UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
LONG BEACH, CA 90802

Refer to NMFS No: WCRO-2024-02917

April 14, 2025

Mr. Adam Nickels
Acting Regional Director
Bureau of Reclamation
Mid-Pacific Region
2800 Cottage Way
Sacramento, California 95825

Re: Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Reinitiation of Consultation on the Long-Term Operations of the Central Valley Project and State Water Project

Electronic transmittal only

Dear Mr. Nickels:

Thank you for your request for consultation with NOAA's National Marine Fisheries Service (NMFS) on essential fish habitat (EFH) for the Long-Term Operations of the Central Valley Project and State Water Project. NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

Based on the best available information, NMFS has concluded that the proposed action would adversely affect EFH designated under the Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species Fishery Management Plans (FMPs). Therefore, in the enclosed, NMFS provides Conservation Recommendations.

As required by Section 305(b)(4)(B) of the MSA, Reclamation 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 timeframes for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects [50 CFR 600.920(k)(1)].

Reclamation 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(1)].

We appreciate your consideration of our Conservation Recommendations. If you wish to discuss this consultation further or have questions concerning our recommendations, please contact Cathy Marcinkevage, of my staff, at (916) 930-3600.

Sincerely,

Jennifer Quan
Regional Administrator

Enclosure

cc: File: ARN: 151422-WCR2021-SA00122

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NATIONAL MARINE FISHERIES SERVICE

MAGNUSEN-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) directs federal agencies to consult with NOAA's National Marine Fisheries Service (NMFS) on all actions or proposed actions that may adversely affect essential fish habitat (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 associated physical, chemical, and biological 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 may result from actions occurring within EFH or outside of it and may include direct, indirect, site-specific or habitat-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 (50 CFR 600.905(b)).

Background

This EFH consultation on the proposed reinitiation of consultation on the long-term operation (LTO) of the Central Valley Project (CVP) and State Water Project (SWP) was written in accordance with section 305(b)(2) of the MSA (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

NMFS has 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 2 weeks at the NOAA Library Institutional Repository (https://repository.library.noaa.gov/welcome). A complete record of this consultation is on file at the Sacramento NMFS Office.

Consultation History

- On September 30, 2021, the Bureau of Reclamation (Reclamation) provided a letter to NMFS requesting reinitiation of consultation on the LTO of the CVP and SWP pursuant to the Endangered Species Act (ESA) section 7 and EFH.

- On October 31, 2024, Reclamation provided NMFS with an EFH Assessment (Reclamation 2024c). On this date, NMFS initiated the EFH consultation.

Proposed Action

The purpose of the proposed action is to continue the operation of the CVP in coordination with the SWP, for their authorized purposes. Reclamation operates the CVP for the congressionally authorized purposes of (1) river regulation, improvement of navigation, and flood control; (2) irrigation and domestic uses, and fish and wildlife mitigation, protection, and restoration; and (3) power, and fish and wildlife enhancement. The California Department of Water Resources (DWR) operates the SWP for the primary purpose of water supply deliveries and flood control, and the SWP provides additional benefits including power generation and environmental stewardship. Conservation measures were included to avoid and minimize or compensate for CVP and SWP effects, and included actions that benefit listed species (Appendix H, Reclamation 2023-2024). Effects to EFH from the proposed action are described in Reclamation's EFH Assessment (Reclamation 2024c). For a full description of the proposed action, we incorporate by reference here, Reclamation's final Biological Assessment (BA, Reclamation 2024d) for the reinitiation of consultation on the LTO of the CVP and SWP, provided to NMFS on October 23, 2024 (Appendix A to the NMFS Biological Opinion, NMFS 2024).

Action Area

The action area for this EFH consultation includes habitat within areas expected to be affected directly or indirectly by the Federal action and not merely the immediate habitat area involved in the action. Specifically, the EFH action area includes (1) the Sacramento River from Keswick Dam downstream to the Sacramento-San Joaquin Delta; (2) Clear Creek from Whiskeytown Dam to its confluence with the Sacramento River; (3) the American River from Lake Natoma Dam downstream to its confluence with the Sacramento River; (4) the Stanislaus River from New Melones Dam to its confluence with the San Joaquin River; (5) the San Joaquin River from the confluence of the Stanislaus River downstream to the Sacramento-San Joaquin Delta; and (6) the Sacramento-San Joaquin Delta, which includes the region of waterways bounded by the Sacramento River downstream from the I Street Bridge in Sacramento, the San Joaquin River downstream from the Airport Way Bridge near Vernalis, waters bounded on the east approximately by the alignment of Interstate 5, and westwards to nearly the western tip of Chipps Island. The action area also includes Spring Creek from Spring Creek Debris Dam to Keswick Reservoir. The action area for this EFH consultation does not extend past Chipps Island since effects of the proposed action are not expected to adversely affect EFH for managed species beyond this point. This EFH consultation also does not include effects to Trinity River, since future Trinity River operations are expected to be addressed in a separate consultation.

Essential Fish Habitat Affected by the Proposed Action

This EFH analysis is based on the EFH assessment provided by Reclamation, the analysis in the NMFS Biological Opinion (NMFS 2024), and descriptions of EFH for various species and life stages of Pacific Coast salmon (Pacific Fishery Management Council [PFMC] 2024c), Pacific Coast groundfish (PFMC 2024b), and coastal pelagic species (PFMC 2024a) contained in the fishery management plans (FMPs) and that occur in the action area. These FMPs were developed by the PFMC and approved by the Secretary of Commerce. Table 1 provides details associated

with this EFH analysis. This consultation also describes conservation measures Reclamation proposes in their BA (Appendix H, Reclamation 2023-2024) to avoid, minimize, mitigate, or otherwise offset potential adverse effects resulting from the proposed action on EFH.

Table 1. Fishery Management Plans and effects by the Proposed Action in the action area.

Fishery Management Plan That Identifies EFH in the Action Area	Does Action Have an Adverse Effect on EFH?	Does Action Have an Adverse Effect on HAPC?	Are EFH Conservation Recommendations Provided?	Portion of the Action Area where EFH is present
Pacific Coast Salmon (PFMC 2024c)	Yes	Yes	Yes	Sacramento River, Clear Creek, American River, Stanislaus River, San Joaquin River, Sacramento-San Joaquin Delta
Pacific Coast Groundfish (PFMC 2024b)	Yes	Yes	Yes	Sacramento-San Joaquin Delta, and portions of the lower Sacramento River and American River
Coastal Pelagic Species (PFMC 2024a)	Yes	No	Yes	Sacramento-San Joaquin Delta

All evolutionarily significant units of Chinook salmon in the Central Valley (Sacramento River winter-run Chinook salmon, Central Valley [CV] spring-run Chinook salmon, CV fall-run Chinook salmon, and CV late fall-run Chinook salmon) are managed under the Pacific Coast Salmon FMP (PFMC 2024c), and all occur within the action area.

EFH for Pacific Coast salmon includes those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. Freshwater EFH for Chinook salmon includes streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC [2024]) and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years).

EFH for Pacific Coast groundfish is defined as the aquatic habitat necessary to allow groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem ((PFMC 2024b). Descriptions of Pacific Coast groundfish EFH for each species and their life stages result in more than 400 EFH identifications. Species most likely to occur in the action area include starry flounder (*Platichthys stellatus*) and English sole (*Pleuronectes vetulus*). The Pacific Coast groundfish EFH in the action area includes all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths.

EFH for coastal pelagic species is described in the Coastal Pelagic Species FMP (PFMC 2024a) and explains the habitat requirements of five pelagic species: Northern anchovy, Pacific sardine, Pacific (chub) mackerel, jack mackerel, and market squid. These four finfish and market squid are treated as a single species complex because of similarities in their life histories and habitat requirements. Species most likely to occur in the action area include Northern anchovy (*Engraulis mordax*) and Pacific sardine (*Sardinops sagax*).

Along the West Coast, the PFMC identifies habitats that fall within "Habitat Areas of Particular Concern" (HAPC) and recommends these to NMFS consistent with the MSA. HAPCs are considered high priority areas for conservation, management, or research because they are important to ecosystem function, sensitive to human activities, stressed by development, or are rare. These areas provide important ecological functions and/or are especially vulnerable to degradation and can be designated based on either specific habitat types or discrete areas. HAPCs are a discrete subset of EFH. This EFH consultation focuses on addressing any adverse effects the proposed action may incur on EFH and in the following designated HAPCs:

- HAPCs for Pacific Coast salmon are: complex channels and floodplain habitats, spawning habitat, thermal refugia, estuaries, and marine and estuarine submerged aquatic vegetation, as described in Appendix A to the Pacific Coast Salmon FMP (PFMC and NMFS 2014b). The marine and estuarine submerged aquatic vegetation HAPC is not present within the action area.

- HAPCs for Pacific Coast groundfish are: estuaries, canopy kelp, seagrass, rocky reefs, and areas of interest, as described in the Pacific Coast Groundfish FMP (PFMC 2024b). Only the HAPC for estuaries is present within the action area.

EFFECTS ON EFH AND EFH CONSERVATION RECOMMENDATIONS

This section provides information by watershed and includes a brief description of the proposed action, adverse effects to EFH, and conservation recommendations. The proposed action includes conservation measures to avoid, minimize, mitigate, or otherwise offset potential CVP and SWP effects and include actions that benefit MSA-managed species. For a full description of the proposed action, we incorporate by reference Reclamation's October 23, 2024, final BA (Reclamation 2024d).

Sacramento River/Shasta Division Proposed Action

For the Sacramento River, the proposed action includes Sacramento River Pulse Flows, Adult Migration and Holding Temperature Objectives, Water Temperature and Storage, Egg Incubation and Emergence Temperature Objectives, Ramping Rates, Base Flows for Shasta Refill and Redd Maintenance including Minimum Instream Flows and Rice Decomposition Smoothing (Table 2). The proposed action also includes conservation measures to minimize potential negative effects (Table 3). We incorporate by reference here the proposed action and its project components found in Reclamation's final BA (Reclamation 2024d).

Within the Sacramento River Division, Reclamation operates Shasta and Keswick dams year-round in coordination with the other facilities of the CVP and SWP. These operations are seasonal in their nature, as Reclamation operates in the winter for flood control, including both the channel capacity within the Sacramento River and Shasta Reservoir flood conservation space. Releases for flood control will vary, depending on the current storage, the forecasted inflow, and the flow in the mainstem Sacramento River at Bend Bridge where flows are held below 100,000 cfs. When not operating for fall and winter flood control, Shasta Dam is operated primarily to conserve storage while meeting minimum flows both down the Sacramento River and in the Delta. During the winter to spring period, there are natural accretions (flows from unregulated creeks) into the Sacramento River below Shasta Dam. In wetter water year types, Reclamation may be able to operate mostly for flood control and minimum instream requirements because of the large volumes of accretions to the Sacramento River. In drier years, these accretions may be lower and, therefore, require Reclamation to release a higher level of releases from the upstream reservoirs to meet state permit requirements as well as project exports in the Delta.

In the spring, reservoir releases are relatively stable until flows are needed to support instream demands on the mainstem Sacramento River and Delta Outflow requirements. When Delta regulatory constraints are reduced, exports can increase during periods of excess flow and Reclamation can build additional storage south of the Delta, in San Luis Reservoir, without increasing releases from upstream reservoirs. An overarching goal for Reclamation when operating the CVP is to fill the reservoirs as much as possible by the end of the flood control season (end of May), while still meeting all other authorized project purposes. An action component in the proposed action is the inclusion of spring pulse releases, where under certain hydrological conditions, Reclamation will make reservoir releases to simulate natural springtime freshets events that stimulate and facilitate juvenile salmonid emigration.

During the summer, operational considerations are mainly flows sufficient to meet Delta outflow requirements, instream demands, temperature control, and exports. A particularly challenging aspect of summer operations is the Cold-Water Pool Management in Shasta Reservoir, where during summer months, Reclamation releases large volumes of water to meet downstream agricultural demands while also providing suitable temperatures for winter-run Chinook salmon spawning and incubation. To meet these competing demands, Reclamation proposed to use a bin strategy that allows for strategically selected temperature compliance locations, based on projected total storage and cold-water pool. Temperature management continues into the fall, and by late fall, the remaining cold-water pool in Shasta Reservoir is usually very limited.

In the fall and with decreasing agricultural demands, Reclamation reduces its reservoir releases, to begin again the process of building storage for the following summer. However, early in the fall, upper Sacramento River flows cannot be too low, as there are still significant instream diversion demands on the mainstem between Keswick Dam and Wilkins Slough, and depending on conditions, SWRCB Delta requirements may require upstream reservoir releases which may include from Shasta Reservoir. This necessitates maintaining higher releases to support the instream demands until they decrease later in the season. To manage that change between higher early-fall releases with the lower releases in the late fall and winter, Reclamation will consider the potential for dewatering redds with a risk analysis of the remaining winter-run Chinook

salmon redds, the anticipated fall-run Chinook salmon redds, and the probability of sufficient cold water in a subsequent year.

The proposed action also includes a number of conservation measures intended to avoid, minimize, mitigate, or otherwise offset CVP and SWP project effects as well as contribute to the recovery and enhancement of species and their habitats (Table 3). These conservation measures include non-flow actions that benefit listed species.

Table 2. Action Components of the Proposed Action for the Sacramento River.

Action Component	Proposed Action
Sacramento River Pulse Flows	To increase the out-migration survival of Chinook salmon, Reclamation would release up to 150 TAF in pulse flow(s) each water year, typically in the spring to benefit Chinook salmon in the Sacramento River watershed, when the pulse "does not interfere with the ability to meet temperature objectives or other anticipated operations of the reservoir" (Reclamation 2023-2024).
Adult Migration and Holding Temperature Objectives	Under circumstances where these conditions may cause water temperatures to rise to concerning levels prior to the completion of the final temperature management plan, Reclamation will begin temperature management as early as March 1 to target water temperatures of 58.0°F daily average at the Sacramento River at the CCR (Sacramento River above Clear Creek) gauge. Reclamation, through coordination, may propose a different temperature based on the potential impacts to winter-run Chinook salmon spawning and egg incubation.
Water Temperature and Storage	The Shasta Reservoir Management Plan (Shasta Management Plan) that will use a system of management "Bins" to administer water temperature and storage levels. There are three Bins (1, 2, and 3) based on the expected End of April storage. Each Bin has two categories: A (standard) and B (drought protection). The letter of the Bin (A or B) is primarily driven by the expected demands on the reservoir which are a function of hydrology, meteorology, system-wide conditions, contractual requirements and other conditions. Bin A years are when the expected demand on the reservoir is lower, meaning it is likely to result in better drought protection should the following year be dry. Bin B years are intended to increase the priority of storage conservation to address the possibility that the ensuing year could be a drought. Bin B years may be when there is limited water supply in the Shasta system, or the system as a whole is more stressed and additional actions are necessary to reach the objectives of that Bin.
Egg Incubation and Emergence Temperature Objectives	An average daily water temperature of 53.5°F is targeted in Bin 1 (Enhance) downstream of the CCR gauge, in Bin 2 (Recover/Maintain) at the CCR gauge, and in Bin 3 (Protect) upstream of the CCR gauge. Bins 1 and 2 target temperature dependent mortality of ≤3% while Bin 3 targets ≤30%.

Action Component	Proposed Action
Ramping Rates	Rapid changes in river elevation from ramping reservoir releases up or down can impact aquatic biota. Sudden flow decreases can strand fishes and macroinvertebrates. Ramping rates to limit how quickly releases are reduced can lessen or minimize these impacts. Under Water Rights Order 90-5, the change in the release rate (ramping) from Keswick Dam from September through February shall not decrease more than the rates noted in the PA, in order to minimize stranding of salmon. In addition to the requirements under Order 90-5, the ramping rates for Keswick Dam between July 1 and March 31 would be reduced between sunset and sunrise, as described in the PA.
Base Flows for Shasta Refill and Redd Maintenance including Minimum Instream Flows	Reclamation proposes to set target base flows from Keswick Dam for the winter (December 1 through the end of February) based on Shasta Reservoir End of September storage. These base flows consider historical performance in building Shasta Reservoir's cold-water pool. Fall and winter base flows support fall-run and Central Valley spring-run Chinook salmon, address winter-run Chinook salmon redd dewatering stressors, and support cold water pool management.
Rice Decomposition Smoothing	Rice decomposition smoothing could minimize impacts to both winter-run Chinook salmon and fall-run Chinook salmon by minimizing fry stranding and redd dewatering as flows drop in the winter. The Sacramento River Settlement Contractors (SRSC) and CVP Water Service Contractors will synchronize their diversions to lower peak rice decomposition demand. Starting in August, Reclamation and the SRSC, through the Sacramento River Group (SRG), will develop a delivery schedule based on dewatering risk for winter-run Chinook salmon redd locations and update as conditions warrant.

Table 3. Proposed Conservation Measures for the Sacramento River. Actions are summarized from Appendix H of Reclamation (2023-2024), unless duplicative with items listed above in Table 2.

Conservation Measure	Description/Objective
Sacramento River Settlement Contractors (SRSC) Delaying or Shifting Spring Diversions to Maximize Storage	Reclamation may request that the SRSC delay diversions in the spring to increase the likelihood that Shasta Reservoir elevations reach the upper gates on the Temperature Control Device.
SRSC Shifting Timing of Delivery of Transfer Water	Reclamation may request that the SRSC shift timing of delivery of transfer water to increase the amount of water in Shasta Reservoir through the water temperature management season.
Wilkins Slough Minimum Flow Criteria Relief	Under this conservation measure, summer flows would be lower than 5,000 cfs in the driest of years. As a default, Reclamation will target a minimum flow of 3,400 cfs under these conditions. October flows may vary due to demands, water transfer operations and protection of winter-run Chinook salmon redds and are likely to be in the 3,250 - 5,000 cfs range, although higher flows may be necessary at times. After the irrigation season, Reclamation expects to begin ramping down to the minimum flow of 3,250 cfs as soon as possible given deliveries, Delta conditions and winter-run Chinook salmon redd dewatering concerns. Reclamation, through coordination with the Shasta Operations Team (SHOT), will determine the appropriate ramp down date after evaluating tradeoffs between Shasta Reservoir storage, next year's water temperature management, winter-run Chinook salmon redd dewatering and fall-run Chinook salmon stranding and redd dewatering.
Rebalancing between other CVP Reservoirs	Under this conservation measure, Sacramento River flows may decrease in dry years as one approach to conserving storage in Shasta Reservoir and operate the temperature control device (TCD) to target 53.5° F upstream of CCR for the most critical period during the winter-run Chinook salmon spawning and egg incubation period to avoid critical loss of winter-run Chinook salmon population. Reclamation will reduce Shasta Reservoir releases for water supply (CVP allocations) to only that needed for meeting public health and safety demands, including minimum salinity levels in the Delta.
Limitation on CVP Allocations for End of September Storage	Under this conservation measure, Reclamation may consider water supply reductions in dry water years. Reclamation will reduce Shasta Reservoir releases for water supply (CVP allocations) to only that needed for meeting public health and safety demands, including minimum salinity levels in the Delta. Reclamation, through coordination with the SHOT, will identify moderate and heavy system-wide tradeoffs with the goal of conserving storage and meeting minimal water temperature objectives. This action attempts to increase end of water year storage for Shasta Reservoir by reducing spring and summer flows. In extremely dry years or in multi-year droughts, it is possible that these actions will not achieve an End-of-September storage above 2.0 million-acre feet (MAF).

Conservation Measure	Description/Objective
Modifications to Water Transfers	Under this conservation measure, Reclamation may request that the SRSC shift timing of delivery of transfer water during the typical irrigation season (April through September) to help improve water temperature management and/or protect against winter-run Chinook salmon redd dewatering and fall-run Chinook salmon stranding. Sacramento River flows would increase, and storage in Shasta Reservoir would be reduced. If the SHOT denies water transfers, the water would be delivered, and Shasta Reservoir would have less cold-water pool.
Limitations in SRSC Water Available Under Contract	Under this conservation measure, Sacramento River flows may decrease in the spring, summer, and fall of dry years as one approach to conserving storage in Shasta Reservoir. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, and green sturgeon.
Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs	Under this conservation measure, Shasta Reservoir releases to refuges in the summer and fall may decrease during the driest of years as a way to increase Shasta Reservoir storage. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, and green sturgeon.
Annual Winter-Run Chinook Salmon Broodyear Assessment	Based on the outcome of the broodyear assessment prepared by the Winter-run JPE sub-team, Reclamation, NMFS, United States Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife will convene appropriate technical staff to make recommendations if it is necessary to increase the production of winter-run Chinook salmon associated with the Integrated-Recovery Supplementation Program or take other actions to protect production of winter-run Chinook salmon at the Livingston Stone National Fish Hatchery. USFWS, through coordination with the SHOT, will implement measures as appropriate. The outcome of the broodyear assessment may also be considered in implementing actions within the drought toolkit as described in Section 3.12 Drought of the Proposed Action.
Drought Operations Priority Framework	Under this conservation measure, Reclamation will develop a Drought Emergency Plan that establishes system priorities and a water temperature management plan that seeks to provide winter-run Chinook salmon spawning water temperatures to avoid catastrophic losses related to summer water temperature management with the goal of achieving a projected End-of-September storage as close to 2.0 MAF as possible. Some of the actions that will be included in the Drought Emergency Plan could occur in any month of the year. Sacramento River flows into the Delta would be reduced to conserve storage in Shasta Reservoir. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

Effects on Essential Fish Habitat in the Sacramento River

Pacific Coast Groundfish and Coastal Pelagic Species EFH is limited in the mainstem Sacramento River upstream of the Delta. Specifically, the upstream extent of Coastal Pelagic Species EFH is delineated around river mile 4, near Sherman Island, well within the legal Delta. Pacific Coast Groundfish EFH extends further upstream to river mile 144, near Colusa, California. The downstream portions are more tidally influenced (e.g., river mile 46, near Freeport, California). HAPCs for Pacific Coast groundfish are estuaries, rocky reefs, canopy-forming kelp, seagrasses, and areas of interest (PFMC 2024b), with only the former of those, the estuaries HAPC, existing in the lower Sacramento River. Of the species managed under the FMP, Elasmobranchs are generally limited to San Francisco Bay, and groundfish and rockfish are nearly exclusively marine. Even euryhaline species, such as Starry flounder, which can be found in the spring as young-of-year in salinities less than 2 parts per thousand (ppt), have not been found more than 75 miles from the ocean. Therefore, estuarine habitat, a crucial environment for groundfish in inland areas, is generally absent in the Sacramento River upstream of the San Francisco Bay Delta, except under very specific flow conditions. Consequently, groundfish species, which rely on these habitats, are unlikely to inhabit the marginal EFH that might exist in these upstream locations. Given the lack of suitable habitat and the low probability of groundfish presence there, NMFS has determined that the proposed action will not result in adverse effects to Pacific Coast groundfish EFH.

The Chinook salmon HAPCs that occur within the Sacramento River include complex channels and floodplain habitats, thermal refugia, and spawning habitat. Various HAPCs are present from Keswick Dam, river mile 302, downstream through the San Francisco Bay Delta, and additionally found in some tributaries and watersheds adjacent to the mainstem Sacramento River. Complex channels are rare on such a heavily managed river, but present in flood bypasses. Thermal refugia is most prevalent upstream, influenced by cold water releases in the spring and summer from Shasta Reservoir. Based on the best available information, NMFS concludes that the following adverse effects on EFH designated for Chinook salmon are reasonably certain to occur:

Effects to Redd Quality

Seasonal operation of Shasta and Keswick dams, as described in the final PA (Reclamation 2024d), include controlling flow and water temperatures in the upper Sacramento River where all runs of Chinook salmon spawn. These operations affect the complex channels and floodplain habitats, and spawning HAPCs. The seasonal flows modeled under the proposed action in the Sacramento River at Keswick Dam are very similar to the observed managed flows in most months under current operations, which both show high summer and early fall flows with lower flows in the winter and spring. Depending on the time of year, higher flows may negatively impact spawning and egg/alevin incubation. If flows are too high, they may result in depths and flow velocities in excess of suitable flows for constructing redds, and for redds that were already constructed, which may be at risk of being scoured from the bed (NMFS 2017). In addition, adults may construct redds under high flow conditions and in areas that are later dewatered or isolated from the main river channel when the flows decline.

Likewise, low flow conditions during the late fall and winter in the spawning reaches of the upper Sacramento River could have a number of negative effects on spawning, egg incubation, and alevins. As described by Windell et al. (2017), potential adverse effects of low flows on eggs and alevins include: an insufficient area of riverbed with suitable attributes to accommodate redds for all spawning-ready fall-run and late fall-run Chinook salmon adults; inadequate flow velocities to flush sediments from the redds; insufficient flow to maintain adequate levels of dissolved oxygen in contact with eggs and alevins in the redds and to flush metabolic wastes from the redd; and insufficient water depths for redds, such that minor reductions in flow result in redd stranding and dewatering.

Overall, NMFS considers the effects of seasonal operations on EFH as being both positive and negative. Seasonal operations where Reclamation builds storage enables Reclamation to make summer releases at a suitable temperature for winter-run Chinook salmon spawning and egg incubation. Conversely, reducing releases in the fall, winter, and spring can limit the available spawning and rearing habitat for fall-run and late fall-run Chinook salmon, negatively impacting EFH. Central Valley spring-run Chinook salmon adults are less frequently detected spawning in the Sacramento River, but juveniles emerging from tributaries can benefit from proposed action flows in the complex channels and floodplain habitats in the mainstem for rearing and outmigration.

Effects to Outmigration Cues

Reclamation proposes to implement spring pulse flows under certain hydrologic conditions to improve the survival of out-migrating juvenile salmon, especially CV spring-run, fall-run, and late fall-run Chinook salmon. These actions affect the complex channels and floodplain habitats, and spawning HAPCs. A spring pulse flow is expected to result in increased survival of juvenile salmon by mimicking the natural hydrologic cues that trigger salmon outmigration (Kjelson *et al.* 1981). NMFS considers this action component to provide a benefit to Chinook salmon EFH, as it would increase survival of out-migrating juveniles by improving the migration corridor function of the mainstem Sacramento River. However, in years with low End of September storage, the prescribed low flows during the late fall and winter can have a negative effect on downstream migration of juvenile salmon. An assessment of mark-recapture survival model runs in the mainstem Sacramento River revealed that of the numerous mortality factors considered, spanning multiple spatial scales, increasing flow correlated most strongly with increasing out-migration success (Iglesias *et al.* 2017). This assessment focused on hatchery-origin Chinook salmon, but it provides additional evidence that flow is one of the most important factors affecting overall survival of Chinook salmon in the Central Valley (Kjelson and Brandes 1989, Zeug *et al.* 2014, Michel *et al.* 2015).

Water Temperature

Temperature management actions affect the thermal refugia, and spawning HAPCs. The temperature targets, associated with implementation of the Shasta Management Framework bin strategy, are described in Table 4.

Table 4. Shasta Management Framework Goals, Objectives and Indicators. Source: summarized from Reclamation (2023-2024). See also Section 3.2 Framework Approach of the BA for descriptions of Bins (Reclamation 2024d)

	Bin 1a	Bin 1b	Bin 2a	Bin 2b	Bin 3a	Bin 3b
Estimated Frequency	80% of Years		~11.5% of Years		~8.5% of Years	
Biological Objective	Enhance		Recover	Maintain	Protect	
Biological Goals	• Maximize species recruitment opportunities • Increase spatial diversity • Maximize floodplain linkages • Enhance ecological flows • Increase available habitat for fall-run Chinook salmon in the fall and winter months		• Maintain or maximize species recruitment opportunities with some reduction in spawning habitat compared to Bin 1 • Maintain or restore river function and key floodplain linkages • Restore key ecological flows		• Avoid critical loss of population • Maintain key refuges of spawning and early rearing habitat • Avoid catastrophic changes to habitat and impacts to the broodyear	
Temperature Management for Sacramento River winter-run Chinook salmon	Manage spawning habitat		Manage the majority of spawning habitat		Manage spawning habitat during the critical periods of the spawning and egg incubation period	
Temperature Target	average daily water temperature of 53.5°F					
Compliance Point	Downstream of the CCR (Sacramento River above Clear Creek) gauge		At the CCR gauge		Upstream of the CCR gauge	
Temperature Dependent Mortality Target	≤3%				≤30%	

NMFS acknowledges that the limited cold-water pool is maximized each year to ensure that suitable spawning and incubation conditions are available to endangered winter-run Chinook salmon in the upper Sacramento River from May 15 through October 31. Relative to current operations, the proposed action and the Cold-Water Pool Management action component would provide a benefit to winter-run Chinook salmon and Chinook salmon EFH generally during the time that Reclamation is able to provide suitable temperatures. However, the use of cold-water reserves for winter-run Chinook salmon through the summer would impact those spring-run and fall-run Chinook salmon spawning later in the season in October and beyond, since the cold water is typically used up by the end of the temperature management season. The effect of the Cold-Water Pool Management on Chinook salmon EFH is both positive and negative, where Reclamation is able to selectively improve access to spawning habitat and thermal refugia during the specific periods of winter-run Chinook salmon spawning in the spring, but where late-summer and fall periods would be subject to reduced access and degraded thermal refugia for spring-run and fall-run Chinook salmon run spawning.

Stranding and Dewatering

Under the proposed action, Reclamation proposes to adjust fall flows based on Shasta Reservoir storage to avoid dewatering winter-run Chinook salmon redds and cold-water pool impacts. Higher flows during the October to November period could increase the available spawning habitat that would benefit fall-run Chinook salmon redds. These actions affect the thermal refugia, and spawning HAPCs. Currently, Reclamation lowers flows in the early fall period in order to conserve water for spring cold-water pool. This can result in dewatering fall-run Chinook salmon redds that were constructed at higher flows when Reclamation was keeping flows higher to minimize dewatering winter-run Chinook salmon redds. Therefore, this action component could potentially benefit fall-run Chinook salmon in years where Reclamation ends the water year with high storage in Shasta Reservoir.

Additionally, as part of the Fall and Winter Refill and Redd Maintenance proposed action component, Reclamation would assess the water demands of the upstream CVP contractors and the Sacramento River Settlement Contractors to better coordinate water deliveries and minimize significant flow fluctuations. Typically, Sacramento Valley rice growers will flood their fields in the fall after the year's harvest to help decompose crop residue (e.g. rice hulls and straw) which can otherwise impede seedbed preparation and contribute to disease and weed problems. The water required for rice decomposition can pose a sudden demand on the system, which in turn can cause significant fluctuation in river flow. Coordinated (i.e. smoothed) diversions in late October and early November could provide increased reliability that target flows would be met according to the Fall and Winter Refill and Redd Maintenance operations. Because NMFS assumes that the minimum flows identified in the proposed action for this season would be achieved, this action component would, therefore, provide greater certainty that Reclamation would be able to reduce releases gradually to meet the base flows according to the Fall and Winter Refill and Redd Maintenance action component. Considering that this action component would contribute to stabilizing flows and increase the reliability of the Fall and Winter Refill and Redd Maintenance action component, the effects of the Rice Decomposition Smoothing are positive for Chinook salmon EFH.

Essential Fish Habitat Conservation Recommendations for the Sacramento River

As described in the above effects analysis, NMFS has determined that the proposed action would adversely affect EFH for Chinook salmon in Sacramento River. NMFS provides the following conservation recommendations to avoid, minimize, mitigate, or otherwise offset the effects of the proposed action on the spawning, complex channels and floodplain habitats, and thermal refugia HAPCs.

Sacramento River Conservation Recommendation 1

To address the potential adverse effects to Chinook salmon spawning habitat related to seasonal operations, NMFS recommends Reclamation operate facilities to maintain flow conditions adequate enough to provide for a properly functioning channel, geomorphology, and spawning conditions. This could include future spawning bed quality surveys, identifying geomorphic flows to achieve gravel transport and full-scale bed mobilization, and leveraging the latest bathymetric data in order to identify Keswick releases that could improve spawning habitat.

Sacramento River Conservation Recommendation 2

NMFS recommends that Reclamation works with the Fish Agencies and Sacramento River Group (SRG) to consider fall-run Chinook salmon needs, specifically the spawning habitat HAPC, in Shasta operations. For example, Reclamation could request that the SRG water operations consider needs of fall-run Chinook salmon spawning and incubation when setting temperature compliance points, flows to avoid redd dewatering, and system-wide tradeoffs. Decision support tools, such as incorporating characterization of fall-run Chinook salmon egg-to-fry survival and redd dewatering can help inform temperature management plans. In addition, to address impacts to the thermal refugia HAPC, Reclamation could coordinate with the SRG to explore late summer and early fall pulse flows from Keswick and Shasta dams to reduce water temperatures. These pulse flows are intended to temporarily break downstream thermal barriers in the adult migratory corridor to allow fish passage upstream to existing cooler areas of the river and increase natural origin fall-run Chinook salmon juvenile survival (Michel *et al.* 2023). A related pulse flow has been implemented to support juvenile spring-run Chinook salmon survival in late spring; this action could potentially be modified to also increase survival of fall-run Chinook salmon.

Sacramento River Conservation Recommendation 3

NMFS recommends Reclamation establish a process through the SRG to reduce the potential for redd dewatering for winter-run Chinook salmon and fall-run Chinook salmon. For example, preventing higher mid-summer flows than necessary during the peak of winter-run Chinook salmon spawning both reduces winter-run Chinook salmon redd dewatering later in the season and thereby makes it easier to stabilize flows for fall-run Chinook salmon spawning and prevent their subsequent redd dewatering. This planning and smoothing out of peak summer flows, when possible given other operational constraints, would benefit the spawning HAPC for winter-run and fall-run Chinook salmon.

Clear Creek Proposed Action

Clear Creek, originating in the Trinity Mountains, is a tributary to the Sacramento River downstream of Keswick Dam. Whiskeytown Reservoir and Dam demarks the Upper and Lower Clear Creek. Lower Clear Creek provides spawning habitat for Chinook salmon that no longer have access to Upper Clear Creek, including spring-run, fall-run, late fall-run, and occasionally winter-run Chinook salmon.

The proposed action components for Clear Creek include a new seasonal flow schedule and revised temperature management (Table 5), as well as ongoing channel maintenance and spring attraction pulse flows (Table 6).

Reclamation proposes to provide seasonally variable instream Clear Creek flows from Whiskeytown Dam to emulate natural processes. Reclamation, with input from the Clear Creek Technical Team (CCTT), will schedule the hydrograph to maximize multi-species benefits, with low flows of approximately 100 cfs in the summer to 300 cfs in the winter. During Critical water year types, flows may be reduced based on available water from Trinity Reservoir.

Reclamation proposes to manage Whiskeytown Dam releases to meet a daily average water temperature of 61°F from June 1 through August 15, 60°F from August 16 through September 15, and 56°F or less from September 16 through November 15 at the Igo stream gauging station on Clear Creek. During Critical water years, Reclamation will operate to as close to these temperatures as possible, but acknowledges temperature criteria may not be met.

Reclamation proposes to release up to 10 thousand acre-feet (TAF) from Whiskeytown Dam for both spring attraction and channel maintenance (during dry or wetter years) pulse flows, except in years with significant uncontrolled spill. We incorporate by reference here the more detailed explanation of the proposed action in Reclamation's final PA (Reclamation 2024d).

Table 5. Action Components of the Proposed Action for Clear Creek.

Action Component	Proposed Action
Water temperature management	Reclamation proposes to manage Whiskeytown Dam releases to meet the following daily average water temperatures at the U.S. Geological Survey (USGS) Igo stream gauge station: ● 61°F from June 1 through August 15 ● 60°F from August 16 through September 15 ● 56°F from September 16 through November 15
Minimum instream (seasonally oscillating) flows	Seasonally oscillating flows, generally between 100 and 300 cfs. Refer to section 3.5 of the final proposed action for more details (Reclamation 2024d).
Channel maintenance and spring attraction pulse flows	Reclamation will release up to 10 thousand acre-feet from Whiskeytown Dam for a channel maintenance pulse flow, spring attraction pulse flows, and other physical and biological objectives (except in years with significant uncontrolled spill). The pulse flows (scheduled on or after February 1) will not exceed the current safe outlet works capacity of 840 cfs.
Temporary weir	A temporary weir is placed in late-August to early-November to physically separate fall-run from spring-run Chinook salmon during spawning to minimize hybridization and redd superimposition.

Table 6. Proposed Conservation Measures for Clear Creek (Appendix H, Reclamation 2023-24)

Conservation Measures	Description/Objective
Down ramping rate of no more than 25 cfs per hour	Down ramping rates would minimize the rate of flow decreases during controlled flow reduction, minimizing the risk of juvenile and yearling salmonids being stranded.
Minimum instream flows	Providing minimum instream flows would help provide refuge habitat, food availability and quality, and reduce predation and competition for juvenile and yearling salmonids.
Pulse flows	Reclamation and Department of Water Resources propose to continue channel maintenance and spring attraction pulse flows. However, the total volume available for channel maintenance pulse flows will be reduced and will not occur in Dry and Critical water year types.
Water temperature management	Provide suitable water temperatures for spawning, holding, and rearing Chinook salmon.

Effects on Essential Fish Habitat for Clear Creek

Chinook salmon EFH impacted by the proposed action includes Lower Clear Creek to the confluence with the Sacramento River. The Pacific Coast salmon HAPCs that occur within Lower Clear Creek include: (1) complex channels and floodplain habitats, (2) thermal refugia, and (3) spawning habitat. Based on the best available information, NMFS concludes that the proposed action would adversely affect EFH for Pacific Coast salmon in Clear Creek. We conclude that the following adverse effects on EFH designated for Chinook salmon are reasonably certain to occur.

Impacts to Substrate Quality and Quantity from Managed Flows

The operation of Whiskeytown Dam contributes to the decrease in magnitude and frequency of flood flows and decreases the downstream movement of sediment and large woody debris. Those effects are expected to continue under the proposed action, with the decreases in the magnitude and frequency of flood flows largely being attributed to proposed operations. The reductions in sediment and large woody debris recruitment limits the natural creation of complex channels and floodplain habitats important for spawning and rearing by trapping sediment, nutrients, and organic matter, creating pools, sorting gravels, and providing cover for salmon (Appendix A to the Pacific Coast salmon FMP, PFMC and NMFS 2014a). Physical responses to altered flow regimes include the deposition of fine sediments in gravel; channel stabilization and narrowing; reduced channel complexity such as the formation of point bars, secondary channels, oxbows, and changes in channel planform; downstream channel erosion; and reduced floodplain connection (Poff *et al.* 1997). These hydrologic effects are expected to continue as a result of proposed action operations. Although these effects are somewhat offset during temporary pulse flows, these responses continue to adversely affect the complex channels and floodplain habitats HAPC.

Due to proposed channel maintenance pulse flows, the adverse effects on the complex channels and floodplain habitats HAPC will be reduced over time as a result of enhancements of riparian floodplain habitat. Channel maintenance pulse flows are likely to improve the salmon spawning HAPC by mobilizing and dispersing gravel, and reducing fine sediment, depending on the frequency of occurrence and magnitude of flow. Spring attraction pulse flows are expected to improve conditions for adult spring-run Chinook salmon migrating upstream towards spawning grounds.

Water Temperature Effects from Water Operations

The thermal refugia HAPC provides areas to escape warm water temperatures, and is critical to Chinook salmon survival. These areas include cool water tributaries, lateral seeps, side channels, tributary junctions, deep pools, areas of groundwater upwelling and other areas that are cooler than surrounding waters. They can occur at spatial scales ranging from entire tributaries to highly localized pockets of water embedded within larger rivers (Appendix A to the Pacific Coast salmon FMP, PFMC and NMFS 2014a).

Reservoir operations are expected to affect water temperatures in Clear Creek, including the thermal refugia HAPC. Controlled reservoir releases minimize large flood events and other

natural flows that would inundate floodplain habitat, recharge groundwater, and would aid in maintaining cooler water temperatures. The proposed action includes summer water temperature management (≤61°F from June 1 to August 15 and ≤60°F from August 16 to September 15) and fall water temperature management (≤56°F from September 16 to November 15). Daily average water temperatures have historically remained below 60°F at Igo during the summer temperature management period. With the new proposed flow schedule, flows will be lower during the summer, and it may be more difficult to keep water temperatures below 60°F. Increased water temperatures are likely to result in reduced dissolved oxygen. Typically, during the fall spawning period, water temperatures have exceeded 56°F in most years. The 56°F daily average water temperature has been determined to be suboptimal, and would likely lead to mortality of incubating eggs and reduced survival (Myrick and Cech 2004, Martin *et al.* 2017). During the beginning of the 56°F water temperature objective period, the proposed action is expected to adversely affect the spawning HAPC for Chinook salmon.

NMFS expects the proposed change in minimum instream flows, which includes decreasing flows in summer and increasing flows in winter and spring, to improve the availability of cooler water in Clear Creek during the 56°F water temperature objective period, which starts in mid-September. This threshold will be most difficult to meet during Critical years. Typically, in October and November, the 56°F water temperature objective is more readily met due to decreasing air temperatures. Although the proposed action will continue water temperature management releases, available thermal refugia and spawning HAPCs for Chinook salmon in Clear Creek will likely continue to be limited by controlled reservoir releases.

Benthic Disturbance and Passage Blockage

A temporary weir is installed between the Gorge Cascade and Clear Creek Road Bridge (approximately river mile 8) each year to physically separate fall-run Chinook salmon from spring-run Chinook salmon, to minimize the risk of hybridization and redd superimposition. Installation of the weir is expected to disturb the benthic community in a small portion of the creek where the weir will be placed and where crew will be entering the creek while placing the structure. Habitat restoration activities are also likely to result in disturbance to the creek channel bottom. These disturbances could physically impact the benthic community and reduce foraging organisms in the immediate area. After the weir is removed, benthic organisms are expected to recover rapidly in the disturbed area due to the small footprint. NMFS expects that the effects of disturbance to the benthic community from the Project's weir installation will be minor.

Although the weir minimizes the risk of hybridization between fall-run and spring-run Chinook salmon, the weir physically blocks fall-run Chinook salmon adults from accessing upstream spawning habitat. This results in fall-run Chinook salmon spawning below the weir, in waters which may be less suitable than in reaches further upstream. This benefits the spawning HAPC for spring-run Chinook salmon, but negatively impacts the spawning HAPC for fall-run Chinook salmon. Fall-run Chinook salmon adults are likely to be exposed to warmer water temperatures and may not have access to suitable spawning substrate. Substrate in Lower Clear Creek is still recovering from debris from the 2018 Carr Fire, and spawning habitat throughout Lower Clear Creek is still limited for both fall-run and spring-run Chinook salmon (Reclamation 2024b).

We incorporate by reference here, Section 3.13.3.3 of the final PA (Reclamation 2024d), which mentions habitat restoration on Clear Creek. Any construction related to restoration projects have the potential to temporarily disturb the creek channel and benthic community, as well as potentially limit passage, depending on the timing and duration of construction activities.

Spawning Habitat Availability

Spawning habitat typically consists of low gradient stream reaches, containing clean gravel with low levels of fine sediment and high intergravel flow. The natural recruitment of spawning habitat substrate has been impacted by Whiskeytown Dam. Maximum available spawning habitat for fall-run Chinook salmon is achieved at approximately 300 cfs (USFWS 2015). Under the proposed action, flows will be low during August to mid-November (100 to 200 cfs released from Whiskeytown Dam) (section 2.5.3, Reclamation 2023-2024). Since flows would be increasing in the fall, spring-run Chinook salmon eggs and emerging fry would experience increased habitat and cooler temperatures, as described in section 7.2.1.3. of the Biological Opinion (NMFS 2024).

Proposed channel maintenance and spring attraction pulse flows under the proposed action represent less than 30% of the flow needed to transport sediment in the absence of flows from downstream tributaries (Whiskeytown releases up to approximately 840 cfs). As a result, effects of these flows are expected to be of low magnitude and occur with low frequency. Based on redd timing, fall-run and late fall-run Chinook salmon eggs and emerging fry would be exposed to the effects of these pulse flows, which could affect the spawning HAPC for fall-run and late fall-run Chinook salmon. Pulse flows may displace incubating eggs from redds, resulting in exposure to predation, abrasion, and increased water temperature if transported out of suitable habitat. For more details on the effects analysis of salmonid critical habitat in Clear Creek, refer to section 7.2.2 of the Biological Opinion (NMFS 2024).

Essential Fish Habitat Conservation Recommendations

As described in the above effects analysis, NMFS has determined that the proposed action would adversely affect EFH for Chinook salmon in Clear Creek. NMFS provides the following conservation recommendations to avoid, minimize, mitigate, or otherwise offset the effects of the proposed action on the spawning, complex channels and floodplain habitats, and thermal refugia HAPCs.

Clear Creek Conservation Recommendation 1

NMFS recommends that Reclamation work with Fish Agencies and the CCTT to determine how to manage releases from Whiskeytown Dam to provide suitable water flows for all life stages of Chinook salmon, including fall-run Chinook salmon, to reduce stranding and isolation, protect incubating eggs from being dewatered, promote habitat quality and availability, and assess whether Clear Creek flows or pulse flows should be further modified to reduce adverse impacts on Chinook salmon. For example, Reclamation, with input from the CCTT, could explore releasing pulse flows in the late summer-early fall to improve conditions for fall-run Chinook salmon. Providing adequate flows for migration, mobilization of spawning gravels, and

providing suitable water temperatures would improve spawning and thermal refugia HAPCs, and would increase the likelihood that Chinook salmon populations persist.

Clear Creek Conservation Recommendation 2

NMFS recommends Reclamation develops water temperature models to improve Clear Creek water temperature management, as described in section 6.1.4.1.2 of the BA (Reclamation 2023-2024), to improve fall water temperature management closer to optimum water temperatures for all life stages of all Chinook salmon in Clear Creek.

Clear Creek Conservation Recommendation 3

NMFS recommends Reclamation develop a new spawning gravel budget and implement a long-term gravel augmentation plan in Clear Creek, including acquisition of a long-term gravel supply, which would benefit Chinook salmon EFH, including spawning HAPC. Gravel augmentation increases the quality and quantity of salmon spawning habitat, and would help address fine sediment deposition in gravel caused by the proposed action. This would also benefit fall-run and late fall-run Chinook salmon spawning habitat.

Clear Creek Conservation Recommendation 4

For construction effects associated with habitat restoration, NMFS recommends implementing appropriate BMPs for Clear Creek using the BMPs described in NMFS's Biological Opinion for the NOAA Restoration Center's Program to Facilitate Implementation of Restoration Projects in the Central Valley of California (NMFS 2018). Reclamation should implement the BMPs that are most protective of aquatic habitats, such as minimizing disturbance to existing riparian vegetation, minimizing the application of herbicide, and providing fish passage during construction.

Clear Creek Conservation Recommendation 5

NMFS recommends that Reclamation develop a plan that identifies and prioritizes projects that restore the creek channel closer to natural conditions, and submit that plan to NMFS. Restoration projects would ideally include incorporating large woody debris that would naturally occur in Clear Creek without the proposed action. Implementing projects that have restoration components would improve the spawning and the complex channels and floodplain habitats HAPCs for all Chinook salmon that spawn and rear in Clear Creek.

American River Proposed Action

Reclamation operates and maintains the American River Division of the CVP for flood control, municipal, industrial and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and Delta water quality. Facilities include Folsom Dam, its reservoir (977 TAF capacity), power plant, temperature control shutters on the power plant, and the Joint Federal Project auxiliary spillway, as well as the Nimbus Dam, Lake Natoma, Nimbus Power Plant, and Folsom South Canal. Folsom Reservoir is the largest storage and flood control reservoir on the American River.

Reclamation proposes to meet water rights, contracts, and agreements that are both specific to the American River Division as well as those that apply to the entire CVP, including the Delta Division. For Lower American River flows (below Nimbus Dam), Reclamation proposes to adopt the American River Minimum Flow Schedule (ARMFS). Flows range from 500 to 2,000 cfs based on time of year and annual hydrology. Notably, the Minimum Release Requirement (MRR) for January will be determined using the Sacramento River Index, while the American River Index will be used for the remaining months, both with a 90% exceedance forecast. These indices will be based on the first Bulletin 120 of each year, in February, then updated with each subsequent month's Bulletin 120, until a final MRR is calculated in May for the remainder of the year. When developing the operational forecast, Reclamation will evaluate an end-of-December Folsom storage of at least 300 TAF, though Reclamation acknowledges that in some years, operational constraints may result in an end-of-December storage of less than 300 TAF.

Key differences between the ARMFS and the Modified Flow Management Standard include using a 90% exceedance forecast for MRR calculations instead of 50% or 75%, establishing a defined timeframe for implementing monthly MRRs, evaluating and potentially adjusting MRR calculations in November and December, and removing the offramp and volume offset in the spring pulse flow to provide more flexibility for flow shaping.

The proposed action for the American River in the EFH Assessment (Reclamation 2024c) includes the ARMFS, as well as conservation measures, to mitigate and offset potential negative effects, to listed species and their critical habitats (Table 7 and Table 8). We also incorporate by reference here the more detailed description of the proposed action provided by Reclamation for the ESA consultation on October 23, 2024 (Reclamation 2024d).

Table 7. Action Components from the Proposed Action for the American River.

Action Component	Proposed Action
Minimum Release Requirements and Redd Dewatering Protective Adjustments	Reclamation's American River operations include the American River Minimum Flow Schedule (ARMFS) which is intended to provide water supply reliability and water temperature management for fisheries. The ARMFS uses two hydrological indices to determine Reclamation's Minimum Release Requirement (MRR) from Nimbus Dam. The Sacramento River Index, a monthly forecast of the total unimpaired water year flow volume for key rivers in the region, is used to determine the January MRR. From February to December, the American River Index (ARI) is used to determine the MRRs. The ARI measures the unimpaired inflow to Folsom Reservoir minus certain spilled water. The MRR curves are based on inflection points, and corresponding index values are determined through an iterative process, while target flows are established based on biological considerations. The ARMFS also incorporates Redd Dewatering Protective Adjustments (RDPA) to safeguard the spawning habitats of fall-run Chinook salmon and California Central Valley (CCV) steelhead from redd dewatering due to reductions in MRR.
Spring Pulse Flows	Reclamation will implement a spring pulse flow when the March MMR falls between 1,000 and 1,500 cfs. This pulse flow will peak at three times the March MRR, not exceeding 4,000 cfs, and last for 2 days. The American River Group will provide technical input on flow volumes, while the final timing will be determined collaboratively by California Department of Fish and Wildlife (CDFW), USFWS, and NMFS. Reclamation, through the American River Group, may facilitate additional pulse flows if water is available from non-CVP sources or if release schedules allow for greater flexibility.
Ramping Rates	Reclamation proposes to ramp down releases in the American River below Nimbus Dam at night, if possible. The maximum allowable decrease within a 24-hour period (ranging from 500 to 4,000 cfs) and the maximum change per step (from 100 to 1,350 cfs) vary depending on the starting flow rate (specified in 10 bins from <5,000 to 20,000). As the flow rate decreases, so do the allowable changes, reflecting a more cautious approach at lower flows to minimize impacts on aquatic life. Specifically, daily decreases of 10% or less are allowed under the lowest flow conditions (e.g., 500 out of 5,000 cfs), but that percentage can be as high as 25% (4,000 out of 16,000 cfs) at the upper end.
Water Temperature Management	The Temperature Management Plan aims to maintain optimal water temperatures for both CCV steelhead and fall-run Chinook salmon in the Lower American River. Ideally, daily average temperatures between Nimbus Dam and Watt Avenue would not exceed 65°F for CCV steelhead rearing, especially during the active temperature management season from May 15 to October 31. While temperatures below 56°F are ideal for Chinook salmon spawning, which typically occurs from mid-October to January, the Automated Temperature Selection Procedure prioritizes CCV steelhead rearing during summer months. This system sets monthly water temperature targets at Watt Avenue, ranging from 63°F to 72°F depending on the schedule. Schedule 78 has a water temperature limit of 72°F from May through November. Schedules 2 through 77 each represent a change in a single month's upper-temperature limit by 1°F.

Table 8. Proposed Conservation Measures for the American River (page 24, Appendix H, Reclamation 2023-2024)

Conservation Measure	Description/Objective
Temperature Management Study	Reclamation would manage the Folsom/Nimbus Dam complex and the water temperature control shutters at Folsom Dam to select the lowest schedule given the available quantity and quality of water in Folsom Reservoir, ideally to maintain a daily average water temperature of 65°F (or other water temperature as determined by the temperature modeling) or lower at Watt Avenue Bridge from May 15 through October 31, to provide suitable conditions for juvenile steelhead rearing in the Lower American River, if cold water is available.

Effects on Essential Fish Habitat for American River:

The American River lacks estuarine habitat, a critical component for groundfish survival in inland areas, rendering the river unsuitable for these species. Consequently, groundfish are unlikely to occupy the marginal EFH designated in the American River roughly downstream of Howe Avenue. This absence of suitable habitat and the low probability of groundfish presence leads to the conclusion that the proposed action will not measurably impact Pacific Coast Groundfish EFH. Furthermore, no HAPCs for Pacific Coast groundfish exist in the American River. Additionally, coastal pelagic species EFH does not extend as far upstream as the American River. Therefore, NMFS anticipates no adverse effects on Pacific Coast groundfish EFH or coastal pelagic species EFH from the proposed action.

The Pacific Coast salmon EFH impacted by the proposed action includes the American River from below the Nimbus Dam complex to the confluence with the Sacramento River. The Chinook salmon HAPCs that occur within the American River include complex channels and floodplain habitats, thermal refugia, and spawning habitat. Fall-run Chinook salmon are the most abundant run of Chinook salmon in the American River and all life stages can be found at different times of the year. The American River also supports non-natal rearing of juvenile winter-run and spring-run Chinook salmon (Phillis *et al.* 2018, Day and Morris 2023). Based on the best available information, NMFS concludes that the proposed action would adversely affect EFH for Chinook salmon in the American River. We conclude that the following adverse effects on EFH designated for Chinook salmon are reasonably certain to occur.

Managed Flows

The complex channels and floodplain habitats and spawning HAPCs are affected by reductions in sediment and large woody debris recruitment is also largely a result from the existence of Folsom and Nimbus dams, which are part of the environmental baseline. Those effects are expected to continue under the proposed action, with proposed operations. The current operations of the Folsom and Nimbus dam complex contribute to a decrease in the magnitude and frequency of flood flows and decrease the downstream movement of sediment and large

woody debris. Specifically, the proposed reservoir system operations reduce the movement of sediment and large woody debris downstream. The hydrologic effects of proposed action operations are expected to result in geomorphic responses including the deposition of fine sediments in gravel; channel stabilization and narrowing; reduced channel complexity such as the formation of point bars, secondary channels, oxbows, and changes in channel planform; downstream channel erosion; bed armoring; and reduced floodplain connection (Poff *et al.* 1997, Graf 2006). All of these operations adversely affect the complex channels and floodplain habitats and spawning HAPCs.

Analysis indicates that, due to natural fluvial geomorphic processes, even well-constructed habitat enhancement sites erode quickly because there is no possibility of any recruitment of suitable spawning material from upstream sources (Fairman 2007, Reclamation 2024a). The Lower American River gravel budget must be regularly augmented to sustain the amount of suitable spawning gravel that is available, and more action is needed to increase habitat extent.

Water Temperature

The presence of and role that thermal refugia may play in the quantity and quality of Chinook salmon habitat in the Lower American River is not well understood. Thermal refugia typically include cool water tributaries, lateral seeps, side channels, tributary junctions, deep pools, areas of groundwater upwelling, and other mainstem river habitats that are cooler than surrounding waters (≥3.6° F cooler). Among those habitats, the Lower American River includes side channels and deep pools, but it is unclear if they act as thermal refugia. Given the evidence that Chinook salmon in the Lower American River show signs of thermal stress, it is likely that thermal refugia are lacking. The specific effect that the proposed action will have on thermal refugia is not clear, but stressful water temperatures for adult Chinook salmon in the American River are expected to continue under the proposed action.

Adult fall-run Chinook salmon females experience egg retention or pre-spawning mortality in the American River in most years when water temperatures in the fall migration and staging period are sub-optimal. From 1993 to 2017, the proportion of unspawned females ranged from 3% to 67% and averaged 20%, and the proportion that retained greater than 30% of their eggs ranged from 6% to 80% with an average of 33% (Reclamation 2019). More recent observations have continued this trend, for example, 26% of female carcasses recovered in October 2021 through January 2022 were partially spawned or unspawned (Grimes and Galinat 2022). To help address this impact to fall-run Chinook salmon adults and EFH, the Automated Temperature Selection Procedure (ATSP) aims to provide suitable conditions, to the extent possible, for fall-run Chinook salmon staging and early spawning. However, due to temperature management throughout the summer for juvenile steelhead rearing and limitations of the Folsom-Nimbus selective withdrawal system, providing cool water temperatures below Nimbus Dam for adult Chinook salmon holding and spawning is challenging. For example, historical data show that water temperatures just below Nimbus Dam at the gage near Hazel Avenue seldom fall below 53.5°F before December (for fall-run Chinook salmon in this location it's understood to be a conservative measure below which no temperature dependent mortality is accrued), when seasonal conditions (cooler air temperatures and shorter days) help to bring water temperatures down (Figure 1). Daily average temperatures at the same location and time period also frequently exceed 56.0°F (the lowest October and November target temperature in the ATSP) (Figure 2).

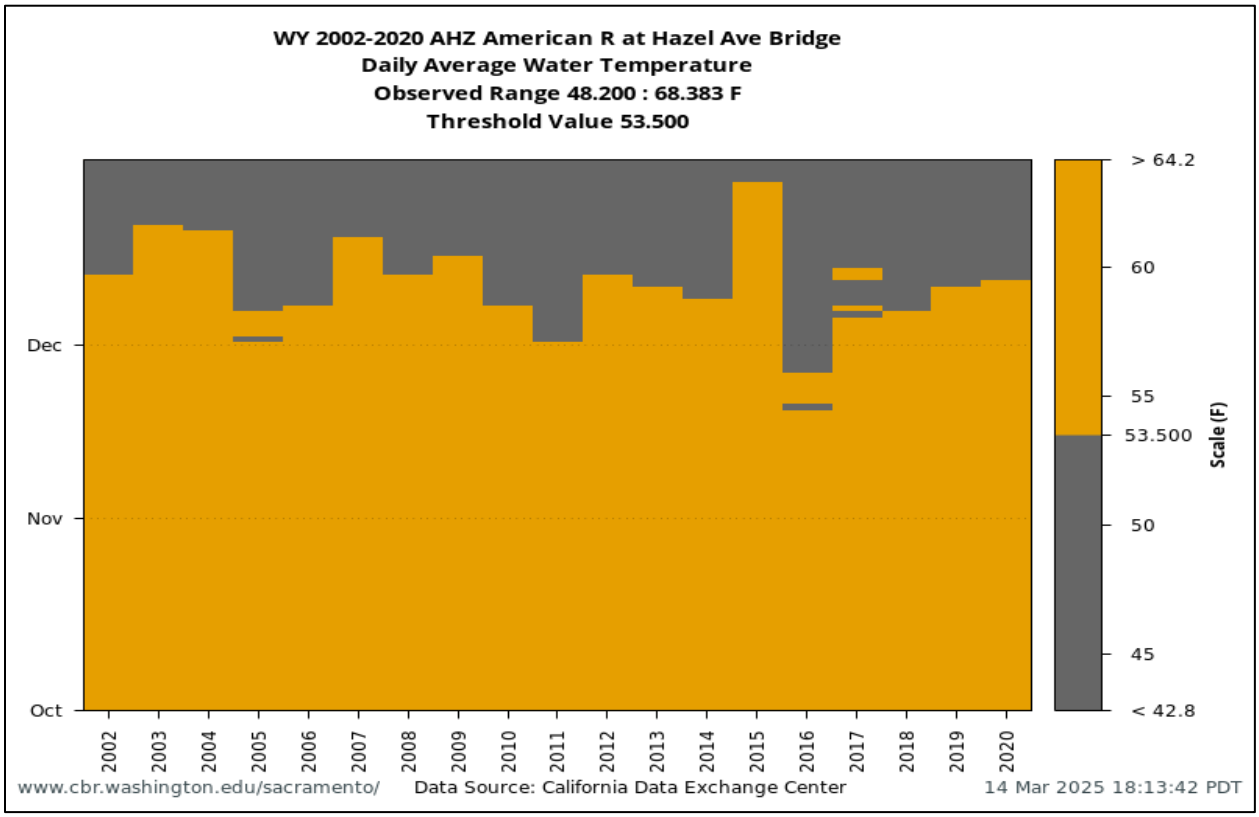

Figure 1. October through December daily average water temperatures in the Lower American River for 2002 through 2020. The color scale indicates water temperature values above (orange) or below (gray) 53.5°F.

Source: SacPAS (University of Washington Columbia Basin Research 2025)

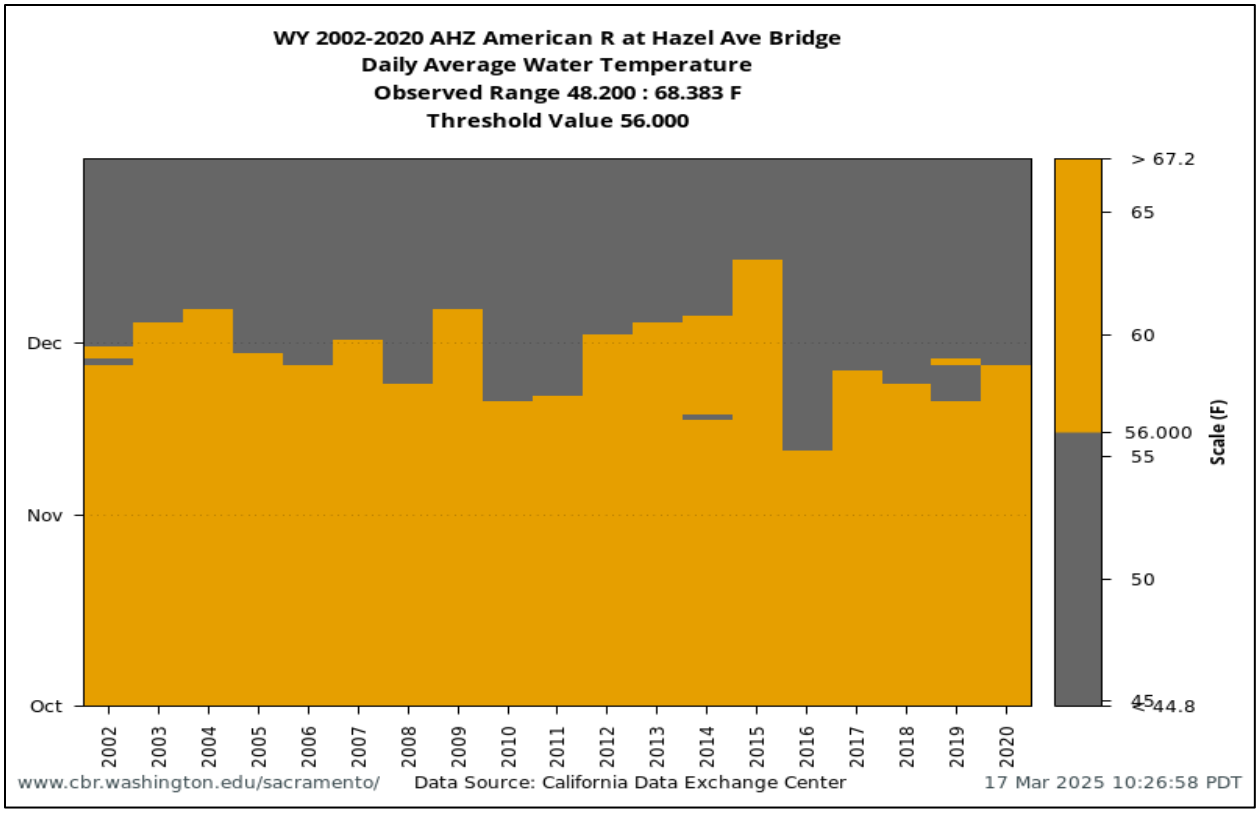

Figure 2. October through December daily average water temperatures in the Lower American River for 2002 through 2020. The color scale indicates water temperature values above (orange) or below (gray) 56° F.

Source: SacPAS (University of Washington Columbia Basin Research 2025)

Spawning Habitat Effects

Spawning habitat consists of the combination of several components including, but not limited to, gravel, depth, flow, temperature, and dissolved oxygen. Among those components, water temperature is the one that the proposed action will have the greatest impact on EFH for Chinook salmon. The proposed action is expected to result in stressful, lethal water temperatures for a relatively large proportion of Chinook salmon spawning and embryo incubation during October and November in the Lower American River. Chinook salmon egg mortality increases as water temperatures warm above 53.5°F (Martin *et al.* 2017, Martin *et al.* 2020). The Lower American River is rarely, if ever, cooler than 53.5°F at Watt Avenue during October and November (Figure 1). In most years, water temperatures at Watt Avenue are above 60°F well into October. The combination of egg retention, pre-spawning mortality, and embryo mortality from warm water temperatures in the Lower American River likely greatly impacts Chinook salmon production. Poor quality spawning habitat is expected to occur under the proposed action because, despite best efforts to protect Chinook salmon spawning, water temperatures in October and November are stressful and lethal every year; and the modeling results presented in the BA (Appendix M Attachment M, Reclamation 2023-2024) suggest that will continue.

The ARMFS is intended to provide suitable habitat conditions for steelhead and fall-run Chinook salmon in the Lower American River. While this element of the proposed action may at times

provide less detrimental spawning and embryo incubation habitat, the many demands affecting operations of the American River Division mean that the overall proposed action is expected to impact spawning habitat for fall-run Chinook salmon. In addition to the water temperature effects described above, salmon spawning habitat will be adversely affected due to flow fluctuations resulting in redd dewatering. Fall-run Chinook salmon eggs and alevins in the American River are vulnerable to dewatering from the time when spawning begins in October through February when fry emergence from the streambed ends (Vogel and Marine 1991, Bratovich *et al.* 2005). The redd dewatering protective adjustments included in the ARMFS help to reduce potential redd dewatering (Appendix M Attachment M, Reclamation 2023-2024).

Low dissolved oxygen levels are another component that has become an emerging stressor on the Lower American River. Dissolved oxygen plays an important role in the survival and healthy development of juvenile CCV steelhead and Chinook salmon eggs in the American River. Low dissolved oxygen levels can cause significant stress and even mortality, particularly in the vulnerable early life stages. The Central Valley Regional Water Quality Control Plan requires dissolved oxygen of at least 7.0 milligrams per liter (mg/L) from Folsom Lake to the Sacramento River. Monitoring in Lake Natoma in 2023 were below this standard, in the 5-6 mg/L range, depending on water depth. Some of the following conservation recommendations are listed to mitigate the effects of the proposed action on dissolved oxygen levels on the spawning HAPC in the Lower American River, which are similar to Term and Condition 3(a) in the Biological Opinion (NMFS 2024).

Essential Fish Habitat Conservation Recommendations for American River:

As described in the above effects analysis, NMFS has determined that the proposed action would adversely affect EFH for Chinook salmon in the American River.

NMFS provides the following conservation recommendations to avoid, minimize, mitigate, or otherwise offset the effects of the proposed action.

American River Conservation Recommendation 1

NMFS recommends that Reclamation develop a gravel budget or utilize an existing and still applicable gravel budget, and augment gravel in accordance with that budget. Gravel and large wood augmentation will help address reductions in channel complexity caused by the proposed action. By setting a consistent sediment budget, using BMPs during construction, and regularly monitoring the suitable gravel between Nimbus Dam and the Sacramento River confluence, these actions can ensure the effectiveness of habitat restoration to restore the complex channels and floodplain habitats HAPC. On a five-year interval, Reclamation should regularly monitor topographic change and evaluate the availability of suitable spawning habitat based on best available scientific methods and data.

American River Conservation Recommendation 2

NMFS recommends that Reclamation implement a power bypass at Folsom Dam in all years as necessary to provide more suitable fall spawning and egg incubation temperatures for Chinook salmon, unless annual September temperature modeling indicate 56°F average daily water

temperature, or lower, could be achieved at Watt Avenue on or before November 1st, without the bypass. NMFS recommends that Reclamation coordinate with the American River Group to develop the water temperature objectives for fall conditions. Additionally, NMFS recommends that Reclamation evaluate implementation of alternative methods to support effective water temperature management in the Lower American River, including infrastructure modifications at Folsom and Nimbus dams, including but not limited to measures evaluated during planning or value engineering studies (Reclamation et al. 2007, Thomas Cook Innovation 2014, LLC).

American River Conservation Recommendation 3

NMFS recommends that Reclamation manage operations on the American River to minimize hypoxic conditions for Chinook salmon migrating and spawning downstream of Nimbus Dam. First, NMFS recommends that dissolved oxygen gauges be installed and made publicly accessible via the California Department Exchange Center (CDEC). These should record dissolved oxygen hourly (or more frequently) and be placed at strategic locations near Nimbus Dam, including the north and south banks of the dam outflow, the hatchery ladder, and between Nimbus Basin and Sailor Bar, since these are where adult Chinook salmon enter the hatchery fish ladder and where a large portion of in-river spawning occurs (Cramer Fish Cramer Fish Sciences 2023, Reclamation 2024a). Reclamation should provide results of this dissolved oxygen monitoring to the American River Group on a monthly basis. Secondly, during the salmon spawning period, Reclamation should consider initiating spilling from Nimbus Dam if dissolved oxygen levels fall below 7 mg/L at any time (the threshold required by the Central Valley Regional Water Quality Control Board (Central Valley Regional Water Quality Control Board [2019]) and open additional gates if levels remain below this threshold after initial spilling. Third, NMFS recommends that Reclamation evaluate potential implementation of alternative methods to support effective management of dissolved oxygen levels in the Lower American River below Nimbus Dam, which could include mechanical means of increasing dissolved oxygen levels (Horne 2019), and report their findings to the American River Group.

Stanislaus River Proposed Action

The proposed action for the Stanislaus River is summarized in Table 9 and Table 10. Reclamation operates to meet water rights, contracts, and agreements that are specific to the East Side Division, including the Stanislaus River. Senior water right holders (Oakdale Irrigation District and South San Joaquin Irrigation District) will receive annual water deliveries consistent with the 1988 Agreement and Stipulation, and water will be made available to CVP contractors in accordance with their contracts and applicable shortage provisions. In high storage, high inflow conditions, Reclamation will operate for flood control in accordance with the U.S. Army Corps of Engineers flood control manual. Because New Melones is a large reservoir relative to its annual inflow, flood control is relatively infrequent; however, Tulloch Lake, located downstream of New Melones Reservoir, is subject to high local inflows, and may be in flood control operations for brief periods when New Melones Reservoir is not. During these periods, releases from Tulloch Lake may be used to meet flow objectives, schedules, or requirements on the lower Stanislaus River below Goodwin Dam.

Table 9. Action Components of the Proposed Action for the Stanislaus River.

Action Component	Proposed Action
Seasonal Operations	Releases for water rights, contracts, reservoir and flood management, other agreements.
Minimum instream flows	2023 Stepped Release Plan, with water year type determined by San Joaquin Valley "60-20-20" Water Year Hydrologic Classification based on the 90% exceedance forecast.
Ramping rates	Flow changes follow specified ramping rates, with some exceptions allowed for on case-by-case basis.

Table 10. Proposed Conservation Measures for the Stanislaus River.

Conservation Measure	Description/Objective
Minimum instream flows and Ramping rates	Implement the 2023 Stepped Release Plan and specified ramping rates.
Spring pulse flows, fall pulse flows, and winter instability flows	Implement pulse flows consistent with the 2023 Stepped Release Plan.
Stanislaus River Water Temperature Management	Reclamation will continue to study approaches to improving temperature for listed species on the lower Stanislaus River, to include evaluating the utility of conducting temperature measurements/profiles in New Melones Reservoir.

Effects on Essential Fish Habitat for Stanislaus River:

As described in Table 1, EFH for Pacific Coast groundfish and coastal pelagic species is not present in the Stanislaus River. Pacific Coast salmon EFH impacted by the proposed action includes the Stanislaus River from below Goodwin Dam to the confluence with the San Joaquin River. HAPCs that occur within the Stanislaus River include complex channels and floodplain habitats, thermal refugia, and spawning habitat. Based on the best available information, NMFS concludes that the proposed action would adversely affect EFH for Pacific Coast salmon in the Stanislaus River. We conclude that the following adverse effects on EFH designated for Chinook salmon are reasonably certain to occur:

Rearing & Migratory Habitat

Water management for flood reduction and water supply will continue to disrupt natural processes that form complex channels and inundate floodplain habitats that support juvenile Chinook salmon rearing and migration (Poff *et al.* 1997, Yarnell *et al.* 2015). Simplified channel form and managed flows also reduce the recruitment of riparian vegetation and large trees such as cottonwoods, which in turn reduces the amount of large woody debris in the river and

associated complex habitats. Potential thermal refugia such as deeper pools or shaded banks are more limited in a simpler, incised, channel. Collectively, these impacts to rearing and migratory habitat adversely affect the complex channels and floodplain habitats HAPC and the thermal refugia HAPC.

Water Temperature

Reservoir operations are expected to affect thermal conditions in the Stanislaus River downstream of Goodwin Dam, and temperatures will sometimes be unsuitable for Chinook salmon life stages. We incorporate by reference the analysis of proposed action effects on water temperatures that is provided in Section 7.4.1.3.1.1 (Tables 76, 77, and 78) of the Biological Opinion (NMFS 2024). These water temperature effects will adversely affect the thermal refugia HAPC and the spawning HAPC. As a conservation measure in the EFH Assessment (Reclamation 2024c), Reclamation proposes to study approaches to improving temperature for listed species on the lower Stanislaus River, which include evaluating the utility of conducting temperature measurements/profiles in New Melones Reservoir. This could provide some benefit to EFH for Chinook salmon if options to improve water temperature are implemented. Reclamation also includes a fall pulse flow in the 2023 Stepped Release Plan, which, by increasing thermal mass in the river, tends to cool mean daily and maximum daily water temperatures in river reaches downstream of Goodwin Canyon.

Spawning Habitat

Recruitment of spawning habitat substrate has been impacted by the operation of New Melones Dam, and the spawning HAPC will continue to be impacted by the proposed action. Under the managed hydrograph, recruitment and mobilization of sediments below Goodwin Dam, including appropriately-sized spawning gravels is disrupted (Kondolf *et al.* 2001, Yarnell *et al.* 2015).

Essential Fish Habitat Conservation Recommendations for the Stanislaus River:

As described in the above effects analysis, NMFS has determined that the proposed action would adversely affect EFH for Chinook salmon in the Stanislaus River. NMFS provides the following conservation recommendations to avoid, minimize, mitigate, or otherwise offset the effects of the proposed action.

Stanislaus River Conservation Recommendation 1

NMFS recommends that Reclamation seek to increase opportunities (through easements or other approaches to alleviate concerns related to seepage) to release flows over 1,500 cfs for more than 10 consecutive days, even when not in reservoir or flood management. This would allow extended inundation of higher-level areas at current and future restoration sites; and improve food production, and rearing and migratory habitat in the river and provide the Stanislaus Watershed Team more flexibility to shape water volumes in a manner most beneficial to Chinook salmon EFH. Improvements to rearing and migratory habitat would help to address effects of the proposed action on the complex channels and floodplain habitats HAPC and the

thermal refugia HAPC. If Reclamation accepts this recommendation, NMFS requests an update on implementation by December 31 of even years, starting in 2026.

Stanislaus River Conservation Recommendation 2

NMFS recommends that Reclamation implement gravel augmentation to maintain, or increase, the extent of suitable spawning habitat that is available between Goodwin Dam and Orange Blossom Bridge. One specific suggestion is to renew efforts to place gravel in Goodwin Canyon, either in the float tube pool or at the cable crossing. This would help to address effects of the proposed action on the spawning HAPC. If Reclamation accepts this recommendation, NMFS requests an update on implementation by December 31 of even years, starting in 2026.

Stanislaus River Conservation Recommendation 3

NMFS recommends that, on approximately a five-year interval, Reclamation monitor topographic change and evaluate the availability of suitable spawning and rearing habitat based on best available scientific methods and data. Improvements to rearing and spawning habitat would help to address effects of the proposed action on the complex channels and floodplain habitats HAPC, the spawning HAPC, and possibly (depending on project design) the thermal refugia HAPC. If Reclamation accepts this recommendation, NMFS requests an update on implementation by December 31 of even years, starting in 2026.

San Joaquin River Proposed Action

The San Joaquin River portion of the action area includes the San Joaquin River from the confluence with the Stanislaus River downstream past Vernalis to approximately Mossdale. While no action components such as releases or diversion are initiated within this area, proposed action components that affect flow in the Stanislaus River will affect flow in this area.

Effects on Essential Fish Habitat for the San Joaquin River

As described in Table 1, EFH for Pacific Coast groundfish and coastal pelagic species is not present in the San Joaquin River upstream of the statutory Delta. Chinook salmon EFH impacted by the proposed action includes the San Joaquin River from the confluence with the Stanislaus River downstream past Vernalis to approximately Mossdale. HAPCs that occur within this area include complex channels and floodplain habitats, and thermal refugia. Based on the best available information, NMFS concludes that operations under the proposed action would adversely affect EFH for Chinook salmon in this reach of the San Joaquin River. We conclude that the following adverse effects on EFH designated for Chinook salmon are reasonably certain to occur:

Rearing and Migratory Habitat

Water management for flood reduction and water supply will continue to disrupt natural processes that form complex channels and inundate floodplain habitats that support juvenile Chinook salmon rearing and migration (Poff *et al.* 1997). Simplified channel form and managed flows also reduce the recruitment of riparian vegetation and large trees such as cottonwoods,

which in turn reduces the amount of large woody debris in the river and associated complex habitats. Potential thermal refugia such as deeper pools or shaded banks are more limited in a simpler channel. Collectively, these impacts to rearing and migratory habitat adversely affect the complex channels and floodplain habitats HAPC and the thermal refugia HAPC.

Water Temperature

Thermal conditions in the San Joaquin River are often unsuitable for migrating Chinook salmon. See analysis of proposed action effects on water temperatures in Section 7.4.3.1.1. (particularly Tables 98 and 99) of the Biological Opinion (NMFS 2024). The effects of the proposed action on water temperatures will adversely affect salmon EFH, including the thermal refugia HAPC.

Essential Fish Habitat Conservation Recommendations for the San Joaquin River

As described in the above effects analysis, NMFS has determined that the proposed action would adversely affect EFH for Chinook salmon in the San Joaquin River. NMFS provides the following conservation recommendations to avoid, minimize, mitigate, or otherwise offset the effects of the proposed action.

San Joaquin River Conservation Recommendation 1

NMFS recommends that Reclamation pursue habitat restoration opportunities along the lower San Joaquin River to address effects of the proposed action on the complex channels and floodplain habitats HAPC and the thermal refugia HAPC. For example, shallower rearing areas with riparian vegetation and large woody debris would provide "rest stops" for juvenile salmonids to use for feeding and as refuges from larger visual predators during outmigration. If Reclamation accepts this recommendation, NMFS requests an update on implementation by December 31 of even years, starting in 2026.

San Joaquin River Conservation Recommendation 2

NMFS recommends that Reclamation support, specifically, habitat restoration efforts that increase food production. Since higher food supply can help to offset thermal stress, this would further address effects of the proposed action on the thermal refugia HAPC. If Reclamation accepts this recommendation, NMFS requests an update on implementation by December 31 of even years, starting in 2026.

Sacramento-San Joaquin Delta Proposed Action

The Sacramento-San Joaquin Delta (Delta) includes portions of the Lower Sacramento River and San Joaquin River as well as portions of Suisun, Honker, and Grizzly bays. It is characterized by freshwater inflows from the two main river systems (Sacramento and San Joaquin rivers) as well as numerous other tributaries, including the Mokelumne, Cosumnes, and Calaveras rivers. Salinity in the Delta region forms a continuum from full freshwater in the upper Delta locations to full marine salinity in the San Francisco Bay Estuary to the west. The estuarine portion of the Delta occurs where salinity is greater than approximately 0.5 ppt and under most hydrologic conditions occurs downstream from approximately Rio Vista on the Sacramento River, and

Jersey Point on the San Joaquin River. This spectrum of salinity gradients allows for multiple fish species to be present in the Sacramento-San Joaquin Delta and San Francisco Bay Estuary, ranging from marine species, to fully freshwater species, and includes multiple species tolerant of varying salinity habitats.

The majority of the Delta region is tidally influenced, as shown by tidally driven river stage changes, which can extend upriver for considerable distances. These changes in water surface elevations in the Delta region occur under most riverine inflow conditions, except for the very highest flood flows. The influence of tidal forcing on the direction and magnitude of flows in channels of the Delta depends on the phase of the tide (i.e., flood or ebb), lunar phase (i.e., spring versus neap tides), elevation above sea level, and riverine inflows into the Delta. In most areas of the Delta, reversal of flows within the Delta channels occurs with the changing phases of the tides. Under natural conditions in tidal regions with bidirectional flows, flood tides will cause the water within most Delta channels to move upstream, and subsequently to flow downstream upon an ebb tide. In those regions where flows are dominated by riverine conditions, flows are unidirectional but may change in magnitude during the tidal cycle.

The Delta has approximately 700 miles of waterways consisting of both natural channels and manmade-constructed channels. These waterways surround more than 60 leveed tracts and islands. Over 1,100 miles of constructed levees protect farmland, cities, and rural communities from flooding in the Delta region. However, the construction of these protective levees has disconnected the adjacent historical floodplains from their associated Delta waterways. Almost all of the shoreline habitat in the Delta consists of armored levees to prevent erosion, which has substantially reduced the presence of any riparian habitat along the waterside of the levees. The current Delta consists of highly modified aquatic habitat, most of which has severely reduced ecological function for native species, including Chinook salmon.

Reclamation proposes to continue to operate the CVP and SWP facilities in the Delta to provide for delivery of water supply to areas adjacent to, and south of the Delta (see Table 3-12 in Reclamation 2024d). We incorporate by reference here the more detailed description of the proposed action in Reclamation's final PA (Reclamation 2024d). Water rights, contracts, and agreements specific to the Delta include Decision (D)-1641, Coordinated Operations Agreement (COA) and other related agreements pertaining to CVP and SWP operations and Delta watershed users. In order to meet these agreements, Reclamation proposed to continue minimum health and safety exports at Jones Pumping Plant and Banks Pumping Plant of 1,500 cfs. Reclamation and DWR propose to continue to use the Sacramento River, San Joaquin River, and Delta channels to transport water to export pumping plants located in the south Delta (Jones, Banks, and Contra Costa Water District pumping plants) and the north Delta (Barker Slough Pumping Plant). Reclamation proposes revised operations to the Delta Cross Channel (DCC); the continuation of the seasonal installation and operation of three agricultural barriers in the South Delta; water transfers within the Sacramento and San Joaquin River basins from July through November; continued Clifton Court Forebay aquatic weed removal; and Old and Middle River flow management.

The proposed action for the Stanislaus River is summarized in Table 11 and Table 12. Conservation measures have been included in the proposed action (Appendix H, Reclamation

2023-2024). These conservation measures include non-flow actions that benefit listed species without impacting water supply. Reclamation proposes the following measures to minimize adverse effects of operations: Suisun Marsh Salinity Control Gates (SMSCG) Operation; Summer and Fall Delta Outflow and Habitat; continuing to implement existing restoration efforts, including completing 8,396.3 acres of tidal habitat restoration in the Delta by 2026; Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project; and the predator hot spot removal effort in the Delta. Reclamation and DWR would continue the implementation of the following actions to reduce mortality of ESA-listed fish species: DCC Gate operations; Tracy Fish Collection Facility improvements to operating procedures; ongoing Skinner Fish Facility operations; incorporating flexibility in salvage release sites; and the Small Screen Program.

Table 11. Action Components of the Proposed Action in the Sacramento-San Joaquin Delta.

Action Component	Proposed Action
Exports	Ongoing exports at the south Delta export facilities and associated fish salvage facilities; and risk-based Old and Middle River (OMR) management incorporating real-time monitoring and models where possible.
Delta Cross Channel (DCC) Gate Operations	DCC operations based on D-1641, closures for fish protections, and operations that avoid exceeding water quality standards.
Delta Outflow	Delta Outflow: Central Valley Project (CVP): Spring Delta Outflow for approximately 2 years, in above normal/below normal/dry years. After approximately 2 years, OMR management Delta outflow to meet D-1641 requirements; Suisun Marsh Salinity Control Gate operation for up to 60 additional days between June 1 and October 31, depending on year type; increased Delta outflow in wet and above normal year types in certain conditions State Water Project (SWP): Pre-adoption of the Voluntary Agreements, implementation of the Incidental Take Permit (ITP) action for duration of permit
Old and Middle River (OMR) Management	OMR Managed Reverse flows based on species distribution, modeling, and risk analysis with provisions for capturing storm flows Early season winter-run Chinook salmon triggers Weekly distributed loss thresholds for winter-run Chinook salmon, Central Valley (CV) spring-run Chinook salmon and California Central Valley (CCV) steelhead CV spring-run Chinook salmon surrogate threshold Spring Outflow; Use of genetic identification Date and temperature offramps with additional temperature site Governance with the Salmon Monitoring Team (SaMT) and Water Operations Management Team (WOMT) coordination and 6-agency director group
Agricultural Barriers	Temporary agricultural barriers installed each year (~May to November) to maintain water levels for south of Delta agricultural water diverters.
Water Transfers	Reclamation and DWR propose to operate the CVP and SWP to facilitate transfers through providing water in streams for delivery to alternative diversion points, conveying water across the Delta for export, or storing water for delivery at a future time.
Suisun Marsh Salinity Control Gates (SMSCG)	SMSCG consists of three radial gates, a boat lock structure, and a maintenance channel operated to decrease the salinity of the water in Montezuma Slough to meet salinity standards set by the State Water Resources Control Board (SWRCB) and Suisun Marsh Preservation Agreement.

Table 12. Proposed Conservation Measures for the Delta (Appendix H, Reclamation 2023-24).

Conservation Measures	Description/Objective
DCC Gate Closure	Reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates Reduce straying of Mokelumne River fall-run Chinook salmon adults and protect out-migrating juvenile salmonids from entering the interior Delta Reduce juvenile salmonid entrainment risk at the salvage facilities
Tracy Fish Collection Facility (TFCF) and Skinner Delta Fish Protective Facility	Screen fish from Jones Pumping Plant with the TFCF using behavioral barriers consisting of primary louvers and four traveling screens in the secondary channel, to guide entrained fish into holding tanks before transport by truck to release sites within the western Delta Screen fish from Banks Pumping Plant with the Skinner Delta Fish Protective Facility using behavioral barriers consisting of primary louvers and secondary screens (louvers and flat plate screens) to guide fish away from the pumps that lift water into the California Aqueduct and into holding tanks before transport by truck to release sites within the western Delta
Tidal Habitat Restoration	Tidal habitat restoration is expected to improve habitat quality and food availability long term
Old and Middle River Management	Manage diversion rates from the South of Delta modified based on abiotic and biotic factors for several listed species Decrease the entrainment risk stressor by potentially preventing adults from being entrained at the export facility
Summer and Fall Delta Outflow and Habitat	Operate the Suisun Marsh Salinity Control Gates (SMSCG) for 60 days using a 7-day tidal 7-day open operation (7-7) schedule to maximize the number of days that Belden's Landing three-day average salinity is equal to, or less than, 4 psu In dry years following below normal years, DWR will operate SMSCG for 30 days using 7-7 operation to maximize the number of days Belden's Landing three-day salinity is equal to, or less than 6 psu Decrease the entrainment risk stressor by increasing flows in the Delta and, thus, benefitting the migratory transport of juveniles to the estuary and potentially preventing entrainment at the export facility Decrease the outmigration cue and food availability stressors by increasing flow through the Delta

Conservation Measures	Description/Objective
Spring Delta Outflow	Actions that will support the additional Delta outflow include the following: (1) Reclamation and DWR south of Delta export modifications; (2) Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds; and (3) passing Delta inflow from water made available by Voluntary Agreement (VA) Parties. Decrease the water temperature stressor by increasing flow in the migratory corridor from the Delta to the Sacramento River Water temperature stressor may also increase the following year due to higher release requirements that could deplete the cold-water pool Decrease the entrainment risk stressor by increasing migratory transport of juveniles to the estuary, potentially preventing entrainment at the export facility May decrease the outmigration cue and food availability stressors by increased flow through the Delta

Effects on Essential Fish Habitat for Sacramento-San Joaquin Delta

Pacific Coast salmon EFH impacted by the proposed action within the Delta region includes all waters of the Sacramento River and San Joaquin River within the Delta, including the multiple channels within the Delta, and tidally influenced portions of tributaries entering the Delta. The Pacific Coast salmon HAPCs that occur within the Delta include complex channels and floodplain habitats, and estuaries. The Pacific Coast groundfish HAPC that occurs within the Delta includes estuaries. No HAPCs were identified in the Coastal Pelagic Species FMP. Based on the best available information, NMFS concludes that the proposed action would adversely affect EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species. We conclude that the following adverse effects on EFH designated for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species are reasonably certain to occur.

Passage Impacts

The proposed action includes operations of the temporary agricultural barriers in the south Delta and the SMSCGs on Montezuma Slough. These operations are expected to result in restricted upstream and downstream passage for adult and juvenile Chinook salmon in these areas.

Temporary agricultural barriers are in place from May to November. Flap gates are tidally operated, and are closed during ebb tides. During this time, passage is blocked for adults migrating upstream and juveniles migrating downstream, temporarily preventing access to the complex channels and floodplain habitats HAPC for Pacific Coast salmon. Juvenile Chinook salmon habitat would be subjected to warm water temperatures, resulting in poor water quality and likely increased predation near the structures. Delaying migration for both adult and juvenile spring-run and fall-run Chinook salmon is expected to reduce survival overall. See Section 7.5.1.14. of the NMFS Biological Opinion (NMFS 2024) for more details on anticipated effects.

SMSCGs are operated for 10 to 80 days per year. When operated, a boat lock is open and allows for passage of adult and juvenile Chinook salmon. However, as described in section 7.5.1.8.2. of the NMFS Biological Opinion (NMFS 2024), migrating adult Chinook salmon are typically delayed or blocked when the gates are closed. This has the potential to adversely impact adults migrating to their spawning grounds, as delays can result in reduced spawning success and reduced survival.

Contaminants

The proposed action could affect water quality within EFH habitat for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species, from storing and diverting water resulting in decreased inflow into the Delta in the winter and spring and increased inflow in the summer. Reduced flows may concentrate contaminants when present, while increased flows may dilute contaminants. Increased flows could also mobilize existing contaminants. Water quality degradation due to contaminant mobilization would impact the quality of the estuaries HAPC for Pacific Coast salmon by direct adverse physiological or behavioral effects on fish upon exposure to the contaminants as well as reducing the abundance and quality of lower trophic level prey resources through biological uptake of contaminants (Phipps *et al.* 1995, Fleeger *et al.* 2003) Release of contaminants in areas containing submerged aquatic vegetation could inhibit or prevent the growth of vegetation, thereby reducing habitat for invertebrates associated with this habitat. The invertebrates serve as food resources for juvenile Chinook salmon. The magnitude of these adverse effects on Chinook salmon EFH are generally expected to remain relatively low compared to contaminant mobilization that might occur without the proposed action.

These same effects would also be expected to impact Pacific Coast groundfish EFH, including effects to the estuaries HAPC (intertidal estuarine habitat in the western Delta).

Since EFH for coastal pelagic species is primarily based on water temperatures, the effects of contaminants is more tenuous on the functioning of this EFH. However, the mobilization of environmental contaminants would be expected to have a negative impact on the health of coastal pelagic species in the estuarine waters of the Delta.

Predator Control

Modification of EFH associated with engineered structures offers cover or advantageous habitat for predators of special-status species. The low spatial complexity and reduced habitat diversity (e.g., lack of cover) of channelized waterways in the Delta could reduce refuge for juvenile Chinook salmon from predators (Raleigh *et al.* 1984, 70 FR 52488 2005). The proposed action includes localized reduction of predatory fish abundance at locations such as Clifton Court Forebay and at Tracy Fish Collection Facility, and thereby reduce predation risks to juvenile salmonids; however, the efficacy of such actions is uncertain. These actions are primarily focused on reducing Chinook salmon predation, and may improve conditions in the estuaries and complex channels and floodplain habitats HAPCs for Pacific Coast salmon. They are not expected to significantly reduce predation on Pacific Coast groundfish or coastal pelagic species within the Delta.

Changes in Flows and Local Hydrodynamics

Modifications of Delta flows are expected to disrupt the migration of adult spawning Chinook salmon and rearing and migrating juvenile Chinook salmon within the complex channels and floodplain habitats HAPC for Pacific Coast salmon, as well as the estuaries HAPC for migrating juvenile Pacific Coast groundfish within the waters of the western Delta. These modifications may arise through the export of water via the CVP and SWP pumping facilities, operations of the DCC gates, water transfers, and operation of the south Delta temporary agricultural barriers. Delta inflows and outflows are anticipated to affect the rearing and distribution of Pacific Coast groundfish within the Delta and San Francisco Bay Estuary through changes in the location of the low salinity mixing zones of the Delta and estuary and the resulting changes in the areas of primary and secondary productivity that support these species. Likewise, changes in Delta outflow may affect the extent of upstream movement of coastal pelagic species within the Delta. Changes in the seasonal distribution of marine and estuarine vegetation are expected based on the amount of Delta outflow related to proposed action operations. The areas of vegetation are likely to increase or decrease, depending on the ambient salinity and the preferred habitat characteristics of the different species of aquatic plants.

Essential Fish Habitat Conservation Recommendations for the Sacramento-San Joaquin Delta

As described in the above effects analysis, NMFS has determined that the proposed action would adversely affect EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species in the Sacramento-San Joaquin Delta. NMFS recommends the following conservation measures to avoid, minimize, mitigate, or otherwise offset the effects of the proposed action.

Delta Conservation Recommendation 1

NMFS recommends Reclamation reduces predator "hot spots" in the Delta to improve survival of juvenile Chinook salmon and juvenile groundfish with the following measures:

- Implement measures to reduce the predation intensity at the San Joaquin River Scour Hole through modifications to the channel geometry and associated habitats. Reducing predator habitat is expected to benefit Pacific Coast salmon EFH.
- Include monitoring data of fall-run and late fall-run Chinook salmon in the decision process for operations of the DCC gates to reduce potential predation associated with routes through the Delta interior. Protective actions regarding the DCC gate operations include closing the gates during periods when juvenile Chinook salmon are emigrating, regardless of run designation.
- Include monitoring data of fall-run and late fall-run Chinook salmon in the decision process for operations of the south Delta temporary barriers to reduce potential predation. Installation of the south Delta temporary barriers should be delayed until the spring emigration of fall-run Chinook salmon from the San Joaquin River basin is nearing completion. After installation of the barriers, the culverts are recommended to remain tied open to allow downstream passage of juvenile Chinook salmon until the monitoring at Mossdale indicates that there are few fish migrating downstream through the San Joaquin River system.

- If Reclamation accepts this recommendation, NMFS requests an update on implementation by December 31 of even years, starting in 2026.

Minimizing or reducing predators at these locations would improve conditions of the complex channels and floodplain habitats and estuaries HAPCs within the Delta for Pacific Coast salmon and Pacific Coast groundfish EFH.

Delta Conservation Recommendation 2

NMFS recommends Reclamation and DWR develop a plan that identifies and prioritizes projects that support riparian and floodplain habitat restoration efforts, and submit that plan to NMFS. These restoration efforts would benefit all migrating and rearing juvenile fish. Riparian and floodplain restoration would improve the quality and quantity of rearing habitat for juvenile fish by providing natural cover, enhancing stream shade, as well as helping to offset water temperature increases (Fogel *et al.* 2022). These restoration efforts are expected to improve the existing conditions of Pacific Coast salmon EFH, Pacific Coast groundfish EFH, and coastal pelagic species EFH, particularly the complex channels and floodplain habitats HAPC for Chinook salmon.

Delta Conservation Recommendation 3

NMFS recommends that if large pulses of Chinook salmon are detected migrating through the Delta or are observed in salvage, regardless of run type, protective actions should be employed to reduce the entrainment and loss of these fish at the CVP and SWP export facilities. These actions include export reductions to reduce the extent of hydraulic impacts within waterways leading to the south Delta export facilities, closure of the DCC gates to prevent routing of juvenile Chinook salmon into the interior Delta, and preferential exports from the CVP facilities to reduce loss during salvage operations. In addition, closing the DCC gates in the fall during pulse flows on the Mokelumne River designed to attract adult Chinook salmon will reduce straying of these fish into the open DCC route. These actions would benefit conditions for the complex channels and floodplain habitats HAPC for Pacific Coast salmon EFH.

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