and low flows. In addition, rearing habitat is poor as the San Joaquin River is leveed and channelized. The floodplain habitat that would otherwise normally exist has been largely removed near the action area due to the high levees, which limits the value of the area for juvenile rearing. Migratory habitat for adults and juveniles would likely not be impacted due to the project timing because the work window is mostly outside of their migration periods.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its conservation value remains high for the CCV steelhead DPS. A large fraction of the CCV steelhead smolts originating in the San Joaquin River Basin will likely pass downstream through the action area within the San Joaquin River mainstem channel, particularly if there is a fish barrier at the Head of Old River (placed from April to May) to prevent smolt entrance into that route. Likewise, adults migrating upstream to spawn are likely to pass through the action area within the mainstem of the San Joaquin River to reach their upstream spawning areas in the San Joaquin River basin. Therefore, it is of critical importance to the long-term viability of the CCV steelhead to maintain a functional migratory corridor and freshwater rearing habitat through the action area to sustain the Southern Sierra Diversity Group, and provide the necessary spatial diversity to aid in recovery.

2.4.1.2. CV spring-run Chinook salmon

Typical CV spring-run Chinook salmon life history patterns have adults returning to freshwater basins in March (Table 5). Capitalizing on spring-time runoff, adults travel to holding pools where available in preparation to over-summer. Adults arrive in an immature state and hold over the summer months and develop gonads until ready to spawn in late summer through mid-autumn.

CV spring-run Chinook salmon are considered functionally extirpated from the Southern Sierra Nevada diversity group despite their historical abundance in the San Joaquin River Basin (NMFS 2016). There have been observations of low numbers of spring-time running fish returning to major San Joaquin River tributaries that exhibit some typical spring-run life history characteristics. While the genetic disposition of such fish remains inconclusive, the implementation of reintroduction of the spring-run Chinook salmon into the San Joaquin River has begun and has resulted in wild-spawned juvenile spring-run Chinook salmon since 2016 (NMFS 2021). These juveniles are imprinted to the upper San Joaquin River mainstem below Friant Dam, and are expected to return as adults when volitional passage is achieved and river conditions are suitable (NMFS 2016). Additionally, Central Valley spring-run Chinook salmon adults have returned to the San Joaquin River Restoration Program area for three consecutive years (2019, 2020, and 2021) (NMFS 2021; SJRRP preliminary data from Zachary Sutphin, Bureau of Reclamation, April 2021).

Based on known spring-run Chinook salmon life history timing and limited information of use of the San Joaquin River Basin, juveniles are expected in the action area November through May as they emigrate through the action area. Returning adults are expected to travel through the action area from March through June. Exact timing of CV spring-run Chinook salmon use of the action area would depend on in-river water being adequate in quality and temperature, and actual life history stage timelines are expected to differ slightly between the Sacramento River and San Joaquin River basins. The proposed construction period for the Project's actions in the mainstem San Joaquin River portion of the action area is from mid-July through mid-October. There is very little likelihood that either adult or juvenile life history stages of CV spring-run would overlap with this timing. However, the long-term operations of the proposed project's flood control gates in Smith Canal would overlap with both adult migration upstream, and juvenile migration downstream as this is likely to occur during the winter when river levels are expected to rise in response to high astronomical tides or flood events, which will also likely trigger fish movements.

Table 5. The temporal occurrence of adult (a) and juvenile (b) Central Valley spring-run Chinook salmon in the Sacramento River.

(a) Adult Migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Late Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
Sac. River basin[a,b]	N	N	N	N	M	M	M	M	H	H	H	H	M	M	M	M	M	M	L	N	N	N	N	N
Sac. River Mainstem[b,c]	N	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	N	N	N	N	N	N	N	N
Mill Creek[d]	N	N	N	N	L	L	M	H	H	H	H	M	M	L	L	N	N	N	N	N	N	N	N	N
Deer Creek[d]	N	N	N	N	L	L	M	H	H	H	H	M	M	N	N	N	N	N	N	N	N	N	N	N
Butte Creek[d,g]	N	N	L	M	M	M	M	H	H	H	H	M	L	N	N	N	N	N	N	N	N	N	N	N
(b) Adult Holding[a,b]	N	N	N	L	L	M	M	H	H	H	H	H	H	H	H	M	M	L	L	N	N	N	N	N
(c) Adult Spawning[a,b,c]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	M	H	H	M	L	N	N	N	N

(d) Juvenile Migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Late Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
Sac. River Tribs[e]	M	M	M	M	M	M	N	N	N	N	N	N	N	N	N	N	N	N	M	M	H	H	H	H
Upper Butte Creek[f,g]	H	H	H	H	M	M	M	M	M	M	L	L	N	N	N	N	N	N	L	L	L	L	H	H
Mill, Deer, Butte Creeks[d,g]	H	H	H		M	M	M	M	M	M	L	L	N	N	N	N	N	N	L	L	L	L	L	L
Sac. River at RBDD[c]	H	H	L	L	L	L	L	L	L	N	N	N	N	N	N	N	N	N	N	N	H	H	H	H
Sac. River at KL[h]	M	M	M	M	H	H	H	H	M	M	N	N	N	N	N	N	N	N	N	N	M	M	H	H

Sources: [a]Yoshiyama et al. (1998); [b]Moyle (2002); [c]Myers et al. (1998); [d]S. T. Lindley et al. (2004); [e]CDFG (1998); [f]McReynolds, Garman, Ward, and Plemons (2007); [g]P. D. Ward, McReynolds, and Garman (2003); [h]Snider and Titus (2000)
Note: Yearling spring-run Chinook salmon rear in their natal streams through the first summer following their birth. Downstream emigration generally occurs the following fall and winter. Most young-of-the-year spring-run Chinook salmon emigrate during the first spring after they hatch.

Darker shades indicate months of greatest relative abundance.
Relative Abundance Symbol Key: H = High M = Medium L = Low N = Not Present
(Used for reference for the San Joaquin River). Darker shades indicate months of greater relative abundance.)

2.4.1.3. sDPS green sturgeon

Adult sDPS green sturgeon enter the San Francisco Bay starting in February, have been recorded in San Pablo Bay in March (Heublein et al., 2008), and in the Sacramento River system between late February and late July (Moyle et al., 1995). In general, sDPS green sturgeon enter the San Francisco Bay estuary in winter and continue upstream to their spawning grounds from mid-winter to late-summer. Spawning occurs from April to July in the mainstem Sacramento River (Poytress et al. 2015) and Feather River (Seesholtz et al. 2015). Adults have been recorded out-migrating from the Sacramento River in the fall (November to December) and summer (June to August) (Heublein et al., 2008). It has been suggested that spawning may also occur in the San Joaquin River (Moyle et al. 1995) however, this was based on a 1-year study in the 1960's collecting a large number of young green sturgeon during the summer at a shallow shoal area in the lower San Joaquin River (Radtke 1966). Data on sDPS green sturgeon distribution is extremely limited and out-migration appears to be variable occurring at different times of year. Seven years of CDFW catch data for adult sDPS green sturgeon show that they are present in the Delta during all months of the year. Adult and juvenile sDPS green sturgeon are therefore assumed to be present in the Delta year-round (Table 6).

Prior to October 2017, all accounts of sDPS green sturgeon sightings in the San Joaquin River Basin were anecdotal at best or misidentified white sturgeon (Gruber et al. 2012, Jackson et al. 2016). During late October in 2017, an adult sDPS green sturgeon was sighted in the Stanislaus River near Knights Ferry by a fish biologist and its identity was genetically confirmed by genetic analysis of green sturgeon environmental DNA in the surrounding water (Breitler, 2017). This is the first confirmed sighting of a green sturgeon in a San Joaquin River tributary, and indicates that adults are able to pass upstream of the proposed action area given river flows of suitable quality and amount. In addition, on April 11, 2020, another adult green sturgeon was captured within the boundaries of the San Joaquin River Restoration area (just upstream with the Merced River confluence in the vicinity of Hills Ferry, California)(Root et al. 2020). Since only one adult has been confirmed in the Stanislaus River and one in the mainstem upstream of Merced River confluence, spawning activities in the San Joaquin River Basin have never been recorded, the production of juveniles from the Stanislaus River is not considered likely in the near future, however with the implementation of recovery actions, potential spawning grounds may become available for sDPS green sturgeon.

While the San Joaquin River Basin may not produce juvenile sDPS green sturgeon, juveniles may use both estuarine and freshwater portions of the Delta to rear for 1 to 3 years prior to exiting the system and entering the Pacific Ocean. During this period, they may range and stray up non-natal waterways searching for appropriate food resources, water quality conditions, and shelter. Therefore, foraging juveniles, subadults, and adults may be found in the San Joaquin River mainstem at the location of the proposed action at nearly any time of year, depending on the local water depth, temperature, and quality.

Both adult and juvenile sDPS green sturgeon are expected to occur in the action area, but in low numbers. The Delta serves as an important migratory corridor for adults during their spawning migrations, and as year round rearing habitat for juveniles. Both non-spawning adults and subadults use the Delta and estuary for foraging during the summer. Since there are no physical barriers to sDPS green sturgeon moving into the action area from the waters of the Delta adjacent to the action area during their rearing or foraging behaviors, presence in the action area is seen as feasible and likely.

The proposed construction period for the project actions in the mainstem San Joaquin portion of the action area is from mid-July through mid-October. Since adult, subadult, and juvenile sDPS green sturgeon may be present in the Delta year round, the construction period will overlap with their presence. Likewise, the long-term operations of the proposed project flood control gates in Smith Canal will overlap with adult, subadult, and juvenile presence in the Delta during the winter when river levels are expected to rise in response to high astronomical tides or flood events occur and the gates are operated. Likewise, the environmental effects of the long-term vegetation policies along the proposed project levees will overlap with fish presence into the future.

Table 6. The temporal occurrence of (a) adult, (b) larval (c) juvenile and (d) subadult coastal migrant sDPS of green sturgeon. Locations emphasize the Central Valley of California. Darker shades indicate months of greatest relative abundance.

(a) Adult-sexually mature (≥145 – 205 cm TL for females and ≥ 120 – 185 cm TL for males)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upper Sac. River[a,b,c,i]	Low	Low	Medium	Medium / High	High	High / Medium	Medium	Medium	Medium	Low	Low	Low
Feather, Yuba Rivers[k]	Low	Low	Medium	Medium / High	High	High / Medium	Medium	Medium	Medium	Low	Low	Low
SF Bay Estuary[d,h,i]	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Low

(b) Larval and juvenile (≤10 months old)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RBDD, Sac River[e, j]					Medium / High	High	High	Medium				
GCID, Sac River[e, j]					Medium	High	High	Medium	Low	Low		

(c) Older Juvenile (> 10 months old and ≤3 years old)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
South Delta*[f]	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Sac-SJ Delta[f]	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Sac-SJ Delta[e]				Medium	Medium	Medium	Medium	Medium	Medium	Medium		
Suisun Bay[e]	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

(d) SubAdult/non-sexually mature (approx. 75 cm to 145 cm for females and 75 to 120 cm for males)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pacific Coast[c,g]	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
San Francisco and San Pablo Bay	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

Relative Abundance: ■ = High ■ = Medium ■ = Low

* Fish Facility salvage operations

Sources: [a]USFWS (2002); [b]Moyle *et al*. (1992); [c]Adams *et al*. (2002) and NMFS (2005); [d]Kelly *et al*. (2007); [e]CDFG (2002); [f]IEP Relational Database, fall midwater trawl green sturgeon captures from 1969 to 2003; [g]Nakamoto *et al*. (1995); [h]Heublein (2009); [i]Gleason et al. 2008, [j]Poytress *et al.* (2011, 2012), [k]Alicia Seesholtz, DWR, personal communication.

2.4.1.4. sDPS green sturgeon critical habitat

The action area is close to the southernmost extent of sDPS green sturgeon designated critical habitat in freshwater, which ends just north of the confluence of the San Joaquin River and the Stanislaus River. There is little data regarding the exact services this portion of their critical habitat offers sDPS green sturgeon, except that the San Joaquin River is believed to have historically supported sDPS green sturgeon populations and therefore they must have used this area for migration and perhaps also for foraging and rearing to some degree.

The PBFs of sDPS green sturgeon critical habitat included within the action area are: (1) food resources; (2) adequate water flow regime for all life stages; (3) water quality; (4) and adequate water depth for all life stages. The San Joaquin River mainstem in this section has sufficient depth to support even adult passage, though as stated before only one adult has been observed in the Stanislaus River to date. Spawning in the San Joaquin River Basin may not be currently possible for sDPS green sturgeon given the extent of degradation prevalent throughout the San Joaquin River Basin. Therefore, juveniles are not expected to be produced in this system for some time; however, juveniles produced by the Sacramento River Basin could range into this area during their long rearing period in the Delta.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its conservation value remains high for sDPS green sturgeon. Due to a deficiency of monitoring data directed at this species, an unknown fraction of the sDPS population utilizes the middle and upper San Joaquin River reaches within the Delta, and even less is known about utilization of the San Joaquin River upstream of the Delta. However, designated critical habitat occurs in the action area and includes the San Joaquin River upstream to the limits of the legal Delta (Vernalis) on the San Joaquin River. Preservation of the functionality of the PBFs within this region is important to the long-term viability of the sDPS green sturgeon population by providing suitable habitat for the rearing of juveniles, and the foraging and migratory movements of adults.

2.4.2. Factors Affecting Listed Species and Critical Habitat in the San Joaquin River

The action area encompasses a small portion of the area utilized by ESA-listed species. Many of the factors affecting these species in the action area are considered the same as throughout their range, as discussed in section 2.2 *(Rangewide Status of the Species and Critical Habitat)* and section 2.4 *(Environmental Baseline)* of this biological opinion. Specifically, levee armoring and channelization, alteration of river flows and timing, reduction of riparian corridors and associated shaded riverine aquatic (SRA) vegetation and the introduction of point and non-point contaminants and are incorporated here by reference. Other factors that impact listed species and critical habitat specific to the action area are discussed below.

2.4.2.1. San Joaquin River Basin water resources

The San Joaquin River is the longest river in California, covering 366 miles, but is considered California's second largest river in California according to average total annual flow (the Sacramento River being the largest). The San Joaquin River has an average mean flow of 6 million acre feet per year compared to the Sacramento River's 18 million acre feet (Reclamation, 2016). It drains the central and southern portions of the Central Valley and joins the Sacramento River near the center of California to form the Delta, the largest estuary on the west coast of the United States. The San Joaquin River is primarily fed (receiving two thirds of its water) by the melting snowpack of the Sierra Nevada Mountains.

The primary storage reservoir on the San Joaquin River is the Friant Dam, which was completed in 1944. Friant Dam created Millerton Lake/Reservoir and can hold more than 500 thousand acre feet in water storage. Friant Dam diverts Sierra snowmelt water into two canals, the Friant-Kern Canal and the Madera Canal, both of which primarily support the irrigation needs of agriculture as part of the Central Valley Project (CVP). Except for releases to manage floods and to meet the requirements of riparian water rights holders, the entirety of San Joaquin River's flow is impounded by the Friant Dam and directed into the canals for distribution. See the existing Coordinated Long-term Operation of the CVP and SWP, and their effects on ESA-listed species and their critical habitats that have been analyzed in the 2009 NMFS CVP Operations Biological Opinion (NMFS 2009) for more information on the effects of federal and state water management on listed species under NMFS jurisdiction. From the high degree of water management of the San Joaquin River, in a typical year, all of the San Joaquin River's flows were allocated to water users. Historically, the river ran dry annually for a 40-mile stretch, only connecting to the Delta during flood releases from Millerton. In recent years, mandated river restoration flows have reconnected the San Joaquin River to the Delta (see section 2.4.2.3, *The San Joaquin River Restoration Program*).

2.4.2.2. San Joaquin River diversions

The Patterson Irrigation District (PID) Fish Screen Intake is located near the City of Patterson, in Stanislaus County, California. The project is located upstream of West Stanislaus Irrigation District (WSID) project, on the west bank of the San Joaquin River, between Merced and Tuolumne rivers. The diversion consists of seven pumps, six vertical turbine pumps and one horizontal centrifugal pump, with a combined pumping capacity of 195 cubic-feet-per-seconds (cfs). PID's original pump station facility used an unscreened intake that had the ability to entrain listed anadromous fish as they migrated through the area. The existing pump station facility could not be retrofitted with a fish screen that would comply with NMFS and the California Department of Fish and Wildlife's (CDFW) fish screen criteria. As a result, PID constructed a new 195 cfs pump station diversion with a screen with reinforced concrete that is 144 feet long supported on 422 steel piles. The fish screen includes ten stainless steel, high profile bars.

Banta Carbona Irrigation District (BCID) Fish Screen and Fish Bypass System is located near the City of Tracy and is downstream from the San Joaquin River and Stanislaus River confluence. The diversion has a 250 cfs capacity. The fish screen facility consists of a V-shaped screen located within the leveed canal close to the river and 18 panel screens installed vertically in a V configuration with 9 panels to a side. Each panel is 6 feet 1-inch tall and 11-feet 6-inches wide. Fish pass the screens and are pumped through a Hidrostal fish pump to the fish return pipeline on the north levee. This pipeline returns fish back to the river downstream from the diversion point. The positive barrier fish screen is fully consistent with the fish screen criteria of the regulatory agencies including NMFS, CDFW, and the USFWS.

2.4.2.3. The San Joaquin River Restoration Program

The SJRRP is the result of a settlement that was reached in 2006 on an 18-year lawsuit between federal agencies, the Natural Resources Defense Council, and the Friant Water Users Authority (SJRRP, 2009). The settlement is based on two goals: 1) Restore and maintain fish populations in "good condition" in the mainstem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally-reproducing and self-sustaining populations of salmon and other fish; and 2) Reduce and avoid adverse water supply impacts to all Friant Division long-term contractors caused by the interim and restoration flows provided for in the settlement.

As previously identified, some critical recovery actions identified in the NMFS recovery plan are achieved through the implementation of the settlement goals. Though this settlement and the SJRRP actions are restricted to the recovery area, the San Joaquin River mainstem from Friant Dam to the Merced River, the achievement of volitional fish passage from the Delta to the base of Friant Dam would increase the use of the San Joaquin River mainstem within the action area of this project by both adult and juvenile salmonid migration.

2.4.2.4. Mitigation banks

There are several conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this opinion. These banks may offer salmonid credits or credits that would benefit salmonid habitat.

Bullock Bend Mitigation Bank: Established in 2016, the Bullock Bend Mitigation Bank is a 116.15-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80) and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement, and salmonid riparian forest credits available. To date, there have been 12.5 of 119.65 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for CV spring-run Chinook salmon, CCV steelhead as analyzed in this opinion, and sDPS green sturgeon.

Cosumnes Floodplain Mitigation Bank: Established in 2008, the Cosumnes Floodplain Mitigation Bank is 472-acre floodplain site at the confluence of the Cosumnes and Mokelumne Rivers (Mokelumne River Mile 22) and is approved by NMFS to provide credits for impacts to CCV steelhead. There are shaded riverine aquatic, floodplain riparian, and floodplain mosaic wetlands credits available. To date, there have been 22.39 of 38.13 floodplain credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for CCV steelhead as analyzed in this opinion.

Fremont Landing Conservation Bank: Established in 2006, the Fremont Landing Conservation Bank is a 100-acre site near the confluence of the Feather River and the Sacramento River, at river mile 78 through 80, on the west bank of the Sacramento River. It is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. Out of 100 acres of potential credits, 28.283 acres have been sold/withdrawn and the ecological value (increased rearing habitat for juvenile salmonids) of these credits are part of the environmental baseline. All features of this bank are designated critical habitat for CCV steelhead as analyzed in this opinion.

Liberty Island Conservation Bank: Established in 2010, the Liberty Island Conservation Bank is a 186-acre site located at the southern end of the Yolo Bypass on Liberty Island in the Delta. Out of the credits relating to salmonid restoration or preservation, 27.67 acre have been sold/withdrawn. It is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. There are riparian shaded aquatic, salmonid preservation, and salmonid restoration credits available, and the ecological value of the sold credits (increased rearing habitat for juvenile salmonids) are part of the environmental baseline. All features of this bank are designated critical habitat for CCV steelhead as analyzed in this opinion.

2.4.3. NMFS Salmon and Steelhead Recovery Plan Action Recommendations

The NMFS Recovery Plan that includes both CCV steelhead and CV spring-run Chinook salmon (NMFS, 2014) identifies recovery goals for the San Joaquin River Basin populations whose range includes the proposed action area. Recovery efforts focus on addressing several key stressors that are vital to both CCV steelhead and CV spring-run Chinook salmon: (1) elevated water temperatures affecting adult migration and holding; (2) low flows and poor fish passage facilities, affecting attraction and migratory cues of migrating adults; and (3) possible catastrophic events (e.g., fire or volcanic activity).

2.4.3.1. CCV Steelhead DPS

The NMFS Recovery Plan (NMFS, 2014) strategy for CCV steelhead lists the San Joaquin River's eastside tributaries (Stanislaus, Tuolumne, and Merced rivers) as Core 2 populations (meaning these watersheds have the potential to support viable populations, due to lower abundance, or amount and quality of habitat) downstream of major dams, and as candidates to reach viable population status if reintroduced upstream of the dams, and lists the San Joaquin River, below Friant Dam, as a candidate to reach viable population status.

2.4.3.2. CV Spring-run Chinook salmon

The NMFS Recovery Plan (NMFS, 2014) indicates that for CV spring-run Chinook salmon, re-establishing two viable populations in the San Joaquin River Basin would be necessary for recovery. The action area is considered to be a priority for re-introduction for CV spring-run Chinook salmon and is a migratory corridor to the upper reaches of the San Joaquin River, below Friant Dam.

2.4.3.3. sDPS green sturgeon

As previously mentioned, the San Joaquin River is not known to currently host sDPS green sturgeon spawning; therefore, the San Joaquin River Basin is not a main focus of their recovery plan. Though the sDPS does utilize the lower San Joaquin River and the discovery of an individual adult in the Stanislaus River in October 2017 highlights that passage for adults is possible during certain river conditions, the recovery plan and efforts are not likely to be modified unless adult spawning or juvenile reproduction occurs (NMFS, 2018).

2.4.4. Summary of Monitoring and Effects from 2019 TPP and Year 1 (2020) Activities of Smith Canal Gate Project

As the current opinion is a reinitiation of a previous opinion (NMFS 2019), SJAFCA completed construction of the 2019 TPP and Year 1 (2020) components of the proposed action. These components include: test pile driving (occurred in 2019), dewatering activities, and installation of ring cofferdam and pipe piles. The effects to species and critical habitat as a result included:

short-term increases in turbidity and noise impacts from pile driving and boat/barge activities. No listed fish were encountered during the dewatering activities.

Year 1 Construction Activities

In November 2020, Year 1 construction was completed and included installation of a ring cofferdam in the San Joaquin River channel, and installation of structural/foundational pipe piles within the ring cofferdam.

Year 1 activities for the Proposed Action consisted primarily of mobilization at the staging area and gate location at the mouth of Smith Canal, installation of a cofferdam to isolate the gate construction area, installation of foundation pipe piles for the gate structure, seepage cutoff wall, and seasonal demobilization of the in-water work area. The gate structure will be constructed in subsequent years within a sheet pile ring cofferdam that was constructed during the in-water work period in Year 1 (i.e., 2020) using a vibratory pile-driver. Upon completion of the cofferdam, installation of 64 foundation pipe piles was initiated in August 2020 using vibratory and impact pile driving methods within the cofferdam.

No flat sheets were driven in Year 1; however, construction of the cofferdam consisted of larger Z-sheet piles and H-piles, which generated greater underwater noise levels than flat sheets and, thus, provide a conservative estimate of the underwater noise created by unattenuated vibratory pile-driving. It should be noted that the contractor constructing the Project uses equipment and methods that generate lower underwater noise levels than that of the TPP, as evidenced by the lower measured noise levels. Of the 193 unattenuated vibratory pile-driving events monitored in Year 1, there were no exceedances of the NMFS-specified underwater noise thresholds. Peak unattenuated noise levels ranged from 139.6 to 190.2 dB, with an average of 164.0 dB (at 10m from the source) (Table 12). The calculated distance to the NMFS specified peak threshold of 206 dB ranged from 0.0 to 1.6 m from the source. RMS levels ranged from 110.3 to 179.1 dB, with an average of 149.9 dB (at 10m from the source). The distance to the NMFS specified threshold of 150 dB RMS ranged from 0.0 to 1,574 m from the source, with an average of 36.5 m from the source. Most RMS readings exceeding 150 dB were due to short instantaneous (i.e., 3 seconds or less) events, such as when the pile hit refusal, rather than extended durations of elevated RMS values.

Increasing the strike count to 5,000 strikes per day for both the unattenuated and attenuated H-piles driven during the TPP increased the SEL value (at 10 m from the source) by approximately 7 dB. Likewise, the distance to the threshold SEL values of 187 dB (for fish ≥ 2 g) and 183 dB (for fish < 2 g) was increased by increasing the strike count to 5,000. However, regardless of the SEL threshold used, the distance to the threshold was 229 m for the unattenuated H-pile (TP1) and 21 m for the attenuated H-pile (TP3)(Table 7). This is because, at these distances, the SEL values of 170.4 and 154.9 dB for TP1 and TP3, respectively, were reduced to the "effective quiet" value of 150 dB, at which point single strike SEL values do not accumulate to cause injury to fish. Strikes per day in Year 2 are expected to be infrequent and unlikely to reach 5,000 strikes per day. However, for the purposes of this assessment, the SEL values for the worst-case scenario of 5,000 strikes per day are compared to the SEL values for 1,000 strikes per day, as summarized in Table 7.

Table 7 (Table 3 of BA 2021). Cumulative sound exposure level (SELcum) values and distance to NMFS-specified fish thresholds calculated for H-piles TP1 and TP3 driven with 1,000 and 5,000 strikes per day during the TPP.

Pile ID	SEL (dB re: 1µPa) [1]	Strikes per Day	SELcum (dB re: 1µPa at 10 m)	Distance to 187 dB SELcum [1]	Distance to 183 dB SELcum [2]
TP1	170.4	1,000	200.4	78	145
		5,000	207.39	229[4]	229[4]
TP3 [3]	154.9	1,000	184.9	7	13
		5,000	191.9	21[4]	21[4]

[1]NMFS SELcum threshold for fish weighing ≥ 2 g.
[2]NMFS SELcum threshold for fish weighing < 2 g.
[3]Attenuated with a bubble curtain.
[4]Distance required to attenuate the SEL value to the "effective quiet" value of 150 dB.

In accordance with Condition 1.a of the Incidental Take Statement in the 2019 NMFS opinion, and the Clean Water Act Section 401 Water Quality Certification and Order (401 WQC) issued by the Central Valley Regional Water Quality Control Board (CVRWQCB), ECORP biologists conducted routine water quality monitoring at locations upstream and downstream of the Project area during in-water work periods. All measurements were made using a Horiba U-50 handheld water quality meter that was calibrated daily prior to data collection. Turbidity was measured from a boat at two locations: (1) approximately 300 linear feet east of the Project site, and (2) approximately 300 linear feet west of the Project site. Because the lower San Joaquin River in the vicinity of Smith Canal is tidal and experiences reverse flows at high tide, the upstream and downstream location varies with tide stage. Under low tides, the river experiences normal outflows and the east monitoring site is the upstream site used to characterize "natural" river background water quality. Under high tides, the river experiences reverse flows and the east monitoring site is downstream of the Project site. All water quality measurements were made near the eastern bank of the San Joaquin River and at mid-depth in the water column.

The results of the water quality monitoring for paired upstream and downstream turbidity measurements indicate that all natural (i.e., upstream) turbidity values ranged from 0.34 to 67.3 NTUs, while all downstream turbidity measurements ranged from 2.48 to 51.2 NTUs. Of the 190 paired turbidity measurements recorded during Year 1 in-water construction activity, 84 paired measurements (44.2%) indicated that turbidity was higher upstream of the construction activities relative to downstream. This is likely attributable to the relatively high and variable turbidity conditions in the lower San Joaquin River. The largest observed increase in downstream turbidity values was 32.3 NTUs; however, the difference was typically less than 10 NTUs. As such, the take limit of 50 NTUs above ambient (i.e., upstream) specified in Term and Condition 1.a of the 2019 NMFS opinion was not exceeded during Year 1 in-water construction activity.

A turbidity curtain was deployed at all times during in-water work activity, which contained elevated turbidity levels associated with pile-driving and prevented these activities from causing a visible or measurable plume outside the turbidity curtain. The most notable increases in turbidity measured at the monitoring locations above resulted from barge movements using the tugboat. However, barge movements were infrequent activities that typically lasted just a few minutes. The resulting increases in turbidity were generally confined to within a short distance of the tugboat and barge, short in duration (e.g., minutes), and, as discussed above, did not exceed the allowable increases in turbidity, as specified in the 2019 NMFS opinion or 401 WQC. Because Year 2 activities would likely require the use of additional barges and, thus, an increase in the number of movements in the barges per day or per week, the frequency of events in which turbidity is temporarily increased around the barges being moved is expected to also increase. However, the magnitude of the turbidity level (i.e., NTUs) is not expected to increase more than Year 1 measurements. Based on these considerations, movements of the barges during the extended Year 2 construction period would likely increase the frequency of short-term increases in turbidity around the barges being moved, but is not expected to increase the magnitude of the turbidity and, therefore, is not anticipated to exceed the allowable turbidity increases specified in the 2019 BO during the extended in-water work window.

No construction-related fuels or other materials were observed outside the cofferdam during Year 1 in-water work activities. As reported in the 2020 annual report (ECORP 2020), a minor accidental spill of nonhazardous clarity hydraulic fluid caused by a leaking hydraulic cylinder seal on the vibratory hammer occurred inside the cofferdam on September 21, 2020, and was contained within the cofferdam until it was cleaned up in accordance with the contractor's spill prevention plan. The same conservation measures, and other water quality minimization measures and monitoring would occur during the extended in-water work periods in Year 2 as required during any in-water work, in accordance with the 2019 NMFS opinion and the 401 WQC. Based on these considerations, the potential for construction-related activities to exceed the 2019 NMFS opinion's turbidity limitation of 50 NTUs above background is expected to be low during the Year 2 extended in-water work window and, during the June 15-30 staging period.

The lower San Joaquin River near Stockton is widely used for commercial ships, recreational boaters (e.g., fishing boats, waterskiing), and other small motorized watercraft (e.g., jet skis). A search of available information yielded no surveys of boat traffic on the lower San Joaquin River and, therefore, the incremental Project-related contribution to boat traffic cannot be quantified. However, The Port of Stockton's (2018) Annual Report states that there were 252 ship calls in 2018, equating to one large commercial ship passing through the Project area on approximately 70% of all days, with the highest occurrences of ship calls occurring in Quarter 1 (29%) and Quarter 2 (28%) (i.e., outside the July 15 - October 15 construction window).

Noise levels generated by project-related boat and barge traffic were measured during construction on October 6 and 7, 2020. These included a total of four (4) events when the tugboat was repositioning the crane barge around the cofferdam in Atherton Cove and one (1) event when the tugboat was transporting the supply barge through the lower San Joaquin River to the construction site. The maximum underwater noise values for these events (at 10 m from the source) were:

- Peak: 125.7 dB;
- RMS: 111.2 dB; and
- SEL: 107.4 dB.

In addition, underwater noise levels were recorded between October 6-7, 2020 when two large freight ships (on their way to/from the Port of Stockton) passed through the lower San Joaquin River adjacent to the Project site. These large ships move relatively slowly and quietly through the San Joaquin River and the maximum underwater noise levels generated as these ships passed by reached maximum underwater noise levels (at approximately 10 m from the source) of:

- Peak: 120.7 dB;
- RMS: 107.6 dB; and
- SEL: 107.3 dB.

All underwater noise values from movements of these boats are considerably lower than the values measured during vibratory or impact driving of the foundation piles and generate a continuous noise profile that does not, unlike impact pile-driving, accumulate SEL values. Moreover, underwater noise levels generated by project-related boat and barge traffic are well below the NMFS-recommended criteria for protecting fish.

The greatest contribution to boat traffic in the Action Area consists of small recreational boats throughout the daylight period with occasional (i.e., semi-daily) passage of large commercial ships. Based on a review of aerial images, a total of 183 private boat docks occur within Smith Canal and around Atherton Island. In addition, numerous marinas, hundreds of other private boat docks and a total of three (3) public boat ramps occur on the San Joaquin River and other channels within five miles of the Project, including the Louis Park public boat ramp located at the base of Dad's Point, which will be used for launching boats for the Project. During the three-day TPP for the Project conducted on October 28-30, 2019 (i.e., outside the construction window), recreational boats were observed regularly within the canal and San Joaquin River, and two large commercial ships passed through the San Joaquin River within the Action Area. During in-water monitoring in 2020, dozens of recreational boats were typically observed daily and large commercial ships passed the Project site on a semi-daily basis. Based on this information, boat and ship traffic within the Action Area is relatively heavy and continuous under baseline conditions.

Fish Capture and Relocation

A fish rescue and relocation effort was conducted on Thursday, August 13, 2020, immediately prior to installing the final Z-sheets to finalize and seal the cofferdam. ECORP (consultant) fisheries biologists removed and relocated fish from the approximately 80 feet by 80 feet cofferdam that will be used to isolate the construction area for the Smith Canal gate structure. No ESA listed fish were observed or captured. All fish rescue and relocation efforts were conducted in accordance with the Fish Rescue and Relocation Plan provided to NMFS and the California Department of Fish and Wildlife (CDFW) on July 9, 2020. The fish removal effort was conducted by CDFW-approved designated biologists/qualified fisheries biologists/biological monitors.

An 8-ft wide gap (i.e., where the final two pairs of sheet piles would be installed to seal the cofferdam) was left in the west wall of the cofferdam, which was filled with water during the fish relocation effort. The fish removal was conducted between approximately 8:30 and 11:30 AM and coincided with the daily low tide.

A large block net measuring 150 ft in length by 8 ft in depth with 1/8-inch mesh was used to remove fish from the interior of the cofferdam. The net was pulled around the interior perimeter of the cofferdam by two (2) two-person crews working in two separate boats. Each crew consisted of a boat operator and a biologist who guided the end of the block net along the interior perimeter of the cofferdam wall, keeping the net tight against the wall to herd fish toward the gap. Additional biologists operating from floating platforms and I-beams installed along the cofferdam wall above the water surface assisted with pulling the net and using long-handled dip nets to move fish away from the interior perimeter of the wall as the boat crews pulled the block net. The block net was pulled along the entire interior perimeter of the cofferdam wall and out through the gap to remove fish. Upon completion of the block net haul through the gap, a smaller block net measuring 30 ft in length by 12 ft in depth with 1/8-inch mesh was immediately placed across the gap to keep fish from re-entering the cofferdam. This process was then repeated for a total of two (2) block net hauls.

Upon completion of the two block net hauls, the interior of the cofferdam was surveyed by a boat-equipped fish finder to ensure that no fish were detected in the cofferdam. The block net placed across the gap to prevent fish from re-entering the cofferdam remained in place until the final piles were driven later in the afternoon to fill the gap and seal the cofferdam. Prior to, and upon completion of the fish removal effort, equipment used in the fish rescue that comes in contact with surface water (i.e., seines, block nets, dip nets, and ropes) are thoroughly dried and rinsed in a “Quat” solution prescribed to kill bacteria and fungus prior to a secondary drying and storage.

Prior to initiating the fish rescue effort, a single sea lion (Zalophus californianus) was briefly observed surfacing in Atherton Cove, approximately 200 ft from the eastern wall of the cofferdam and was not observed again during the fish removal effort. During the fish removal effort, a single young-of-the-year (YOY) black bass of unknown species (Micropterus spp.) was briefly observed swimming near the water surface as the block net was being pulled through the gap and was, presumably, removed from the cofferdam untouched as the net was pulled through the gap. During retrieval of the net after it was pulled through the gap, a total of five (5) threadfin shad (Dorosoma petenense) and two (2) YOY bluegill (Lepomis macrochirus) were removed from the block net and, upon identification and enumeration, were immediately (i.e., within seconds or minutes) released alive a short distance west of the cofferdam in Atherton Cove using handheld dip nets.

Water quality parameters were recorded in the San Joaquin River just west of the cofferdam using a Horiba U50 handheld meter before and after the fish rescue effort. Water temperature ranged from 26.4-27.3°C. Dissolved oxygen concentration ranged from 9.8-10.4 mg/L. pH ranged from 9.37-9.46. Turbidity ranged from 14.9-17.7 NTUs. Visibility was estimated to be less than two feet below the water surface within Atherton Cove and in the interior of the cofferdam.

No California native or special-status fish species were observed or captured during the fish removal effort. No fish or other wildlife were injured or killed during the fish removal effort. As such, no incidental take of ESA-listed fish species occurred during the Year 1 dewatering and fish relocation effort.

The quality of the current condition of the PBFs for CCV steelhead and sDPS green sturgeon in the action area are poor compared to historical conditions (pre-levees). The habitat does not provide the functionality of the conservation values necessary for the long-term survival and recovery of the species. In particular, levees, riprapping, and removal of riparian vegetation have greatly diminished the value of the aquatic habitat in the action area by decreasing rearing area, food resources via food-web degradation, and complexity and diversity of habitat forms necessary for holding and rearing (channel and bathymetry diversity). Perpetuating levee structures with armored riprap and the addition of the proposed permanent installation of the gate structure, would continue to degrade the status of the designated critical habitat into the foreseeable future.

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 following is an analysis of the potential effects to listed fish species that may occur as a result of implementing the proposed action on the San Joaquin River.[1] For our analysis, we have used the presence of listed species in the action area to determine the risk each species and life stage may face if exposed to project impacts. The expected effects of the proposed action include impacts due to: (1) water quality, (2) noise exposure, (3) dewatering and fish relocation, (4) habitat loss/modification, (5) and operations and maintenance. As described in section 2.1 Analytical Approach, we use completed construction components of Year 1 as best available information to inform the anticipated effects of the action (Year 2 and Year 3).

2.5.1. Effects to species: Construction impacts, pile driving, and maintenance

2.5.1.1 Construction Impacts

Water Quality: Sediment and Turbidity

Construction activities could result in turbidity, suspended sediment concentrations, and contaminant concentrations. Construction activities could disturb sediments and soils within and adjacent to waterways. These activities, including construction of the new tidal gate, use of

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[1] As stated previously, there are no interrelated or interdependent actions associated with this project.

staging areas, installation of sheet piles, wildlife viewing platforms, riprap placement, and placement of excavated material, could disturb sediments and soils within and adjacent to waterways. Any construction-related erosion or disturbance of sediments and soils would increase downstream turbidity and sedimentation in the project area if soils were transported in river flows. During the long-term period of gate operations, the narrow gate opening (~50 feet) will create a higher velocity flow through the structure than currently exists through the undeveloped channel during each tidal cycle. NMFS expects that elevated turbidities will occur in association with this higher velocity until the surrounding channel substrate has come to an equilibrium between heavier and coarser sediments lining the scour hole and the redistribution of the lighter material more prone to resuspension into other areas of the channel. It is unknown how long this process will take, and what level of turbidity is likely to occur as a result.

The abundance, distribution, and survival of fish populations have been linked to levels of turbidity and silt deposition. Prolonged exposure to high levels of suspended sediment could create a loss of visual capability in fish in aquatic habitats within the project area, leading to reduced feeding and growth rates. Such exposure could also result in a thickening of the gills, potentially causing the loss of respiratory function; in clogging and abrasion of gills; and in increased stress levels, which in turn could reduce tolerance to disease and toxicants (Waters 1995). Turbidity also could result in increased water temperature and decreased dissolved oxygen (DO) levels, especially in low-velocity pools, which can cause stressed respiration.

High levels of suspended sediments could also cause redistribution and movement of fish populations in the San Joaquin River, and could diminish the character and quality of the physical habitat important to fish survival. Deposited sediments can reduce water depths in stream pools and can contribute to a reduction in carrying capacity for juvenile and adult fish (Waters 1995). Increased sediment loading downstream from construction areas could degrade food-producing habitat by interfering with photosynthesis of aquatic flora, and could displace aquatic fauna.

Many fish, including salmonids (Chinook and steelhead), are visual feeders and turbid waters reduce the ability of these fish to locate and capture prey. Some fish, particularly juveniles, could become disoriented and leave the areas where their main food sources are located, ultimately reducing growth rates. Prey of fish populations, such as macroinvertebrates, could be adversely affected by declines in habitat quality (water quality and substrate conditions) caused by increased turbidity, decreased Dissolved Oxygen (DO) content, and an increased level of pollutants.

Avoidance of adverse habitat conditions by fish is the most common result of increases in turbidity and sedimentation (Waters 1995). Fish are not expected to occupy areas unsuitable for survival unless they have no other option. Therefore, increased turbidity attributed to construction activities could preclude fish from occupying habitat required for specific life stages. A review by Lloyd (1987) indicated that several behavioral characteristics of salmonids can be altered by even relatively small changes in turbidity (10 to 50 nephelometric turbidity units [NTUs]) that are expected to result from this proposed project. Salmonids exposed to slight to moderate increases in turbidity exhibited avoidance, loss of station in the stream, reduced feeding rates and reduced use of overhead cover. Reaction distances of rainbow trout to prey were reduced with increases of turbidity of only 15 NTUs over an ambient level of 4 to 6 NTUs in experimental stream channels (Barret *et al.* 1992).

During installation of the sheet piles, wildlife viewing piles, riprap placement, and dredging, there would be an increase in sediment and turbidity. The Smith Canal structure is anticipated to take two years for completion, with the majority of the work occurring over the two summer work windows for Year 2 (July 1 through November 30, 2021) and Year 3 (July 15 through October 15, 2022). During these periods, NMFS anticipates short-term, localized (no more than 300 feet upstream and downstream) construction related turbidity events will occur. In addition, based on Year 1 water quality monitoring, the turbidity limitation of 50 NTUs above background stayed below that threshold.

These in-water work activities that would result in increased sediment and turbidity would occur from July to November (2021) and mid-October (2022). This period coincides with when CCV steelhead are least likely to be present in the action area. Adult CCV steelhead may commence their upstream migration as early as October. However, juveniles would not likely be migrating downstream during this time. There is likely to be little exposure to any CV spring-run adults resulting from the reintroduction efforts based on the expected timing of their life histories. Rearing juveniles and resident or holding CCV steelhead and CV spring-run Chinook salmon are not expected to occur in the project site during the in-water work window due to unsuitable habitat conditions such as warm water temperatures; these species are only likely to be present within the project site during migrations so timing the construction outside of the primary migratory periods will limit the potential for CV spring-run Chinook and CCV steelhead to be present during construction and be impacted by construction activities. NMFS expects that foraging adult sDPS green sturgeon and rearing juvenile sDPS green sturgeon could be present in the Delta. However, diminished water quality (low DO, low flow, and increased water temperatures) in the action area would preclude presence of green sturgeon during the in-water work window.

Installation of the sheet piles and platform pilings is expected to result in short-term, localized increases in turbidity. Therefore, there could be some impacts to the listed species if present during the installation of the cofferdam and associated construction activities. However, because the cofferdam will isolate the work area, continued increases and sediment mobility during in-water work activities is not expected to occur.

Since in-water work will be extended in Year 2, the probability of in-water work overlapping with listed salmonid presence increases and the potential for exposure to elevated turbidity increases. Although the risk of exposure is still quite low, this increases the risk for exposure, resulting in non-lethal adverse effects, including behavioral responses such as displaced feeding and migration delays.

Water Quality: Contaminants

During construction, the potential exists for spills or leakage of toxic substances that could enter the waterways. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, sealants, and oil). Adverse effects to listed fish may result from point and non-point source chemical contaminant discharges within the action area. These contaminants include, but are not limited to ammonia/ammonium, pesticides and herbicides, and oil and gasoline product discharges. Oil and gasoline product discharges may be introduced into the waterways from shipping and boating activities and from urban activities and runoff. These contaminants may adversely affect fish reproductive success and survival rates. Fish could also be exposed to legacy contaminants during sediment disturbing activities such as dredging.

High concentrations of contaminants can cause short-term and long-term effects to fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. Sublethal effects include increased susceptibility to disease that reduces the overall health and survival of the exposed fish. A long-term effect of contamination is reduced prey availability. Invertebrate prey species survival can be reduced therefore making food less available for fish. Also, fish consuming infected prey can absorb toxins directly. However, only a small number of salmonids would be expected to be exposed to such effects because of the timing of in-water work.

Green sturgeon may be more susceptible to aquatic contaminants since they are benthic foragers. Studies on white sturgeon found that bioaccumulation of pesticides and other contaminants adversely affect growth and reproductive development (Feist et al. 2005). However, green sturgeon occurrence in the relatively shallow water of the action area during sediment disturbance is likely to be limited because the species tends to occupy deeper water by day.

With the continued implementation of the water quality conservation measures (as described in the project description) and in-water work window, the potential effects from exposure to contaminants are expected to be avoided.

Noise Exposure

2.5.1.2 Vibratory and impact pile driving

Construction of the Smith Canal Gate and associated dolphins and flood walls will require the use of both vibratory and impact pile driving to install the sheet piles for the permanent cofferdam and pipe pile foundations of the gate structure across the canal, the temporary construction support platforms, and the permanent fishing platforms and retaining walls. Table 8 describes a summary of all pile driving activities.

A pile driving test was conducted the year prior to starting construction in 2019, to gather data on site-specific subsurface conditions to ensure subsequent in-water pile driving work is completed in the expected timeframe, and to evaluate the observed underwater sounds created during the test and the effectiveness of sound attenuation measures. During the test, a 20-inch steel sheet pile and an “H” pile were driven into the riverbed from two barges at three locations in the construction area. Each test pile was first vibrated to the maximum possible depth, and then driven to its design elevation with an impact hammer. No more than 1,000 impact strikes per day were performed during the test period and the test piles were removed via vibratory pile driving before moving on to the next sampling location. In addition, five CPTs were conducted across the cellular sheet pile wall alignment, which involved pressing a sensor mounted on a 2-inch wide sectional pole into the channel bottom from a barge-mounted rig but since these CPTs do not involve pile driving, effects of CPTs are not analyzed in this section. While the test pile program was short in duration (three in-water work days), it is believed that the test program will require extension past the fish avoidance in-water work window, up to November 1, to complete all testing in the 2019 construction season. During the test program, environmental awareness training, biological monitoring, hydroacoustic underwater sound monitoring, and turbidity monitoring was ongoing.

During the construction period, steel pipe piles and sheet piles will be placed into the river channel first via vibratory pile driving to the maximum depth possible or desired, and then via impact pile driving for final setting and then load testing during the proposed in-water work window of July 15th – October 15th. To ensure in-water pile driving work is completed in two construction seasons, it is estimated up to 5,000 impact strikes per day are necessary. Most in-water pile driving will be accomplished with a barge-mounted crane, and once the sheet pile retaining wall of the gates form a cofferdam, the internal area will be dewatered so that foundation piles can be installed "in-the-dry." Water depths in the pile driving locations are assumed to be variable but less than 5 meters overall.

Table 8. Summary of all pile-driving associated activities for Year 2 and Year 3 of the Smith Canal Gate and associated structures (Table from Corps Biological Assessment 2018).

Structure	**Number of Piles**	**Pile Description**	**Type of Pile Driving**	**Environment**	**Estimated Duration (days)**
Floodgate Foundation	64	36-inch diameter steel pipe piles	Impact	Inside cofferdam surrounded by water	10
Dolphins	39	36-inch diameter steel pipe piles	Impact	In water	4-5
Protective Piles Around Dolphins	18	20-inch diameter steel pipe piles	Impact	In water	3-4
Fixed Cellular Sheet Pile Wall	~1,465 sheets	AS-500-12.7 sheet piles	Vibratory	In water	6 months
Fishing Platforms	24	24-inch diameter steel pipe piles	Impact	In water (16) and on land (8)	3-4
Dad's Point Flood Wall	770 sheets	NZ-26/AZ-26	Vibratory	On land	60

Pile driving near or in water has the potential to kill, injure, and cause delayed death to fish through infection of minute internal injuries, or cause sensory impairments leading to increased susceptibility to predation. The pressure waves generated from driving piles into river bed substrate propagate through the water and can damage a fish's swim bladder and other internal organs by causing sudden rapid oscillations in pressure, which translates to rupturing or hemorrhaging tissue in the bladder when the air in swim bladders expand and contract (Gisiner

1998, Popper, Carlson et al. 2006). Sensory cells and other internal organ tissue may also be damaged by pressure waves generated during pile driving activities as sound reverberates through a fish's viscera (Caltrans 2015). In addition, morphological changes to the form and structure of auditory organs (saccular and lagenar maculae) have been observed after intense noise exposure (Hastings and Popper 2005). Smaller fish with lower mass are more susceptible to the impacts of elevated sound fields than larger fish, so acute injury resulting from acoustic impacts are expected to scale based on the mass of a given fish. Since juveniles and fry have less inertial resistance to a passing sound wave, they are more at risk for non-auditory tissue damage (Popper and Hastings 2009) than larger fish (yearlings and adults) of the same species. Beyond immediate injury, multiple studies have also shown responses in the form of behavioral changes in fish due to human-produced noises (Wardle et al. 2001, Slotte et al. 2004, Popper and Hastings 2009).

Based on recommendations from the Fisheries Hydroacoustic Working Group (FHWG), NMFS uses an interim dual metric criteria to assess onset of injury for fish exposed to pile driving sounds (NMFS 2008, Caltrans 2015, Caltrans 2019). The interim thresholds of underwater sound levels denote the expected instantaneous injury/mortality and cumulative injury, as well as a third threshold criteria for behavioral changes to fish. Impact pile driving is expected to produce underwater pressure waves at all three threshold levels. Vibratory pile driving generally stays below injurious thresholds but often introduces pressure waves that will incite behavioral changes. Even at great distances from the pile driving location, underwater pressure changes/noises from pile driving is likely to cause flight, hiding, feeding interruption, area avoidance, and movement blockage as long as pile driving is ongoing.

For a single strike, the peak exposure level (peak) above which injury is expected to occur is 206 decibels (dB) (reference to 1 micro-pascal [1µpa] squared per second). However, cumulative acoustic effects are expected for any situation in which multiple strikes are being made to an object with a single strike peak dB level above the effective quiet threshold of 150 dB. Therefore, the accumulated SEL level above which injury to fish is expected to occur is 187 dB for fish greater than 2 grams in weight, and 183 dB for fish less than 2 grams. If either the peak SEL or the accumulated SEL threshold is exceeded, then physical injury is expected to occur to fish within the estimated distance thresholds. Underwater sound levels below injurious thresholds are expected to produce behavioral changes. NMFS uses a 150 dB root-mean-square (RMS) threshold for behavioral responses in salmonids and green sturgeon. Though the dB value is the same, the 150 dB RMS threshold for behavioral effects is unrelated to the 150 dB effective quiet threshold.

According to the Caltrans 2012 pile driving compendium of field data (Caltrans 2012), in-water impact pile driving of the 36-inch diameter steel pipe piles for this project could generate unattenuated underwater sound waves of up to 210 dB peak, 190 dB SEL, and 190 dB RMS, as measured at 10 meters from the strikes, in approximately 5 meters of water depth or less (Table 9). These estimates are calculated from field data gathered from pile driving activities at other locations and are considered informative only, not the definite levels that will be generated by impact pile driving in the San Joaquin River/Smith Canal/Atherton Cove during the course of this project. This is because each pile driving situation is unique and variations in the substrate, channel shape, depth, salinity, and water temperature can alter how the underwater pressure waves propagate and the amount of transmission loss that will dampen the underwater sounds as they travel.

Table 9. Expected maximum unattenuated hydroacoustic sounds based on the size of pile and method of placement, empirical data from the 2012 FHWG pile driving compendium Caltrans (Caltrans 2012).

Pile Type	Driver Type	Pile Location	Reference Distance	Peak (dB)	SEL (dB)	RMS (dB)
15-inch diameter steel "H" piles (thin-walled)	Impact	In water, >4 meters depth	10 meters	187	154	164
20-inch diameter steel pipe piles	Impact	In water, >5 meters depth	10 meters	208	176	187
20-inch diameter steel pipe piles	Impact	In water, >5 meters depth	20 meters	201	173	184
20-inch diameter steel pipe piles	Impact	On land	10 meters	198	171	183
20-inch diameter steel pipe piles	Impact	On land	20 meters	188	NA	172
24-inch diameter steel pipe piles	Impact	In water, ~ 5 meters depth	10 meters	203	177	190
30-inch diameter steel pipe piles	Impact	In water, +/- 3 meters depth	10 meters	210	177	190
36-inch diameter steel pipe piles	Impact	In water, <5 meters depth	10 meters	208	180	190
36-inch diameter steel pipe piles	Impact	On land	10 meters	201	174	186
36-inch diameter steel pipe piles	Impact	On land	20 meters	198	171	183
36-inch diameter steel pipe pile	Vibratory	In water, ~ 5 meters	10 meters	180-185	170-175	170
24-inch AZ steel sheet pile	Vibratory	In water, ~15 meters	10 meters	175-182	160-165	160-165
24-inch AZ steel sheet pile	Impact	In water, 12-14 meters	10 meters	203-205	175-179	187-189

Construction Pile Driving Effects

Considering the scenario which will be most acutely harmful during construction installation (36-inch diameter steel pipe piles in less than 5 meters water depth, impact pile driving in water, 5,000 strikes a day, no attenuation) with the production of 208-210 dB peak/180-190 dB SEL/177-190 dB RMS underwater sounds, the NMFS Pile Driving Calculator (NMFS 2008) indicates that the distance threshold within which instantaneous mortality would be expected to occur is 18 meters or less from the driven pile. For fish above 2 grams, the distance at which injury is expected to occur due to cumulative SEL exposure above 187 dB is within 1,585 meters from the driven pile (Table 10). The distance within which behavioral changes are expected is 4,642 meters from the driven pile, where the RMS sound will be above 150 dB RMS. SELs below 150 dB are assumed to not accumulate and cause fish injury, or be significantly different from ambient conditions, (i.e., effective quiet). If the number of strikes per day is increased to 5,000 (the maximum presented in the BA), the distances affected by injurious cumulative SELs is increased to almost the entirety of the affected area, out to 4,634 meters from the driven pile.

Pressure levels in excess of 150 dB_{RMS} are expected to cause temporary behavioral changes (startle and stress) that could decrease a fish's ability to avoid predators or delay normal migration past the work site. The background RMS sound pressure levels, or effective quiet, is assumed to be 150 dB_{RMS} and the acoustic impact area is the area where the predicted RMS sound pressure level generated by pile driving exceeds this threshold. Once the pressure waves attenuate below this level, fish are assumed to no longer be adversely affected by pile driving sounds. Under the concept of effective quiet being equal to 150 dB_{RMS}, the distance fish are expected to be adversely affected during pile driving is out to 4,642 meters (Table 10) from the location of the pile being driven, assuming a transmission loss constant of 15 (NMFS 2008). This distance effectively covered the width of the San Joaquin River bank to bank, the San Joaquin River being approximately 250 meters in width in this section, and would be expected to propagate 2.88 miles both up- and downstream from the pile driving location.

Table 10. Threshold distances to in-water adverse effects using unattenuated maximum expected underwater sound (210 dB peak, 190 dB SEL, 190 dB RMS) modulated by strikes per day, when fish weight >2 grams, calculated by the NMFS pile driving calculator (NMFS 2008).

Strikes per Day	**Peak (dB) ≥ 206**	**Cumulative SEL (dB) ≥187**	**RMS (dB) ≥150**
1,000	18 meters	1585 meters	4,642 meters
3,200	18 meters	3,442 meters	4,642 meters
5,000	18 meters	4,634 meters	4,642 meters

The underwater sound conditions in Table 11 would be expected to occur on days when in-water impact pile driving of 36-inch diameter piles occur (i.e., during the installation of the dolphins), and represent unattenuated underwater sound monitoring data. Installation of the floodgate foundation piles will occur in the dewatered area behind a cofferdam, effectively isolating the exposed portion of the driven pile and dampening any vibration's translation into the water column. However, the portion of the pile beneath the riverbed will translate vibrations through the saturated substrate sideways and up into water column outside of the cofferdam, therefore some underwater pressure waves will propagate. NMFS considers that attenuation measures, such as pile driving within a dewatered cofferdam, reduces the underwater pressure waves by 5 dB for each application. Therefore, using a reduced underwater sound estimate, driving the floodgate foundation piles the distance over which fish injury would occur is greatly reduced (Table 11).

Table 11. Threshold distances to in-water adverse effects using attenuated maximum expected underwater sound (205 dB peak, 185 dB SEL, 185 dB RMS) modulated by strikes per day, when fish weight >2 grams, calculated by the NMFS pile driving calculator (NMFS 2008).

Strikes per Day	**Peak (dB) ≥ 206**	**Cumulative SEL (dB) ≥187**	**RMS (dB) ≥150**
1,000	9 meters	736 meters	2,154 meters
3,200	9 meters	1,597 meters	2,154 meters
5,000	9 meters	2,151 meters	2,154 meters

Table 8. In-water pile driving will occur on 233 of those days, and on land pile driving will occur for approximately 64 days. The in-water work window of July 15th through October 15th is a span of only 92 days, therefore the proposed action would likely require at least three seasons of pile driving with few breaks to complete in-water work during the in-water work window, even with the high number of impact strikes (5,000 strikes) proposed per day. It is far more likely the project will take more than three in-water work seasons to complete this amount of pile driving within the work window due to holidays and weekends.

The proposed in-water work window is effective in avoiding most interactions with CV spring-run Chinook salmon, with the bulk of their upstream adult migration concluding by the end of June, in part due to summer water temperatures that often exceed their lethality threshold at this location. However, CCV steelhead adults can begin their upstream migration anytime from July through December, and sDPS green sturgeon may remain in freshwater systems feeding and rearing throughout the year. It is possible that adult CCV steelhead may use the action area as a migration corridor, while sDPS green sturgeon adults and juveniles may use the action area as foraging and rearing habitat during the in-water work window, whenever water temperatures are suitable (at least below 75°F). According to in-river monitoring data available on the California Data Exchange Center for the San Joaquin River at Garwood Bridge station, water temperatures upstream of the action area in the San Joaquin River are likely to exceed anadromous fish (CCV steelhead, CV spring-run Chinook, and sDPS green sturgeon) thermal limits regularly during the work window. Water temperatures are likely to drop in September, with atmospheric temperature drops and increased cloud cover and rainfall. In some years, water temperatures may be tolerable to anadromous fish use throughout the summer, as seen in 2011 and 2017. Therefore, CCV steelhead and sDPS green sturgeon are assumed to be present when local water temperatures are below 75°F, though the total number of individual fish using the area during the work window is expected to be low.

Due to the large area that will be impacted by elevated underwater sounds above effective quiet (2,154 to 4,642 meters from the location of the pile being driven), and the large number of days required to complete the proposed project, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are expected to be adversely affected by vibratory pile driving associated with this action. While vibratory pile driving is generally not immediately injurious to fishes even when performed in water without attenuation, it is likely that the underwater pressure waves and sounds will disturb the normal behaviors of fish using this area, including potentially interrupting migration patterns and foraging activities, even while the project observes the proposed in-water and on-land work windows, and uses underwater sound control measures.

Impact pile driving is expected to immediately injure or kill fishes within certain distance thresholds, depending on the size of pile being driven, the number of strikes used in a day, and whether attenuation measures are being employed. Using the greatest numbers of strikes estimated to drive the largest piles (up to 5,000), it is expected that fish greater than 2 grams may be killed within 9 meters (with underwater sound control, Table 11) to 18 meters (without underwater sound control, Table 11) of the driven pile due to in-water impact pile driving. In the same scenario, it is expected that fish greater than 2 grams may be injured within 736 meters (with underwater sound control, Table 11) to 4,634 meters (without underwater sound control, Table 10) of the driven pile due to the cumulative SELs produced by in-water impact pile driving. If in-water impact pile driving is limited to only the in-water work window (including in-river work behind a dewatered area), then CCV steelhead and sDPS green sturgeon are expected to be affected. CV spring-run Chinook salmon are not expected to be present in the action area July through October.

Acoustic Effects of Barge and Boat Traffic

Barge and tugboat traffic will create additional sources of noise in the aquatic environment. This would be an acoustic-related stressor that could result in negative impacts to listed species present. Ships under power produce a substantial amount of mechanical- and flow-induced noise from motor, propeller, and hull turbulence. Measurements of sound intensity from commercial shipping have shown sound levels up to approximately 180 dB (ref. 1 µPa) at the point source (1 meter from ship) (Kipple and Gabriele 2007). This level of noise will drop off by 40 dB at 100 yards away and approximately 53 dB lower at one quarter mile (Kipple and Gabriele 2007). The narrow confines of channels in the action area would indicate that the elevated noise levels generated by the passage of commercial vessels such as tugboats would extend essentially from bank to bank in the San Joaquin River, thus subjecting all fish within the confines of the channel to anthropogenic-produced noise conditions. The relatively rapid passage of the barge and tugboat past a given point will somewhat attenuate these effects by decreasing the duration of the elevated sound levels, but some temporary effects can be anticipated to occur, depending on the proximity of the exposed fish to the sound source. The presence of underwater noise, such as that originating with shipping, may adversely affect a fish's ability to detect predators, locate prey, or sense their surrounding acoustic environment (Slabbekoorn et al. 2010, Radford et al. 2014). Other species of fish have been shown to respond to recorded ambient shipping noise by either reacting more slowly to predators, thus increasing their susceptibility to predation (Simpson et al. 2015, Simpson et al. 2016), or becoming hyper-alert and reacting more quickly to a visual predator stimulus, causing them to cease feeding and hide (Voellmy et al. 2014b). Voellmy et al. (2014a) states that elevated sound levels could affect foraging behavior in three main ways: noise acting as a stressor, decreasing feeding behavior in the short-term through reduced appetite, or in the long-term through a reduction in activity and locomotion and alterations to the cognitive processes involved in food detection, classification, and decision making; noise acting as a distracting stimulus, diverting an individual's limited amount of attention from their primary task to the noise stimuli that have been added to the environment; noise masking crucial acoustic cues such as those made by both prey and predators.

Fish also may exhibit noise-induced avoidance behavior that causes them to move into less suitable habitat for foraging or will wait to feed when the noise has abated. Voellmy et al. (2014a) surmised that sustained decreases in food consumption could have long-term energetic impacts that result in reductions in growth, survival, and breeding success. Moreover, compensatory feeding activities could increase predation risks by increasing time exposed to predators or by forcing animals to feed in less favorable conditions, such as in times or areas of higher predation pressure.

Increased noise, produced by barge and tugboat traffic may result in salmonids and green sturgeon fleeing the area of those noises and moving into the channel's shallowest margins or adjacent habitat. The channel margins of many Delta waterways have submerged and emergent vegetation (e.g., Egeria) and rock rip-rapped levees where predatory species are likely to occur in greater numbers than in the open waters of the channel. This scenario therefore could increase the predation risk of salmonids, particularly smolts. Likewise, elevated noise exposure can reduce the ability of fish to detect piscine predators, either by reducing the sensitivity of the auditory response in the exposed fish or masking the noise of an approaching predator. Such would be the case if open water predators such as striped bass (*Morone saxatilis*) encounter the juvenile fish in the open channel while a barge and tug are present.

If barge traffic is limited to only the in-water work window, then only CCV steelhead and sDPS green sturgeon are expected to be affected because CV spring-run Chinook salmon should be out of the area July through October. However, because of the variability and uncertainty associated with the population sizes of the species present, annual variation in the timing of migration and variability regarding individual habitat use of the action area, the actual number of individuals present in the action area during the in-water work window is not known. However, there would be few individuals present since most juvenile salmonids would have left the action area by late spring and are least likely present in the action area during in-water work season, therefore impacts resulting from elevated noise levels from barge or tugboat are expected to be low.

Updated Acoustic Effects of Barge and Boat Traffic

The following assessment adds the proposed project-related incremental increase in boat traffic during the extended in-water work window, June 15-30 staging period, and December 1-15 demobilization period.

Year 1 project-related boat and barge traffic typically included two relatively short periods of daily barge movements (i.e., approximately 15 minutes per trip totaling 30 minutes per day) to travel 1.26 nautical miles each way to and from the staging area. This daily period of boat and barge traffic amounts to just 3 hours per week (i.e., less than 1.8% of a 7-day period) that is done during daylight hours. Based on these data, noise and disturbance associated with the Project-related boat and barge traffic is not expected to reach levels that would cause measurable behavioral effects, injury, or lethality to ESA-listed anadromous fishes during Year 2 and Year 3.

The small boats would be used for short durations (i.e., typically 10 minutes or less at time), primarily for shuttling personnel and equipment over short distances from the boat launch to the barge, relocating the underwater noise monitoring equipment, or for water quality and biological monitoring (i.e., typically 3-4 times per day). These boats would be used primarily within the mouth of the canal and, most often, in the 1,800-foot channel between the boat ramp and the active construction area and within approximately 300 feet of the active construction area. Trips into the San Joaquin River (e.g., to inspect for the presence of marine mammals, when necessary) would be infrequent, of short duration (i.e., typically ≤15 minutes), and usually limited to within a few hundred feet of the mouth of Smith Canal.

The larger tugboat used to move the barge would be used less frequently and primarily for repositioning or deploying the barge during different phases of construction. After deployment of the barge on or around June 15, this would be done on a semi-daily basis (i.e., typically a few times per week at most) and the duration of each movement would be relatively short (i.e., typically <30 minutes per barge movement). Movement of the barge would be primarily confined to within the mouth of Smith Canal, although there may be infrequent occasions that the tugboat would use the San Joaquin River mainstem to move or deploy a barge.

Based on these considerations, the Project-related incremental increase in boat and barge traffic in the San Joaquin River (i.e., outside of the mouth of Smith Canal) is expected to be minimal, and, therefore, would not create additional disturbance-related impacts on ESA-listed anadromous fishes moving through the river. Most increased boat and barge traffic would be confined to within the mouth of Smith Canal and, specifically, within the 1,800-foot-long dead-end channel between the Louis Park boat ramp and the active construction area. This channel provides low quality habitat adjacent to a reach of the lower San Joaquin River that is used primarily as a migratory corridor for anadromous fishes. However, it could be used opportunistically by anadromous salmonids moving between the Delta and spawning and rearing habitats in higher elevation tributaries to the San Joaquin River. While the incremental increase in project-related boat and barge traffic is not anticipated to preclude opportunistic use of habitats in the canal, any potential impacts will be further minimized by the proposed limit for all project boats to follow the posted 5 mph speed limit in the canal at all times and limiting boat and barge traffic to the minimum amount necessary to complete the project work.

A tugboat will be used to move the construction barge(s) into position at the mouth of Smith Canal and, occasionally, to reposition the barge to complete work within the cofferdam and along the alignment of the gate. In Year 2, deployment of the barge(s) and staging of equipment and materials on the barges would primarily occur from June 15-30, 2021 (i.e., prior to the requested July 1 to November 30 in-water work window). Upon deployment, the frequency and duration of the tugboat and barge movements will vary and will occur on an as-needed basis to position the barge and construction equipment at the appropriate location and orientation to complete the necessary tasks for different phases of the Project. As discussed above, this will typically be a semi-daily basis (e.g., several times per week) and each movement is anticipated to be relatively short (e.g., less than 30 minutes each). The tugboat motor will be turned off (i.e., silent) when not in use.

There are few reported values of underwater noise levels associated with tugboats in the scientific literature, as the majority of reported values for marine vessels pertain to large, commercial ships. However, Richardson et al. (1995) reported tugboat values of 172 dB RMS and 175 dB peak values for tugboats at 1 m from the source. The Xodus Group (2015) calculated a 16 m radius of potential fish disturbance (i.e., noise levels above 150 dB RMS) associated with tugboats. In a study comparing the noise levels associated with different marine ship classes, Veirs et al. (2016) reported source levels (SL) of 166-170 dB and received signal levels (RL) of just 108 dB for tugboats traveling at approximately 8 knots (9.2 mph). In all cases, these underwater noise values are associated with tugboats in transit (i.e., travelling at speeds greater than 5 mph) and thus are considered conservative for assessing the Project's use of the tugboat (i.e., to move a relatively small construction barge a short distance within the mouth of Smith Canal).

Based on data recorded during tugboat movements and underwater sound levels generated by tugboats in the available literature, the use of a tugboat outside the construction window is not anticipated to create underwater noise levels above 180 dB. Rather, the noise levels associated with the tugboat for the Project are anticipated to be below threshold values for injury to fish within a short distance (i.e., 16m) of the tugboat. To further minimize the potential for any impacts, the tugboat will obey the posted speed limit of 5 mph within the canal, use of the tugboat will be limited to the minimum amount necessary to complete the Project work, and the tugboat motor will be turned off when not in use. A fisheries biologist will be on-site during barge movements to monitor for erratically behaving fish in the Project area.

The primary boating activity that will occur during the extended in-water work window, (June 15-30 staging period, and December 1-15) will consist of the use of small (i.e., <25 feet) boats with outboard motors. These boats will be used primarily to shuttle construction personnel, supplies, and small equipment to and from the barge and active construction area for observation of construction activities and to conduct biological and water quality monitoring required in the Project's permits. Other uses of small boats may include monitoring of underwater noise, biological monitoring (e.g., presence of marine mammals), and water quality monitoring. These boats will primarily be running only during short periods throughout the work day, while transporting personnel and supplies to and from the dock (i.e., approximately 1,800 feet from the construction site) and movements will primarily be confined to within the mouth of Smith Canal and the boat ramp. This area of the lower San Joaquin River is a popular recreation boating and angling area. As such, the incremental increase in Project-related boat traffic to the overall boating activity in the Action Area will be minor and localized to within a channel that primarily serves as recreational boating access to the San Joaquin River.

Underwater noise levels generated from water vessels are affected by, and generally increase, with increasing boat size, speed, and revolutions per minute (RPM) of the boat propeller (Kipple and Gabriele 2007; Matzner et al. 2010). Kipple and Gabriele (2007) reported that small (i.e., up to 20 feet in length) recreational boats traveling at 10 knots (11.5 mph) had peak SPL values ranging from 157-172 dB re 1 µPa at 1 yard. This range of values equates to peak SPL values of 136-151 dB re 1 µPa at 10 m. RMS values associated with these SPLs would be considerably lower and would be less than, the "effective quiet" value of 150 dB. In a study of underwater noise associated with coastal boat traffic in North Carolina, Haviland- Howell et al. (2007) reported that small outboard motorboats comprised the highest percentage of boat traffic and had a maximum RMS value of approximately 71 dB re 1 µPa. Matzner et al. (2010) evaluated the underwater noise levels generated by small vessels equipped with one and two outboard motors, each with 3-blade and 4-blade propellers, at RPMs ranging from 2,000 to 6,000. The highest observed broadband noise level was 45 dB over background noise with the dual-engine boat at 6,000 RPMs, whereas the broadband noise was increased by only 15 dB for the single-engine boat at 2,000 RPMs. Notably, the SPL values for the single-engine boat at 2,000 RPMs were between 90-100 dB (Matzner et al. (2010). Barlett and Wilson (2002) reported that small boats operating at 2,600-6,000 RPMs had peak underwater noise levels of 150-165 dB. The SPL and peak values reported in these studies were below the thresholds for protection of fish. Furthermore, the boats used for the Project will typically be operating at well below 2,000 RPMs and, therefore, are anticipated to have even lower underwater noise levels.

Based on these considerations, the use of small boats, tugboats, and barges during the proposed Year 2 extended in-water work window and outside the in-water work window is not anticipated to reach underwater noise levels that would exceed NMFS criteria. While the incremental increase in the use of small boats outside the construction window is not anticipated to increase underwater noise levels by an amount that would exceed the thresholds for injury to fish, any potential impacts will be further minimized by limiting all project boats to the posted 5 mph speed limit in the canal at all times, limiting boat traffic to the minimum amount necessary to complete the project work, and turning boat motors off when not in use.

July 1 to July 14 Extension

Based on underwater noise levels measured during the TPP (ECORP 2019) and Year 1 (ECORP 2020), underwater noise levels are not anticipated to exceed NMFS criteria and impacts to anadromous fish during the first two weeks of July as fish are not expected to be present in the action area during that time. Unattenuated vibratory driving of two sheet piles during the TPP resulted in instantaneous peak underwater noise levels ranging from 174.3 to 193.9 dB (at 10m from the source) (Table 12), which was substantially lower than the 206 dB (at 18m from the source) peak threshold specified in the 2019 BO. RMS values for unattenuated vibratory driving of the two sheets during the TPP ranged from 167.7 to 182.3 dB (at 10m from the source). RMS values did not exceed 150 dB beyond 1,423 m from the pile-driving activity.

Table 12 (Table 1 from BA 2021). Underwater peak and RMS noise levels for unattenuated pile-driving events and distance to NMFS 2019 BO thresholds under the 2019 TPP and Year 1 of construction.

Table 1. Underwater peak and RMS noise levels for unattenuated pile-driving events and distance to NMFS 2019 BO thresholds under the 2019 TPP and Year One (2020) of construction.

Year	Count	Pile Types	Noise Level (dB re: 1µPa)[1]				Distance to Threshold (m)			
			Peak		RMS		Peak		RMS	
			Range	Average	Range	Average	Range	Average	Range	Average
2019 TPP	2	Flat	174.3 to 193.9	184.1	167.7 to 182.3	179.2	0 to 2	1	151 to 1,423	787
2020 Year One	193	Z- and H-piles	139.6 to 190.2	164.0	110.3 to 179.1	149.9	0.0 to 1.6	0.3	0.0 to 1,574	36.5

[1] Values calculated for 10 m from the pile.

Based on Year 1 values, vibratory pile-driving noise is not anticipated to reach peak levels that would injure or kill ESA-listed anadromous fishes during the July 1-14 extended construction window in Year 2. While instantaneous peak underwater levels may be exceeded within less than 2 m from the source, anadromous fish are not likely to come within that close to an active pile-driving site due to the presence of equipment, personnel, and the turbidity curtain. RMS values that could cause behavioral effects (e.g., avoidance) would typically occur with 36.5m of the vibratory pile-driver, and is not anticipated to exceed the NMFS specified RMS threshold of 150 dB at 2,154m from the source at any times.

Historic temperature data indicates that San Joaquin River temperatures in the action area are generally well above 75°F during this period (ECORP 2020) and, thus, above the preferred temperatures for listed anadromous fishes. Therefore, any effects to ESA-listed anadromous fish during Year 2 in-water work window (July 1 to July 14) will be minor as anadromous fish would unlikely be in the area due migrating time and increased water temperatures. In addition, since most outmigrating juvenile salmonids would have left the action area by late spring, they would unlikely be present in the action area during the extended in-water work season, therefore impacts resulting from elevated noise levels from the extended in-water work season is very low.

October 16 to November 30 In-water Extension

Construction activities during the Year 2 in-water work window will consist primarily of pile-driving of flat sheets for the southern-most portion of the southern cellular wall near Dad's Point. While the contractor intends to drive all piles with vibratory methods when possible, the underlying geomorphology near Dad's Point may require the use of an impact hammer to drive the piles to tip if the vibratory driver hits refusal. As discussed above, vibratory pile-driving of the flat sheets is not anticipated to reach levels that could injure or kill ESA-listed anadromous fishes, except infrequent instantaneous peaks that exceed 206 dB within less than 2 m from the source, which fish would be expected to avoid, and RMS values would typically be below the 150 dB threshold for behavioral effects (reduced feeding and area avoidance) within 36.5 m of the source.

Impact pile-driving of the flat sheets would likely be infrequent and only required to complete the installation of piles that have reached refusal with the vibratory hammer. The underwater noise levels generated from impact pile-driving of flat sheets was not assessed during the TPP or Year 1 of construction. However, a comparison of vibratory pile-driving of H-piles and sheet piles during the TPP indicates that the smaller sheet piles generated lower underwater noise levels than the larger H-piles.

During the TPP, vibratory driving of seven H-piles had peak values (at 10 m) ranging from 171.2 to 189.8 dB (average: 182.6 dB) and RMS values ranging from 172.9 to 183.2 (average: 175.0 dB), while vibratory driving of four sheet piles were lower, having peak values ranging from 170.8 to 193.9 dB (average: 177.7 dB) and RMS values ranging from 164.3 to 182.3 dB (average: 172.3 dB).

Based on these measurements, it is reasonable to assume that impact pile-driving of sheet piles would generate lower underwater noise levels than the two H-piles installed with an impact hammer in the TPP. Of the two H-piles driven with an impact hammer in the TPP, one was driven unattenuated with 270 strikes and had a peak value of 202.6 dB, an RMS value of 182.3 dB, and a SEL value of 194.7 dB (at 10m from the source). The second H-pile was driven within a bubble curtain with 317 strikes and had a peak value of 178.1 dB, an RMS value of 161.1 dB, and a SEL value of 179.9 dB (at 10 m from the source).

Table 13 (Table 2 from BA 2021). Underwater noise levels measured for installation of test H-piles using an impact hammer on October 29-30, 2019.

Table 2. Underwater noise levels measured for installation of test H-piles using an impact hammer on October 29-30, 2019.

Date	Pile Number	Attenuation	Number of Strikes	Noise Level (dB re: 1μPa) [1]			SELcum [1]
				Peak	RMS	SEL	
10/29/19	TP1	None	270	202.6	182.3	170.4	194.7
10/30/19	TP3	Bubble Curtain	317	178.1	161.1	154.9	179.9

[1] Values calculated for 10 m from the pile.

Based on the 1,000 strike/day limit, impact driving of the H-piles in Table 13 would reach the NMFS-specified SEL threshold of 187 dB at 78 m for the unattenuated H-pile and at 7 m for the attenuated H-pile, both of which are well within the 1,597 m distance to the threshold specified in the 2019 NMFS opinion for protection of fish weighing 2 grams or more. Although the 2019 NMFS opinion does not have a threshold for smaller fish (e.g., juvenile CV spring-run Chinook salmon that may occur in the Action Area in November), NMFS guidance does specify a SEL threshold of 183 dB for fish weighing less than 2 grams. Based on the SEL values in Table 13 the 183 dB SEL value would be exceeded at 145 m from the source for unattenuated impact driving and at 13 m for attenuated impact driving. As discussed above, the SEL values associated with impact driving of flat sheets in Year 2 would be attenuated (with cushion blocks) and also expected to be lower than those measured for the H-piles. As such, the SEL values and distance to the threshold for sheet piles is likely more similar to, or lower than, those of the attenuated H-pile.

Based on these liberal surrogate H-pile values, the underwater noise levels that are expected from driving sheet piles with an impact hammer are unlikely to exceed NMFS criteria. Although the bubble curtain provided considerable attenuation of underwater noise levels during the TPP, the use of a bubble curtain is not feasible for installation of sheet piles in Year 2 because the sheet piles are inter-joined to form the walls of the cellular floodwall. However, the impact hammer used by the contractor does employ a cushion block to attenuate underwater noise levels. Furthermore, the use of an impact hammer to finish the installation of sheet piles is anticipated to be infrequent.

Based on these considerations, extending the Year 2 in-water work window to include the period October 16 through November 30, 2021, would likely increase the potential for adult CCV steelhead and juvenile CV spring-run Chinook salmon migrating through Action Area to be exposed to elevated underwater noise levels. However, based on the underwater noise values measured for impact pile-driving during the TPP, the underwater noise levels are not anticipated to exceed NMFS criteria; moreover, the noise levels are anticipated to be confined to within a short distance of the pile-driving activity. Because the construction activity will cause fish migrating through the area to avoid the area immediately around the active construction site, the potential for exposure to adverse noise effects on adult CCV steelhead, juvenile CV spring-run Chinook salmon, and other ESA-listed anadromous salmonids during the extended in-water work window is low. Those few fish exposed would be displaced for short duration during underwater noise activities.

Removal of the Temperature-dependent Impact Strike Limitation

Impact pile-driving may be required infrequently during the extended (i.e., October 16 through November 30) in-water work window to drive the sheet piles to tip, if the underlying geomorphology near Dad's Point causes vibratory pile-driving to hit refusal. The number of impact hammer strikes needed to drive these sheets to tip is not known, but may exceed the expected 1,000 strikes per day during the latter portion of the Year 2 in-water work window. As such, SJAFCA is proposing 5,000 strikes per day at any time during the Year 2 in-water work window. Because no impact hammering is proposed for the initial two weeks (i.e., July 1-14) of the extended Year 2 in-water work window, the 5,000 strikes per day would only occur at infrequent times during the latter portion of the in-water work window. This would effectively extend the allowance of 5,000 strikes per day in Year 2 from mid-September (i.e., when San Joaquin River daily temperatures typically reach 75°F) to November 30, 2021. Increasing the impact strike count will increase the SEL value, which increases the potential for impacts on ESA-listed anadromous fish, particularly immigrating adult CCV steelhead and emigrating CV spring-run Chinook salmon, which may occur in the Action Area during the latter portion of the extended Year 2 in-water work window.

Based on Year 1 construction, which did not exceed 1,000 for daily impact strike count, we expect that Year 2 will exceed 1,000 strikes per day infrequently, due to the extended work-window, but is expected to be less than 5,000 strikes per day. The SEL values associated with impact driving of sheet piles in Year 2 are expected to be below 187 dB, and below 183 dB for protection of juvenile fish within this distance. Underwater noise levels associated with impact driving of the sheet piles are likely considerably lower than the TP1 values, and more similar to the levels measured and associated calculations for the attenuated impact driving of TP3 (Table 7). As such, increasing from 1,000 to 5,000 strikes per day will likely increase the distance to the 187 dB and 183 dB SEL thresholds from 7 and 13 m, respectively, to 21 m from the source in the unlikely event that 5,000 strikes per day is needed to complete installation of any piles.

Based on these considerations, removing the 1,000 impact strikes per day limitation when local water temperatures are below 75°F would have a small incremental increase in the distance to the SEL thresholds for protection of ESA-listed fishes migrating through the Action Area. Under the assumption that up to 5,000 strikes per day would be required, the distance to the threshold would be increased by a small amount. Moreover, the frequency in which more than 1,000 strikes per day is needed is anticipated to be low. For these reasons, only small numbers of juveniles and adults are expected to be exposed to these levels resulting in behavioral changes or injury.

Dewatering and fish relocation activities

Fish have the potential to become entrapped behind the cofferdam during the dewatering activities, resulting in injury or death, and/or require handling for relocation, which may result in injury or death. Fish capture and relocation would be necessary during dewatering activities if listed fish are present and found in the enclosed area of the cofferdam.

Each step during the capture/relocation process could also induce physiological stress even when a skilled fish biologist performs the relocation. The capture and relocation of salmonids associated with the dewatering of the cofferdam is expected to adversely affect a small number of salmonids expected to be present in the action area. Dewatering activities occurring during the in-water work window would overlap with juvenile CCV steelhead and sDPS green sturgeon, while CV spring-run Chinook salmon should be out of the area July through October. Although upstream-migrating adult CCV steelhead and rearing or migration adult sDPS green sturgeon may occur in the project area during in-water work, the large size and probable avoidance of the enclosed area makes it unlikely that they would be trapped in the cofferdams. Juvenile green sturgeon could occur during any month in the Delta, although in small numbers in the action area.

Because of the variability and uncertainty associated with the population sizes of the species present, annual variation in the timing of migration, and variability regarding individual habitat use of the action area, the actual number of individuals present in the action area during the in-water work window is not known. However, there would be few individuals present since most juvenile salmonids would have left the action area by late spring and are least likely present in the action area during the in-water work season. A small proportion of those few individuals present are expected to be trapped behind the cofferdam and would be relocated to the mainstem San Joaquin River.

Habitat loss/modification

The proposed project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat. Once the fixed wall is constructed, approximately 3,400 tons of riprap (approximately 200 linear feet) would be placed along the banks at the Stockton Golf and Country Club (approximately 100 linear feet on each side of the fixed wall), as well as 230 linear feet around the tip of Dad's Point. The fixed gate wall would extend approximately 800 feet from the north tip of Dad's Point Levee to the right bank of the San Joaquin River, at the Stockton Golf and Country Club. The walls would be constructed to be between approximately 29 feet apart at the connection between cells and 34 feet apart at the widest part of each cell, and would have a top elevation of 15.0 feet, extending 10 feet above the mean water level at the entrance to Smith Canal.

The placement of the gate structure and habitat occupation by artificial material (riprap) in the San Joaquin River can result in adverse effects to listed fish. The action area is a major migratory corridor for juvenile and adult listed fish. The placement of the permanent floodwall gate would not impede fish passage, but it would occupy a portion of the area adjacent to the San Joaquin River (Smith Canal) and could have some operation and maintenance effects on migrating fish. The placement of the permanent gate structure could result in an increase in predation and prey on juvenile listed salmonids when migrating through the action area. The action area currently does not provide suitable aquatic riparian habitat, but the modification and placement of riprap would preclude in its footprint any potential for future riparian vegetation to grow that would provide shelter and resting areas for migrating juveniles. The intent of riprap is to stabilize stream channels and limit natural fluvial processes. The reduction of the erosion and consequent deposition cycle, naturally inherent to all alluvial channels, eliminates a channel's ability to maintain bedforms for salmonid habitat and impairs the ability for a stream to be maintained in a dynamic steady state. This alteration of the aquatic ecosystem has diverse deleterious effects on aquatic communities, ranging from carbon cycling to altering salmonid population structures and fish assemblages (Schmetterling et al. 2001). Riprap does not provide the intricate habitat requirements for multiple age classes or species similar to natural banks, or banks that include instream woody material (Peters et al. 1998).

Therefore, adverse effects resulting from permanent habitat loss/modification to listed fish are expected to occur. Since it is impossible with the currently available monitoring data to determine how many individual fish will be taken through the loss or modification of the habitat, NMFS will use the values for lineal feet of aquatic habitat impacted and lost on waters bearing NMFS' listed species as ecological surrogates for the detrimental effects upon listed fish.

Long-term Operations and Maintenance

According to the construction sequence for the proposed action, the gate structure would be constructed in Year 1 of the project from July to March (after the cofferdam is installed) in the dry. The gate is a 50-feet wide mitered double-door metal structure that when open extends outward into the San Joaquin River. The purpose of the gate when closed is to provide a tool for flood control when the San Joaquin River reaches a water surface elevation of 8.0 feet, North American Vertical Datum of 1988 [NAVD88]. Isolating Smith Canal and the 15,000 residents identified in a designated FEMA 100-year floodplain, will meet the Central Valley Flood Protection Act of 2008 which requires a 200-year flood protection by 2025 for urban and urbanizing areas.

Typically, the gates would be operated (closed) under specific conditions during the rainy season and during times when high tides occur in the area. Generally, extreme high tides and floods associated with the rainy season occur between November 1 and April 30. The gate will typically be operated only during extreme high tides and flood events when the water elevation exceeds + 8.0 feet (NAVD 88) in the channels containing the gates, or when operated for maintenance purposes. When operated for forecasted high tides above +8.0 feet, the gates will be closed on the lowest tide prior to the predicted high tide, typically within a 24-hour period. The gates will not be opened until the high tide elevation drops below +8.0 feet, thus allowing any accumulated water behind the gate to flow out. The Corps predicts that the duration of the gate closures for extreme high tides should not last more than 6 to 12 hours per a high tide event. They further state that the closures related to extreme high tides will occur approximately 10 times a month during the months of January and February, and rarely will two extreme tides occur within a 24-hour period. On these rare occasions, the gates may remain closed for more than 24 hours.

The gate is controlled by programmable preset operating controls housed in a fixed building on Dad's Point adjacent to the fixed wall tie-in. A second set of controls may be installed at the end of the sheet pile wall near the shore and a portable generator will be used in the event of a power outage. Included in building the gate structure is the construction of a cofferdam to isolate the work are from the San Joaquin River. The cofferdam will be installed using a vibratory pile driver. The cofferdam will be built first and will take approximately 1-month to construct and will be part of the Year-1 construction activities. Following its completion, construction activities will begin on the gate structure and take approximately 6 months to complete. The first step will be to drive 64 concrete-filled steel pipe piles that are 36-inches in diameter along the inside edge of the cofferdam to provide support for the concrete floor and walls.

During the long-term period of gate operations, the narrow gate opening (~50 feet) will create higher velocity flow through the structure than currently exists through the undeveloped channel during each tidal cycle. NMFS expects that elevated turbidities will occur in association with this higher velocity until the surrounding channel substrate has come to an equilibrium between heavier and coarser sediments lining the scour hole and the redistribution of the lighter material more prone to resuspension into other areas of the channel. It is unknown how long this process will take, and what level of turbidity is likely to occur as a result.

Additionally, NMFS expects that the presence of the flood gate structures would create altered flow conditions related to the narrow width of the flood control structure gates. This would increase predation upon listed fish species. These conditions would be present throughout the year and are created by daily tidal flows. A portion of all listed species identified above would be exposed to the operations of the Smith Canal flood control structure. Listed fish would have an elevated vulnerability to predation due to the hydrodynamic conditions created by the open gate structures and the vertical sheet pile wall structure placed into the open water environment, both of which are expected to attract predators. If the gate opening is made narrower, the velocity increases, thereby creating more adverse conditions for listed fish passing through it. Higher velocities create more turbulence, eddies, and disorientation to the fish caught in the high velocity jet, allowing them to become easier targets for predators. Thus a wider gate opening would have the opposite effect, reducing the velocity of the flow.

Effects of turbidity on fish and aquatic habitat

Resuspension of contaminated sediments may have adverse effects upon salmonids or sDPS green sturgeon that encounter the sediment plume, even at low turbidity levels. Lipophilic compounds in the fine organic sediment, such as toxic PAHs, can be preferentially absorbed through the lipid membranes of the gill tissue, providing an avenue of exposure to salmonids or sDPS green sturgeon experiencing the sediment plume (Newcombe and Jensen 1996). Such exposures to PAHs have been linked with declines in the immune systems of exposed fish as well as damage to genetic material through formation of breaks or adducts on the DNA strands. Similarly, charged particles such as metals (*e.g.*, copper), may interfere with ion exchange channels on sensitive membrane structures like gills or olfactory rosettes. This reduces the sensitivity of fish to detect smells or chemical cues in their environment and may interfere with ion exchange metabolism across cellular membranes necessary for osmoregulation. Increases in ammonia from the sediment may create acutely toxic conditions for salmonids or sDPS green sturgeon present in the channel's margins.

An increase in flow velocity due to gate operations between November 1 and April 30 overlaps with species run timing and adds to the probability of potential exposure of listed salmonids and green sturgeon to effects of higher levels of turbidity.

Effects Related to Long Term Operations of the Flood Control Gates

These episodes of extreme tides create larger than normal movement of waters in the Delta and may stimulate adult fish holding in the Delta to move upstream to spawn. When the gates are operated, any fish moving with the increased tidal activity may enter the waterways behind the gates on prior tides and become trapped by the closed gates. However, fish trapped behind the closed gate would typically be detained for less than 24 hours, and usually only for 6 to 12 hours.

Fish trapped behind the gate will have typically short-term exposures to the waters behind the gates, and any deleterious water quality issues or predator populations that may exist there. Any fish caught behind the gates cannot leave the area of degraded water quality until the gates are reopened, and thus are exposed to any negative conditions existing for the duration of the closure. The short duration of exposure is probably not sufficient to cause mortality from any contaminants that might be present, but sublethal effects may start to manifest themselves even with exposures of only a few hours. Smith Canal, as well as several waterways draining to the eastern Delta in the action area, are listed under the EPA's 303(d) listing of impaired water bodies in California (State Water Resources Control Board 2010) containing elevated levels of organic materials, pesticides, heavy metals, and pathogens, as well as many other constituents that impair water quality. Furthermore, it is unclear how the physical barriers will affect the level of contaminants in the impacted waterways, but it is likely to degrade water quality over the long-term by preventing dilution and muting tidal exchange with the larger Delta. Finally, when fish are trapped behind the gates, they become susceptible to predators that may reside in the waterways behind the gate. Entrapped fish will be exposed to these predators for the duration of the gate closure with a reduced avenue of escape through the narrow gate opening. Fish such as CCV steelhead smolts and juvenile CV spring run Chinook salmon are highly vulnerable to predation by predators such as striped bass (*M. saxatilis*) or largemouth bass (*Micropterus salmoides*) that may also occupy the waters behind the gates.

Adult CV spring-run Chinook salmon and CCV steelhead are less likely to be predated upon, unless marine mammals such as California sea lions (*Zalophys californianus*) also are present in the waterways when they are closed off. Sea lions are known to occur within the Stockton DWSC leading to the Port of Stockton and are likely to be present near the Smith Canal gates.

The Corps has indicated that if necessary the gates will be closed for an extended period during flood conditions particularly when they are coupled with high tides. If flood conditions, either by themselves or in combination with high tide events, raise the water elevation to greater than +8.0 feet NAVD 88, the gates will be closed until the water elevation recedes below +8.0 feet. Records show that the high water conditions may last several days. As indicated above, there is the potential for listed fish to be trapped behind the flood control gates when they are closed. Under flood conditions, the longer duration of gate closures will expose fish to longer periods of degraded water quality or predation within the enclosed water bodies. Furthermore, flood conditions usually coincide with increased precipitation events that create surface runoff from upland areas. This results in increased stormwater flows into waterbodies such as Smith Canal and the sloughs feeding into other waterways. Stormwater runoff has the potential to be heavily contaminated with organic materials (which decrease DO content in the water), petroleum products and heavy metals from roadways, pathogens, and pesticides. Stormwater is cited as a source for these contaminants in Smith Canal (State Water Resources Control Board 2010).

Elevated contaminant loads coupled with longer exposure periods will increase the likelihood of sublethal and lethal effects on exposed fish. Furthermore, increased durations of gate closure will expose any listed fish trapped behind the gates to longer periods of predation risk in those waters. Periods of high runoff that could trigger longer gate closures usually occur in the winter and spring seasons. This period overlaps with the migrations of adult and juvenile CCV steelhead in the San Joaquin River basin. Likewise, adult and juvenile CV spring-run Chinook salmon from the experimental population and their future progeny would be migrating through the San Joaquin River adjacent to the Smith Canal flood control gates during the late winter and spring periods. There is also an increased potential for adult sDPS green sturgeon to begin movements upstream into the San Joaquin River in response to increased flows in the mainstem of the river and its tributaries. Movements of juvenile sDPS green sturgeon in the Delta may also be enhanced by increases in river flows and increased turbidity.

It is uncertain what the risk to the populations of listed fish will be due to entrapment behind the gates. If the gates remain closed for extended periods of time, then no additional fish will be exposed to entrapment due to gate operations. However, any individual fish that is trapped behind the closed gates will be vulnerable to increased mortality with prolonged closures. In contrast, more frequent gate operations expose more individual fish to the effects of the flood control structure, but the duration of their captivity is shorter, and lethal effects are less likely to occur due to exposure to contaminants and predation. Although there is significant risk to any individual fish trapped behind the gates, the risk to the population depends on the proportion of the population moving past the gates at the time the gates are closed and what fraction of that number is actually behind the gates when they are operated. This level of detail is currently unknown.

Risks to fish are not limited to being entrapped behind the gates when they are closed. The construction of the flood control gates and the accompanying flood wall create a barrier to the free exchange of water into the Smith Canal waterway during the daily tidal cycle. The relatively narrow opening of the gates (50 feet) compared to the width of the unobstructed channel will create a region of high velocity flows through the gate openings with each tidal change in water surface elevation. This zone will be bi-directional as a result of the changes in tidal elevation; flow will move from the area of higher water elevation to the area of lower water elevation depending on the stage of the tide. On the flood tide, water elevations will be increasing on the outside of the gate structures relative to the inside of the gate structures and water will flow up-channel through the narrow gate opening into the area behind the gates at increasing velocity due to head differentials between the two sides of the gate structure. Flow through the gates will diminish as the two water elevations reach equilibrium at high tide. When the tide changes to ebb, the water inside the flood structure will be higher than the water elevation outside and remain so for a longer period of time due to the gate constriction. The flow will now go in the reverse direction through the gate at high velocities.

The creation of a high velocity stream through the gate opening creates a field of velocity shears and their resulting eddies and turbulence along the boundary between high velocities and low velocities on the down current side of the gate. The region of velocity shears and turbulence creates favorable habitat for predators to hold and feed on prey as the prey moves through the high velocity stream. This is particularly true when the flood structure creates vertical structure for predators to orient to immediately adjacent to the higher velocity flow, and hold station outside the higher velocity flows without physically exerting themselves to remain in the favorable feeding locations. The structure also creates shade and obscures the presence of the predators holding against the vertical sheet pile wall, creating an increased risk of predation for smaller sized fish such as juvenile CV spring-run Chinook salmon and CCV steelhead smolts that are entrained in the fast moving stream of water going through the gate opening. This condition will occur typically four times a day with each change of the tide while the gates are open.

In addition to the creation of the high velocity flows through the gate openings and increased predation risks, the flood-gate structures also are likely to degrade water quality conditions inside the waterways when the gates are closed. The presence of the gates will reduce the free exchange of water within the waterways they block with the larger Delta system. This will reduce the volume of water exchanged on each tidal cycle with the larger Delta water volume and increase the residence time of the water behind the gate structures and flood wall. This situation is likely to allow contaminants behind the flood structure to increase in concentration since they are not being flushed out of the system as fast as the pre-gate conditions allowed. Finally, without appropriate modeling, NMFS cannot predict what the magnitude of the water quality changes will be, however the changes are expected to occur under all water elevations, and be exacerbated when the gates are closed.

In summary, the long-term operations of the flood control gates on Smith Canal will create barriers to the free movement of individual fish moving within close proximity to the gates and may cause fish to become entrained behind the closed gates. Listed fish that enter through the narrow gate opening will be subject to increased predation risk and exposure to degraded water quality conditions. The gate structures will also create physical conditions that decrease the value of the habitat adjacent to these structures. Diminished circulation will decrease flushing flows through these waterbodies, potentially allowing any contaminants discharged into the waterbody behind the structures to increase in concentration and not be transported away from the confined waterbodies. The narrow gate opening will create hydraulic conditions that will favor predatory fish, which will be attracted to the open water structure created by the flood barrier. Both of these physical conditions will increase adverse effects to listed fish exposed to them. These conditions will be present at all water elevations to some extent as described above.

2.5.2. Project Effects on CCV steelhead and sDPS green sturgeon Critical Habitat

The project is expected to adversely impact several PBFs of critical habitat for CCV steelhead (freshwater rearing habitat and freshwater migration corridors) and sDPS green sturgeon (food resources, water quality, water depth, and migratory corridors).

The proposed project is expected to cause short- and long-term, and permanent effects on critical habitat for CCV steelhead and sDPS green sturgeon. Potential project effects include temporary water quality degradation from localized increases in turbidity and suspended sediment, permanent habitat loss/modification of critical habitat, and in-channel disturbance from pile driving and placement of the tidal gate. Long-term effects on designated critical habitat are expected to result in potential decrease in survival of fish due to increased predation in the action area and impacts from the operations of the tidal gate and fish becoming entrained behind the gate.

Poor water quality and elevated contaminant concentrations due to low water exchange rates can impact salmonids, particularly juveniles that rear in these waters year-round and consume prey exposed to the contaminants such as sDPS green sturgeon. The prey base (green sturgeon food resources) are likely to bioaccumulate some of the contaminants listed in the 303(d) list for impaired waters that are present in the Smith Canal, as green sturgeon are bottom feeders. Alternatively, prey populations may be diminished due to mortality related to the contaminants present or perhaps a combination of diminished prey populations with the remaining prey populations bearing contaminant loads that are then transferred to the green sturgeon that consume them. Green sturgeon that consume contaminated prey may incur sublethal or lethal effects depending on the load and type of contaminates consumed.

The placement of the tidal gate will extend 800 linear feet from the tip of Dad’s Point levee to the right bank of the San Joaquin River. In addition, 200 linear feet of riprap will be placed on the banks of Stockton Golf and Country Club. Therefore, the project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat.

The habitat found in this portion of the San Joaquin River is characterized as a relatively deep, medium velocity channel, with silt and sand substrate. The action area does not include salmonid spawning habitat; however, adult and juvenile CCV steelhead use the area as a migratory corridor and juvenile CCV steelhead likely use the area for rearing during their downstream migration. Foraging adult and juvenile sDPS green sturgeon may be present in the action area but in low numbers.

While the sandy substrate in the vicinity of the proposed project provides some submerged aquatic and emergent vegetation, it is not currently favorable rearing habitat for salmonids due to the lack of shaded aquatic habitat and habitat complexity. However, placement of permanent infrastructure would prevent improvements to provide more suitable habitat for listed species. In addition, the placement of riprap for scour protection is expected to decrease habitat quality for salmonids, as warm-water predatory species (such as bass) would be likely to occupy this habitat post-construction.

Because the proposed project will occupy some amount of CCV steelhead and sDPS green sturgeon critical habitat, a purchase of compensatory mitigation credits is included as part of the proposed action to offset this impact to some degree. SJAFCA will purchase salmonid credits at a 3:1 ratio from a NMFS approved mitigation bank. SJAFCA will purchase 2.46 credits for the loss of 0.82 acres of tidal perennial habitat and 2.49 credits for the loss of 0.83 acres of riparian habitat.

The purchase of compensatory mitigation credits will restore and preserve, in perpetuity, shaded riverine aquatic habitat or similar types of riverine habitat that will be beneficial to salmonids. The mitigation banks that serve the action area offer floodplain or other habitat that can support migrating juvenile and adult CCV steelhead and sDPS green sturgeon in the same way that river margin habitat otherwise would have, had the project not occurred. Shaded riverine habitat types of conservation credits can benefit both adult and juvenile CCV steelhead and sDPS green sturgeon, even if such banks are located far from the action area and individuals affected by the project would be unlikely to benefit from the compensation purchase.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase will be realized because each of the NMFS-approved banks considered in this biological opinion have mechanisms in place to ensure credit values are met over time. Such mechanisms include legally-binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage and maintain the bank and habitat values in perpetuity, performance security requirements, a remedial action plan, and site inspections by NMFS. In addition, each bank has a detailed credit schedule, credit transactions, and credit availability that are tracked on the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the Corps, with support from the Environmental Protection Agency, the UUSFWS, the Federal Highway Administration, and NMFS to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas, as well as information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation. RIBITS also contains links to bank establishment documents. The Bullock Bend Mitigation Bank was established on June 23, 2016; the Cosumnes Floodplain Mitigation Bank was established on August 4, 2008; the Fremont Landing Conservation Bank was established on October 19, 2006; and the Liberty Island Conservation Bank was established on July 21, 2010.

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).

The private and state activities described below are likely to adversely affect CV spring-run Chinook salmon, CCV steelhead, sDPS green sturgeon, and designated critical habitats for CCV steelhead and sDPS green sturgeon. These potential factors are ongoing and expected to continue into the future. However, the extent of the adverse effects from these activities is uncertain, and it is not possible to accurately predict the extent of the effects from these future non-Federal activities.

2.6.1. Agricultural Practices

Agricultural practices in the action area may adversely affect riparian habitats through upland modifications of the watershed that lead to increased siltation, reductions in water flow, or agricultural runoff. Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which can flow into the receiving waters of the associated watersheds. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect listed salmonids reproductive success and survival rates (Dubrovsky et al. 1998, Daughton 2003).

2.6.2. Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth would place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, would not require Federal permits, and thus would not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways.

This potentially would degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This in turn would reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.3. Rock Revetment and Levee Repair Projects

Depending on the scope of the action, some non-federal riprap projects carried out by state or local agencies do not require federal permits. These types of actions as well as illegal placement of riprap occur within the watershed. The effects of such actions result in continued degradation, simplification, and fragmentation of riparian and freshwater habitat.

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 diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1. Status of the CCV Steelhead DPS

The 2016 status review (NMFS 2016) concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review. Therefore, we concluded that CCV steelhead should remain listed as threatened, as the DPS is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Further, there is still a general lack of data on the status of wild steelhead populations. There are some encouraging signs, as several hatcheries in the Central Valley (such as Mokelumne River), have experienced increased returns of steelhead over the last few years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Delta fish facilities, and the percent of wild fish in those data remains much higher than at Chipps Island. Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin River Basin continue to show an overall very low abundance, and fluctuating return rates. The NMFS Recovery Plan (NMFS 2014) strategy for CCV steelhead lists the San Joaquin River's eastside tributaries (Stanislaus, Tuolumne, and Merced rivers) as Core 2 populations (meaning these watersheds have the potential to support viable populations, due to lower abundance, or amount and quality of habitat) downstream of major dams, and as candidates to reach viable population status if reintroduced upstream of the dams, and lists the San Joaquin River, below Friant Dam, as a candidate to reach viable population status. The action area serves as a migratory corridor to these eastside tributaries.

2.7.2. Status of the CV spring-run Chinook salmon

The CV spring-run Chinook salmon ESU is also listed as threatened under the ESA but is considered extirpated from the San Joaquin River Basin (NMFS 2016). The NMFS 2016 5-Year Status Review re-evaluated the status of CV spring-run Chinook salmon and concluded that the species should remain listed as threatened (NMFS 2016a). Through recovery plan implementation and SJRRP reintroduction efforts (SJRRP, 2018), reintroduced CV spring-run Chinook salmon are expected to use the action area. One of the primary reasons these fish species are listed under the ESA is the ubiquitous artificial modifications to, and destruction of, crucial freshwater habitat and the services it provides in the Central Valley (NMFS 2016a). This threat currently persists and is expected to grow as human populations, land development and freshwater demands increase in California. Such trends are likely to suppress the recovery potential of these populations, despite recovery efforts, based on the effective scale of adverse habitat changes compared to recovery actions. The NMFS Recovery Plan (NMFS 2014) indicated that for CV spring-run Chinook salmon, re-establishing two viable populations in the San Joaquin River Basin would be necessary for recovery. The action area is a migratory corridor to the upper reaches of the San Joaquin River, below Friant Dam.

2.7.3. Status of the sDPS green sturgeon

The federally listed sDPS green sturgeon and its designated critical habitat occur in the action area and may be affected by the proposed action. It was listed as threatened in 2006 and its designated critical habitat in 2009. Adult sDPS green sturgeon potentially migrate through the action area to reach upstream riverine habitat based on catches of sDPS green sturgeon in the San Joaquin River mainstem, upstream of the Delta (CDFW sturgeon report card data). Juvenile sDPS green sturgeon migrate toward seawater portions of natal estuaries as early as one and a half years old (Allen and Cech 2007). Juvenile and subadult sDPS green sturgeon may rear in freshwater and brackish water for up to three years in the Delta. During laboratory experiments, juvenile sDPS green sturgeon select low light habitats and are primarily inactive during daylight hours, while they seemed to forage actively during night (Kynard et al. 2005). Juvenile sDPS green sturgeon were captured over summer in shallow shoals (1-3 meters deep) in the lower San Joaquin River (Radtke 1966), and are assumed to occupy similar habitats in other Delta region waterways. There is a strong need for additional information regarding sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their micro- and macro-habitat ecology. The upstream portion of the San Joaquin River is not known to currently host sDPS green sturgeon spawning; therefore, the San Joaquin River Basin is not a main focus of their recovery plan. Though the sDPS does utilize the lower San Joaquin River and the discovery of an individual adult in the Stanislaus River October 2017 highlights that passage for adults is possible during certain river conditions, the recovery plan and efforts are not likely to be modified unless adult spawning or juvenile reproduction occurs (NMFS, 2018).

2.7.4. Status of the Environmental Baseline and Cumulative Effects in the action area

The listed salmonids use the action area as a primary migratory corridor. For CCV steelhead and CV spring-run Chinook, the San Joaquin migratory corridor is an essential piece of the recovery strategy (NMFS 2014), which provides for two viable populations for each species to be established in the San Joaquin River Basin. The San Joaquin River Basin is not the main focus for sDPS green sturgeon recovery plan. Currently, the San Joaquin River, although degraded due to levees and lack of floodplain habitat, is an important migratory corridor for the recovery of these species.

The Cumulative Effects section of this Opinion describes how continuing or future effects such as the discharge of point and non-point source chemical contaminants discharges and increased urbanization affect the species in the action area. These actions typically result in habitat fragmentation, and conversion of complex nearshore aquatic habitat to simplified habitats that incrementally reduces the carrying capacity of migratory corridors.

2.7.5. Summary of Project Effects on listed species

1) Construction-related Effects

During construction, behavioral effects as well as injury or death to individual fish is expected to result from placement of the gate structure which includes pile driving, boat/barge activities, and capture and relocation from dewatering. Construction activities would occur during the summer and fall months, when the abundance of individual fish is low and outside of most of the migrating adult and juvenile timing period, which would result in correspondingly lower levels of injury or death, and behavioral effects. In addition, during construction activities, water quality impacts, including increased sediment and turbidity are expected to occur, but with the implementation of mitigation measures, impacts would be minor to listed species, resulting in behavioral modifications such as displacement and reduced feeding.

2) Long-term Operations and Maintenance Effects

All species considered in this consultation would be present at some point in time when the Corps anticipates the gate would be operated to protect against high water events (November 1 through April 30). All species entrapped would be affected by degraded water quality behind the flood control gates in Smith Canal. As a result of operations and maintenance, NMFS expects that water quality would degrade overtime due to a decrease in tidal flushing of the Smith Canal waterway and an increase in the residence time of water behind the sheet pile walls due to the obstruction of the channel. Salmonids and sturgeon tend to be sensitive fish species to reduced water quality compared to other fish species, particularly non-native species (Waters 1995, Barret et al. 1992). It is uncertain what fraction of the listed fish populations would be present when the gates are operated, and of that fraction present, how many would be entrapped behind the gates. It is certain that those fish trapped behind the gates would be exposed to more highly degraded water quality conditions than those fish remaining outside the gates, and would likely have a higher risk of predation while remaining behind the gates. NMFS assumes that fish trapped behind the gates are likely to die in the enclosed area. The gate structure increases the risk to passing salmonids and green sturgeon above the current conditions and therefore should be considered as adversely affecting the populations of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon in the action area.

Gates will be operated for approximately 17 percent of the time in January and February when adults may be moving upriver to spawning grounds, leaving the gates open for 83 percent of the time. The majority of adults are expected to migrate upriver in December and January with the run tapering off quickly in February and March. The gate operations for tides overlaps with a significant proportion of the adult spawning run, however, there is low probability of CCV steelhead being attracted into Smith Canal due to a lack of any tributary inflow, although some false attraction may be created by the high velocity currents described above as a result of tidal elevation differentials. The duration of any entrapment for adults in response to tidal operations will typically be brief (usually lasting no more than 6 to 12 hours per a high tide event), and exposure to contaminants should not result in mortality. CCV steelhead smolts are not likely to be emigrating downriver at the time that gates are being operated for the high tides. Therefore, there is a low risk of smolts being entrapped by the gates closing. Gate closures for high water events due to high inflows will result in an average of three closures per year, meaning that there are only that many gate closures to entrap adults or juveniles. While the fish trapped behind the gates for flood closures are likely to be lost to the population, there are no new fish being entrapped by gate operations on additional days while the gates remain closed.

Few CV spring-run Chinook salmon juveniles or smolts would be expected to be moving downstream at this time past the Smith Canal flood gate location, thus exposure to the tidal operations are limited. Some individuals may be present and subsequently entrapped by the operations of the gates and lost. The gates may be closed for approximately 12 percent of the operating season (3 weeks out of 25 weeks; November through April) but will only amount to three gate closures per year on average. Thus, there are only three events per year that will trap fish behind the gates. It is unlikely that these three closure events will overlap with a substantial proportion of the population being present at the gate when it is closed. While the gates are closed during high water events, juvenile and adult fish in the DWSC are unaffected by the presence of the gate structure.

The gates will be operated when both juvenile and adult sDPS green sturgeon may be present in the vicinity of the gate structure. Individual fish may be present in the DWSC and potentially on the flats in front of the gates and thus may become vulnerable to entrapment behind the gates when they are closed. Some of these individuals may be lost to the population. However, available information indicates that sDPS green sturgeon are present in low densities and numbers in this area of the Delta based on the low numbers of fish catches on the CDFW sturgeon report cards, compared to other areas of the Delta. The majority of reported sDPS green sturgeon catches in monitoring efforts and sport fishing catches indicate that sDPS green sturgeon utilize other areas of the Delta and Sacramento River watershed for their life history needs, rather than the DWSC in the Port of Stockton. Using the same reasoning as given for CV spring-run Chinook salmon and CCV steelhead, there is a low likelihood of trapping green sturgeon behind the gates due to the low frequency of gate closures overall, compared to the time they are open, and the low numbers of fish present.

2.7.6. Summary of Project Effects on CCV steelhead and sDPS green sturgeon critical habitat

Within the action area, the relevant PBFs of the designated critical habitats for listed CCV steelhead are migratory corridors and rearing habitat, and for sDPS green sturgeon the six PBFs include food resources, water flow, water quality, migratory corridors, water depth, and sediment quality.

Several components of the proposed project are expected to result in adverse effects to the designated critical habitat in the action area for both CCV steelhead and sDPS green sturgeon. The temporary construction impacts to designated critical habitat would negatively affect the ability of CCV steelhead and sDPS green sturgeon to use the action area as rearing habitat and as migratory corridors during the overlap of migration periods and construction as discussed in the effects to species section. Construction effects would last for a period of weeks, but would not permanently modify critical habitat function as noise and turbidity would end after construction ends.

The impacts of the Smith Canal flood control gate operation would permanently create unsafe migration conditions when fish become entrapped. However, the flood control structure is not expected to substantially impede migration, as the periods of potential entrapment would only occur during closure of the gate for short-term operations (due to tidal fluctuations). Estimated closure would occur approximately 10 times a month during January and February, but gate closures should last no more than 6 to 12 hours. Taking the maximum closure time of 12 hours and a closure frequency of 10 times per month in January and February, the gates will be closed approximately 17 percent of the time during these two months. For flood events, the SJAFCA has estimated that the gates will be closed on average three times a year from a few days to a few weeks based on the past 20 years of hydrology records. If the gates are closed for 3 weeks every year for high water elevations due to tides and inflow, then the gates are closed approximately 12 percent of the time out of 25 weeks (November through April).

2.7.7. Mitigation Bank Credits

SJAFCA's' mitigation credit purchase is expected to mitigate a portion of the impacts from the Smith Canal Gate project, by providing some benefits to the CCV steelhead DPS by improving riverine or floodplain habitat conditions elsewhere through restoration and ensuring their preservation into the future. The benefits offered to these populations are expected to exist in perpetuity. Although some of the banks that cover the action area in their service area may not technically offer sDPS green sturgeon credits, we expect that some sDPS green sturgeon individuals should benefit from the purchase of credits from these banks since individuals should be able to access the purchased riverine habitat areas created and maintained by the banks/programs.

2.7.8. Synthesis of Effects at the ESU/DPS Level

The flood control structure is not expected to substantially impede migration, as the periods of potential entrapment would only occur three times per year (usually lasting no more than 6 to 12 hours per a high tide event). The flood control structure is located along the opening of Smith Canal set back from the San Joaquin River. The presence of the gate structure will continue into the foreseeable future, thus creating a perpetual source of poor water quality (when the gates are closed and no fresh water coming in from San Joaquin River) and predation impacts to the action area, and a permanent adverse effect of the structure itself to rearing and migratory corridor habitat, and to the San Joaquin River populations of the listed species. However, the long-term effect of the structure itself is not expected to affect the other populations of the ESU or DPSs within the Sacramento River of CV spring-run Chinook salmon ESU, CCV steelhead DPS, and green sturgeon DPS populations and will not negatively affect their viability.

The number of fish present when the gates are closed, and subsequently trapped behind the closed gate, is unlikely to represent a substantial proportion of the population present in the system, thus impacts to the DPS/ESU are minimal. The low impact of the Smith Canal Gate to the CCV steelhead population in the San Joaquin River basin over the foreseeable future will not substantially affect the CCV steelhead DPS and will not negatively affect its viability. It is not expected that the operations of the Smith Canal flood control gates will have any demonstrable effect on other populations of CV spring-run Chinook salmon in the ESU. The low impact to the CV spring-run experimental population and its progeny over the foreseeable future will not substantially affect the CV spring-run Chinook salmon ESU and will not negatively affect its viability. The loss of the few individual fish that are trapped behind the gate when it is closed will not substantially affect the green sturgeon DPS in the Central Valley and should not impair its viability.

Combining the adverse and beneficial effects (compensatory mitigation) associated with the proposed action described above, environmental baseline, cumulative effects, and status of the species and critical habitat, the project is not expected to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated critical habitat for the conservation of the species.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the Proposed Action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon, or destroy or adversely modify designated critical habitat for CCV steelhead and sDPS green sturgeon.

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

NMFS cannot, using the best available information, quantify and track the amount or number of individuals that are expected to be incidentally taken per species because of the variability and uncertainty associated with the population sizes of the species, annual variation in the timing of migration, and variability regarding individual habitat use of the action area. However, it is possible to express the extent of incidental take in terms of ecological surrogates for those elements of the proposed action that are expected to result in incidental take.

These ecological surrogates are measureable, and the Corps and SJAFCA can monitor the ecological surrogates to determine whether the level of anticipated incidental take described in this incidental take statement is exceeded.

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

- ***Construction-related increased turbidity*** – The ecological surrogate for turbidity increase (in NTU) is equal to or less than 50 NTUs higher within 1000-feet of the disturbance activity when compared to the NTU background levels measured upstream of the project.

- ***Pile Driving*** – The ecological surrogate for piling driving is 150dB RMS behavioral threshold up to 2,154 meters from the pile, 187 dB cumulative SEL threshold up to 1597meters from the pile, and peak 206 dB threshold up to 18 meters from the pile.

- ***Barge and boat traffic noise*** – The ecological surrogate for underwater noise from barge and boat traffic is monitoring 500 feet of construction activity in adjacent waterways during any 24 hour period without observation of erratically behaving fish.

- ***Capture of juvenile fish during in-water work area isolation*** - The size of the cofferdam and fixed wall area (800 linear feet) will serve as the ecological surrogate in the form of harm. In addition, total immediate mortality during fish capture/handling/relocation process would be equal to or less than 3% of relocated fishes.

- ***Operations and Maintenance of the flood gate*** – The ecological surrogate for fish exposure to entrapment behind the flood gates is operation of the gates at water elevations greater than +8 feet NAVD88 only occurring during the period from November 1 through April 30.

- ***Square footage of area impact for permanent structure and riprap placement*** - The proposed project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat. This square footage will serve as the ecological surrogate.

2.9.1.1. Incidental take associated with water quality (elevated in-river turbidity plumes and disturbance)

NMFS expects that during the in-water work window of July 1 through November 30 (for 2021 season) and mid-July through mid-October (for 2022 season), there would be effects from increased turbidity as a result of the project to listed species present. NMFS expects the following species and life stages to be present during the in-water work window:

- Adult CCV steelhead
- Adult and juvenile sDPS green sturgeon

The most appropriate threshold for incidental take consisting of fish disturbance and sub-lethal effects associated with elevated in-river turbidity plumes is an ecological surrogate of the amount of increase in downstream in-river turbidity generated by dredging, riprap, or pile driving related activities. In-river pile driving, dredging, and riprap placement are expected to mobilize sediment and increase water turbidity beyond natural levels to some degree. Increased turbidity is expected to cause harm to listed species present through elevated stress levels and disruption of normal habitat use. These temporary responses are linked to decreased growth, survivorship, and overall reduced fitness as described for underwater noise avoidance.

The ecological surrogate for turbidity increase is based on salmonids sensitivity to raised turbidity levels. Typical background turbidity in the San Joaquin River during the in-water work season is approximately 25 to 80 NTU (CDEC 2018). Fifty NTUs is above the range at which salmonids experience reduced growth rates but below the range, salmonids would be expected to actively avoid the area. Therefore, the surrogate for turbidity increase is 50 NTUs higher than NTU background levels measured upstream of the project. Turbidity would be measured immediately downstream of the boundary already established for the action area and construction noise/pile driving disturbance surrogate (1000 feet in the San Joaquin River waterway from the northernmost boundary of the construction footprint) (SJAFCA 2018). Within 1000-foot, the San Joaquin River water is expected to increase up to 50 NTUs above the turbidity level in upstream measurements. Exceeding 50 NTUs will be considered as exceeding the expected incidental take levels.

2.9.1.2. Incidental take associated with pile driving

During pile driving activities associated with the project, NMFS expects the following species and life stages to be present during the pile driving portion of the construction in-water work window from July 1 through November 30 for 2021 season, mid-July to mid-October for 2022 season:

- adult CCV steelhead
- adult and juvenile sDPS green sturgeon

Quantification of the number of fish exposed to the pile driving associated noise and turbidity is not currently possible with available monitoring data. All fish passing through or otherwise present during construction activities will be exposed to noise from pile driving. Only the level of acoustic noise generated during the construction phases can be accurately and consistently measured, thus providing a quantifiable metric for determining incidental take of listed fish. Therefore, the measurement of acoustic noise generated during the construction phase, and in particular the vibratory and impact pile driving described in the proposed project, will serve as physically measurable surrogates for the incidental take of listed fish species.

The most appropriate threshold for incidental take consisting of fish displacement, behavior modification, injury, and death associated with elevated underwater noise is an ecological surrogate of the amount of habitat affected by elevated underwater noise and vibration within a certain distance from the construction site. Elevated noise disturbance is also expected to elevate fish stress levels even when no observable behavior changes are made, and are expected to decrease individual's overall fitness and survival through compounding sub-lethal effects.

Vibratory pile driving is expected to produce underwater pressure levels over 150 dBRMS out to 2,154 meters from the location of the pile driving sites. Though underwater sound levels are not expected to injure or kill fish directly, since the sounds will be above the effective quiet threshold, they are expected to cause disruption of normal habitat utilization, stress, and elicit temporary behavioral effects in CCV steelhead and sDPS green sturgeon juveniles and adults leading to harm as described below. Any behavioral alterations in juvenile fish are expected to decrease their fitness and ultimate survival by decreasing feeding opportunities, which will decrease their growth, and by causing area avoidance which will delay their downstream migration and increase their predation risk. Adult fitness is expected to decrease slightly when area avoidance delays their upstream migration, and in the case of adult sDPS green sturgeon, will also cause decreased feeding opportunities. Beyond 2,154 meters, underwater sound is expected to attenuate down to effective quiet underwater sound levels, or 150 dB RMS or less, and therefore 2,154 meters from the pile being driven is considered the limit of this ecological surrogate. The behavioral surrogate will be limited in general to 2,154 meters from the boundary of the construction footprint and cofferdam placement, and exceeding 150 dBRMS beyond 2,154 meters from the construction site boundary will be considered exceeding expected incidental take levels for this surrogate.

Impact pile driving is also expected to produce underwater pressure waves that are expected to injure or kill CCV steelhead and sDPS green sturgeon within 18 meters of the pile being driven. The largest size of pile is estimated to produce a maximum of 210 dB peak sound. Risk to fishes will be present as long as impact pile driving is occurring. Beyond 18 meters, cumulative SELs are expected to injure fish that remain in the area during in-water pile driving activities. Considering that underwater sound will be controlled by working behind dewatered cofferdams/inside the gate foundations and the cumulative SELs over 187 dB will be somewhat controlled. Injuries to fish are expected to occur out to 1,597 meters from the driven pile. Beyond these distance thresholds, underwater pressure waves are expected to decrease below lethal and injurious levels. The lethal distance surrogate will be limited to an 18-meter radius from each pile driven with an impact hammer. The injurious distance surrogate will be limited 1,597 meters from the construction site boundary, and exceeding 206 dB peak or 187 dB cumulative SEL, respectively, beyond these distances will be considered exceeding expected incidental take levels for these surrogates.

2.9.1.3. Incidental take associated with barge and boat traffic noise

During construction of the tidal gate, barges and boats would be needed to transport materials and machinery. NMFS expects the following species and life stages to be present during the construction in-water work window from June 15 through December 15 for 2021 season and mid-July to mid-October for 2022 season:

- adult CCV steelhead
- adult and juvenile sDPS green sturgeon

Quantification of the number of fish exposed to the underwater noise from barge and boat traffic is not currently possible with available monitoring data. All fish passing through or otherwise present during construction activities will be exposed to construction noise. Based on the project description and effects analysis, elevated noise disturbance is expected to elevate fish stress levels even when no observable behavior changes are made, and are expected to decrease individual's overall fitness and survival through compounding sub-lethal effects. The most appropriate threshold for incidental take in the form of harm, resulting in fish displacement, behavior modification, due to elevated underwater noise is an ecological surrogate of the amount of habitat affected by elevated underwater noise within 500 feet distance from the construction site. Any observations of erratically behaving fish within 500 feet of construction activity in adjacent waterways during any 24 hour period will be considered to have exceeded anticipated take levels, triggering the need to reinitiate consultation on the Project.

2.9.1.4. Incidental take associated with dewatering and fish relocation

NMFS expects that during the dewatering activities of the cofferdam, a small number of fish present will become entrained behind the cofferdam and fish handling and relocation would be required. This would occur at some point during the in-water work window of mid-July through mid-October. NMFS expects that small numbers of the following species and life stages to be present and become entrapped behind the cofferdam:

- Adult CCV steelhead
- Adult and juvenile sDPS green sturgeon

Dewatering of the work area behind the cofferdam is expected to result in take in the form of harm, injury or death to stranded fish, as well as to handling of captured and relocated fish. The size of the cofferdam area and fixed wall, from the north tip of Dad's Point levee to the right bank of the San Joaquin River (800 linear feet) will serve as the incidental take ecological surrogate in the form of harm. During the fish capture/handling/relocation process, total immediate mortality is expected to be equal to or less than 3% of the total number of all relocated fishes. If this overall mortality level or size of the cofferdam is exceeded, the proposed action will be considered to have exceeded anticipated take levels.

2.9.1.5. Incidental take associated with operations and maintenance of the flood gate

NMFS expects that during the operations of the flood gate structures, closures for water elevations greater than +8.0 feet NAVD88 will occur only during the period from November 1 through April 30. NMFS expects the following species and life stages to be present during this portion of the proposed project operations:

- adult and juvenile CCV steelhead
- adult and juvenile sDPS green sturgeon
- adult and juvenile CV spring-run Chinook salmon

All listed species identified above would be exposed to the operations of the Smith Canal flood control structure. NMFS expects that incidental take would occur in the form of mortality or morbidity resulting from entrapment of listed fish behind the closed gate. Trapped fish would have an elevated vulnerability to predation and exposure to degraded water quality in the waterbodies upstream of the closed gate structures. Gate closures would occur during high tides or water elevations exceeding +8.0 feet NAVD88 or when in operation for maintenance purposes. Therefore, the frequency of gate operations is defined by the water elevation and is used as the ecological surrogate for the exposure of fish to entrapment behind the gates. Operations of the gates at water elevations below +8 feet NAVD would result in more frequent operations of the flood gate structure which would result in more occurrences of entrapped fish. These conditions would indicate incidental take has been exceeded, triggering the need to reinitiate consultation on the proposed project.

Additionally, NMFS expects that the presence of the flood gate structures would create altered flow conditions related to the narrow width of the flood control structure gates. This would increase predation upon listed fish species. These conditions would be present throughout the year and are created by daily tidal flows. A portion of all listed species identified above would be exposed to the operations of the Smith Canal flood control structure. NMFS expects incidental take in the form of mortality or morbidity resulting from predation of listed fish moving through the open gate or along the face of the flood structure. Listed fish would have an elevated vulnerability to predation due to the hydrodynamic conditions created by the open gate structures and the vertical sheet pile wall structure placed into the open water environment, both of which are expected to attract predators. The level of incidental take is associated with the creation of a high velocity flow through the narrow gate opening, designed to be approximately 50 feet wide. The width of the gate is an integral factor in determining the velocity of the water flowing through the open gate, as well as the water elevation differential between the two sides of the flood structure. If the gate opening is made narrower, the velocity increases, thereby creating more adverse conditions for listed fish passing through it. Higher velocities create more turbulence, eddies, and disorientation to the fish caught in the high velocity jet, allowing them to become easier targets for predators. A wider gate opening would have the opposite effect, reducing the velocity of the flow. NMFS considers any changes to the gate opening that would make it narrower and thus increases the velocity of water moving through the open gate as exceeding anticipated incidental take as analyzed in this biological opinion. The level of take associated with placing a vertical structure in the channel (*i.e.*, the sheet pile wall) is related to the linear length of the wall, and the holding and hiding habitat that it can provide to predators residing in the area. Increasing the length of the wall would increase the potential predator holding habitat. Conversely, shortening the length of the wall would reduce the predator holding habitat. NMFS considers any changes to the length of the wall that demonstrably increases its linear length (currently designed to be approximately 800 feet for Smith Canal) would exceed the anticipated incidental take of listed fish as assessed in this biological opinion.

2.9.1.5 Incidental Take Associated with the Permanent Loss of Habitat

NMFS expects that there will be permanent loss of habitat associated with the placement of the tidal gate structure. NMFS expects the following species and life stages to be present during this portion of the proposed project operations:

- adult and juvenile CCV steelhead
- adult and juvenile sDPS green sturgeon
- adult and juvenile CV spring-run Chinook salmon

The placement of the tidal gate will extend 800 linear feet from the tip of Dad's Point levee to the right bank of the San Joaquin River. In addition, 200 linear feet of riprap will be placed on the banks of Stockton Golf and Country Club. Therefore, the project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat.

The placement of the tidal gate and riprap is expected to harm juvenile and adult listed fish. It will reduce the amount of feeding and sheltering/escapement areas locally for juveniles. A reduction in the amount of feeding and resting areas is expected to reduce the fitness of fishes that would have otherwise used this area, in perpetuity. The occupation of the permanent structure and rip rap will reduce the amount of feeding and resting areas locally, and create ambush habitat for predators of juvenile steelhead, in perpetuity. In addition, the permanent structure could change migration behavior for adult and juveniles due to the operations (changes in flow) and permanent placement of structure in the migratory corridor. NMFS considers any changes to the length of the wall that demonstrably increases its linear length (currently designed to be approximately 800 feet for Smith Canal) or increased rip rap placement would exceed the anticipated incidental take of listed fish as assessed in this biological opinion.

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).

1) Measures shall be taken by the Corps, or its applicant, to minimize sediment events and turbidity plumes in the action area and related effects, as discussed in this biological opinion.

2) Measures shall be taken by the Corps, or its applicant, to reduce underwater sound impacts and other disturbances related to pile driving and barge and boat traffic, as discussed in this biological opinion.

3) Measures shall be taken by the Corps, or its applicant, to reduce mortality of listed species requiring capture/relocation in association with dewatering activities.

4) Measures shall be taken by the Corps, or its applicant, to reduce the extent of degradation and alteration to the habitats in the action area as a result of the tidal gate and riprap placement, related to effects of this project, as discussed in this biological opinion.

5) Measures shall be taken by the Corps, or its applicant, to prepare and provide NMFS with a plan and a report describing how listed species in the action area would be protected and/or monitored and to document the observed effects of the action on listed species and critical habitat. In the report, the Corps or SJAFCA shall demonstrate how the conservation measures were incorporated.

2.9.4. Terms and Conditions

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

1. The following terms and conditions implement reasonable and prudent measure 1:

    a. Since in-river values change daily, the upstream comparison value must therefore be taken daily, in association with the downstream readings. A qualified biologist shall use a held-hand turbidity monitor to conduct water quality monitoring during all in-water activities to ensure the turbidity control measures are functioning as intended. If an in-river turbidity plume is created and conditions within the plume exceed take limits (50 NTUs above ambient) for listed species, the Corps, or its applicant, shall coordinate with NMFS within 24 hours after an event that exceeds the given water turbidity surrogate, to discuss ways to reduce turbidity back down to acceptable levels.

    b. The following BMPs shall be incorporated into the Project to reduce, minimize or avoid turbidity associated with construction activities:

        i. Implement appropriate measures, such as straw wattles and silt fencing, to prevent debris, soil, rock, or other material from entering the water from land.

        ii. Use a water truck or other appropriate measures to control dust on haul roads, construction areas, and stockpiles. Application of water would not be excessive or result in runoff into storm drains or waterways.

        iii. Schedule construction to avoid the rainy season as much as possible. If rains are forecasted during construction, additional erosion and sedimentation control measures would be implemented.

        iv. Maintain sediment and erosion control measures during construction. Inspect the control measures before, during, and after a rain event.

        v. Train construction workers in stormwater pollution prevention practices.

        vi. Revegetate disturbed areas with native seeds or plantings in a timely manner to control erosion.

vii. If vegetation is not growing sufficiently it shall be replanted or provided with irrigation if necessary.

viii. Erosion control BMPs will be monitored for effectiveness during the active construction window and during periods of inactivity following the active construction window for effectiveness, particularly during the rainy season.

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

   a. Barge and boat traffic shall not occur outside of the in-water work windows, as described for Year 2 and Year 3.

   b. During the seasonal in-water work windows, at least one day per week, the project activities shall not include pile-driving of any kind so that CCV steelhead and sDPS green sturgeon using the habitat may migrate or forage undisturbed.

   c. During the in-water work windows, when water temperatures are below 75°F, the daily work schedule shall be limited to between one hour after sunrise to one hour before sunset, to avoid peak fish migration times and to allow for cumulative SEL impacts to reset daily.

   d. When local water temperatures are below 75°F, the number of impact strikes per day shall be limited to 1,000 to reduce potential injuries to CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon through cumulative SEL, except for the 2021 season which would be limited to 5,000 strikes per day without the 75°F threshold.

   e. When local water temperatures are below 75°F, attenuation measures shall be used during impact pile driving to control and dampen underwater pressure wave propagation. Effective attenuation measures include:

      i. Pile driving within a dewatered cofferdam or caisson.

      ii. Use of a bubble curtain.

      iii. Use of a cushion block.

   f. Underwater sound monitoring shall be conducted during impact pile driving when water temperatures are below 75°F, to ensure incidental take limits are not exceeded according to the ecological surrogates designated.

      i. No more than 150 dB RMS beyond 2,154 meters from the boundary of the construction footprint/cofferdam placement.

      ii. No more than 187 dB SEL cumulative beyond 1,597 meters from the construction site boundary per day.

      iii. No more than 206 dB peak beyond an 18-meter radius from each pile driven with an impact hammer.

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

    a. During dewatering activities, a qualified fish biologist shall be present onsite to make observations, and capture/relocate fish if they become entrapped in the dewatered area.

    b. Only fish biologists trained in salmonid capture and relocation shall remove and relocate fish during dewatering activities.

    c. A fish relocation plan shall be submitted to NMFS for approval prior to commencing activities.

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

    Following the placement of riprap on the river bank at the extent described in the project Biological Assessment, voids created by the riprap boulders shall be filled by smaller diameter rocks/gravel when below the OHWM to avoid supporting piscivorous predator ambush habitat. After the first storm and snowmelt season following placement of this smaller gravel, the area shall be examined to ensure the smaller gravel was not scoured out and effectively removed. If it is found to be removed, the Corps or its applicant shall develop a plan for maintenance of this BMP over time so that this adverse effect can be reduced and controlled.

    a. Provide NMFS with a draft of the plan for review, and implement the plan after receiving NMFS' concurrence.

    b. The Corps or the applicant shall minimize the removal of existing riparian vegetation and instream woody material (IWM) to the maximum extent practicable, and where appropriate, removed IWM will be anchored back into place or if not feasible, new IWM will be anchored in place.

    c. The Corps shall continue to coordinate with NMFS during all phases of construction, implementation, and monitoring by hosting annual meetings and issuing annual reports throughout the construction period.

5. The following terms and conditions implement reasonable and prudent measure 5:

    i. The Corps, or its applicant, shall provide a report of project activities to NMFS by December 31 of each year construction takes place. The report shall include a summary description of in-water construction activities, incidental take avoidance and minimization measures taken, and any observed incidents of take, including number and species captured and relocated during dewatering.

2.10. Conservation Recommendations

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

1) The Corps should continue supporting and promoting aquatic and riparian habitat restoration within the San Joaquin River and other watersheds, especially those with listed aquatic species. Practices that avoid or minimize adverse effects to listed species should be encouraged.

2) The Corps should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects.

3) The Corps should use all of their authorities, to the maximum extent feasible to implement high priority actions in the NMFS Central Valley Salmon and Steelhead Recovery Plan. High priority actions related to flood management include setting levees back from river banks, increasing the amount and extent of riparian vegetation along reaches of the Lower San Joaquin River Feasibility Study Project.

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

2.11. Reinitiation of Consultation

This concludes formal consultation for the Smith Canal Gate 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.

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 salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The geographic extent of salmon freshwater EFH is described as all water bodies currently or historically occupied by PFMC managed salmon within the USGS 4th field hydrologic units identified by the fishery management plan (PFMC, 2014). This designation includes the Lower San Joaquin River (HUC 18040002) for all runs of Chinook salmon that historically and currently use these watersheds (spring-run, fall-run, and late fall-run). The Pacific Coast salmon fishery management plan also identifies Habitat Areas of Particular Concern (HAPCs): complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation, of which, the HAPC for complex channel and floodplain habitat is expected to be either directly or indirectly adversely affected by the proposed action. Because of the extensive urbanization that has occurred in the California Central Valley over the last 100 years, the San Joaquin River in the action area has been leveed and channelized and is currently degraded habitat for complex channel and floodplain HAPC.

3.2. Adverse Effects on Essential Fish Habitat

Effects to the HAPC for complex channel and floodplain habitat are discussed in the context of effects to critical habitat PBFs as designated under the ESA and described in section 2.5.2. A list of adverse effects to this EFH HAPC is included in this EFH consultation, which are expected to be similar to the impacts affecting critical habitat, including: sediment and turbidity, in-channel disturbance from pile driving, and permanent habitat loss/modification.

Sediment and turbidity

- Degraded water quality (temporary sedimentation and turbidity)

In-channel disturbance from pile driving

- Channel disturbance and noise pollution from pile driving activity and associated piles

Permanent habitat loss/modification

- Permanent habitat loss due to placement of riprap
- Reduced shelter from predators

- Reduction/change in aquatic macroinvertebrate production
- Reduced habitat complexity
- Reduced water quality (flow and contaminants) due to the operations of the tidal gate
- Permanent loss of habitat due to placement of tidal gate

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

The following are EFH conservation recommendations for the proposed project:

To address the adverse effects of sediment and turbidity:
Implement BO Section 2.9.4 Terms and Condition 1.

To address the adverse effects of in-channel disturbance from pile driving:
Implement BO Section 2.9.4 Terms and Condition 2.

To address the adverse effects of permanent habitat loss/modification:
Implement BO Section 2.9.4 Terms and Condition 4 and 5.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 1.65 acres of designated EFH for Pacific Coast salmon.

3.4. Statutory Response Requirements

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

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

3.5. Supplemental Consultation

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

4. 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 SJAFCA and the Central Valley Flood Protection Board. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. 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 contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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