Long-Term Operation

Appendix AC – Terrestrial Biological Assessment

July 2024

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Acronyms and Abbreviations

Banks Pumping Plant	Harvey O. Banks Pumping Plant
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
CVP	Central Valley Project
CVPCP	Central Valley Project Conservation Program
CVPIA	Central Valley Project Improvement Act
Delta	Sacramento–San Joaquin Delta
DMC	Delta-Mendota Canal
DPS	distinct population segment
DWR	California Department of Water Resources
ESA	Endangered Species Act
FR	Federal Register
HCP	habitat conservation plan
NMFS	National Marine Fisheries Service
PBF	physical or biological feature
PCE	primary constituent element
PSU	practical salinity unit
Reclamation	Bureau of Reclamation
SJRNWR	San Joaquin River National Wildlife Refuge
SJRRP	San Joaquin River Restoration Program
SMP	Suisun Marsh Habitat Management, Preservation and Restoration Plan
SMSCG	Suisun Marsh Salinity Control Gates
SRSC	Sacramento River Settlement Contractor
SWP	State Water Project
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
YBWA	Yolo Bypass Wildlife Area

Chapter 1 Introduction

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) operates the Central Valley Project (CVP). The California Department of Water Resources (DWR) operates the State Water Project (SWP). Reclamation and DWR coordinate operations under the 1986 Coordinated Operation Agreement, as amended in 2018, between the federal government and the State of California, as authorized by Public Law 99-546. A February 18, 2020, Record of Decision implements the Proposed Action consulted upon for the 2019 Biological Opinions from the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). On September 30, 2021, Reclamation requested to reinitiate consultation on the Long-Term Operation of the CVP and SWP under Section 7 of the Endangered Species Act (ESA) of 1973, as amended, due to anticipated modifications to the previous Proposed Action that may cause effects on federally listed species or designated critical habitat not analyzed in the current 2019 Biological Opinions. Modifications would address the review of the 2019 Biological Opinions required by Executive Order 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, and voluntarily reconcile CVP operating criteria with requirements of the SWP under the California ESA. The USFWS acknowledged the reinitiation request on October 1, 2021, and offered technical assistance.

This Biological Assessment supports Reclamation's consultation under the requirements of ESA Section 7 and documents the potential effects of the Proposed Action on federally listed, or proposed, terrestrial endangered and threatened species that have the potential to occur in California's Central Valley and designated critical habitat for these species.

1.1 Background

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 CVP consists of 20 dams and reservoirs that together can store nearly 12 million acre-feet of water. Reclamation holds over 270 contracts and agreements for water supplies that depend upon CVP operations. Through operation of the CVP, Reclamation delivers water in 29 of California's 58 counties, which include approximately:

- 5 million acre-feet of water for farms;
- 600 thousand acre-feet of water for municipal and industrial uses (enough water to supply about 2.5 million people for a year); and
- 355 thousand acre-feet of water for wildlife refuges.

Reclamation operates the CVP under water rights granted by the State of California, including those intended to protect agricultural and fish and wildlife beneficial uses in the Sacramento-San

Joaquin Delta (Delta). The CVP generates approximately 4.5 million megawatt hours of electricity annually on average.

DWR operates the SWP under water rights granted by the State of California, including those intended to protect agricultural and fish and wildlife beneficial uses in the Delta. DWR operates the SWP for the primary purpose of water supply deliveries and flood control, and the SWP provides additional benefits including environmental stewardship. The SWP's main facilities are Oroville Dam, the Harvey O. Banks Pumping Plant (Banks Pumping Plant), and San Luis Reservoir. These facilities are operated and connected by a network of canals, aqueducts, and other facilities of the SWP to deliver, on average, approximately 2.6 million acre-feet of contracted water supplies annually. DWR holds contracts with 29 public agencies in the Feather River Area, North Bay Area, South Bay Area, San Joaquin Valley, Central Coast, and Southern California for water supplies from the SWP.

The State Water Resources Control Board (Water Board) is currently considering Voluntary Agreements with other water right holders in its update to the Bay-Delta Water Quality Control Plan. If approved, the Voluntary Agreements would provide additional flows, facility improvements, and habitat restoration that benefit listed species, with a proposed funding mechanism to implement these enhancements. This Proposed Action consults on the potential operation of SWP facilities in the Delta and operation of the CVP consistent with the currently proposed Voluntary Agreements. The analysis covers Reclamation and DWR Voluntary Agreement actions under an early implementation condition, a condition if Voluntary Agreements are not approved and no substitute Water Quality Control Plan is implemented, and a condition where full Voluntary Agreements are implemented. Voluntary Agreements are anticipated to benefit federally listed species and their designated critical habitats.

Ongoing actions with independent utility that may have separate Section 7 consultations and are not being reinitiated by this Proposed Action but warrant consideration for their effects on listed species are listed as contemporaneous programs within the Environmental Baseline.

1.2 Action Area

For the purposes of this Biological Assessment, the action area encompasses the following reservoirs, rivers, and the land between the levees adjacent to the rivers (Figure 1-1).

- Clear Creek from Whiskeytown Reservoir to its confluence with the Sacramento River: A portion of the water from the Trinity River Basin is stored in Trinity Lake behind Trinity Dam, re-regulated in Lewiston Lake, and diverted through the Clear Creek Tunnel and Carr Powerplant into Whiskeytown Reservoir on Clear Creek and then into the Sacramento River through the Spring Creek Tunnel and Spring Creek upstream of Keswick Dam. This Biological Assessment covers Clear Creek.
- Sacramento River from Shasta Reservoir downstream to the Delta: A portion of the water from the upper Sacramento River is stored in Shasta Reservoir and re-regulated in Keswick Reservoir. Water in Shasta Lake may be diverted at Shasta Dam or released into the Sacramento River. Water from the upper Sacramento River, imports from the Trinity

River Basin, releases from other reservoirs owned or operated by local agencies, and other inflows enter the Sacramento River and may be diverted into the Tehama-Colusa and Corning Canals at the Red Bluff Pumping Plant.

- American River from Folsom Reservoir downstream to its confluence with Sacramento River: A portion of the water from the American River is stored in Folsom Reservoir and re-regulated in Lake Natoma. Water in Folsom Reservoir may be diverted at Folsom Dam, diverted into the Folsom South Canal, or released into the American River.
- Stanislaus River from New Melones Reservoir to its confluence with the San Joaquin River: A portion of the water from the Stanislaus River is stored in New Melones Reservoir. Water in New Melones Reservoir may be released into the Stanislaus River.
- San Joaquin River from Friant Dam downstream to the Delta: A portion of the water from the upper San Joaquin River is stored in Millerton Reservoir behind Friant Dam. Water is diverted into the Madera and Friant-Kern Canals or released into the San Joaquin River.
- Delta, Suisun Bay, and Suisun Marsh: The Sacramento River and San Joaquin River carry water to the Delta. As water moves down the mainstem of the Sacramento River, gates at the Delta Cross Channel are operated for water quality and flood management. Water in the Delta may be exported into the Contra Costa Canal at Rock Slough and delivered to the Contra Costa Water District. The C.W. Bill Jones Pumping Plant is at the southern end of the Delta, lifting water into the Delta-Mendota Canal (DMC). CVP water is conveyed in the DMC for direct diversion or for delivery to San Luis Reservoir. Water from the San Luis Reservoir is conveyed through the San Luis Canal and Pacheco Tunnel. The DMC-California Aqueduct Intertie connects the CVP and SWP conveyance facilities after export from the Delta. Prior to the C.W. Bill Jones Pumping Plant, the Tracy Fish Collection Facility salvages salmonids and other species. Water flowing through the Delta passes into Suisun Bay and Suisun Marsh then into the San Francisco Bay and the Pacific Ocean.

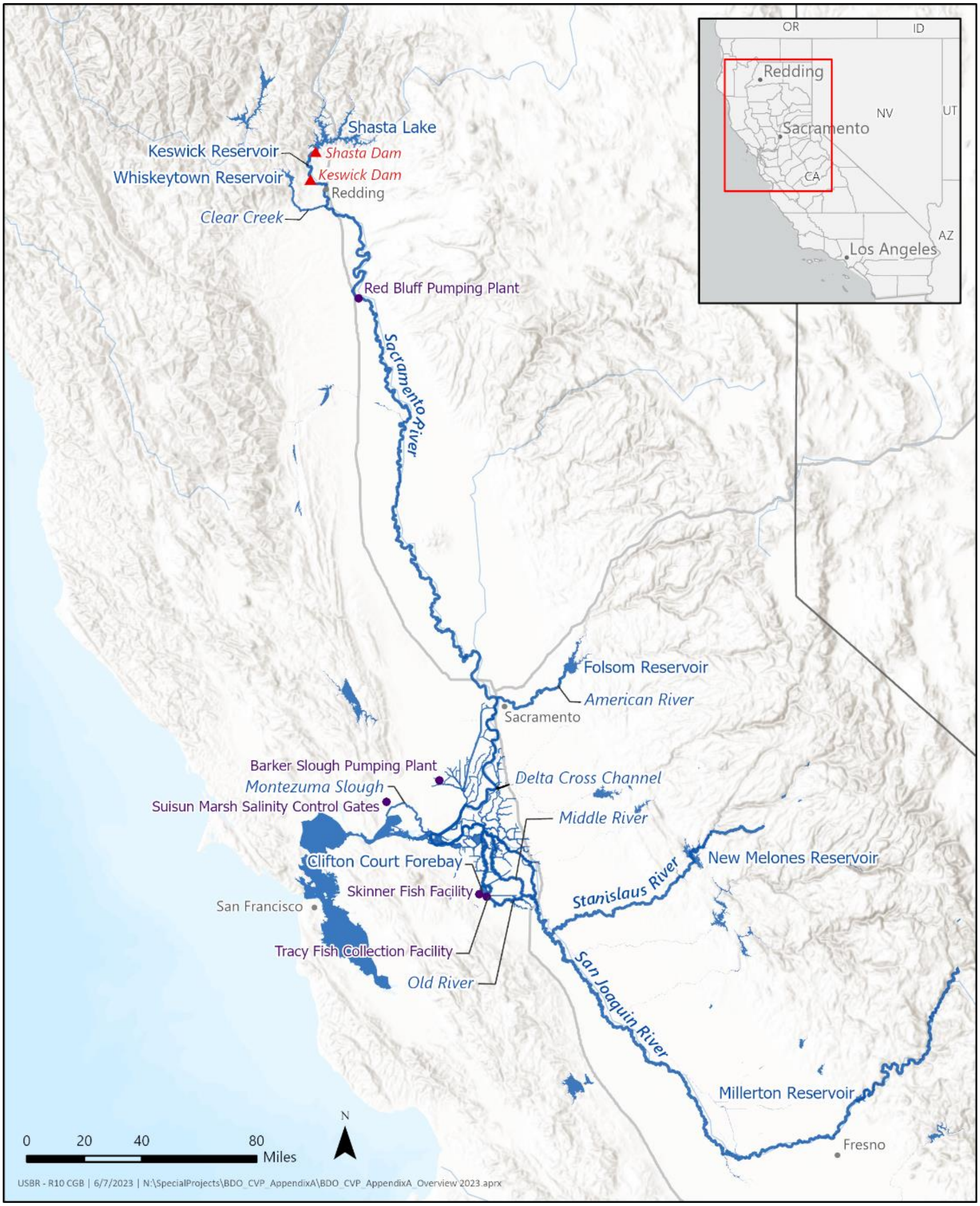


Figure 1-1. Action Area for Section 7 Consultation on the Long-Term Operation of the Central Valley Project and State Water Project.

The action area also includes areas downstream of the Feather River and SWP facilities in the Delta, Cache Slough Complex, and Suisun Marsh. Feather River operations of Lake Oroville and Oroville Dam are not addressed as part of this consultation.

- In the Cache Slough Complex, the Barker Slough Pumping Plant lifts water into the North Bay Aqueduct.
- In Montezuma Slough, the Suisun Marsh Salinity Control Gates are tidally operated to maintain fresh water in Montezuma Slough and the Suisun Marsh.
- The Banks Pumping Plant at the southern end of the Delta, behind Clifton Court Forebay, lifts water into the California Aqueduct, which conveys water to the San Luis Reservoir for storage and to the South Bay Aqueduct for deliveries to the SWP contractors. The DMC-California Aqueduct Intertie connects the CVP and SWP conveyance facilities after water export from the Delta. Prior to the Banks Pumping Plant, the Skinner Delta Fish Protection Facility salvages salmonids and other species. The SWP also pumps water through the Banks Pumping Plant and conveys it through the California Aqueduct to the Cross Valley Canal for CVP water service contractors when the systems have capacity.

Entities using project water within the CVP and SWP service areas are responsible for decisions on the use of project water after diversion. The action area for the Proposed Action extends to the point of diversion, except as described in the framework programmatic sections of the Proposed Action. ESA Section 7 consultations on water delivery contracts and water acquisitions and transfers cover effects of Reclamation’s discretionary actions beyond the point of diversion.

1.3 Terrestrial Species and Critical Habitat Considered

Terrestrial species considered in this Biological Assessment include those that are federally listed as threatened or endangered. The following input was used to determine which listed species should be considered:

- ESA-listed, proposed and candidate species distributional maps and literature review of species life-history requirements and habitat use
- Environmental documentation prepared in support of other Reclamation projects
- Discussions with federal and state agencies
- USFWS Information for Planning and Conservation system
- Official species list requested on April 26, 2023, updated on September 19, 2023: McDonald’s Rock-cress *(Arabis macdonaldiana)* was on the April 26, 2023 list but not on the updated September 19, 2023 list and is omitted from consideration in this document.

Terrestrial species subject to consultation are shown in Table 1-1.

Table 1-1. Federally Protected Species and Critical Habitat subject to Consultation.

Species	Status	Critical Habitat
California Clapper Rail (*Rallus longirostris obsoletus)*	Endangered	Not proposed or designated
California Least Tern (*Sterna antillarum browni*)	Endangered	Not proposed or designated
Least Bell's Vireo (*Vireo bellii pusillus*)	Endangered	Designated, but not in action area
Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*)	Endangered	Not proposed or designated
Suisun Thistle (*Cirsium hydrophilum var. hydrophilum*)	Endangered	Designated in action area
Soft Bird's-beak (*Cordylanthus mollis ssp. Mollis*)	Endangered	Designated in action area
Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)	Threatened	Designated in action area
Riparian Brush Rabbit (*Sylvilagus bachmani riparius*)	Endangered	Not proposed or designated
Riparian Woodrat (*Neotoma fuscipes riparia*)	Endangered	Not proposed or designated
Western Yellow-billed Cuckoo (*Coccyzus americanus*)	Threatened	Designated in action area
Western Snowy Plover (*Charadrius nivosus nivosus*)	Threatened	Designated, but not in action area
Foothill Yellow-legged Frog South Sierra DPS (*Rana boylii*)	Endangered	Not proposed or designated

1.4 Terrestrial Species and Critical Habitat not further Considered

Reclamation's Proposed Action is focused on hydrologic alterations and water operations in the action area and does not include ground disturbing activities. Therefore, due to the nature of the Proposed Action and based on an analysis of current information on the potential effects of the action, known existing populations and habitat requirements of the following terrestrial species and critical habitat will not be considered further in this Biological Assessment:

- Alameda Whipsnake (Masticophis lateralis euryxanthus)
- Antioch Dunes Evening-primrose (Oenothera deltoides ssp. howellii)
- Bay Checkerspot Butterfly (Euphydras editha bayensis)

- Blunt-nosed Leopard Lizard (Gambelia silus)
- Butte County Meadowfoam (Limnanthes floccosa ssp. Californica)
- California Condor (Gymnogyps californianus)
- California Freshwater Shrimp (Syncaris pacifica)
- California Red-legged Frog (Rana draytonii)
- California Seablite (Suaeda californica)
- California Spotted Owl (Strix occidentalis occidentalis)
- California Tiger Salamander (Ambystoma californiense)
- Callippe Silverspot Butterfly (Speyeria callippe callippe)
- Chinese Camp Brodiaea (Brodiaea pallida)
- Colusa Grass (Neostapfia colusana)
- Conservancy Fairy Shrimp (Branchinecta longiantenna)
- Contra Costa Goldfields (Lasthenia conjugens)
- Contra Costa Wallflower (Erysimum capitatum var. angustatum)
- Delta Green Ground Beetle (Elaphrus viridis)
- Fisher (Pekania pennanti)
- Fleshy Owl's-clover (Castilleja campestris ssp. Suucculenta)
- Foothill Yellow-legged Frog Central Coast DPS (Rana boylii)
- Fountain Thistle (Cirsium fontinale var. fortinale)
- Franciscan Manzanita (Arctostaphylos franciscana)
- Fresno Kangaroo Rat (Dipodomys niratoides exilis)
- Giant Garter Snake (Thamnophis gigas)
- Giant Kangaroo Rat (Dipodomys ingens)
- Gray Wolf (Canis lupus)
- Green Sea Turtle (Chelonia mydas)
- Greene's Tuctoria (Tuctoria greenei)
- Hairy Orcutt Grass (Orcuttia pilosa)
- Hartweg's Golden Sunburst (Pseudobahia bahiifolia)

- Hickman's Potentilla (Potentilla hickmanii)
- Hoover's Spurge (Chamaesyce hooveri)
- Keck's Checker-mallow (Sidalcea keckii)
- Lange's Metalmark Butterfly (Apodemia mormo langei)
- Large-flowered Fiddleneck (Amsinckia grandiflora)
- Longhorn Fairy Shrimp (Branchinecta longiantenna)
- Marbled Murrelet (Brachyramphus marmoratus)
- Marin Dwarf-flax (Hesperolinon congestum)
- Marsh Sandwort (Arenaria paludicola)
- Mission Blue Butterfly (Icaricia icarioides missionensis)
- North American Wolverine (Gulo luscus)
- Northern Spotted Owl (Strix occidentalis caurina)
- Pacific Marten, Coastal Distinct Population Segment (Martes caurina)
- Pallid Manzanita (Arctostaphylos pallida)
- Palmate-bracted Bird's Beak (Cordylanthus palmatus)
- Presidio Clarkia (Clarkia franciscana)
- Presidio Manzanita (Arctostaphylos hookeri var. ravenii)
- Red Hills Vervain (Verbena californica)
- Robust Spineflower (Chorizanthe robusta var. robusta)
- Sacramento Orcutt Grass (Orcuttia viscida)
- San Francisco Garter Snake (Thamnophis sirtalis tetrataenia)
- San Francisco Lessingia (Lessingia germanorum(=L.g. var. germanorum)
- San Joaquin Kit Fox (Vulpes macrotis mutica)
- San Joaquin Valley Orcutt Grass (Orcuttia inaequalis)
- San Mateo Thornmint (Acanthomintha obovata ssp. Duttonii)
- San Mateo Woolly Sunflower (Eriophyllum latilobum)
- Santa Cruz Tarplant (Holocarpha macradenia)
- Sebastopol Meadowfoam (Limnanthes vinculans)

- Short-tailed Albatross (Phoebastria (=Diomedea) albatrus)
- Showy Indian Clover (Trifolium amoenum)
- Slender Orcutt Grass (Orcuttia tenuis)
- Solano Grass (Tuctoria mucronata)
- Sonoma Sunshine (Blennosperma bakeri)
- Tiburon Jewelflower (Streptanthus niger)
- Tiburon Mariposa Lily (Calochortus tiburonensis)
- Tiburon Paintbrush (Castilleja affinis ssp. Neglecta)
- Tidewater Goby (Eucyclogobius newberryi)
- Vernal Pool Fairy Shrimp (Branchinecta lynchi)
- Vernal Pool Tadpole Shrimp (Lepidurus packardi)
- White-rayed Pentachaeta (Pentachaeta bellidiflora)

Although the Proposed Action is not expected to result in effects to the listed species above, including giant garter snake, the consultation on the Sacramento River Drought Mitigation and Voluntary Conservation Program to support Long Term CVP Operations and Ecosystem Restoration will provide analysis of potential effects on giant garter snake. The Sacramento River Drought Mitigation and Voluntary Conservation Program to support Long Term CVP Operations and Ecosystem Restoration is a separate action with independent utility, but occurring in parallel with this Proposed Action. The Sacramento River Drought Mitigation and Voluntary Conservation Program establishes a water shortage program, a carryover water purchase program, a durable water program, and provides for support of the Winter Run Action Plan.

1.5 Scenarios Depicting the Environmental Baseline

Two operational scenarios inform the environmental baseline that, for this Biological Assessment, includes nondiscretionary operations. Figure 6-1 to Figure 9-2 include these scenarios to provide a contrast to the Proposed Action that includes Reclamation and DWR discretionary operations.

- The first scenario is a run-of-river scenario (EXP1) that eliminates all operations, except those needed to provide flood control and to protect existing facilities. EXP 1 depicts conditions without Reclamation exercising discretion to store, divert, or route water. The run-of-river scenario, when examined in the context of the Proposed Action, can be used to determine how the storage, release, diversion, and routing of water in the Proposed Action affects river flows.
- The second scenario is a minimal release operation (EXP3) that uses stored water only to meet nondiscretionary requirements and obligations. That scenario depicts “ongoing

agency activities . . . that are not within the agency's discretion to modify." EXP3 is used to describe the effect of nondiscretionary operations on flows below dams and storage in reservoirs where releases are necessary to meet downstream requirements and where water is diverted from the system. This scenario (EXP 3), when examined in the context of the Proposed Action, can be used to determine how the release and diversion water in Proposed Action affects storage.

The environmental baseline condition does not include effects of the Proposed Action. In determining which scenarios would be appropriate to characterize the environmental baseline, Reclamation considered the 2019 Proposed Action adopted in the Record of Decision (ROD), which is currently being implemented, as modified by the Interim Plan Operations. Reclamation determined that the 2019 Proposed Action adopted in the ROD includes various components also included in this current Proposed Action. Thus, the 2019 Proposed Action adopted in the ROD would encompass some of the effects of this Proposed Action and would not be appropriate to inform the environmental baseline condition. The 2019 Proposed Action adopted in the ROD, however, is used in representing the No Action Alternative in the Environmental Impact Statement (EIS) associated with this Biological Assessment. The No Action Alternative represents the current management direction of Reclamation and DWR, as required by the National Environmental Policy Act (NEPA). Although Figure 6-1 to Figure 9-2 include a representation of the No Action Alternative, this is provided for reference only but not intended to represent the environmental baseline or the Proposed Action

Chapter 2 Consultation History

Reclamation has consulted with the USFWS on CVP operations as species were listed and critical habitat designated since the early 1990s. The most recent consultation on CVP and SWP long-term operations was completed in 2019 with a February 2020 Record of Decision. The USFWS 2019 Biological Opinion was challenged in federal court with litigation stayed pending a voluntary remand. The consultation history includes:

- 2004: Reclamation provided a Biological Assessment with a determination of may effect, not likely to adversely affect several listed terrestrial species.
- 2004: The USFWS issued a Biological Opinion with a concurrence letter on the effects to terrestrial species.
- 2008: The USFWS issued a Biological Opinion with a concurrence letter on the effects to terrestrial species.
- 2019: Reclamation provided a Biological Assessment with a determination of likely to adversely affect several terrestrial species.
- 2019: The USFWS issued a Biological Opinion with a finding of non-jeopardy for relevant terrestrial species.
- 2021: Reclamation sent the USFWS a request to reinitiate consultation. The USFWS responded to the request and offered technical assistance.

Chapter 3 Proposed Action

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. 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. Public Law 99-546 authorized the 1986 Coordinated Operation Agreement (COA), which sets procedures for Reclamation and DWR to share joint responsibilities for meeting Delta standards and other legal uses. Operation of the CVP and SWP also provide recreation and water quality benefits.

The Proposed Action covers CVP service areas and the operation of CVP dams, power plants, diversions, canals, gates, and related Federal facilities located on the watersheds of Clear Creek; the Sacramento, American, Stanislaus, and San Joaquin rivers; and CVP and SWP facilities in the Sacramento–San Joaquin Delta (Delta) and Suisun Marsh and Bay.

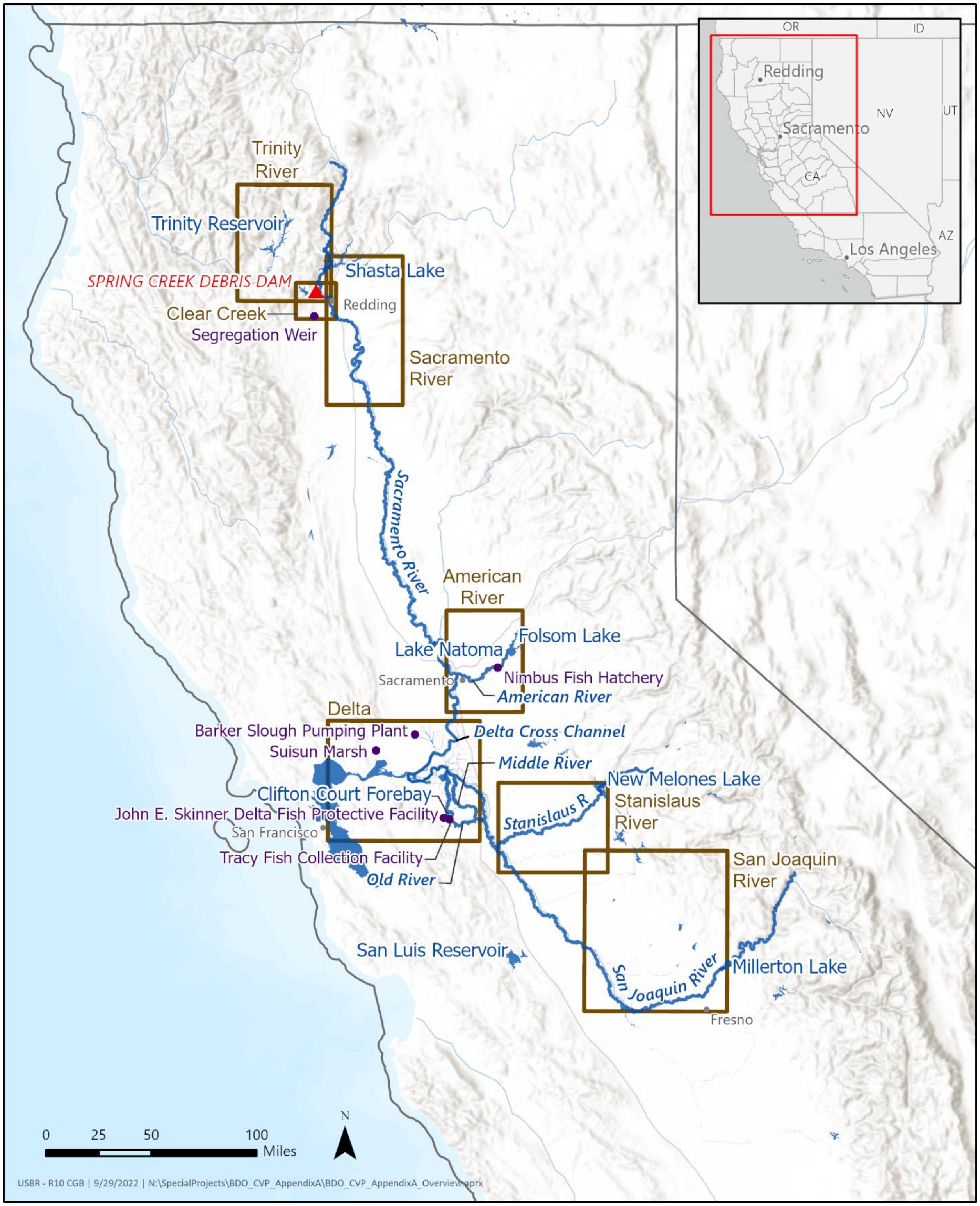


Figure 3-1. Overview of the Facilities Operated in the Proposed Action

Reclamation plans the operation of the CVP by projecting monthly, on a 12-month lookahead cycle, an "operations outlook" for how available water resources can best meet regulatory requirements and water supply purposes, including considerations for public health and safety, wildlife refuges, senior water rights, water quality, fishery needs, other environmental requirements, and water service or repayment contracts. In most years, the combination of storage and runoff into CVP reservoirs and the Central Valley, after meeting statutory requirements, is not enough to fully meet CVP water service contractor demands and shortages occur. The water available for delivery to CVP water service contractors is determined by an administrative process, referred to as "allocations," that considers storage, forecasted inflow, system accretions and depletions, facility limitations, and project requirements under the operations outlook. The estimate of available water supply in the north of Delta system, along with the anticipated quantity of water needed to meet requirements throughout the year (such as D-1641), determine the north of Delta allocations. The estimate of water supply upstream, previously stored water south of the Delta (in San Luis Reservoir), and the potential conveyance capability through the Delta determine south-of-Delta allocations. The Municipal and Industrial (M&I) Water Shortage Policy determines the quantity of water during shortages for M&I and agricultural uses, for those water service and repayment contractors that reference the policy.

No later than February 15, Reclamation makes "Critical Year" determinations for Central Valley Project Improvement Act (CVPIA) wildlife refuges under Refuge Water Supply Agreements and senior water right holders under Sacramento River Settlement Contracts, the San Joaquin River Exchange Contract, and San Joaquin River Settlement Contracts, as described by those contracts and agreements. Depending upon hydrologic conditions, the determination may be updated.

On or about February 20 of each year, Reclamation provides an initial declaration of the water made available under water service contracts, an "Initial Allocation." Water service contracts generally run from March through February. Beginning in February, Reclamation prepares forecasts of water year runoff using precipitation to date, runoff to date, and snow water content accumulation. Reclamation typically updates forecasts of runoff and operations plans at least monthly through May. If the water initially anticipated to be available is no longer likely to be available, Reclamation provides a reduced allocation and notifies the water service contractors that less water will be available for delivery. This approach is generally based on a 90% forecast and is intended to minimize the frequency of drier or warmer conditions than forecasted and avoid situations where a previous allocation for fisheries and agriculture cannot be supported. Reclamation may execute temporary contracts, not to exceed one year, for delivery of an unusually large water supply not otherwise storable or infrequent and otherwise unmanaged flood flows[1]. Reclamation may make water available under the water service or repayment contracts in addition to the allocation and consistent with legal obligations[2]. Under the Accelerated Water Transfer Program, Reclamation may transfer water within counties, watersheds, or other areas of origin without showing it as having been consumptively used or irretrievably lost. Actions to make water available are described in the Seasonal Operations

[1] Section 215 of the Reclamation Act

[2] Paragraph 3(f) of Water Service and Repayment Contracts

sections for each CVP and SWP facility in this appendix and modelled to identify changes in river flows.

DWR similarly plans the operations of the SWP by projecting monthly on a 12-month look-ahead cycle. The initial allocation for SWP deliveries is made by December 1 of each year with a conservative assumption of future precipitation to avoid over-allocating water before the hydrologic conditions are well defined for the year. As the water year unfolds, Central Valley hydrology and water supply delivery estimates (Table A Deliveries) are updated using known information and conservative forecasts of future hydrology. DWR may deliver water that is surplus to Table A Deliveries (Article 21 water). Feather River Service Area contracts provide the terms for DWR to avoid interference with claimed senior water rights on the Feather River.

The Fish and Wildlife Coordination Act and the CVPIA, among others, authorize Reclamation to operate, in part, for fish and wildlife project purposes, undertake projects for habitat restoration and facility improvements, and to improve scientific understanding through developing models and supporting data. Following the 1995 Bay-Delta Accord, Reclamation and DWR operate the CVP and SWP to meet certain water quality control plan requirements for Delta outflow and salinity under State Water Resources Control Board (Water Board) Decision 1641 (D-1641). The responsibilities of DWR and Reclamation for senior water rights on the Sacramento River, Feather River, and in the Delta, as well as other regulatory requirements are allocated by the 2018 amended COA.

The Proposed Action is organized as follows:

- **Watersheds:** basin-by-basin description of facilities and the proposed operation for fish and wildlife, water supply, and power generation including proposed conservation measures to promote the recovery and/or to minimize or compensate for adverse effects of operation on federally listed species.
- **Monitoring:** the long-term evaluation of performance to assess overall effectiveness over time. Although each watershed has unique requirements, Reclamation and DWR integrate monitoring across watersheds; therefore, monitoring is organized in a single section.
- **Special Studies:** science-based efforts to address uncertainties in the Proposed Action that affect a reasonable balance among competing demands for water, including the requirements of fish and wildlife, agricultural, municipal, and industrial uses of water, and power contractors to inform subsequent decision making.
- **Drought:** actions to recognize extreme dry conditions may occur during operations. The boom-and-bust nature of California hydrology and the resulting effect on species warrants special consideration for operation during droughts. Although each drought is unique, contingency planning can facilitate a response.
- **Governance:** ongoing engagement by Reclamation and DWR with USFWS, NMFS, CDFW, interested parties, and the public following completion of Biological Opinions and a Record of Decision.

- **Adaptive Management:** science and decision analytic-based approach to evaluate and improve actions, with the aim to reduce uncertainty over time and increase the likelihood of achieving and maintaining a desired management objective.

Each subsequent watershed section highlights authorizing legislation and requirements under the regulations, contracts, and agreements. Watershed sections identify ongoing efforts in the baseline that mitigate the effects of the operation of the CVP and SWP and for which Reclamation and DWR are not consulting nor reinitiating consultation on as part of this Proposed Action. These programs have existing environmental compliance, agreements, and/or contracts with severable utility. These activities are in the baseline and may mitigate the effects of the operation of the CVP and SWP, some of which have been described in previous consultations and implemented.

3.1 Sacramento River

Reclamation operates and maintains the Shasta Division of the CVP for flood control and navigation, M&I and agricultural water supplies, fish and wildlife, hydroelectric power generation, Sacramento River water quality, and Delta water quality. Facilities include the Shasta Dam and Power Plant, Keswick Dam and Power Plant, and a Temperature Control Device (TCD) on the Upstream face of Shasta Dam. Flood control operations are based on regulating criteria developed by the U.S. Army Corps of Engineers (USACE) pursuant to the provisions of the Flood Control Act of 1944. Flood control requirements reserve up to 1.3 million acre-feet (MAF) of space (flood control pool) behind Shasta Dam, leaving 3.2 MAF of space (conservation pool) for storage management during the winter flood season. Reclamation generally maintains flows of at least 5,000 cubic feet per second (cfs) at Wilkins Slough year-round and these flows may be reduced in low-storage and/or drought years.

Major facilities in the Sacramento Division of the CVP include the Red Bluff Pumping Plant, Tehama-Colusa Canal, and Corning Canal (Figure 3-2). Agricultural deliveries provide for the irrigation of over 150,000 acres of land in Tehama, Glenn, Colusa, and Yolo Counties. The Red Bluff Pumping Plant is the intake for the Tehama-Colusa Canal and the Corning Canal. Water is diverted from the Sacramento River approximately 2 miles southeast of Red Bluff through the 2,500 cfs, screened Red Bluff Pumping Plant. In 2011, Reclamation permanently welded the Red Bluff Diversion Dam gates in the open position.

Imports from the Trinity River Basin (Trinity Division) are delivered to the Sacramento River for downstream needs via two pathways: released from Whiskeytown Reservoir to Clear Creek and joins the Sacramento River at the mouth of Clear Creek south of Redding or delivered to Keswick Reservoir through the Spring Creek Tunnel and Power Plant where water mixes with releases from Shasta Reservoir and is released from Keswick Dam.

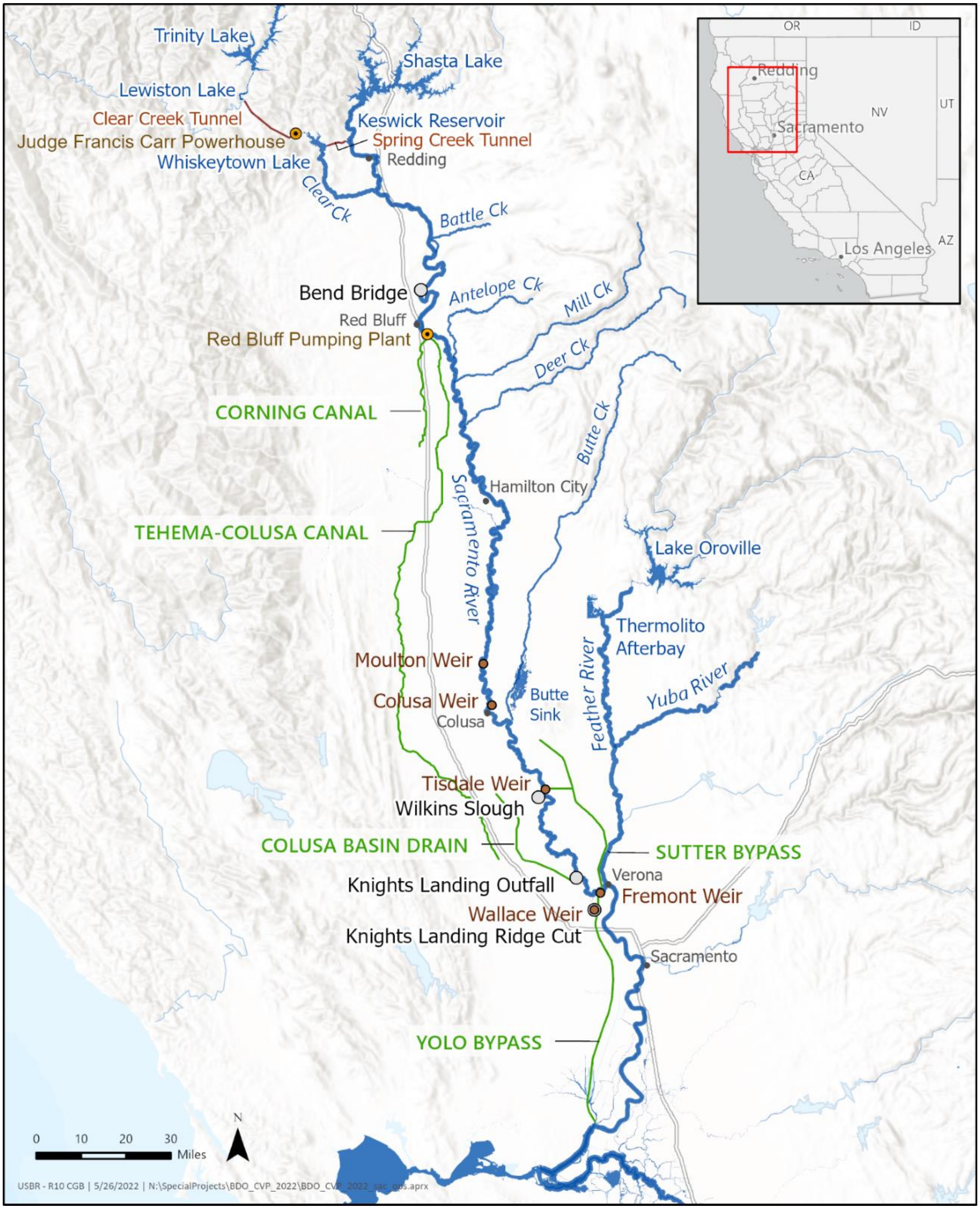


Figure 3-2. Sacramento River Facilities in the Shasta and Sacramento Divisions of the CVP and Flood Control Weirs and Bypasses

For more information on statutory, regulatory, and contractual requirements, see Appendix A:

- Section 7 of the Flood Control Act of 1944
- Public Law 74-392 CVP Re-Authorization Act
- Public Law 81-839 Sacramento Valley Canals
- Central Valley Project Improvement Act (CVPIA)
- State Water Board Decision 990
- State Water Board Water Rights Order 90-5
- State Water Board Water Rights Order 91-1
- State Water Board D-1641
- Settlement Contracts
- Exchange Contracts
- Water Service Contracts

Programs in the environmental baseline to highlight:

- Spawning and Rearing Habitation Restoration

3.1.1 Seasonal Operations

Reclamation operates Shasta Dam in the winter primarily for flood control and minimum flows in the Sacramento River and in the Delta. With flashboards installed on top of the drum gates that raise the elevation to 1,067 feet, the maximum capacity of Shasta Reservoir is 4.552 MAF. For the flood season, USACE provides a flood control diagram that specifies by date a top of conservation pool storage. Flood operational criteria target flow rates below 100,000 cfs at Bend Bridge for the protection of downstream populations; therefore, reservoir elevations may temporarily exceed the top of the conservation pool and encroach into flood space in order to limit downstream flows. In the winter, when not releasing for flood control, Reclamation seeks to store inflows to Shasta Reservoir and releases the minimum flows necessary to meet downstream requirements. State Water Board Water Rights Order 90-5 provides a target for minimum releases from Keswick Reservoir from September through February, the 1937 Act includes consideration for navigation at Wilkins Slough, and State Water Board D-1641 provides flow standards in the Delta. Reclamation may make releases above the minimum to maintain fall-run Chinook salmon redds in wetter hydrologic year types when storage levels are higher in Shasta Reservoir.

In the spring, when not operating for flood control, Reclamation seeks to minimize releases and store inflow to optimize the filling of CVP reservoirs by the end of the flood control season (end of May). Higher storage improves the ability to meet downstream temperature requirements and increases the ability to make releases later in the year for water supply. Accretions (flows from non-project creeks into the Sacramento River below Shasta Dam) reduce the need for additional releases from Shasta Reservoir and help to meet both instream demands and Delta outflow requirements. Wetter years with high accretions may allow Reclamation to store water in the spring and operate mostly for flood control. Drier years with lower accretions may require Reclamation to make releases from Shasta Reservoir for downstream requirements throughout the spring season. Toward the middle to end of spring, instream diversion demands increase on the mainstem Sacramento River and require releases above minimums at Keswick Reservoir Reclamation operates to flow objectives at Wilkins Slough to support diversion by Sacramento River Settlement Contractors with a prior entitlement to water in the Sacramento River, for deliveries to CVPIA wildlife refuges, and for deliveries to CVP water service contractors at the Red Bluff Pumping Plant. The majority of these diversions typically occur mid-April through November with variations depending on hydrology.

Delta salinity and outflow requirements may necessitate additional releases from Shasta Reservoir. When system-wide demands require augmenting flows in the system, Reclamation coordinates imports from the Trinity Basin, releases by DWR from Oroville Reservoir, and releases from Folsom Reservoir. Each reservoir has factors to consider including instream requirements, amounts in storage, forecasted inflow, and refill potential. The 2018 COA describes the CVP portion of Delta outflow requirements. Reclamation balances releases for the CVP portion of Delta outflow requirements between Shasta and Folsom Reservoirs to maximize storage in each reservoir and minimize negative impacts between CVP tributaries. When increased releases are necessary to meet delta needs, Reclamation generally first adjusts exports, then releases from Folsom Reservoir while releases from Shasta Reservoir travel down the Sacramento River. Once releases from Shasta Reservoir arrive in the Delta (about 5 days' travel time), releases from Folsom Reservoir can be reduced to balance the demands on each reservoir. When Reclamation can export water from the Delta during periods of excess flow, Reclamation can store more water in San Luis Reservoir south of the Delta. Maximizing exports in the spring reduces the reliance on stored water later in the year for meeting late season demands.

Summer operational considerations include releases for temperature control, to support essential features of designated critical habitat, instream diversion demands, Delta outflows, Delta salinity, and exports. In-river temperatures downstream of Keswick Dam can be controlled via two methods. The first is thermal mass, by changing release volume or shifting releases between Trinity imports and Shasta Reservoir, and the second is selective withdrawal of colder water through the TCD. Determination of which method to use is made daily as operators balance releases from multiple reservoirs to meet downstream needs. Releases in the summer meet temperature objectives, support essential features of critical habitat and support water supply deliveries. Releases from Shasta Reservoir typically begin increasing in April as storm frequency decreases, air temperatures increase and system-wide demands increase. Peak releases from Shasta Reservoir typically occur June through August and begin to decrease from the peak sometime in August or September. Occasionally, in wetter years, high storage levels through the summer may result in a need to release higher than normal flows in early fall to meet flood control requirements for the next water year. Consideration of fall conditions may also warrant measures for drought protection and rebalancing of storage between reservoirs.

In the fall, Reclamation's objective is to reduce Keswick Dam releases and rebuild storage in Shasta Reservoir. Reclamation balances fall operations based on highly variable conditions: temperature control (dependent on winter-run Chinook salmon emergence timing), maintenance of winter-run redds (dependent on spawning depths), instream diversion demands on the mainstem of the Sacramento River upstream and downstream of Wilkins Slough (dependent on seasonal planting and wildlife refuges), minimizing fall-run Chinook salmon redd dewatering (dependent on late-summer flows and fall spawning timing), and stabilizing releases through fall-run Chinook salmon egg and alevin incubation. The remaining coldwater pool in Shasta Reservoir is usually limited in the fall at the end of the temperature management season. Release reductions from Shasta Reservoir early in the fall consider that some winter-run Chinook salmon eggs and alevin are still incubating, significant instream diversion demands (e.g., rice decomposition) remain on the mainstem of the Sacramento River between Keswick Dam and Wilkins Slough and, depending on conditions, Delta requirements may require upstream reservoir releases for Delta outflow under requirements from the State Water Board or for Delta smelt habitat. If early fall flows drop substantially after fall-run Chinook salmon spawn at high river stages, their redds may be dewatered when flows are later reduced to rebuild storage.

Seasonal Operations will be managed by Reclamation in coordination with the Shasta Operations Team (SHOT), following the monthly SHOT Planning and Actions.

3.1.2 Sacramento River and Shasta Reservoir Coordination Forums

Governance is described in detail in Section 3.13, which includes group members, protocols, meeting frequencies, decision making approaches and other details. For the Sacramento River and Shasta Reservoir, three main coordination forums will meet regularly to discuss seasonal and real-time operations. These include the Winter-run JPE SubTeam, Sacramento River Group (SRG) and the Shasta Operations Team (SHOT). The Winter-run JPE SubTeam is a technical group tasked with development of the winter-run JPE each year and the winter-run broodstock assessment. It is composed of technical staff from Reclamation, DWR, NMFS, USFWS, and CDFW. The SRG is a technical group to discuss pulse flow shaping, temperature management, fall flow smoothing and fall/winter base flows. It is composed of technical staff from Reclamation, DWR, NMFS, USFWS, CDFW, SRSCs, WAPA, SWRCB and Native Tribes. The SHOT is a policy level group that discusses the actions described in this proposed action when implementation may have biological, system conditions or water supply impacts or tradeoffs. It is composed of management and policy staff from key management agencies including the SRSCs. Generally, topics will be discussed at a technical level through SRG with agency feedback provided prior to being discussed at the SHOT. Each action below briefly describes the coordination process within these two groups prior to Reclamation making decisions that have risks, impacts and tradeoffs. For the matters listed below, Reclamation requests NMFS, FWS and CDFW provide technical assistance along with the other members through these groups.

3.1.3 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 quick releases are reduced can lessen or minimize these impacts. Under Order 90-5, the release rate (ramping) from Keswick Dam from September through February shall not decrease more than the following rates to minimize stranding of salmon.

- Releases shall not be decreased more than 15% in a 12-hour period.
- Releases shall not be decreased more than 2.5% in a 1-hour period.

In addition to the requirements under Order 90-5, ramping rates for Keswick Dam between July 1 and March 31 would be reduced between sunset and sunrise.

- Keswick Dam releases >6,000 cfs, reductions in releases may not exceed 15% per night, and no more than 2.5% per hour.
- Keswick Dam releases 4,000 cfs to 5,999 cfs reductions in releases may not exceed 200 cfs per night, or 100 cfs per hour.
- Keswick Dam releases between 3,250 cfs and 3,999 cfs; reductions in releases may not exceed 100 cfs per night.

Reclamation after coordination through the SHOT, may make deviations from this ramping rate to provide incremental benefits to fish species. Such deviations would be initially discussed through the SRG prior to coordination through the SHOT.

3.1.4 Fall and Winter Baseflows for Shasta Refill and Redd Maintenance

Fall and winter base flows support fall- and spring-run Chinook salmon, address winter-run Chinook salmon redd dewatering stressors, and support cold water pool management. Reclamation will operate to a consistent fall and winter baseflow between December and February unless additional releases are necessary for meeting downstream purposes. Consistent minimum flows are intended to avoid unintentional dewatering, support aquatic habitat, and avoid other impacts from regular flow fluctuations. Targets for fall and winter base flows (December 1 through the end of February) from Keswick would be set in October based on Shasta Reservoir end-of-September storage and the current hydrology. Base flows will range from 3,250 cfs to 5,000 cfs. Each year, the base flow will be set to balance between the risk of required storage management or flood control releases in the coming fall and winter with supporting refill capabilities for Shasta Reservoir to build cold water pool for the following year.

Table 3-1. Keswick Dam December through February Default Release Schedule determined by End-of-September Storage

Keswick Release (cfs)	Shasta End-of-September Storage (MAF)
3,250	≤ 2.4
4,000	≤ 2.8
4,500	≤ 3.2
5,000	> 3.2

cfs = cubic feet per second; MAF = million acre-feet

Reclamation, after coordination through the SRG and SHOT, will determine the schedule for release reductions as well as any deviations from this default table by developing a risk analysis that relies on real-time fish monitoring data, winter-run redds remaining in the river, fall-run returns, expected fall water deliveries and transfers. Based on this analysis and the coordination through SRG and SHOT, Reclamation may delay or extend the ramp down to minimum fall and winter flows for the benefit of the fish populations. Such a delay will be coordinated through SRG and SHOT in light of the expected tradeoffs between minimizing winter-run redd dewatering, building storage for the next water year for temperature management and minimizing fall-run stranding and redd dewatering later in the fall. When higher storage exists at the end of September, but the fall hydrology is dry (generally defined as below 90% exceedance of historical hydrology), Reclamation, after coordination through the SRG and SHOT, may reduce flows below those described in the table (or as modified by the risk analysis), if beneficial for fish populations and to building storage for the following year.

This approach to selecting fall, winter, and spring minimum flows allows Reclamation to build and conserve storage for supporting cold water pool management and summer demands. Data indicating that the flood control curve will be reached in December may result in flood control releases over the minimum flows, typically in the December through May period. Low minimum flows in the fall and winter period directly increases the likelihood and magnitude of the flood control releases in the winter and spring months.

In order to minimize the risk of juvenile stranding and redd dewatering during the fall season, to the extent possible given Reclamation's other legal and contractual obligations, Reclamation will coordinate with the SRG to consider planned summer flows that are smoothed out to minimize the net difference between the flow at spawning versus emergence.

3.1.5 Minimum Instream Flows

Under certain hydrologic circumstances during fall and winter months, side flows from creeks within and around the City of Redding may experience short term periods of high flows in response to major storm events. Reclamation, after coordination through the SRG and SHOT, and also through adaptive management, may temporarily reduce Keswick Dam releases below 3,250 cfs to preserve storage, as long as flows at the SAC CDEC gage maintain a minimum 3,250 cfs throughout that Keswick Dam flow reduction.

3.1.6 Rice Decomposition Smoothing

Rice decomposition smoothing could minimize impacts to fall-run Chinook salmon by minimizing fry stranding and redd dewatering as flows drop in the winter. Reclamation will release flows based on Sacramento Valley Water Service Contractors demand and Sacramento River Settlement Contractors coordinated rice decomposition smoothing diversion schedule. Sacramento River Settlement Contractors and CVP Water Service Contractors will synchronize their diversions to lower peak rice decomposition demand. Starting in August, Reclamation and the Sacramento River Settlement Contractors, through the SRG, will develop a delivery schedule based on dewatering risk for winter-run redd locations. The delivery schedule will be updated as conditions warrant.

3.1.7 Sacramento River Pulse Flows

To increase outmigration 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 will schedule this pulse after coordination through the SRG and SHOT and may include coordinating timing with natural flow events, potential storage management operations and/or pulse flows in tributaries.

The timing, magnitude, duration, and frequency of the pulse flows will be refined through the SRG to maximize multi-species benefits, which may include coordinating timing with natural flow events, potential storage management operations, potential SRSC demands and infrastructure limitations, and/or pulse flows in tributaries or reducing the volume of the pulse flow. The pulse flow volume and schedule will be developed through the SRG and provided to the SHOT. Reclamation, through the SHOT, will discuss the plan and make any appropriate and/or necessary refinements prior to implementation.

The VA flow assets may contribute to augmenting a pulse flow. Under conditions when the pulse flow is reduced or not released due to potential impacts on temperature management or other project purposes, the VA flow assets may be used to meet part or all of the pulse flow action. In certain cases, it may be most beneficial to release both the pulse flow and the VA asset together to provide the best benefit to the species.

3.1.8 Adult Migration and Holding Temperature Objectives

Spring temperatures can impact winter-run adults in multiple ways (gamete viability, spawning initiation, temperature shock, adult migration, disease risk, interaction with thiamine deficiency) as well as Late fall-run (impacts to redds). Water temperatures in the March through May period (prior to the start of the typical temperature management season) are typically well under any thresholds of concern for adult migration and adult holding. It is possible that high air temperatures and/or an intentional warm-water power bypass could cause warmer temperatures than normal and may require additional protective measures. Under a circumstance where these conditions may cause water temperatures to rise to concerning levels prior to the final temperature management plan, Reclamation will begin temperature management as early as March 1st to target water temperatures of 58.0° F daily average at the Sacramento River above Clear Creek gage (CCR).

Reclamation, through the SRG and SHOT, may propose a different temperature based on potential impacts to winter-run Chinook salmon spawning and egg incubation in the developing temperature management plan. The Adaptive Management section of this proposed action includes a proposal to look more closely at these pre-spawning temperature objectives and may eventually refine the standard.

Additional details on a potential warm-water power bypass to aid in temperature management are included in the drought tool kit and described further in the drought operations priority framework.

3.1.9 Water Temperature and Storage Management

Shasta Reservoir is the largest reservoir in the Central Valley Project and the State of California. It is relied upon for meeting multiple and often competing objectives throughout the State but with limited ability to meet these objectives in drought years. In general, the approach to managing Shasta, as with all CVP reservoirs, is to best meet all the authorized purposes of the reservoir while limiting high flow, or flood control, releases where possible to maximize the beneficial use of inflow and provide flood protection for the Sacramento River and surrounding area. As climate change has been affecting the hydrology and meteorology, the drought periods have become more severe with significantly less inflow as in previous droughts, higher evaporation and evapotranspiration due to increased temperature and more extreme hydrological and meteorological events. In addition, the viability of critically endangered species and other salmon populations that rely on the Sacramento River are not improving due to multiple stressors and are being significantly impacted by these extreme events, particularly the lack of available water (including cold water) in droughts and high air temperatures.

In order to recognize and adapt to these significant changes to the system as a whole, Reclamation is proposing a new approach to managing Shasta which changes the balance between risks of flood control releases (aka spills) and maintaining water in storage for future drought protection and temperature management. This approach, described below, places a higher priority on maintaining storage for drought protection for all project purposes while limiting the frequency of spilling water due to flood control limitations. Reclamation is committed to support a separate Winter-Run Action Plan with NMFS, FWS, CDFW, DWR and SRSCs to pursue a science and monitoring plan, winter-run habitat and infrastructure actions, and water operations. For this Proposed Action, Reclamation is consulting on the water operations of CVP facilities in the Shasta and Sacramento Division of the CVP.

The following sections describe the management framework for the Shasta Management Plan and drought protection; an annual winter-run broodyear assessment that influences Livingston Stone National Fish Hatchery (LSNFH) decision making, the monthly actions that will be considered by the Shasta Operations Team (SHOT); the temperature objectives for winter-run Chinook salmon holding, spawning, egg development and early rearing downstream from Shasta and Keswick Reservoirs; and the process for developing an annual temperature management plan.

3.1.10 Water Temperature and Storage Framework

The goals of the Plan for Shasta Reservoir Management (Shasta Management Plan) are to provide increased drought protection and maximize suitable temperature regimes for the critically endangered Sacramento River Winter-run Chinook salmon. The Shasta Management Plan considers drought protection actions in nearly every year and identifies actions that will protect storage for multiple project purposes including temperature management. A key principle of the Shasta Management Plan is that drought protection and fish protections are linked. The strategy is framed around an objectives-based management framework adapted from the multi-year drought sequence experienced in Victoria, Australia (Mount et al. 2016, “Victorian Objectives”) that establishes different objectives depending on hydrologic conditions and identifies actions that can be taken for fishery management and drought protection. The general premise is that when hydrologic conditions are good and water resources are available to meet demands they are managed to improve species conditions, which follows the ENHANCE category in Mount et al. 2016, when hydrologic conditions are moderately limited and not available to meet all demands they are managed to RECOVER and MAINTAIN species conditions, and when hydrologic conditions are constrained and the system is stressed they are managed to PROTECT species conditions.

The Shasta Management Plan proposes to integrate Sacramento Basin flow and non-flow measures that are part of the Voluntary Agreements to update and implement the Bay-Delta Water Quality Control Plan. These measures are further described in Section 3.7.5. The Voluntary Agreements offer a watershed-wide approach that includes new flows, habitat restoration, and a governance and science program that would be deployed adaptively. Specifically, under the VAs, flow and non-flow actions covered under this proposed action are not intended to conflict with the SWRCB's Narrative Salmon Objective of the Narrative Viability Objective once adopted.

3.2 Framework Approach

The framework establishes management "Bins" to manage water temperature and storage to meet the Victorian Objectives described above. The framework includes three Bins that are each divided into two categories: standard (Bin A) and drought protection (Bin B). The Bin number (1, 2 or 3) is defined by the projected end of April storage which is primarily driven by hydrology. 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. The A Bins are years when the expected demand from the reservoir is lower meaning it's likely to result in better drought protection should the following year be dry. The B-bins are intended to increase the priority of storage conservation to address the risk that the ensuing year could be a drought. B bins may be conditions where 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. A stressed system is typically indicated by multiple reservoirs across the CVP and SWP having below average storage with below average hydrology either seasonally or in a particular month. Bin assignments will begin in February and will be updated monthly as needed through mid-April. Adjustments after April will be made as appropriate based on changes in hydrology and through coordination with the SHOT. The approach establishes biological objectives for each Bin and identifies potential actions based on forecasted End-of April (EOA) storage and forecasted End-of September (EOS) storage indicators.

Based on the outcome of the broodyear assessment prepared by the Winter-run JPE sub-team, Reclamation, NMFS, FWS and CDFW 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 LSNFH. FWS, 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 4.9.

During any of the Bins described below, Reclamation may request that the Sacramento River Settlement contractors employ some of their voluntary actions identified in their resolution in Section 3.4 to help improve temperature management and/or protect against winter-run redd dewatering and fall-run stranding. If requested, these actions would be implemented in a manner that does not impact the ability of the SRSC to divert per their contract and would be discussed through SHOT with final decision making by the SRSC. These actions include:

- Delaying or shifting spring diversions to maximize storage
- Shifting timing of delivery of transfer water
- Smoothing of fall rice decomp flows.

In addition, the SRSCs are expected to have an action under the Voluntary Agreement to make water available for the purposes of benefiting aquatic species in the upper Sacramento River and increasing delta outflow. This action may occur in any Bin and is more likely to occur in Bins 1 or 2. Decisions on Shasta-related VA flow assets would be managed through SHOT, as described in Section 3.13, *Governance*.

Reclamation recognizes that some years may indicate (using a conservative forecast) a 0% CVP north of delta agricultural allocation early in the year (primarily February and March) even though a non-zero allocation is expected in the coming months as the hydrology solidifies. This may be due to late precipitation, lower storage from the previous year or higher regulatory requirements. In some cases, this 0% early allocation could have detrimental impacts to agricultural lands due to the gap in available supplies between the previous contract year (which ends in February) and when transfer water may come available (in April). In consideration of these unique years, Reclamation will consider providing an allocation by mid-February for 3-30 TAF to avoid these significant agricultural impacts while also maintaining the goals of the PA and not risking a Bin 3 year. Whether or not this allocation maintains the goals of the PA will be determined through discussions with the SHOT. The SHOT may discuss the expected risks with the relevant contractors to determine the appropriate volume to evaluate and may choose to support an incremental allocation between February and March as more information is received. Should the SHOT determine that even the minimum allocation of 3 TAF can not be made while meeting the goals of the PA and/or risks the potential of a Bin 3 year, then the 0% allocation will remain.

3.2.1 Bin 1 – Enhance – ~80% of years

Under Bin 1, hydrologic conditions are generally good and water resources are available to meet demands. Generally, EOA Shasta Reservoir storage is forecasted to allow use of the upper gates of the temperature control device (TCD) to preserve the colder water for later in the season when air temperatures are much higher. This bin begins with an EOA storage forecasted at least 3.7 MAF with a possible storage increase in May and/or June. Bin 1 typically comes with a high confidence to meet cold water temperatures for winter-run Chinook salmon downstream from the Clear Creek gage and to meet drought protection objectives of at least 2.4 MAF EOS storage. In these years, the primary management objectives are to target 53.5F at a location downstream of CCR to maximize suitable habitat for winter-run Chinook salmon and to look for water supply neutral opportunities throughout the system to improve Shasta carryover storage for future year drought protection.

During Bin 1 years, Shasta may be operated to meet a variety of different demands. During the typical irrigation season (April through September), when Wilkins Slough is controlling and there is flexibility to have a Wilkins Slough flow below 5,000 cfs, Reclamation will discuss the appropriate minimum Wilkins Slough flow with the SHOT to ensure flows can both meet biological goals and objectives while also meeting obligations to senior water right holders under the Sacramento River Settlement Contracts. Expected monthly average Keswick and Wilkins

Slough flows for these types of years are shown below for reference. 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 5,000-7,000 cfs range although higher flows may be necessary at times. Flows beyond these ranges will be discussed through the SHOT with a comparison of expected biological and storage tradeoffs including the potential for these higher flows to increase the likelihood of a bin 2 year the following year. Due to the higher storage that defines Bin 1, it is unlikely that higher releases would result in a Bin 3 year the following year.

- **Bin 1A—**Bin 1A is typically a result of a good water year where the system is not stressed and additional water management actions are not necessary to achieve an EOS storage of at least 3.0 MAF. Bin 1A is defined as having an end of April storage at or above 3.7 MAF and a projected end of September storage of at least 3.0 MAF. In these years, the primary management goal is to target 53.5F at a location downstream of CCR to maximize suitable habitat for winter-run chinook salmon. The SHOT will discuss tradeoffs of establishing downstream temperature locations that support the biological goal of maximizing suitable habitat and the risk of running out of cold water. As discussed in previous sections, minimum fall and winter flows would be expected to be in the 4,000 – 5,000 cfs range to provide increased fall run habitat or higher if needed for storage management. Bin 1A is defined as having an end of April storage at or above 3.7 MAF and a projected end of September storage of at least 3.0 MAF. As discussed above, this EOA storage ensure good temperature management through providing access to using the upper gates of the TCD and the EOS storage provides a high likelihood of EOA storage greater than 3.7 MAF the following year. An EOS storage of 3.0 MAF along with the higher fall/winter minimum flows also limits the high potential for fall/early winter flood control releases, although these releases are still expected to occur under wetter hydrology.
- **Bin 1B—**Bin 1B is typically a result of a good water year but the system may be slightly stressed or the water supply may be less than what is seen under Bin 1A. Bin 1B is defined as having an end of April storage at or above 3.7 MAF and a projected end of September storage of at least 2.4 MAF. Consistent with Bin 1A years, this EOA storage ensure good temperature management through providing access to using the upper gates of the TCD. The EOS storage of 2.4 MAF provides a high likelihood of EOA storage greater than 2.8 MAF the following year which is a point at which biological impacts from higher temperatures start to increase significantly. An EOS storage of 2.4 MAF along with the higher fall/winter minimum flows also lessens the potential for fall/early winter flood control releases, although these releases are still expected to occur under wetter hydrology. Similar to Bin 1A, Reclamation, through coordination with SRG and the SHOT, will analyze tradeoffs of establishing downstream temperature locations that support the biological goal of maximizing suitable habitat and the risk of running out of cold water. Reclamation will consider light system tradeoffs for supporting higher Shasta storage (up to 3.0 MAF) with minimal impacts to other parts of the system during their monthly forecasting process. If there are tradeoffs with higher impacts that should be considered to meet the Bin 1 Shasta EOS storage range, Reclamation will consider these through coordination with the SHOT. Available actions primarily include rebalancing between other CVP reservoirs while maintaining all operational goals. If available actions result in storage of 2.4-3.0 MAF, then no further actions would be pursued. If available

actions are not sufficient to result in a storage of at least 2.4 MAF, then this year would be reclassified as Bin 2A.

- Operational Goals and Objectives
    - Maintain sufficient storage for drought protection should the next year be dry
    - Limit early season October through December spill
    - Deliver available water while meeting regulatory requirements and obligations to senior water right holders under the Sacramento River Settlement Contracts
- Biological Goals and Objectives
    - Victorian objective: Enhance and Recover
    - Maximize species recruitment opportunities
    - Increase spatial diversity
    - Maximize floodplain linkages
    - Enhance ecological flows
    - Manage winter-run spawning habitat downstream from CCR to average daily water temperature of 53.5
    - Targeted Resulting Temperature Dependent Mortality to be ≤3%
    - When necessary, manage adult holding temperatures to a daily average temperature no higher than 58dFto minimize pre-spawning mortality
    - Increase available habitat for fall-run chinook salmon in the fall and winter months
    - Appropriate reach-specific survival objectives will be developed through the Winter-Run Action Plan.
- Bin 1A Operational Goals and Indicators
    - February, March and April forecasts project ≥ 3.7 MAF EOA storage based on 90% exceedance, or other conservative approach
    - February, March and April forecasts projects ≥ 3.0 MAF EOS storage based on 90% exceedance, or other conservative approach
- Bin 1B Operational Goals and Indicators
    - Hydrologic Goal: Initiate drought protection
    - February or March forecasts project ≥ 3.7 MAF EOA storage based on 90% exceedance

- February or March forecasts project ≥ 2.4 MAF EOS storage based on 90% exceedance
- The goal of actions is to increase projected EOS storage above 2.4 MAF. If this is not possible, shift to Bin 2A.

3.2.2 Bin 2 – Recover and Maintain - ~11.5% of years:

Under Bin 2, hydrologic conditions are more limited than in Bin 1 and adequate water resources are not available to meet all demands. Generally, the upper end of the EOA storage is showing upper gates may be used temporarily and even when not, there is high confidence to meet cold water temperatures at the Clear Creek (CCR) gage for the critical development periods of the temperature management season and to meet some drought protection objectives that prevent critical storage levels at the end of September and in the subsequent year. Shasta management actions in this Bin would have light to moderate reductions in water supply or require light to moderate adjustments to system management.

During Bin 2 years, Shasta may be operated to meet a variety of different demands. During the typical irrigation season (April through September), when Wilkins Slough is controlling and there is flexibility to have a Wilkins Slough flow below 5,000 cfs, Reclamation, through coordination with the SRG and SHOT, will identify the appropriate minimum flow to ensure flows can both meet biological objectives while also meeting obligations to senior water right holders under the Sacramento River Settlement Contracts. Expected monthly average Keswick and Wilkins Slough flows for these types of years are shown below for reference. October flows may vary due to demands, water transfer operations and protection of winter-run redds and are likely to be in the 5,000-7,000 cfs range although higher flows may be necessary at times. Reclamation expects to begin ramping down to the minimum flow of 3,250 cfs as described above in late October or early November. Reclamation, through coordination with the SRG and SHOT, will determine when to begin this ramp down after discussing the tradeoffs between storage, next year's temperature management, winter-run redd dewatering and fall run stranding and redd dewatering. Flows or timing outside all ranges described above will be discussed through the SHOT with a comparison of expected biological and storage tradeoffs including the potential for these higher flows to increase the likelihood of a bin 2 or bin 3 year the following year. Should the following year be a Bin 3 year which, in part, was due to releases higher than these expected ranges, these higher flows may limit the available actions to conserve storage in that year.

- **Bin 2A**—Bin 2A is a drier water year and can be the start of a multi-year drought sequence or a single year within a multi-year drought sequence. Bin 2A is defined as having an end of April storage at or above 3.0 MAF and a projected end of September storage of at least 2.2 MAF. This EOA storage does not typically allow full use of the TCD, but, when combined with the EOS of 2.2 MAF, is expected to be adequate to provide sufficient temperatures during the majority of the winter-run spawning and egg incubation period to avoid high temperature-related biological impacts. An EOS storage of 2.2 MAF provides a high likelihood of exceeding an EOA storage of 3.0 MAF the following year and has a low potential for fall/early winter flood control releases, although these releases may still occur under wetter hydrology. In these years, the primary management goals are to target meeting 53.5F at CCR during the winter-run spawning and egg incubation period and to manage water supply to support a carryover that provides some drought protection. The temperature management objectives may be shaped through SRG and SHOT based on forecasted and/or real-time meteorologic and hydrologic conditions and best available science. Reclamation will consider water supply (CVP allocation) reductions and, through coordination with the SHOT, will identify moderate system-wide tradeoffs and potential transfer modifications with the goal of meeting both of these temperature and storage goals. Moderate system wide tradeoffs general include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system. If available actions result in storage of 2.2-2.4 MAF, then no further actions would be pursued. If available actions are not sufficient to result in a storage of at least 2.2 MAF, then this year would be reclassified as Bin 2B.

- **Bin 2B—**Bin 2B is typically a drier water year and can be the start of a multi-year drought sequence or a single year within a multi-year drought sequence. Bin 2B is defined as having an end of April storage at or above 3.0 MAF and a projected end of September storage of at least 2.0 MAF. This EOA storage does not typically allow full use of the TCD, but, when combined with the EOS of 2.0 MAF, is expected to be adequate to provide sufficient temperatures during the majority of the winter-run spawning and egg incubation period to avoid high temperature-related biological impacts. An EOS storage of 2.0 MAF provides a high likelihood of exceeding an EOA storage of 2.8 MAF the following year and has a low potential for fall/early winter flood control releases, although these releases may still occur under wetter hydrology. In these years, the primary management goals are to target meeting 53.5F at CCR during the winter-run spawning and egg incubation period and to manage water supply to support a carryover that provides some drought protection. The temperature management objectives may be shaped through coordination with SRG and SHOT based on forecasted and/or real-time meteorologic and hydrologic conditions and best available science. Reclamation will consider water supply (CVP allocation) reductions and, through coordination with the SHOT, will identify moderate system-wide tradeoffs and potential transfer modifications and with the goal of meeting both of these goals. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system, transfer timing modifications, situation-specific adjustments to Delta water quality standards under D-1641 to address developing drought conditions and other actions from the Drought Toolkit. If available actions result in an EOS storage of 2.0-2.2 MAF, then no further actions would be pursued. If available actions are not sufficient to result in an EOS storage of at least 2.0 MAF, then this year would be reclassified as Bin 3.
- Operational Goals and Objectives
    - Maintain sufficient storage for drought protection should the next year be dry
    - Limit early season October through December spill to the extent possible
    - Deliver available water while meeting regulatory requirements and obligations to senior water right holders under the Sacramento River Settlement Contracts
- Biological Objectives

- Victorian objectives: Recover (Bin 2a) and Maintain (Bin 2b)
- 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
- Manage the majority of winter-run spawning habitat at CCR to average daily water temperature of 53.5° F
- Targeted Resulting Temperature Dependent Mortality to be ≤3%
- Manage adult holding temperatures to 58° F to minimize pre-spawning mortality
- Appropriate reach-specific survival objectives will be developed through the Winter-Run Action Plan.

- Bin 2A Operational Goals and Indicators
    - February or March forecasts project 3.0-3.7 MAF EOA storage based on 90% exceedance or other conservative approach
    - February or March forecasts project 2.2-2.4 MAF EOS storage based on 90% exceedance or other conservative approach
    - The goal of actions is to increase projected EOS storage above 2.2 MAF. If this is not possible, shift into Bin 2B.
- Bin 2B Operational Goals and Indicators
    - Hydrologic Goal: Increase drought protection
    - February or March forecasts project 3.0-3.7 MAF EOA storage based on 90% exceedance or other conservative approach
    - February or March forecasts project 2.0-2.2 MAF EOS storage based on 90% exceedance or other conservative approach
    - The goal of actions is to increase projected EOS storage above 2.0 MAF. If this is not possible, shift into Bin 3A.

3.2.3 Bin 3 – Protect - ~8.5% of years

Under Bin 3, critically dry conditions exist, the system is stressed and water resources are not available to meet all demands. There is low confidence to meet sufficient temperatures at the Clear Creek gage and future drought protection is at risk. The main biological objective is to protect winter-run Chinook salmon against decline. This Bin includes the widest array of potential water supply and fishery management actions to protect winter-run Chinook salmon from significant impacts and to protect against future drought risks.

During Bin 3 years, Shasta is expected to be operated primarily for meeting public health and safety (including salinity management in the delta), obligations to senior water right holders under the Sacramento River Settlement Contracts and minimum instream flows. The extent to which Shasta is relied upon to meet these demands depends on both hydrology and available water in other parts of the system. During the typical irrigation season (April through September), when Wilkins Slough is controlling releases from Keswick, Reclamation, through coordination with the SHOT, will identify the appropriate minimum Wilkins Slough flow to ensure flows can both meet biological goals and objectives while also meeting obligations to senior water right holders under the Sacramento River Settlement Contracts. 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 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 redd dewatering concerns. Reclamation, through coordination with the SHOT, will determine the appropriate ramp down date after evaluating tradeoffs between storage, next year's temperature management, winter-run redd dewatering and fall run stranding and redd dewatering. Should the following year be a Bin 3 year which, in part, was due to releases higher than these expected ranges, these higher flows may limit the available actions to conserve storage in that year.

- **Bin 3A—**Bin 3A is an unusual year type where the hydrology is generally drier, but with a wetter spring or heavy snow-melt based inflow with lower demands expected. Bin 3A is defined as having an end of April storage below 3.0 MAF and a projected end of September storage greater than 2.0 MAF. This EOA storage does not allow full use of the TCD and is unlikely to meet sufficient temperatures at CCR. In these years, the primary management goals are to conserve storage and operate the TCD to target 53.5 F upstream of CCR for the most critical period during the winter-run spawning and egg incubation period to avoid critical loss of winter-run population. Reclamation will reduce Shasta releases for water supply (CVP allocations) to conserve storage with the goal of meeting the EOS storage objective of 2.0-2.2. Reclamation, through coordination with the SHOT, will identify moderate system-wide tradeoffs and potential transfer modifications with the goal of conserving storage and meeting temperature objectives. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system, transfer timing modifications, situation-specific adjustments to Delta water quality standards under D-1641 to address developing drought conditions and other actions from the Drought Toolkit. If available actions result in storage of 2.0-2.2 MAF, then no further actions would be pursued. If available actions are not sufficient to result in a storage of at least 2.0 MAF, then this year would be reclassified as Bin 3B.
- **Bin 3B—**Bin 3B is typically a dry water year and is often within a series of drier years such as during a multi-year drought sequence. Bin 3B is defined as having an end of April storage below 3.0 MAF and a projected end of September storage less than 2.0 MAF. An EOA storage below 3.0 MAF combined with an EOS storage of below 2.0 MAF will make protective temperature management very challenging. In addition, carryover less than 2.0 MAF provides little drought protection if the following year continues to be dry. As a result, years which fall into bin 3B are intended to be an "all-

hands-on-deck" year where all actions from the drought tool kit are considered to determine if they can help support increased Shasta storage. In addition, these years are likely to be ones where the entire system is stressed and many actions from the drought toolkit may be required to address the status of the entire system. It is likely that many drought actions considered in these years are not solely targeting Shasta storage but looking at system wide storage for meeting highest priority demands and providing some overall system wide drought protection should the following year be dry. There is confidence that a temperature management plan will include a strategy to provide winter-run Chinook spawning temperatures that avoid critical losses of egg and fry production, maintain key spawning refuges in upstream areas and avoid catastrophic impacts to the broodyear.

- In these years, the primary management goals are to conserve storage and operate the TCD to target 53.5° F upstream of CCR for the most critical period during the winter-run spawning and egg incubation period to avoid critical loss of winter-run population. Reclamation will reduce Shasta 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 temperature objectives. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system, transfer timing modifications, situation-specific adjustments to Delta water quality standards under D-1641 to address developing drought conditions and other actions from the Drought Toolkit. Heavy system wide actions include requesting significant relaxations to D1641, limitations in water available under contract (see further description below) and other actions from the Drought Toolkit. In extremely dry years or in multi-year droughts, it is possible that these actions will not achieve an EOS storage above 2.0 MAF.

- During Bin 3B years, defined as having an end of April storage below 3.0 MAF and a projected end of September storage less than 2.0 MAF, which are also designated as critical years under the SRSC's contracts and have an October through April inflow of less than 2.5 MAF, available water supply for diversion under the SRSCs is limited to between 75% and 50% of total contract quantities, or approximately 1.5 - 1.1 MAF. The available water for diversion within this range depends on the water available to meet an expected end of September storage of 2.0 MAF using a conservative forecast (90% exceedance or equivalent). This reduced volume of available water will be applied to all SRSCs collectively and individual contractor reductions may vary based on agreements and transfers between different SRSCs. In these years, previously described SRSC voluntary actions under their resolution may not be possible due to the very limited supply. It is also unlikely that VA water would be made available in these years as they are typically critical water year types. Should there be a request for a VA asset, the origin and use of that asset will be discussed through the appropriate governance teams. During these years, Reclamation will coordinate with FWS to maintain summer deliveries of Level 2 supplies to Sacramento Valley CVPIA refuges to provide essential dry year habitat for Giant Garter Snake, Western Pond Turtle, Tricolored blackbirds and migratory waterfowl in a manner consistent with refuge contracts and agreed upon operational priorities. If conditions remain dry through the fall Reclamation and FWS will coordinate on how to address instream flow objectives, lake levels and refuge needs. Reclamation will continue to utilize level 4 to supplement supplies for refuges in drier years when storage and coldwater pool are limited.

- SRSCs will be asked to provide input through the SHOT on minimum Keswick and Wilkins Slough flows to meet obligations to senior water right holders under the Sacramento River Settlement Contracts while meeting biological objectives and other requirements such as public health and safety. In situations where appropriate fall and winter flows were discussed and tradeoffs were evaluated but there was not agreement on the implemented flow regime from the SRSCs, SRSCs propose alternative methods to meet obligations to senior water right holders under the Sacramento River Settlement Contracts with the SHOT should the following year be a 3B year. Should a similar disagreement occur during a Bin 3B year after the Bin has been designated, flows in disagreement will not affect the determination on volume of available water. Under these conditions, the likelihood of storage below 2.0 MAF will increase. Reclamation will coordinate through the SHOT with a goal of agreement on all release decisions in 3B years in order to avoid a disagreement on the use of critical and limited water supplies.
- Operational Goals and Objectives
    - Maintain and conserve minimal storage for to avoid catastrophic low storages should the next year also be dry
    - Meet public health and safety demands including delta salinity
    - Meet obligations to senior water right holders under the Sacramento River Settlement Contracts
- Biological Objectives
    - Victorian objective: Protect
    - Avoid critical loss of population
    - Maintain key refuges of spawning and early rearing habitat
    - Avoid catastrophic changes to habitat and impacts to the broodyear
    - Manage winter-run spawning habitat upstream of CCR average daily water temperature of 53.5° F during the critical periods of the spawning and egg incubation period
    - Targeted Resulting Temperature Dependent Mortality to be ≤30%
    - Manage adult holding temperatures below 58 daily average to minimize pre-spawning mortality
    - Appropriate reach-specific survival objectives will be developed through the Winter-Run Action Plan.
- Bin 3A Operational Goals and Indicators

    - February or March forecasts project <3.0 MAF end of April storage based on 90% exceedance or other conservative approach
    - February or March forecasts project >2.0 MAF end of September storage based on 90% exceedance or other conservative approach
    - The goal of actions is to increase projected EOS storage to 2.2 MAF. If this is not possible to increase projected EOS storage above 2.0 MAF shift to Bin 3B.
- Bin 3B Operational Goals and Indicators
    - Hydrologic Goal: Increase drought protection
    - February forecasts projects <3.0 MAF end of April storage based on 90% exceedance or other conservative approach
    - February forecasts projects <2.0 MAF end of September storage based on 90% exceedance or other conservative approach
    - The goal of actions is to increase projected EOS storage above 2.0 MAF, If this is not possible identify system priorities and contingencies.

3.3 Egg Incubation and Emergence Temperature Objectives

Water temperature management generally occurs May 15 through October 30th; however, start and end dates may be adjusted through coordination with the SRG and SHOT based on the winter-run Chinook salmon spawning and emergence. Water temperature management would target 53.5°F at locations identified in the Bins above. The application of Victorian Objectives will be applied to support a greater habitat extent, duration and frequency on the Sacramento River below Keswick Dam, when storage resources allow, water temperature management will expand habitat for early or later spawners, spawners further downstream, and juveniles rearing.

3.3.1 Temperature Management Plan

Reclamation will coordinate through the SRG to prepare a draft Temperature Management Plan (TMP) in April. The draft TMP will include: projected reservoir releases, assumed meteorological conditions, anticipated water temperatures and target locations, and TDM estimates for both Martin (2017) and Anderson (2022). Reclamation will finalize the TMP in May or later through coordination with the SRG and SHOT. Reclamation may update the TMP through coordination with the SRG and SHOT.

A final TMP after May is more likely in wetter years when the location of 53.5° F is expected to be downstream of CCR or in years when hydrologic conditions changed significantly after the draft TMP. For the final TMP, Reclamation will use conservative assumptions for determining the temperature management strategy, including relying on the actual May 1 storage, a conservative inflow forecast for inflow May through September, expected releases based on a conservative forecast and a conservative historical meteorology. Reclamation will utilize a forecast with 90% exceedance in the aggregate (when jointly considering multiple significant known uncertainties such as hydrology and meteorology) to develop conservative water temperature forecasts, although certain circumstances may lead Reclamation to use different exceedance levels to incorporate an appropriately more conservative approach.

Reclamation will operate the Shasta Dam Temperature Control Device to manage water temperatures below Keswick Dam according to the Temperature Management Plan and monitor the results. Reclamation will proactively monitor and manage water temperatures and make operational changes to maintain temperatures consistent with the objectives from the TMP throughout the temperature management season. If monitored water temperatures exceed the average daily target temperature for three consecutive days, despite efforts to monitor conditions and manage proactively, Reclamation will notify NMFS of what actions, if any, are being or will be taken to address the exceedances and will arrange for a follow-up on day 4 if the actions do not resolve the issue. Reclamation will monitor implementation of the TMP using updated data on reservoir storage and coldwater pool via reservoir profiles and water temperatures downstream of Keswick Reservoir.

3.3.2 Temperature Profile Tracking

Reclamation will collect temperature profile measurements for Shasta, Whiskeytown, and Trinity reservoirs every month at 25 ft intervals and distributed through the SRG following QA/QC, generally within [TBD] days.

Table 3-2. Temperature Profile Measurements for Shasta Reservoir

Dates	Profiles
Dec. – Feb.	Monthly at 25 ft. Intervals
Mar. – April	Every Two Weeks at 5 ft. Intervals
May – Nov. 15	Every Week at 5 ft. Intervals
Nov. 15 – Nov. 30	Every Two Weeks at 5 ft. Intervals

3.3.3 Annual Winter-run Chinook Salmon Broodyear Assessment

In order to inform operations, risk tradeoffs for determining the downstream extent of water temperature management, and the need to pursue increasing production or taking other actions at LSNFH, the JPE Subteam will conduct a winter-run Chinook salmon broodyear assessment for the previous year's cohort and the cohort of return adults that hatched three years prior. The purpose is to track species conditions and take appropriate actions to avoid adverse impacts to the following year’s cohort. If the previous year’s cohort and the cohort three years prior, is determined to have experienced “adverse conditions”, then more actions would be taken to manage the objectives for each Bin, including both biological and drought protection objectives. The broodyear assessment will be developed by February 1 or each year using the best available science to guide calculation of each metric described below. The broodyear assessment will be based on the best available science each year and the JPE Subteam may consider using the following indicators or information:

- >30% TDM
- <20% ETF survival

- 25%ile of historic JPE
- TMP compliance point was above CCR
- Adverse Population Viability Trends (per previous years annual brood year report if there was an increase in any of the five criteria in Lindley et. al. 2007)
- High Risk of Extinction (per 5 year status review)
- Outyear adult escapement forecast based on Pacific Fishery Management Council winter-run stock abundance analyses

The JPE Subteam will provide the broodyear assessment to Reclamation and the SHOT. If the broodyear assessment determines Adverse Conditions for Winter-run Chinook salmon and identifies that Shasta storage and hydrology are expected to result in continuing adverse conditions to the coming broodyear, the SHOT will report these conditions and proposed actions to the Directors and all reasonable actions will be taken to avoid continued adverse conditions. These indicators of broodyear strength can be revised by the SHOT with NMFS approval .

3.4 Sacramento River Settlement Contractor Resolution

The Sacramento River Settlement Contractors approved *A Resolution Regarding Salmon Recovery Projects in the Sacramento River Watershed, Actions Related to Shasta Reservoir Annual Operations, and Engagement in the Ongoing Collaborative Sacramento River Science Partnership Effort*. Pursuant to the resolution, the SRS Contractors will continue to participate in, and act as project champions for future Sacramento Valley Salmon Recovery Program projects, subject to the availability of funding, regulatory approvals, acceptable regulatory assurances, and full performance of the SRS Contracts.

Pursuant to the resolution, the SRS Contractors will meet and confer with Reclamation, NMFS, and other agencies as appropriate to determine if there is any role for the SRS Contractors in connection with Reclamation's operational decision-making for Shasta Reservoir annual operations in those years. This determination will include consideration of what actions are feasible, consistent with the terms of the SRS Contracts. In addition to the 25% reduction during Shasta Critical Years as set forth in the SRS Contracts, the types of actions that may be considered include, but are not necessarily limited to: (1) the scheduling of spring diversions by the SRS Contractors; (2) voluntary, compensated water transfers by the SRS Contractors subject to Reclamation approval; and (3) smoothed SRS Contractor diversion for rice straw decomposition during the fall months. Any mutually agreeable proposed actions resulting from these meet and confer discussions must be consistent with the terms of the SRS Contracts and may also be subject to other regulatory approvals.

Decisions related to implementation of these Shasta-related voluntary actions will be carried out through SHOT.

3.4.1 Monthly SHOT Planning and Actions

This section describes the monthly SHOT planning process and actions that will be discussed. The planning approach is based on the seasonal water year and identifies actions that are necessary to implement the Shasta Management Plan.

- October
    - The SHOT begins meeting for the new water year
    - Kick-off JPE subteam – establish 5-agency team, confirm meetings, schedule, work products
    - Expected work products: JPE, Winter-run Broodyear assessment
    - Begin tracking system conditions and hydrologic outlook. Goal is to take stock of system conditions and tracking water year hydrology
    - SHOT discussing October releases for purpose of tracking WR dewatering and incidental take limits
    - SHOT available for elevation for Redd Maintenance and Fall Flow Smoothing actions
    - Reclamation, through coordination with SHOT, planning for winter refill flows
    - Reclamation, through coordination with SHOT, tracking VA assets and discussing options for deployment
    - If necessary, SHOT discussing water transfer schedules
    - SHOT tracking downstream winter-run counts
- November
    - SHOT provides support to JPE Subteam as needed
    - Continue tracking system conditions and hydrologic outlook
    - SHOT discuss November-April Keswick minimum releases based on EOS. In the event of a dry fall where the previous year was a Bin 2 or 3 year, strive to get to 3,250 cfs by December 1 or sooner.
    - SHOT available to the SRG for elevation for Redd maintenance and Fall Flow Smoothing
    - SHOT tracking winter refill flows
    - SHOT is tracking VA assets and discussing options for deployment
    - Receive winter-run adult spawning escapement numbers from summer
    - SHOT tracking downstream winter-run counts

- December
    - SHOT provides support to JPE SubTeam.
    - JPE Subteam issues JPE Memo to SHOT by December 31
    - Continue tracking system conditions and hydrologic outlook
    - For the most part, December is not a drought planning month, but may be in extreme low storage conditions
    - Under very dry fall conditions that have resulted in extremely low storage conditions, Reclamation and DWR, in coordination with the SHOT, will start to review the drought toolkit in anticipation of drought conditions developing or persisting.
    - Tracking fishery conditions
    - SHOT is tracking VA assets and discussing options for deployment
    - Review the temperature and TDM results from the previous water year versus the objectives from TMP to determine if 1) any deviances from the TMP were understood by the SRG and SHOT team, 2) if an independent panel review is appropriate for better understanding the differences and 3) if any adjustments to the planning process are warranted. In some cases, the SHOT may work with the SRG to conduct an operational and/or biological necropsy to determine the cause of any exceedance.
- January
    - SHOT provides support to JPE SubTeam.
    - If an adjustment is needed, the JPE Subteam will issue JPE Adjustment Memo to SHOT Team by January 15-31
    - SHOT reviewing drought tool kit in low storage years or if drought conditions are present
    - SHOT is tracking VA assets and discussing options for deployment
    - SHOT evaluating possible need for LSNFH production adjustments or other actions to protect winter-run production at the hatchery.
    - SHOT considering non-critical year voluntary actions if low storage conditions or drought conditions are developing.
- February
    - If February 90% forecast EOA/EOS projections indicate Bin 2:
        - SHOT may initiate Meet and Confer regarding water supply neutral actions. Discussions based on 90% February forecast unless a different forecast is more appropriate to reflect a conservative outlook

    - SHOT evaluating system-wide tradeoffs
    - SHOT evaluating Drought Toolkit for possible actions
    - FWS, through coordination with SHOT, determines if it's appropriate to increase production at LSNFH or to take other actions to protect winter-run production
    - Broodstock collection begin.
    - VA asset planning begins
- If February 90% forecast EOA/EOS projections indicate potential Bin 3:
    - SHOT may initiate Meet and Confer regarding voluntary actions discussions based on 90% February forecast unless a different forecast is more appropriate to reflect a conservative outlook
    - SHOT evaluating system-wide tradeoffs
    - SHOT evaluating Drought Toolkit for possible actions
    - FWS, through coordination with SHOT, determines if it's appropriate to increase production at LSNFH or to take other actions to protect winter-run production
    - Broodstock collection begin.
- Regardless of Bin type:
    - JPE Subteam issues annual winter-run broodyear assessment memo to SHOT
    - SHOT coordination on February Operational Outlook
    - Reclamation announces initial Shasta-critical determination and CVP allocations – Note: most deliveries do not start until April or May
    - If Shasta end of September storage is projected to be above 2.4 MAF, then walk through the forecast after the allocation comes out
    - If a borderline year, then Reclamation will discuss any key forecasting assumptions with the SHOT prior to allocations. This may include expected release ranges and storages for all reservoirs, expected pumping levels and expected regulatory requirements. Due to the very tight time frame for reviewing any data before the allocation is released, this may not include a full outlook but rather the key factors that prevent Shasta from reaching 2.4 MAF or higher. This may be done either verbally in a SHOT meeting or via email.
    - SHOT is tracking VA assets and discussing options for deployment
    - VA asset planning begins

        - SHOT begins discussing system-wide tradeoff actions
        - SRG meets to start planning for possible March pulse flow either from the PA or from the VAs. If SRG recommends an early (March) pulse flow, it will be recommended to SHOT as soon as possible but no later than the end of February.
        - SHOT decision on spring pulse flow could be based on temp modeling or could be based on storage and broodstock only. If the SRG decides spring pulse flow is appropriate, will pass to SHOT as a recommendation. To the extent possible when consistent with action objectives, try to combine the spring pulse flow with meeting delta objectives, either D1641 or the VA system-wide objectives depending on the source of the pulse flow water.
        - SHOT considers tradeoffs associated with a pulse flow action in the context of the broodyear assessment, projected EOA and EOS storage, system conditions, current hydrology and forecasts.

- March
    - If March 90% forecast indicates EOA/EOS projections indicate Bin 2:
        - SHOT needs confirmation on scheduling for spring diversions per SRSC resolution
        - Confirmation on resolution items, particularly the delayed spring offset and begin to get an idea of volumes of transfers
        - Preliminary temperature modeling; convene SRG
    - If March 90% forecast EOA/EOS projections indicate Bin 3:
        - Preliminary signal for allocation or delivery adjustments
        - Preliminary temperature modeling; convene SRG
    - Regardless of Bin type:
        - SHOT begins meeting weekly or as needed
        - SHOT begins enhanced reporting out to WOMT
        - SHOT initiates preliminary scenarios and TMP planning.
        - SHOT begins discussions to plan for April and May release patterns
        - Continue to coordinate on non-critical year voluntary actions. Need a preliminary idea of SRSC diversion quantities and transfers
        - SHOT evaluating Drought Toolkit for possible actions
        - SHOT discusses potential signals for possible drought actions
        - Continuing to evaluate system wide tradeoffs

        - LSNFH broodstock collection continues
        - Reclamation shares the March Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
        - Reclamation tracking Shasta Critical Determination
        - Reclamation announces March allocations if appropriate. SHOT coordination involves:
        - If Shasta EOS is projected to be above 2.4 EOS, then walk through the forecast after the allocation comes out
        - If a borderline year, discuss key forecasting parameters that prevent Shasta from reaching 2.4 MAF
        - VA asset planning continues
        - SHOT discussing system-wide tradeoff actions
        - SRG Planning
        - SRG pulse flow group planning for possible March or April pulse flow
        - SHOT Decision on spring pulse flow – could be based on preliminary temp modeling or could be based on storage and broodstock only. If the SRG decides spring pulse flow is appropriate, will pass to SHOT as a recommendation. To the extent possible when consistent with action objectives, try to combine the spring pulse flow with meeting delta objectives either D1641 or the VA system-wide objectives depending on the source of the pulse flow water.
        - SHOT considers pulse flow action in consideration of broodyear assessment, storage, system conditions…risk/balance/tradeoffs
- April
    - If April 90% forecast indicates EOA/EOS projections indicate Bin 2:
        - Transfer planning – Identify bounds of volume and timing
    - If April 90% forecast EOA/EOS projections indicate Bin 3:
        - Transfer planning – Identify bounds of volume and timing
        - Final decisions on many drought actions including available water supply for SRSC diversions and diversion patterns
    - Regardless of Bin type:
        - SHOT meeting weekly or as needed
        - SHOT continues enhanced reporting out to WOMT

- Reclamation announces April allocations if appropriate. SHOT coordination involves:
    - If Shasta EOS is projected to be above 2.4, then walk through the forecast after the allocation comes out
    - If a borderline year, then discuss key forecasting parameters that prevent Shasta from reaching 2.4 MAF
    - SHOT continues planning discussions for April and May release patterns
    - Continue to coordinate on non-critical year voluntary actions
    - May pulse flow decision
    - LSNFH actions continuing
    - Reclamation shares the April Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
    - Draft Temperature Management Plan (table and/or graphs only – no report):
    - If going into a bin 2 or 3 (90% exceedance unless altered by hydrology) then based on March forecast with a date of April 15th to allow for SRG coordination
    - If bin 1, then date of April 30th using the April forecast unless later decided by SHOT
    - Profile frequency – SHOT determines optimal frequency
    - Determine final shoulder temps if necessary

- May
  - If May 90% forecast indicates EOA/EOS projections indicate Bin 2:
    - Transfer planning – Identify bounds of volume and timing
  - If May 90% forecast EOA/EOS projections indicate Bin 3:
    - Continue Meet and Confer. Make decisions regarding commitments under SRSC resolution
    - Transfer modifications – Draft/Final bounds
    - Evaluating drought toolkit if necessary
  - Regardless of Bin type:
    - SHOT back to meeting Monthly or as needed

    - Reclamation shares the May Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
    - SHOT continues planning discussions for May release patterns
    - Final allocations in appropriate: SHOT Coordination includes:
    - If Shasta EOS is projected to be above 2.4, then walk through the forecast after the allocation comes out
    - If a borderline year, then discuss key forecasting parameters that prevent Shasta from reaching 2,4 MAF
    - It is common that May will be the final allocation
    - Continue to coordinate on non-critical year voluntary actions
    - Evaluate system wide trade offs
    - LSNFH actions continue
    - Possible May pulse flow
    - Final TMP shared with both NMFS and SWRCB with a copy to all SHOT and SRG members. Final will be issued by May 31st unless a later date is agreed upon by the SHOT.
- June
  - SHOT is meeting monthly or as needed and coordinating with the SRG during implementation of the TMP
  - SHOT may consider adjustments to the TMP if recommended by the SRG
- July
  - SHOT is meeting monthly, or as needed, and coordinating with the SRG during implementation of the TMP
  - SHOT may consider adjustments to the TMP
- August
  - SHOT is meeting monthly, or as needed, and coordinating with the SRG during implementation of the TMP
  - SHOT may consider adjustments to the TMP
  - SRG begins discussing fall release planning
- September
  - SHOT is meeting monthly, or as needed, and coordinating with the SRG during implementation of the TMP. There may be a need to coordinate on fall transition

planning to minimize redd dewatering based on available cold water and overall storage conditions.

3.4.2 Drought Operations Priority Framework

Under certain conditions, such as prolonged drought or unexpected hydrologic conditions, the February 90% forecast may indicate that EOS is projected to be less than 2.0 MAF. Under these conditions, Reclamation will develop a drought emergency plan that, at a minimum, will include the following actions with the goal of achieving a projected EOS storage as close to 2.0 MAF as possible:

- Evaluation of system priorities
- Plan to continue to pursue all applicable 3B actions
- Full assessment of hydrologic and ecosystem conditions
- Assessment of Public Health and Safety needs
- Managing salinity to meet basic public health and safety needs
- Ability to meet demands for public health and safety water deliveries
- Enhanced coordination between the SHOT, Directors and SRSCs
- After exploring all applicable 3B actions, develop a Temperature Management Plan which accounts for the drought emergency plan and applies the best available approaches for managing the available coldwater supply to best balance tradeoffs between the spatial and temporal extent of winter-run suitable habitat while considering impacts to other species.

All actions in the Drought Toolkit will also be considered. Over the long-term additional actions are being considered or implemented to provide improved conditions for species during future droughts in addition to the actions identified in this plan:

- Designing habitat projects with drought refugia and resilience in mind
- Investments in other habitats for salmon spawning
- Consider objectives when planning for and implementing other water projects

Management Rationale: In these circumstances, all of the relevant Bin 3B actions will be considered but there is a low likelihood that taking all of the actions would increase forecasted EOS conditions above 2.0 MAF and therefore, Reclamation, in coordination with the SHOT and WOMT, will develop a drought emergency plan that establishes system priorities and a temperature management plan that seeks to provide winter-run Chinook spawning temperatures to avoid catastrophic losses related to summer temperature management.

3.5 Clear Creek

As a component of the Trinity Division of the CVP, Reclamation operates and maintains Whiskeytown Dam on Clear Creek, with a capacity of 241,100 acre-feet, for irrigation and other beneficial uses, hydroelectric power generation, fish and wildlife, recreation, and upper Sacramento River temperature control and water rights requirements. Whiskeytown Lake provides reregulation of trans-basin imports from the Trinity River. Diversions from Lewiston Lake on the Trinity River through the Judge Francis Carr Powerhouse and the runoff from the Clear Creek drainage area flow into Whiskeytown Lake. Water from Whiskeytown Lake is released into Clear Creek, diverted through the Muletown Conduit, or diverted through the Spring Creek Tunnel and Spring Creek Powerplant into Keswick Reservoir. Whiskeytown Lake has two temperature curtains to pass cold water through the bottom layer and limit warming from Judge Francis Carr Powerhouse to the Spring Creek Powerplant.

Reclamation operates and maintains Spring Creek Debris Dam on Spring Creek, with a capacity of 5,870 acre-feet, for hydroelectric power generation and upper Sacramento River temperature control and water rights requirements. Spring Creek Debris Dam controls debris and contaminated runoff resulting from old mine tailings on Spring Creek, which would otherwise enter the Spring Creek Powerplant tailrace. Water from Spring Creek Debris Dam and Spring Creek Powerplant discharges into Keswick Reservoir.

Statutory, Regulatory, and Contractual Requirements, see Appendix A:

- Public Law 84-386 Trinity River Division
- Section 3406(b)(12) of CVPIA
- Instream Flow Preservation Agreement 2000 (Contract No. 00-WC-1719-B8)
- April 15, 2002, State Water Board permit, minimum flows
- 1980 Memorandum of Understanding (MOU) with California Department of Fish and Wildlife (CDFW) and State Water Board (Spring Creek Debris Dam)

Programs in the environmental baseline to highlight:

- Spawning and Rearing Habitation Restoration

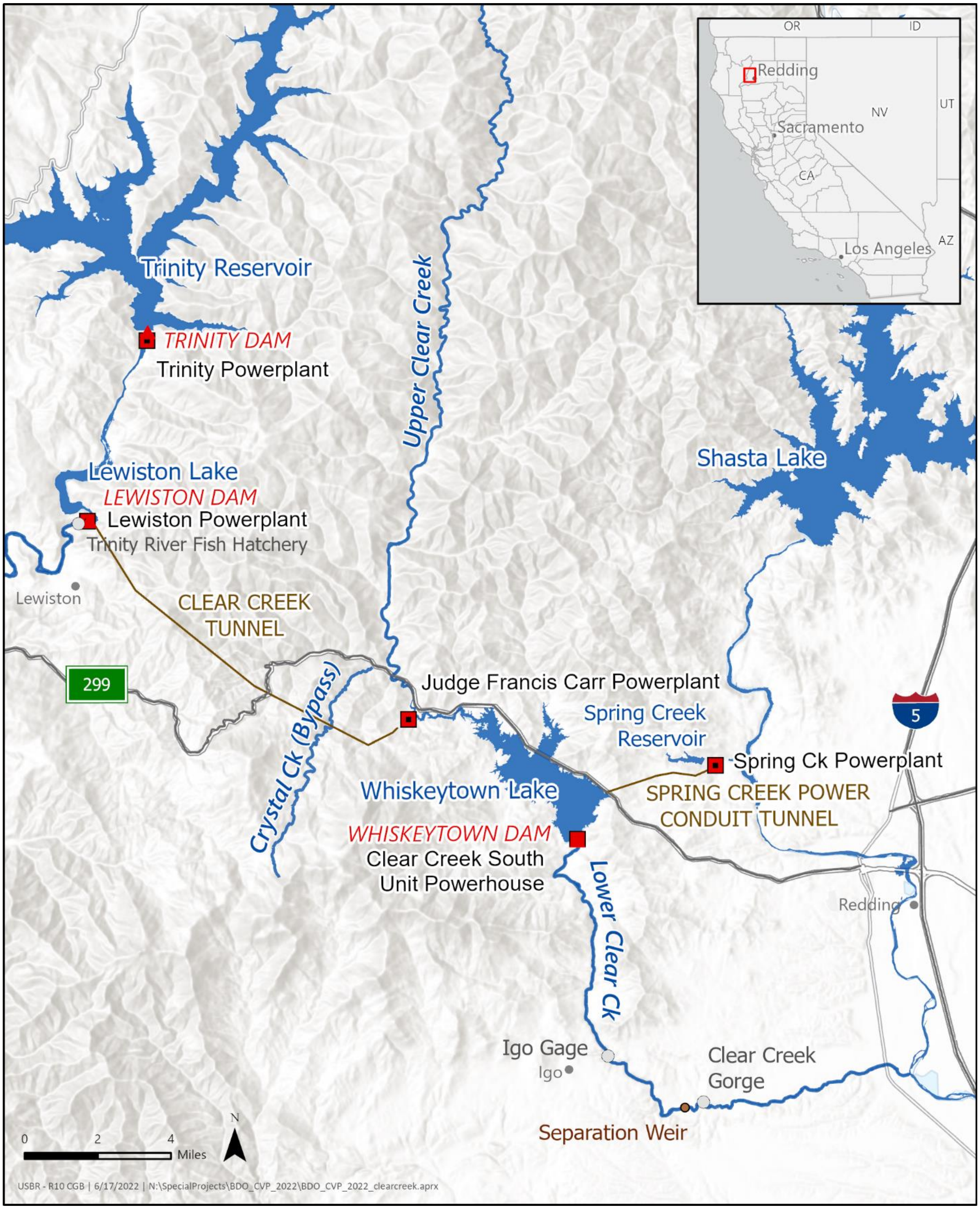


Figure 3-3. Clear Creek Facilities in the Trinity Division of the CVP

3.5.1 Seasonal Operations

In the winter and spring, Whiskeytown Lake is operated to regulate flows for flood management. Starting in November, Reclamation will draw down Whiskeytown Lake by approximately 35 thousand acre-feet (TAF) to create flood management space, generally refilling in April or May. USACE does not regulate Whiskeytown Lake for flood control. Operations at Whiskeytown Lake during flood conditions are complicated by its operational relationship with the Trinity River, Sacramento River, and upper Clear Creek. On occasion, imports of Trinity River water to Whiskeytown Lake may be suspended to avoid aggravating high flow conditions in the Sacramento Basin. Heavy rainfall events occasionally result in uncontrolled gloryhole spillway discharges to Clear Creek, through the Whiskeytown Gloryhole.

During the summer and early fall, Reclamation operates to provide lake elevations as full as practical for recreation. Whiskeytown Lake is a major recreational destination with recreational facilities administered by the National Park Service. Summer and fall imports help maintain Whiskeytown Lake elevations, provide cool water for releases to Clear Creek for temperature control objectives, decrease residence time in Lewiston Lake for Trinity River temperature control, and help maintain temperature objectives in the Sacramento River by supplying water to Keswick Reservoir.

3.5.2 Ramping Rates

Ramping rates address the stranding risk stressor. Reclamation will use down ramping rates of up to 25 cfs per hour and schedule these reductions in consideration of listed species behavior (e.g., diel movement patterns).

Reclamation may vary from these ramping requirements during flood control. Reclamation, through Clear Creek Technical Team (CCTT), may develop a faster or slower down ramping rate on a case-by-case basis.

3.5.3 Minimum Instream Flows (Seasonally Variable Hydrograph)

Minimum instream flows address habitat stressors. Reclamation will release water through Whiskeytown Dam to provide intra-annual variation to emulate natural processes. As provided in Figure 3-4 and Table 3-3, flows will oscillate over a 1-year period, with releases transitioning from 300 cfs in the winter, down to 100 cfs in the summer, and back to 300 cfs by the following winter. In critical years, Reclamation will target an average 150 cfs based on available water from Trinity Reservoir and attempt to maintain above 100 cfs.

Reclamation, through the CCTT, will schedule the hydrograph to maximize multi-species benefits. Reclamation, through the CCTT, may modify the timing and flow rates provided in Figure 3-4 and Table 3-3 by February 1 and updated through May on a case-by-case basis. The flow schedule is subject to agreement by Redding Electric Utility for use of their facilities.

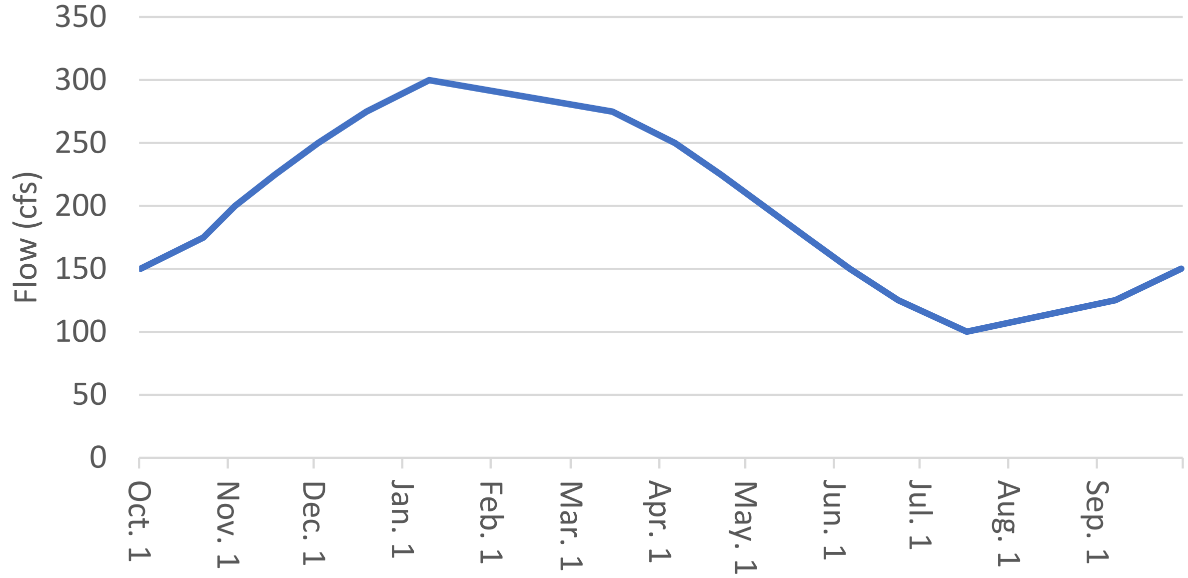


Figure 3-4. Clear Creek Seasonally Variable Hydrograph Minimum Flows, Except Critical Years

Table 3-3. Proposed Annual Clear Creek Flows Changes

Date	**From (cfs)**	**To (cfs)**
October 1	125	150
October 23	150	175
November 3	175	200
November 17	200	225
December 2	225	250
December 19	250	275
January 10	275	300
March 15	300	275
April 6	275	250
April 22	250	225
May 7	225	200
May 22	200	175
June 6	175	150
June 23	150	125
July 17	125	100
September 7	100	125

cfs = cubic feet per second.

3.5.4 Pulse Flows

Pulse flows address the stressors on migration cues. Except in years with significant uncontrolled spill, Reclamation will release up to 10,000 acre-feet from Whiskeytown Dam for channel maintenance, spring attraction flows, and to meet other physical and biological objectives. In critical years, Reclamation will release up to 5,000 acre-feet. Reclamation, through CCTT, will develop pulse flow schedules, which include measures (e.g., nighttime down ramping, slow down ramping rates, coordination with natural precipitation events) to mitigate for potential risks (e.g., potential juvenile fish stranding). The pulse flows are not to exceed safe outlet works capacity of Whiskeytown Dam, currently 840 cfs, and will be scheduled on or after February 1.

Availability of water for pulse flows is tied to water year type. The determination of water year type will be based on the Sacramento Valley Index (SVI), at 90% exceedance level. Due to unknowns in winter precipitation, Clear Creek pulse flows are not to occur prior to the February SVI reporting. The full pulse flow volume (10,000 acre-feet) will be available if the SVI is greater than 5.4, at the SVI updates (i.e., dry or wetter years). If the SVI updates are equal to or less than 5.4 (critical years), Reclamation would limit releases of pulse(s) flows to 5,000 acre-feet.

3.5.5 Water Temperature Management

Water temperature management addresses adult water temperature and egg incubation stressors. Reclamation will target Whiskeytown Dam releases to not exceed the mean daily temperatures at Igo gauge:

- 61°F from June 1 through August 15.
- 60°F from August 16 through September 15.
- 56°F from September 16 through November 15.

Water temperature management on Clear Creek is implemented through changes in guard gate configurations and flow manipulations. In dry, critical, or import curtailment years, Reclamation may not be able to meet these temperatures and will operate Whiskeytown Dam as close to these temperatures as practicable.

Additional flows may be required to meet temperature objectives. Reclamation will determine if additional water is available for temperature management and inform the agency representatives through the CCTT. If two consecutive days of mean daily temperature are exceeded, and Reclamation determines additional water is available, then 25 cfs per day will be added to the base flow to address temperatures.

Any flow changes completed for temperature management in the late-summer or fall, implemented at 25-cfs increments, would be maintained until the base flow of the seasonal hydrograph rises to meet the elevated temperature release. For example, if flows were increased to 150 cfs on September 10 to decrease water temperatures, they would remain there until October 23 when the hydrograph would normally increase to 175 cfs. This relieves the need to down ramp during spawning and potentially dewater redds. If additional flows are needed to meet temperature in late spring or summer during a hot spell for instance, ramp-down to base flow would occur when meteorological conditions allow.

3.5.6 Segregation Weir

The segregation weir addresses competition, introgression, and broodstock removal stressors. Reclamation proposes to ensure placement of a segregation weir on Clear Creek typically installed between the Clear Creek Gorge Cascade and Clear Creek Road Bridge in late August and remain in place through early November. Reclamation, through the CCTT, will select the location based on channel cross-section suitability for weir placement and the distribution of adult spring run Chinook Salmon holding locations. Previous placements have occurred at river mile 8.2 or 7.5. An additional location is being prepared at river mile 7.25. Placement of the weir would occur before fall run Chinook Salmon enter Clear Creek to minimize hybridization with spawning spring-run Chinook Salmon and redd superimposition. Removal of the weir would occur after the peak of fall run Chinook Salmon spawning when the risk of redd superimposition is very low. The weir location and timing protect most of the spring-run Chinook Salmon utilizing Clear Creek, while minimizing effects to other salmonids.

3.6 American River

Reclamation operates and maintains the American River Division of the CVP for flood control, M&I 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. The CVP additionally delivers water to the Freeport Regional Water Project Intake. Releases from Folsom Dam are re-regulated approximately seven miles downstream by Nimbus Dam. Nimbus Dam creates Lake Natoma, which serves as a forebay for diversions to the Folsom South Canal and the Nimbus Fish Hatchery. Water diverted to the fish hatchery returns to the American River through four outfalls approximately 0.5 mile downstream of Nimbus Dam. Releases from Nimbus Dam to the American River pass through the Nimbus Power Plant, or the spillway gates at flows more than 5,000 cfs.

Folsom Reservoir is the main storage and flood control reservoir on the American River. Numerous other smaller non-CVP and SWP reservoirs in the upper basin provide hydroelectric generation and water supply without specific flood control responsibilities. The total upstream reservoir storage above Folsom Reservoir is approximately 820 TAF, and these reservoirs are operated primarily for hydropower production. Ninety percent of this upstream storage is contained by five reservoirs: French Meadows (136 TAF); Hell Hole (208 TAF); Loon Lake (76TAF); Union Valley (271 TAF); and Ice House (46 TAF). Reclamation coordinates with the operators of these non-CVP and SWP reservoirs to aid in planning for Folsom Reservoir operations.

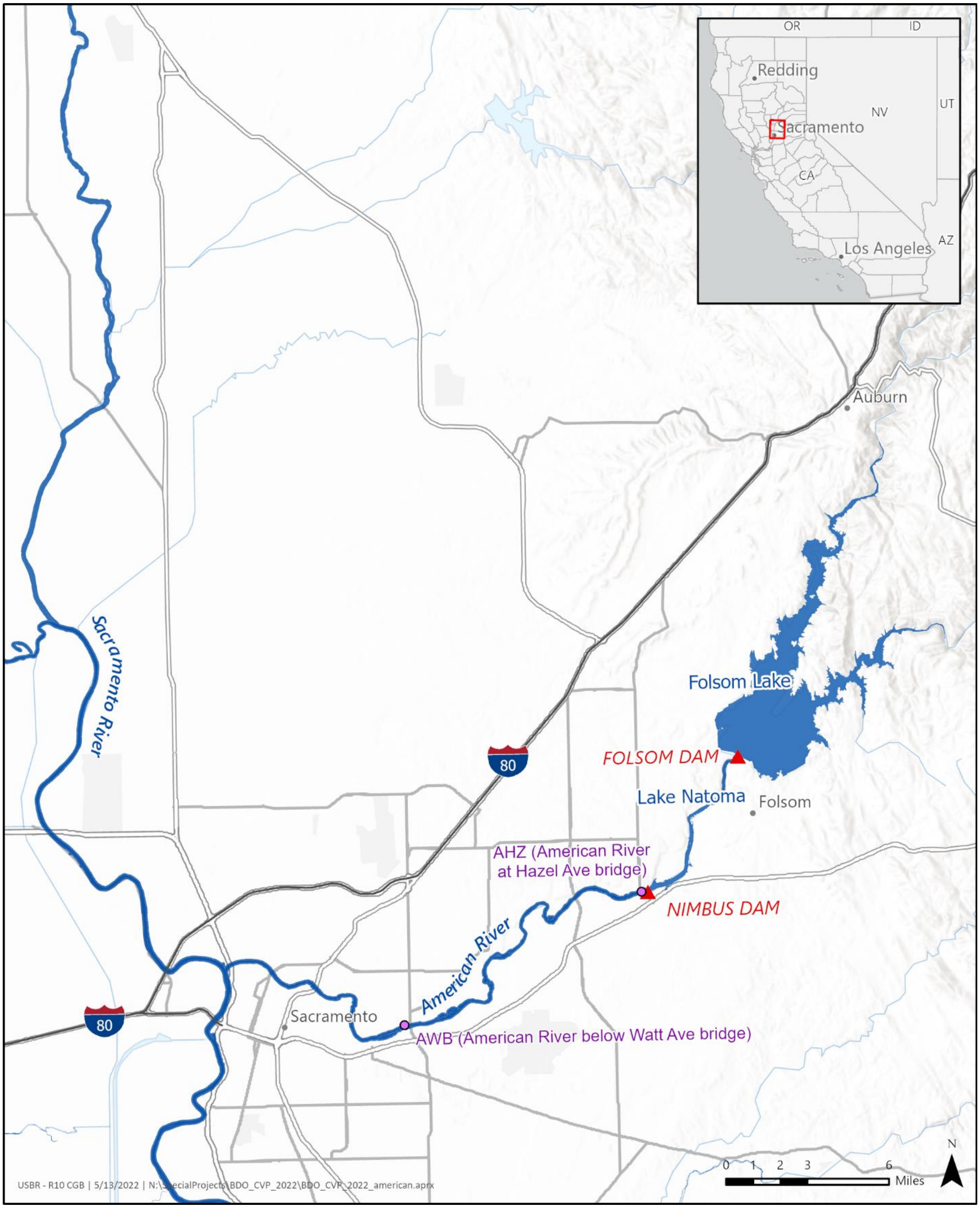


Figure 3-5. Facilities in the American River Division of the CVP

Statutory, Regulatory, and Contractual Requirements, see Appendix A:

- Public Law 81-356 American River Development Act of October 14, 1949, ch. 690, 63 Stat. 852
- Public Law 89-161 Auburn-Folsom South Unit - Act of September 2, 1965, 79 Stat. 615
- Freeport Regional Water Authority Intake
- State Water Board D-893
- State Water Board D-1641
- Water Control Manual for Folsom Dam and Lake (June 12, 2019) and its October 16, 2018, NMFS Biological Opinion
- Water Forum MOU March 29, 2021

Programs in the environmental baseline to highlight:

- Nimbus Hatchery Genetics Management Plan
- Temperature Modeling Platform.
- Spawning and Rearing Habitat Restoration.
- Folsom Dam Raise and Temperature Control Shutters

3.6.1 Seasonal Operations

Reclamation operates Folsom Reservoir in the winter primarily for flood control and minimum flows in the American River and Delta. Flood control may drive operations in wetter years. The USACE 2019 *Water Control Manual: Folsom Dam and Lake* provides operational rules for dam safety and flood risk management. Flood operation criteria target flow rates below downstream channel capacities. During non-flood control operations, Reclamation stores Folsom Reservoir inflows that exceed releases for minimum instream flows and Delta water quality requirements. Reclamation seeks consistent steady releases to minimize potential redd dewatering, redd scouring, and juvenile stranding for steelhead and fall-run Chinook salmon, but Delta outflow requirements may require varying releases.

In the spring, when not operating to flood control requirements, Reclamation seeks to maximize capture of the spring runoff to fill as close to full as possible. The American River Minimum Flow Schedule (ARMFS), Appendix [TBD], includes both minimum releases and, in some years, a pulse flow to cue juvenile salmonids to emigrate. Reclamation also operates for water supply and Delta outflow requirements. As the closest reservoir to the Delta, increased releases from Folsom are frequently called on to address Delta water quality requirements under State Water Board D-1641. When releases from upstream CVP and SWP reservoirs meet Delta outflow requirements, Folsom releases can be reduced, and system-wide reservoirs balanced.

When developing the operational forecast, Reclamation would evaluate an end-of-December Folsom storage of at least 300 TAF. In some years, operational constraints may result in an end-of-December storage of less than 300 TAF. If, based on the May forecast, Reclamation does not anticipate meeting 300 TAF at the end of December, it will be reported at the May American River Group meeting. In those instances, Reclamation and the American River Parties will develop a list of potential actions that may be taken to either improve forecasted storage or decrease demand on Folsom Reservoir. The objective of considering storage in the forecasting process is to provide releases of salmonid-suitable temperatures to the Lower American River and reliable deliveries to American River water agencies dependent on deliveries or releases from Folsom Reservoir. In September, storage is typically at its lowest after releases and diversions for summer demands. When planning in the spring for temperature management later in the year, meteorological forecasts of precipitation events are uncertain for October through December. Assuming higher precipitation events than may materialize may present a higher risk of the reservoir not having sufficient carryover storage by the end of December. Reclamation is implementing a pilot program that considers an end-of-December planning minimum of 300 TAF (Water Forum MOU, March 2021).

In the summer, Reclamation typically releases flows above the minimum instream flow requirements for instream temperature control, Delta outflow, and water supply. Reclamation manages water temperatures through the volume of water released and shutter elevations, in consideration of projected meteorological conditions. Reclamation balances the need to access Folsom Reservoir coldwater pool for instream temperature control during the summer for steelhead and the need to preserve cold water for fall-run Chinook salmon.

In the fall, operations focus on temperature control management. Limited coldwater pool and limited storage require balancing releases and shutter operations to maximize the ability to maintain suitable temperatures for steelhead rearing and fall-run Chinook salmon spawning. If reservoir inflows are greater than the release needs, Reclamation stores the surplus water. Reclamation will ramp down to the revised minimum flows from Folsom Reservoir as soon as possible in the fall and maintain these flows through fall-run Chinook salmon spawning and egg emergence, where possible, to minimize redd dewatering and juvenile stranding.

3.6.2 Ramping Rates

Ramping rates address the stranding stressor. Reclamation will ramp down releases in the American River below Nimbus Dam as shown in Table 3-4 and at night, if possible.

Table 3-4. American River Ramping Rates

Lower American River Daily Rate of Change (cfs)	Amount of Decrease in 24 Hours (cfs)	Maximum Change per Step (cfs)
20,000 to 16,000	4,000	1,350
16,000 to 13,000	3,000	1,000
13,000 to 11,000	2,000	700
11,000 to 9,500	1,500	500
9,500 to 8,300	1,200	400
8,300 to 7,300	1,000	350

Lower American River Daily Rate of Change (cfs)	Amount of Decrease in 24 Hours (cfs)	Maximum Change per Step (cfs)
7,300 to 6,400	900	300
6,400 to 5,650	750	250
5,650 to 5,000	650	250
<5,000	500	100

cfs = cubic feet per second.

Reclamation may vary from these ramping requirements during flood control. Reclamation, through ARG, may develop a faster down ramping rate on a case-by-case basis to implement temporary flow reductions for critical monitoring or maintenance needs.

3.6.3 Minimum Instream Flows (Minimum Release Requirements)

Minimum release requirements address egg dewatering, adult stranding and juvenile habitat stressors. For lower American River flows (below Nimbus Dam), Reclamation proposes to adopt the ARMFS. The ARMFS is based on the Modified Flow Management Standard developed by the Water Forum in 2017 (2017 MFMS), with additional modifications as described below. The ARMFS includes Minimum Release Requirements (MRRs) ranging from 500 to 2,000 cfs based on time of year and annual hydrology. The flow schedule is intended to provide suitable habitat conditions for steelhead and fall-run Chinook salmon. As detailed in Appendix X, the Sacramento River Index (90% exceedance forecast) will be used to develop the MRR in January. The American River Index (90% exceedance forecast, with certain spills subtracted) will be used to calculate the MRR in February through December. All MRR calculations will be based on the hydrologic indices reported in the first Bulletin 120 of each month. Reclamation will continue to work with the American River Group to coordinate the shaping of upcoming releases within operational constraints.

Key differences in the ARMFS compared to the 2017 MFMS include the following:

- While the 2017 MFMS calculates the MRR for each month using a hydrologic index based on a 50% or 75% exceedance forecast, Reclamation proposes to calculate the MRR based on the 90% exceedance forecast for the relevant hydrologic index.
- The 2017 MFMS didn’t specify how to transition from one month’s MRR to the next month’s MRR. In the ARMFS, Reclamation established a more defined timeframe for when the MRR would go into effect, targeting five business days after the initial monthly release of Bulletin 120. If the MRR is not implemented within five business days, Reclamation will notify the American River Group.
- Within one year of the ROD, Reclamation, through the American River Group, will (a) evaluate the equations used to calculate the MRRs in November through December to consider whether an adjustment to the maximum MRR is warranted based on habitat improvements and other relevant information, (b) develop recommendations, (c) and explanations on any recommendations not accepted.

- The offramp and volume offset in the spring pulse flow were removed so that in years when a spring pulse flow is triggered (based on the March MRR), the full volume is available to shape without a reduction in the MRR later in the spring. The current proposed action also specifies that the fish agencies, within operational constraints, may determine the timing of the flow.

3.6.4 Spring Pulse Flows

Spring pulse flow addresses stressors on outmigration cues to increase emigration rates and move juveniles downstream. Reclamation will implement a spring pulse in years that the MRR for March (based on the March forecast) is between 1,000 cfs and 1,500 cfs, as described in the ARMFS. The peak flow of the pulse flow would be 3 times the March MRR, even if implemented in April or May, but no higher than 4,000 cfs and lasting two days. Following two days at the peak flow, Nimbus releases would be decreased at no more than 500 cfs per day and no more than 100 cfs per hour. Changes in Nimbus releases would occur at night, if possible. The American River Group will provide technical input on shaping Spring Pulse Flow volumes, with the final timing determined by CDFW, FWS, and NMFS.

Reclamation, through the ARG, will develop a pulse flow schedule. Reclamation, through the ARG, may facilitate an additional spring pulse flow event if water is made available from non-CVP sources, or if there is flexibility to shape planned releases in a more variable schedule.

3.6.5 Redd Dewatering Protective Adjustments

The redd dewatering protective adjustment (RDPA), as described in ARMFS, adjusts the MRR to account for hydrology and potential dewatering impacts to fall-run Chinook salmon redds in January and February and steelhead redds in February through May based on the MRR. Dewatering Protective Adjustments based on the MRR are not protective when actual flows in-river are above the MRR. Releases can be above the MRR in the fall and winter due to contractual obligations, Delta water quality requirements, and precipitation events. There are not Redd Dewatering Protective Adjustments based on actual flows. The American River Group will provide technical input on shaping Redd Dewatering Projective Adjustments.

In January, the minimum release requirement (MRR) can only decrease and cannot be less than 70% of the December MRR. In February, the MRR cannot be less than 70% of the December MRR. Based on the January MRR, Table 3-5 shows the minimum flow for steelhead redds through May. If the February MRR is higher than January, the February MRR is used through May.

Table 3-5. Steelhead Redd Dewatering Protective Adjustment-based MRR for February through May[3]

January or February MRR (cfs)	Steelhead Redd MRR through May (cfs)
≤700	500
800	520
900	580
1,000	640
1,100	710
1,200	780
1,300	840
1,400	950
1,500	1,030
1,600	1,100
1,700	1,180
1,800	1,250

cfs= cubic feet per second; MMR = minimum release requirement.

The maximum MRR in January through May is 1,750 cfs, but 1,800 cfs is included in the table as a maximum value. In February, the ARI-based and fall-run Chinook salmon RDPA-based MRRs for February are compared to the steelhead RDPA-based MRR in Table 3-5, using the controlling MRR in January as a basis. The highest of the three MRRs controls operations.

For March through May, the ARI-based MRR for the month is compared to the steelhead RDPA-based MRR in Table 3-5, using the highest of the controlling MRRs in January or February as a basis. The highest of the two MRRs controls operations.

3.6.6 Water Temperature Management

Temperature management supports fall-run and addresses the water temperature stressor on steelhead. The most suitable water temperature for juvenile steelhead rearing habitat in the lower American River is 65°F or lower. Ideally, the Temperature Management Plan would provide for daily average water temperatures no higher than 65°F from Nimbus Dam (just upstream of the Hazel Avenue bridge) down to the Watt Avenue bridge. The active temperature management season is approximately May 15 to October 31. Of additional importance, water temperatures below 56°F are suitable for fall-run Chinook salmon spawning. Carcass surveys in the lower

[3] The maximum MRR in January through May is 1,750 cfs, but 1,800 cfs is included in the table as a maximum value

American River indicate spawning from approximately mid-October through December and into January.

Reclamation will implement the Automated Temperature Selection Procedure (ATSP), which was developed in consultation with representatives of state and federal agencies and prioritizes water temperatures during the summer to support steelhead rearing over water temperatures in the fall to support Chinook salmon spawning. Each ATSP schedule determines a monthly series of water temperature targets (for daily average water temperature) at the Watt Avenue bridge. Schedule 1 has a water temperature upper limit of 63°F from May through September, and 56°F in October and November. Schedule 78 has a water temperature upper 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. Reclamation would consider modification to the ATSP or utilize another method in the event ARG members and fish agencies request consideration based on year-type conditions.

In years in the lower American River will have temperatures unsuitable for rearing or spawning, Reclamation, will meet with fisheries agencies to evaluate actions that can be taken to minimize temperature impacts to fisheries, may modify the ATSP as follows:

- For Schedule 28 or higher (greater than 65°F at Watt Avenue Bridge, May through September), the TMP may consider a temperature location at Hazel Avenue.
- For greater than 65°F at Hazel Avenue bridge for May through September, the TMP will include an evaluation of whether modified Folsom operations could support an improved temperature schedule (e.g. an alternate release schedule over the summer).
- For greater than 68°F at Hazel Avenue for May through September, the TMP will include an evaluation of whether modified Folsom operations could support an improved temperature schedule (e.g. an alternate release schedule over the summer) and evaluate a power bypass during the summer and/or fall.
- For greater than 56°F at Hazel Avenue in November, the TMP will evaluate a power bypass in the fall, with the evaluation likely to occur in August and September.

By May 15, Reclamation will provide a draft TMP and solicit technical input from the ARG. By June 15, Reclamation, through ARG, will annually prepare a Temperature Management Plan for the summer through fall. The Temperature Management Plan will contain: (1) forecasts of hydrology and storage; and (2) a modeling run or runs, using these forecasts, demonstrating what temperature compliance schedule can be attained. Reclamation will plan shutter configurations to attain the best possible (lowest numbered) temperature schedule. The priority for use of the lowest water temperature control shutters at Folsom Dam, within operational constraints, will achieve the water temperature requirement for steelhead, and may also be used to provide cold water for fall-fun spawning. During plan implementation, if the temperature is exceeded for 3 consecutive days, or is exceeded by more than 3°F for a single day, Reclamation, will notify NMFS and the ARG, and outline steps to realign water temperature with the Temperature Management Plan.

3.7 Delta

Reclamation operates and maintains the Delta Division of the CVP for M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and Delta water quality. The major CVP features are the Delta Cross Channel, Contra Costa Canal and Rock Slough Intake facilities, Tracy Fish Collection Facility and C. W. “Bill” Jones Pumping Plant (Jones Pumping Plant), and Delta-Mendota Canal. The Jones Pumping Plant, located about 5 miles north of Tracy, has six fixed-speed pumps with an operating capacity of 4,600 cfs. The Jones Pumping Plant discharges into the head of the Delta-Mendota Canal.

Reclamation operates and maintains the San Luis Unit of the West San Joaquin Division for M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and water quality. The major joint CVP and SWP features are the O’Neill Forebay, San Luis Reservoir, Bernice Frederic Sisk Dam, O’Neill Pumping-Generating Plant, William R. Gianelli Pumping-Generating Plant, San Luis Canal, Dos Amigos Pumping Plant, and Los Banos and Little Panoche Detention Dams and Reservoirs. The major CVP-only facilities include the Coalinga Canal and Pleasant Valley Pumping Plant.

Reclamation operates the San Felipe Division for M&I and agricultural water supplies, fish and wildlife protection, and recreation. The major CVP features are the Pacheco Pumping Plant, Tunnel, and Conduit.

The main SWP Delta features are the Barker Slough Pumping Plant, Suisun Marsh facilities (including the Suisun Marsh Salinity Control Gate, Roaring River Distribution System, Morrow Island Distribution System, Goodyear Slough Outfall Gates), Clifton Court Forebay, and John E. Skinner Delta Fish Protective Facility, Harvey O. Banks Pumping Plant (Banks Pumping Plant) and a portion of the California Aqueduct. The Barker Slough Pumping Plant diverts water from Barker Slough into the North Bay Aqueduct for delivery to the Solano County Water Agency and the Napa County Flood Control and Water Conservation District. The Suisun Marsh Control Gates (SMSCG) are located on Montezuma Slough about 2 miles downstream from the confluence of the Sacramento and San Joaquin Rivers, near Collinsville. The purpose of SMSCG operation is to decrease the salinity of the water in the eastern portion of the Suisun Marsh. When operated tidally, the gates reduce salinity by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides and by retaining lower salinity Sacramento River water from the previous ebb tide. Operation of the gates in this fashion lowers salinity in eastern Suisun Marsh channels and results in a net movement of water from east to west through Suisun Marsh.

The SWP Banks Pumping Plant, located near the Jones Pumping Plant, has 11 pumps. Pumping is limited to a maximum permitted capacity of 10,300 cfs per day. The Banks Pumping Plant discharges into the California Aqueduct.

The Delta-Mendota Canal/California Aqueduct Intertie (Intertie) is used to move water between the California Aqueduct and the Delta-Mendota Canal. The Intertie can pump up to 700 cfs from the Delta-Mendota Canal to the California Aqueduct and convey up to 900 cfs from the California Aqueduct to the Delta-Mendota Canal. This structure was built to help both federal and state water projects more effectively move water from the Delta into the San Luis Reservoir.

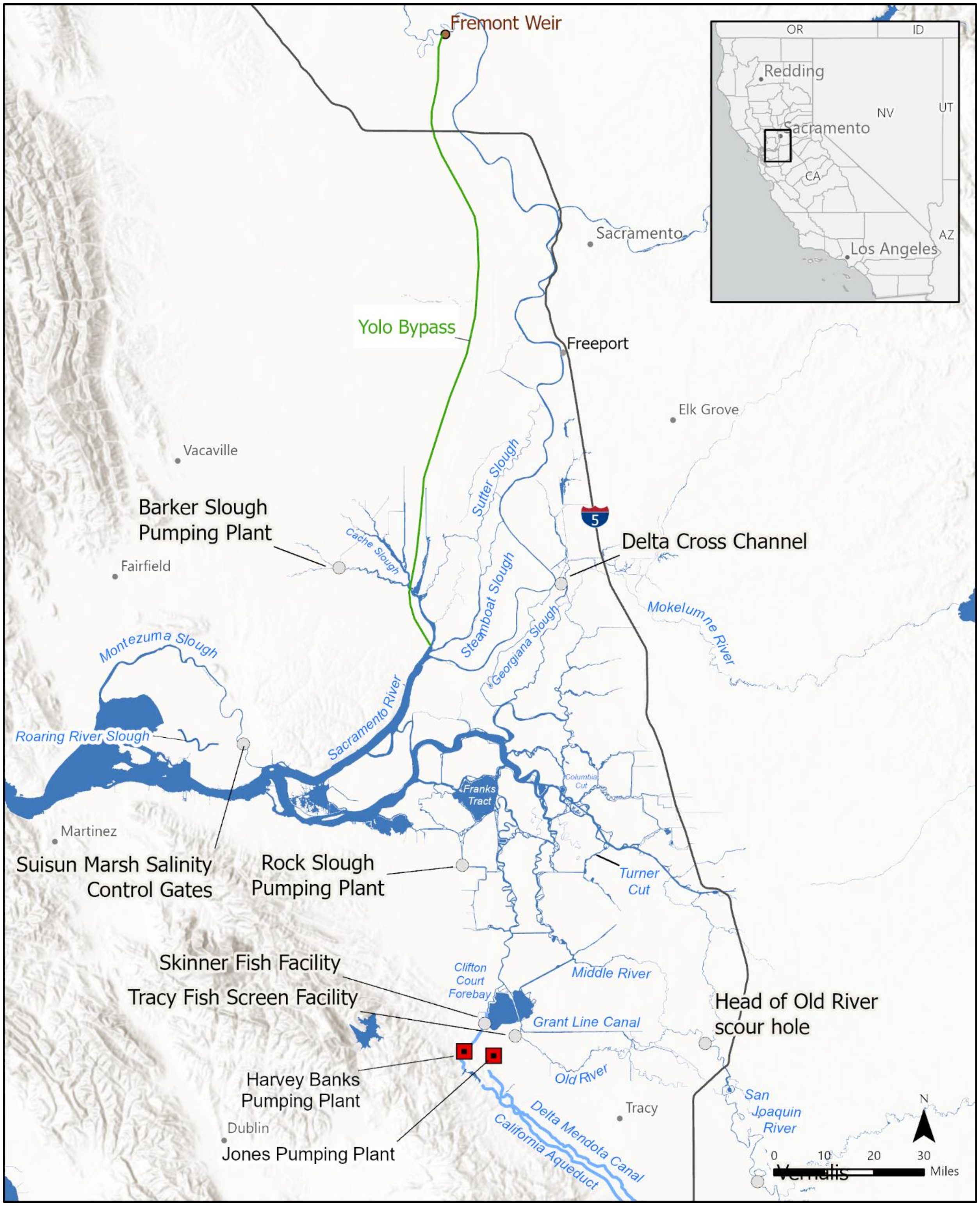


Figure 3-6. Map of the Delta Division Facilities

Statutory, Regulatory, and Contractual Requirements, see Appendix A:

- Public Law 74-392 CVP Re-Authorization Act
- State Water Board D-1641
- 1986 Coordinated Operations Agreement (COA) and 2018 COA amendment
- Public Law 99-546, Suisun Marsh Preservation Act
- 1986 Settlement Agreement with South Delta Water Agency (Clifton Court Forebay gate operations)
- October 13, 1981, USACE Public Notice #5820A (Clifton Court inflow criteria)
- DWR's Division of Safety of Dams criteria (Clifton Court Forebay storage)
- USACE permit number 199900715 (Clifton Court Forebay additional 500 cfs)
- DWR/CDFW Agreement (Skinner Delta Fish Protective Facility)
- USACE permit numbers SPK-200100121, SPK-20000696 (Temporary Barriers)

Programs in the environmental baseline to highlight:

- Agricultural Barrier Construction (USACE)
- Barker Slough Pumping Plant Fish Screen (DWR)
- Contra Costa Los Vaqueros Expansion – Phase 1
- Contra Costa Rock Slough Fish Screen
- Delta Cross Channel Gate Improvements Study
- Georgiana Slough Non-Physical Barrier (DWR, USACE)
- Head of Old River – Scour Hole Predation Reduction Study
- B.F. Sisk Dam Raise and Reservoir Expansion Project Construction
- Suisun Marsh Habitat Management, Preservation, and Restoration Plan
- Tracy Fish Collection Facility Improvement Program
- Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

3.7.1 Seasonal Operations

In the winter and spring, Reclamation and DWR typically export excess water. Excess water conditions occur when releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses and exports. Actions to minimize entrainment of listed fish into the south Delta and at the Jones and Banks Pumping Plants limit the export of excess water. Exports during the winter and spring reduce the reliance on conveying previously stored water in the summer and fall for south-of-Delta water supply needs. In dry conditions, Reclamation and

DWR may need to increase releases from upstream reservoirs beyond what is needed to meet minimum flow requirements in order to meet water quality or outflow requirements in the Delta.

During the summer, the CVP and SWP convey previously stored water through the Delta for export at the Jones Pumping Plant, Banks Pumping Plant, and other Delta facilities. Delta operations during the summer typically focus on maintaining salinity and meeting Delta outflow objectives while maximizing exports with the available water supply. In addition, the CVP and SWP make upstream reservoir releases for water temperature management and instream flows, which may be available for export after outflow, salinity, and in-Delta needs have been met.

In the fall, operations are adjusted to meet salinity requirements, Delta outflow requirements, and peak demands from CVPIA wildlife refuges. Upstream and in-Delta demands typically decrease, and accretions within the system typically increase. When water is available and not required for salinity and Delta outflow requirements, late summer and fall provide an opportunity to export water and start filling San Luis Reservoir for the next water year. When conditions are dry, there is little opportunity for exports. Releases from upstream reservoirs generally decrease to conserve water in storage for the next year. On occasion, releases to conserve flood storage or redds may occur and result in additional flows into the Delta.

The Banks Pumping Plant pumps water from Clifton Court Forebay. The Clifton Court Forebay radial gates are closed during critical periods of the ebb and flood tidal cycle for water quality and water levels in the south Delta. During July through September, the maximum daily diversion limit from the Delta into the Clifton Court Forebay is increased from 6,990 cfs to 7,490 cfs, and the maximum averaged diversion limit over any 3 days is increased from 6,680 cfs to 7,180 cfs. From mid-December through mid-March, diversions into CCF may be increased by one-third of the San Joaquin River flow at Vernalis when those flows exceed 1,000 cfs. Further, Banks Pumping Plant will pump up to 195,000 acre-feet for the CVP in accordance with the 2018 COA Addendum.

3.7.2 Delta Cross Channel Gate Closures

The Delta Cross Channel closures address the outmigration cues and entrainment risk stressor for salmon and steelhead. Reclamation operates the Delta Cross Channel to: improve the movement of water from the Sacramento River to the export facilities at the Jones and Banks Pumping Plants; improve water quality in the central and south Delta; reduce salinity intrusion rates in the west Delta; and allow passage for boaters. Reclamation closes the Delta Cross Channel during the late fall, winter, and spring to reduce straying of Mokelumne River fall-run Chinook salmon, protect out-migrating salmonids from entering the interior Delta, facilitate the State Water Board D-1641 Rio Vista flow objectives for fish passage, and reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates when Sacramento River flows exceed 20,000 cfs on a sustained basis. Delta Cross Channel closure will continue to occur as follows:

3.7.2.1 October 1 – November 30, Catch Index Closure

From October 1 through November 30, Reclamation proposes to close the DCC gates in addition to the requirements in D-1641 to further reduce juvenile salmonid entrainment risk based on the Knights Landing Catch Index and Sacramento Catch Index as described in Table 3-6.

Observations of daily increases in catch indices are typically associated with increased flows at Wilkins Slough and tributaries to the upper Sacramento River, cooler water temperatures at these locations, and entry of migrating juvenile winter-run and spring-run Chinook salmon (Del Rosario et al. 2013; White and Low 2006).

Table 3-6. Delta Cross Channel Action Triggers and Responses from October 1–November 30

Action Trigger	Action Response
• Water quality criteria per D-1641 are met; and • Knights Landing Catch Index or Sacramento Catch Index (daily index) ≥ 3.0	Within 48 hours of index being reported to Reclamation, close the DCC gates for at least 3 days and keep closed until the catch index is less than three fish per day at both the Knights Landing and Sacramento monitoring sites for two consecutive days
• Water quality criteria per D-1641 are met; and • Knights Landing Catch Index or Sacramento Catch Index (daily index) ≥ 3.0; and • Real time hydrodynamic and salinity modeling shows water quality concern level targets (Table 3-7) are exceeded during 14- day period following DCC closure	Reclamation and DWR, through Delta Monitoring Teams, review monitoring data and complete risk assessment to inform real-time operations of DCC gate closure.
• Water quality criteria are not met per D-1641 criteria	No DCC gate closure

Indices: Juvenile Chinook salmon at or above the minimum winter-run size based on the length-at-date Delta model used at a particular sampling location, and below the maximum size (for any run of salmon) considered by the length-at-date Delta model, on a given sampling date, are considered “older juveniles”.

- *The Knights Landing Catch Index (KLCI):* based on reported catch of older juveniles at the Knights Landing rotary screw trapping location and is calculated as the total catch of older juveniles (adjusted, as necessary, for partial cone operations) divided by the number of “trap days” (adjusted, as necessary, for downtime resulting from, for example, debris removal) since the last sampling event. This calculation for older juveniles/trap-day is implemented as [(total number of older juveniles/% cone sampling effort)/total hours fished)] * (24 hours fished/trap day).
- *The Sacramento Catch Index (SCI):* Both the Sacramento trawl (at Sherwood Harbor) and the Sacramento seine data are used to derive the SCI. The reported catch of older juvenile Chinook salmon is used to generate a SCI; a separate index for the seine data and a separate index for the trawl data.
    - The seine version of the catch index is standardized to eight hauls; therefore, the index is calculated as: (total number of older juveniles captured/# hauls) * 8. The Sacramento Seine route is based on eight sites: Verona, Elkhorn, Sand Cove,

Discovery Park, American River, Miller Park, Sherwood Harbor, and Garcia Bend.

- The trawl version of the catch index is standardized to 10 tows; therefore, the index is calculated as: (total number of older juveniles captured/# tows) * 10.

Table 3-7. Water Quality Levels of Concern Criteria (Simulated 14-day average Electrical Conductivity)

Station	Water Quality Concern Level (µmhos/cm)
Jersey Point	1800
Bethel Island	1000
Holland Cut	800
Bacon Island	700

µmhos/cm = micromhos per centimeter.

3.7.2.2 October 1 – November 30, Lower Mokelumne River Fall Closure

From October 1 through November 30, Reclamation proposes to close the DCC gates in addition to the requirements in D-1641 to enhance adult fall-run Chinook salmon passage into the Mokelumne River as described in Table 3-8. If the East Bay Municipal Utility District releases Lower Mokelumne River (LMR) attraction flows, water quality modeling shows concern level criteria (Table 3-7) are not likely to be exceeded for at least 14 days following the action, and there is no observed deterioration of interior Delta water quality, then Reclamation would close the DCC gates as soon as practicable (generally within 48 hours) for up to 5 days. Closure of the DCC gates when adult fall-run Chinook salmon attraction flows pass through the LMR can reduce straying of Chinook salmon between the Mokelumne and American rivers and increase the abundance of fall-run Chinook salmon returning to the Mokelumne River and its hatchery.

Table 3-8. Delta Cross Channel Action Triggers and Responses during Lower Mokelumne River (LMR) flow releases.

Action Triggers	Action Responses
• Water quality criteria per D-1641 are met and Real- time hydrodynamic; and • Salinity modeling shows water quality concern level targets are not exceeded during 14-day period following DCC closure; and • There is no observed deterioration of interior Delta water quality	Within 48 hours of start of LMR attraction flow release, close the DCC gates for up to 5 days
• Water quality criteria per D-1641 are met; and • Real time hydrodynamic and salinity modeling shows water quality concern level targets are	Reclamation and DWR, through Delta Monitoring Teams, review monitoring data and complete risk assessment to inform real-time operations of DCC gate closure.

Action Triggers	Action Responses
exceeded during 14-day period following DCC closure	
• Water quality criteria are not met per D-1641	No DCC gate closure

3.7.2.3 December 1 – January 31

From December 1 to January 31, Reclamation proposes to close the DCC gates, except to avoid exceeding a D-1641 water quality criterion within the next 14 days based on water quality modeling (rather than increase releases and reduce reservoir storage further). Reclamation and DWR will prepare an assessment to evaluate opening the DCC gates for up to 5 days for up to two events within this period to avoid D-1641 water quality criteria exceedance. Reclamation and DWR will coordinate with USFWS, NMFS, CDFW and the SWRCB on how to balance D-1641 water quality and ESA-listed fish requirements and inform the Salmon Monitoring Team and Smelt Monitoring Team. The assessment will consider relevant monitoring information (e.g. upstream rotary screw traps, Delta juvenile fish monitoring surveys, Rio Vista flow standards, acoustic telemetered fish monitoring information) as well as potentially DSM2 modeling informed with recent hydrology, salinity, and tidal data. During these potential DCC gates openings, the CVP and SWP will limit combined exports as not to exceed 1,500 cfs, Health and Safety pumping level.

3.7.2.4 February 1 – May 20

Reclamation will keep the Delta Cross Channel Gates closed. State Water Board D-1641 requires the Delta Cross Channel Gates be closed.

3.7.2.5 May 21 – June 15

Reclamation will close the Delta Cross Channel Gates for a total of 14 days. Reclamation and DWR, through SaMT, will prepare a plan that considers relevant information including: the upstream rotary screw traps, Delta juvenile fish surveys, Rio Vista flow standards, acoustic telemetered fish information, and DSM2 modeling. Reclamation typically schedules the Delta Cross Channel closures to occur on weekdays and keeps it open on weekends to accommodate recreational interests. State Water Board D-1641 requires the Delta Cross Channel to be closed for a total of 14 days after consultation with the USFWS, CDFW, and NMFS.

3.7.2.6 June 16 – September 30

From June 16 to September 30, Reclamation proposes to open the DCC gate.

3.7.3 Maintenance and Repair

The Reclamation Designers Operating Criteria, dated September 24, 1971, requires Reclamation to undertake routine maintenance and repair of the Delta Cross Channel Gates to continue reliable operation.[4] Certain routine maintenance and repair require cycling of the Delta Cross

[4] Bureau of Reclamation. September 24, 1971. Reclamation Designers Operating Criteria.

Channel Gates (i.e., open and close the gates several times in a row). Routine maintenance and repair will require cycling of one or both gates approximately twice per year for one day each. To avoid and minimize effects, Reclamation to the extent practicable will:

- Perform cycling when federally listed fish are not likely present (mid-June through September).
- Perform cycling during daylight hours.
- Minimize the duration of the time Delta Cross Channel is open during cycling when salmonids are present.

Reclamation is required to maintain the Delta Cross Channel and may not have discretion over when the maintenance must occur. Reclamation will notify the USFWS and NMFS of maintenance prior to its implementation, if it occurs during a closure period.

3.7.4 Old and Middle River Flow Management

Old and Middle River flow management addresses the entrainment stressor on adult delta smelt, larval and juvenile Delta smelt, adult longfin smelt, larval and juvenile longfin smelt, winter-run juveniles, spring-run juveniles, steelhead juveniles, and green sturgeon. OMR provides a surrogate indicator for how export pumping at Banks and Jones Pumping Plants influence hydrodynamics in the south Delta. OMR will be calculated using the equation provided in Hutton 2008. If an equation is developed that results in a better representation of OMR flows, and Reclamation, DWR, NMFS, USFWS, and CDFW agree, then that equation will be updated in calculating the OMR index.

3.7.4.1 Winter-Run Early Season Migration

Winter-Run Early Season Migration: To minimize entrainment and salvage of early-migrating natural older winter-run Chinook salmon and yearling spring-run Chinook salmon, DWR and Reclamation will reduce exports to achieve a 7-day average OMR value no more negative than -5,000 cfs for seven consecutive days when the genetically verified 7-day rolling sum of winter-run and spring-run Chinook salmon loss, calculated daily, exceeds the following annually calculated thresholds (see calculation details in Appendix Y):

- From November 1 – November 30: 0.0044% (e.g. WY 2023) of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in October.
- From December 1 – December 31: 0.0084% (e.g. WY 2023) of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in November.

If the 7-day rolling sum of winter-run and spring-run Chinook salmon loss, calculated daily, is exceeded during a period of reduced exports, DWR and Reclamation will continue to reduce exports to achieve a 7-day average OMR value no more negative than -5,000 cfs until 7 days after the most recent exceedance.

Reclamation and DWR will restrict exports in response of meeting the threshold above based on initial length-at-date identification of natural older juvenile Chinook salmon. If genetic analysis of natural older juvenile Chinook salmon observed in salvage at the SWP or CVP indicates that any given Chinook salmon is not genetically winter-run or spring-run Chinook salmon, these fish will not count towards the loss threshold exceedance, and continued export restrictions pursuant to the OMR limit are not required. Given that SHERLOCK is a new methodology currently undergoing peer review and field testing, both methodologies will be used to determine the final identification. In the event that SHERLOCK and GT-seq provide different run assignments, the results from the GT-seq method will be used to determine the final run assignment for the purposes of implementing this early season migration action.

3.7.4.2 Start of OMR Management

The OMR management season starts any time after December 1 if an Adult Longfin Smelt Entrainment Protection Action, if appropriate (see Section 0), or First Flush Action occurs (i.e., immediately following completion of the First Flush Action) or any time after December 20 if the turbidity threshold in the Adult Delta Smelt Entrainment Protection Action is reached. If neither the Adult Longfin Smelt Entrainment Protection Action or First Flush Action occurs or the Adult Delta Smelt Entrainment Protection Action is reached, the OMR management season starts automatically on January 1. Once initiated, the OMR index on a 14-day running average will be no more negative than -5,000 cfs until the end of the OMR management season. A reduction in exports to achieve a new OMR index will occur within three days of an action that requires a change in OMR.

First Flush Action: to minimize project influence on the movement of Delta smelt and potentially other listed fish species into the South Delta, Reclamation and DWR will reduce CVP and SWP exports for 14 consecutive days, anytime between December 1 and the last day of February, to maintain a 14-day average OMR index no more negative than -2,000 cfs within three days of when the following criteria are met:

- Three-day running average of daily flows at Freeport is greater than, or equal to, 25,000 cfs, and
- Three-day running average of daily turbidity at Freeport is greater than, or equal to, 50 Formazin Nephelometric Units (FNU)

These criteria will be evaluated using data from the California Data Exchange Center (CDEC) Sacramento River at Freeport (FPT). The First Flush Action may only be initiated once each water year. The First Flush Action is exempt from the high-flow offramps as outlined below.

Reclamation and DWR, through WOMT, may prepare an assessment to initiate the First Flush Action early if real-time monitoring of abiotic and biotic factors and salvage prediction models indicates the First Flush Action is likely to be triggered (i.e., within two to three days) and delta smelt salvage is possible.

Reclamation and DWR recognize that readings at individual turbidity sensors or localized groups of turbidity sensors can generate spurious results in real-time. To avoid triggering an OMR flow action during a sensor error or a localized turbidity spike that might be caused by local flows or a wind-driven event, Reclamation and DWR will consider and review data from other locations. In the event that the three-day running average of daily turbidity at Freeport is 50 FNU (or greater), and Reclamation and DWR believe that a First Flush action is not warranted based on additional data sources, DWR and Reclamation will provide the additional data to the SMT and request they convene to confirm criteria will be met because of increased precipitation rather than sensor error or localized turbidity spike. If it is determined through WOMT that there is sensor error or a localized turbidity spike, Reclamation and DWR will take no additional action and provide the supporting information to the Service and CDFW within 24 hours.

3.7.4.3 Real-time Adjustments

Reclamation and DWR will manage to a more positive OMR than -5,000 cfs on a 14-day average under the following conditions:

3.7.4.4 Adult Delta Smelt Entrainment Protection Action (Turbidity Bridge)

The purpose of this action is to minimize adult Delta smelt entrainment risk by reducing exports during periods when turbidity is elevated in the south Delta resulting in habitat conditions that support movement of Delta smelt from the lower San Joaquin River into the south Delta and toward the export facilities (Smith et al. 2021). If after a First Flush Action or after December 20, whichever occurs first, daily average turbidity remains or becomes elevated to 12 FNU or higher at each of three turbidity sensors in the OMR corridor creating a continuous bridge of turbidity from the lower San Joaquin River to the CVP and SWP export facilities, Reclamation and DWR will manage exports to achieve a five-day average OMR flow that is no more negative than -3,500 cfs until the daily average turbidity in at least one of the three turbidity sensors is less than 12 FNU for two consecutive days, thereby indicating a break in the continuous bridge of turbidity. The three turbidity sensors are Holland Cut (HOL), Old River at Bacon Island (OBI), and Old River at Highway 4 (OH4).

If the three turbidity sensors remain over 12 FNU at the end of a High Flow Off-Ramp or any time after five consecutive days, then Reclamation and DWR, through WOMT, may prepare an assessment to determine if another Adult Delta Smelt Entrainment Protection Action is warranted based on continued entrainment risk following the period of elevated flows and whether delta smelt distribution has shifted downstream, as informed by available quantitative tools and real-time data.

The Adult Delta Smelt Entrainment Protection Action ends when the three-day continuous average water temperatures at Jersey Point or Rio Vista reach 53.6ºF (12ºC).

When San Joaquin River flows at Vernalis are greater than 10,000 cfs, the Adult Delta Smelt Entrainment Protection Action (Turbidity Bridge) is offramped. While offramped, the OMR Index will be managed to no more negative than –5,000 cfs on a 14-day average. The Adult Delta Smelt Entrainment Protection Action (Turbidity Bridge) would be immediately reinstated when San Joaquin River flows at Vernalis drop below 8,000 cfs.

Adult Longfin Smelt Entrainment Protection Action

If cumulative water year salvage of Longfin smelt with fork length ≥ 60 mm at the CVP and SWP facilities exceeds the savage threshold, where:

$$Salvage\ threshold = \left(\frac{San\ Francisco\ Bay\ Study\ Longfin\ smelt\ index}{20}\right) + 1$$

Where:

- The San Francisco Bay Study Longfin smelt index is calculated using age 1+ fish captured in the mid water trawl from the full Bay Study sampling area (California Department of Fish and Game 1999). The index is additive for the months of August, September, October, November, and December. If December data is not available at the start of this action period, then the August to November threshold will be used until the December data is available.

Then:

- From December 1 to the start of the OMR management season, Reclamation and DWR shall operate to an OMR flow no more negative than -5,000 cfs on a seven-day average for seven consecutive days and then, if appropriate, initiate the start of OMR management season. During the 7-day period, WOMT may convene and determine if initiation of OMR management season is warranted. If WOMT determines initiating OMR management is not warranted, the OMR management season does not begin at the conclusion of the 7-day period. If salvage of Longfin smelt ≥ 60 mm continues following the 7-day period where OMR is no more negative than -5,000 cfs, then Reclamation and DWR, through WOMT, may prepare an assessment to determine if additional Longfin smelt entrainment protection action is warranted based on continued entrainment risk, as informed by available quantitative tools and real-time data. WOMT may determine if OMR management should be initiated. If WOMT does not meet then protections will be initiated.
- From the start of the OMR management season to the end of February, Reclamation and DWR shall operate to an OMR flow no more negative than -3,500 cfs on a seven-day average for seven consecutive days. If salvage of Longfin smelt ≥ 60 mm continues following the 7-day period where OMR is no more negative than -3,500 cfs, then Reclamation and DWR, through WOMT, may prepare an assessment to determine if additional Longfin smelt entrainment protection action is warranted based on continued entrainment risk, as informed by available quantitative tools and real-time data.

3.7.4.5 Larval and Juvenile Delta Smelt Protection Action

Larval and juvenile Delta smelt protections start upon the end of the Adult Delta Smelt Entrainment Protection Action. Reclamation and DWR will operate south Delta exports to a 7-day average OMR index no more negative than -5,000 cfs when the average Secchi disk depth in the most recent survey is greater than one meter. The Secchi disk depth will be calculated as the average measurement from all sampled stations on the San Joaquin River upstream of Jersey Point and stations south of the lower San Joaquin River. If the average Secchi disk depth in the most recent survey is less than 1 meter, then Reclamation and DWR will operate to an OMR index no more negative than -3,500 cfs until the average Secchi depth has increased to more than 1 meter. The projects will operate to whichever of these OMR thresholds is appropriate given the latest Secchi disk depth data until the End of OMR Management Season.

Larval and Juvenile Longfin Smelt Protection Action

From January 1 through the end of OMR management season (see below), if:

- The 7-day average QWest is < +1,000 cfs (as calculated using the Dayflow QWest equation), and;
- Larval and juvenile Longfin smelt catch in the most recent SLS or 20mm survey at stations 809 and 812 exceeds the catch threshold set by the San Francisco Bay Study Longfin smelt index (see Table 3-10 for catch thresholds).

Reclamation and DWR will restrict the 7-day average OMR flow to no more negative than -3,500 cfs for seven days. This OMR action may be off-ramped if larval and juvenile Longfin smelt combined catch per unit effort (CPUE) at stations 809 and 812 is less than 5% of the total catch across the stations identified in Table 3-9 for the same SLS or 20mm survey used to on-ramp the action (second bullet above). This off-ramp would be in effect until a subsequent SLS or 20mm survey is conducted.

If the above trigger is reached and the WY cumulative juvenile Longfin smelt salvage at the CVP and SWP facilities exceeds 50% of the average annual salvage observed from 2009 through the water year preceding the current water year, then Reclamation and DWR shall operate to a seven-day average OMR of -3,500 cfs for 14 days. If the WY cumulative juvenile Longfin smelt salvage at the CVP and SWP facilities during this period exceeds 75% of the average annual salvage observed from 2009 through the water year preceding the current water year, then Reclamation and DWR shall operate to a 7-day average OMR of -2,500 cfs for 14 days. If salvage of larval and juvenile Longfin Smelt continues following the 14-day period where OMR is no more negative than -2,500 cfs, then WOMT may request advice from the SMT on appropriate OMR flows through the remainder of the Larval and Juvenile Longfin Smelt Entrainment Protection period.

Table 3-9. SLS and 20mm Survey Stations

Station #
306
308
323
338
340
344
411
602
501
519
606

Station #
508
705
520
809
812
716
723
711

Table 3-10. San Francisco Bay Study Longfin Smelt Index Catch Threshold

San Francisco Bay Study Longfin Smelt Index[1]	Catch Threshold at 809 & 812
0 – 149	10
150 – 299	20
300 – 499	30
500 – 999	40
≥ 1000	50

High-Flow Offramps for Larval and Juvenile Delta Smelt and Longfin Smelt

When Sacramento River flows at Rio Vista are greater than 55,000 cfs, or San Joaquin River flows at Vernalis are greater than 8,000 cfs, then the Larval and Juvenile Delta smelt and Longfin smelt Protection Actions are offramped. While offramped, the OMR Index will be managed to no more negative than –5,000 cfs on a 14-day average. The Larval and Juvenile Delta smelt and Longfin smelt Protection Actions would be immediately reinstated when the Sacramento River flows at Rio Vista drop below 40,000 cfs or the San Joaquin River flows at Vernalis drop below 5,000 cfs. Rio Vista flows are calculated from the Dayflow equation and reported in the daily DWR Delta Hydrologic Conditions Report.

Winter-Run Chinook Salmon Annual Loss Threshold

Reclamation and DWR will manage OMR to avoid exceeding the following annual loss thresholds:

- Natural winter-run Chinook salmon (loss = 0.5% of JPE)
- Hatchery winter-run Chinook salmon (loss = 0.12% of JPE)

Juvenile Production Estimates (JPEs) and annual loss thresholds will be calculated for natural winter-run Chinook and for each of the hatchery winter-run Chinook Salmon populations from LSNFH and Battle Creek. The JPE for natural and hatchery winter-run Chinook salmon will be calculated at least annually by the JPE Subteam as described in Appendix Y. Hatchery releases of winter-run Chinook salmon will be tracked individually, and cumulative loss will be summed across release groups with the same JPE and annual loss threshold.

Annual loss of natural and hatchery winter-run Chinook salmon at the CVP and SWP salvage facilities will be counted for each Brood Year, starting July 1 of the calendar year through June 30 of the following calendar year. If cumulative loss of natural or hatchery winter-run Chinook salmon in a brood year exceeds 50% of the annual loss thresholds, then DWR and Reclamation will restrict south Delta exports to maintain a 7-day average OMR value no more negative than -3,500 cfs for 7 consecutive days. Once exceeded, each winter-run observed in salvage would trigger another operation to an OMR limit of -3,500 cfs for 7 days.

If the cumulative loss of natural or hatchery winter-run Chinook salmon in a brood year exceeds 75% of the annual loss thresholds, then DWR and Reclamation will restrict south Delta exports to maintain a 7-day average OMR value no more negative than the -2,500 cfs when the Winter-Run Chinook Salmon Machine Learning Model (WRCML) and associated OMR Conversion Tool predict that the change to -2,500 cfs will shift the model output to a classification of absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the 7 most recent prediction days. These prediction values are calculated based on length-at-date and will be updated once genetic analysis is fully adopted.

Reclamation and DWR will restrict exports in response to meeting the above thresholds based on the initial length-at-date identification of natural older juvenile Chinook salmon and the thresholds described above. If genetic analysis of natural older juvenile Chinook salmon observed in salvage at the SWP or CVP indicates that any given Chinook salmon is not genetically winter-run Chinook salmon, these fish will not count towards annual the loss threshold exceedance, and continued export restrictions pursuant to the OMR limit are not required. Given that SHERLOCK is a new methodology currently undergoing peer review and field testing, both methodologies will be used to determine the final identification. In the event that SHERLOCK and GT-seq provide different run assignments, the results from the GT-seq method will be used to determine the final run assignment for the purposes of implementing this early season migration action.

Winter-Run Chinook Salmon Weekly Distributed Loss Threshold

To minimize the potential for a disproportionate impact of entrainment on any single week of natural winter-run Chinook salmon present in the Delta, Reclamation and DWR will manage the OMR index based on a weekly distributed loss threshold. There is no weekly distributed loss for hatchery winter-run Chinook salmon as they generally move through the Delta quickly.

The weekly loss threshold is a product of the weekly percentage of natural winter-run Chinook salmon present in the Delta, scaled to 100% (Table 3-11, Column E), and 50% of the natural winter-run annual loss threshold.

If the weekly distributed loss threshold is exceeded on any single day by the 7-day rolling sum of winter-run loss, then DWR and Reclamation will reduce exports to achieve a 7-day average OMR no more negative than -3,500 cfs for seven consecutive days.

The averaging period for OMR will begin within 3 days of a criterion being exceeded.

If a JPE is not available at the start of OMR management, then the RBDD Brood Year Total from the most recent bi-weekly period will be used and applied, as described for early season management. If a fish is not genetically identifiable or if genetic identification is pending, then the length-at-date identification will be used to classify the race of the juvenile Chinook salmon in salvage.

Weekly thresholds will be based on historical distribution (Table 3-11, Column E) of genetically-identified winter-run Chinook salmon from 2017-2021 and change every week (e.g. January 1-7, January 8-15). Each week, Reclamation and DWR, through SaMT, will compare weekly Delta entry and exit information to determine if the present data is tracking with the historical distribution data. Reclamation and DWR, through SaMT, may adjust subsequent weekly loss thresholds based on year-specific conditions. At the conclusion of the OMR management season, Reclamation and DWR will review and may adjust the historical distribution table, through SaMT, for the following year.

Table 3-11. Historical (Water Years 2017–2021) Presence of Winter-run Chinook Salmon Entering the Delta (Column B), Exiting the Delta (Column C), in the Delta (Column D = Column B–Column C) and in the Delta Scaled to 100% (Column E)

Week (starting January 1) (A)	Historical Cumulative entering the Delta (Sherwood Harbor) (B)	Historical Cumulative exiting the Delta (Chipps Island) (C)	Historical Present in Delta (D)	Historical Present in Delta (Scaled to 100%) (E)
1/1–1/7	2.47%	1.65%	0.82%	0.32%
1/8–1/14	2.47%	1.65%	0.82%	0.32%
1/15–1/21	4.94	1.65%	3.29%	1.30%
1/22–1/28	4.94%	1.65%	3.29%	1.30%
1/29–2/4	19.75%	2.20%	17.55%	6.91%
2/5–2/11	38.27%	4.95%	33.32%	13.13%
2/12–2/18	43.21%	5.49%	37.72%	14.86%
2/19–2/25	46.91%	9.89%	37.02%	14.59%
2/26–3/4*	50.62%	18.13%	32.49%	12.80%
3/5–3/11	55.56%	30.77%	24.79%	9.77%
3/12–3/18	77.78%	38.46%	39.32%	15.49%
3/19–3/25	85.19%	64.84%	20.35%	8.02%
3/26–4/1	93.83%	90.11%	3.72%	1.47%
4/2–4/8	98.77%	99.45%	0%	0%
4/9–4/15	100.00%	100.00%	0.00%	0.00%
4/16-End of Winter–run OMR Season	100.00%	100.00%	0.00%	0.00%

Notes: Data from genetically identified winter-run Chinook salmon entering the Delta (Sherwood Harbor Trawl) and exiting the Delta (Chipps Island Trawl) are used to estimate the percentage of winter-run Chinook salmon present in the Delta each week. Presence prior to January 1 each year is included in the first week of presence.
* The week of 2/26–3/4 includes 8 days during leap years

Steelhead Annual Threshold

In each year, Reclamation and DWR will manage exports to reduce loss at the CVP and SWP salvage facilities. To support survival and decrease entrainment loss, Reclamation and DWR will manage OMR to avoid exceeding the following annual loss threshold at CVP and SWP salvage facilities through the weekly distributed loss threshold described below.

- Unclipped juvenile CCV steelhead loss = 3,000

Annual loss of unclipped juvenile CCV steelhead at the CVP and SWP salvage facilities will be counted cumulatively for each Brood Year, starting July 1st of the calendar year through June 30th of the following calendar year. Loss will be calculated for the South Delta Export Facilities using CDFW's steelhead loss multiplier until a loss method for steelhead (see Section [TBD]) is approved by CDFW and NMFS. This loss threshold will be used until a new loss threshold is developed through the steelhead JPE Special Study (See Section [TBD]).

Steelhead Weekly Distributed Loss Threshold

To minimize the potential for a disproportionate impact of entrainment of steelhead present in the Delta on any single week, Reclamation and DWR will manage OMR based on a weekly distributed loss threshold. The weekly loss threshold is the annual loss threshold distributed over the period of observed steelhead salvage between January 1 and June 30 using the 7-day weekly periods identified in the weekly distributed loss table for winter-run Chinook salmon, extended through June 30. DWR and Reclamation will reduce exports to achieve a 7-day average OMR value no more negative than -3,500 cfs for seven consecutive days when the 7-day rolling sum of steelhead salvage, calculated daily, exceeds the weekly loss threshold of 120 fish.

Spring-Run Chinook Salmon and Surrogate Thresholds

To provide additional minimization protection for emigrating natural juvenile spring-run Chinook salmon from the Sacramento River and tributaries, including the Feather and Yuba rivers, into the channels of the central Delta, south Delta, and into SWP and CVP south Delta pumping facilities, DWR and Reclamation will restrict exports based on the presence of hatchery produced spring-run and associated yearling late-fall-run and young-of-year fall-run Chinook salmon surrogate groups at the CVP and SWP salvage facilities. DWR and Reclamation, in coordination with CDFW, NMFS, and USFWS through the SaMT, will select spring-run yearling and young-of-year surrogate groups. Yearling spring-run surrogates will be selected from late-fall Chinook salmon in-river release groups from the Coleman National Fish Hatchery. Spring-run young-of-year and associated surrogate groups will be selected from fall- and spring-run Chinook salmon in-river release groups from the Feather River Fish Hatchery and Coleman National Fish Hatchery.

From November 1 through the end of the OMR flow management period of each water year, if a cumulative loss threshold is exceeded, Reclamation and DWR will reduce south Delta exports to achieve a 7-day average OMR index of no more negative than -5,000 cfs in November and December, and no more negative than -3,500 cfs beginning January 1 (or whenever the OMR management begins) through the end of OMR flow management season, or June 30, whichever occurs first. The cumulative loss threshold for coded wire tagged (CWT) spring-run Chinook salmon surrogate groups at the CVP and SWP salvage facilities is 0.25% for each release group:

- Yearling spring-run Chinook salmon surrogates: WOMT, with input from SaMT, will select three in-river releases of late-fall Chinook salmon from Coleman National Fish Hatchery from November through January to use as yearling spring-run Chinook salmon surrogates. Input from SaMT could include a proposal with several alternatives. If three in-river releases appropriately distributed from November through January are not achievable in a given year because of hatchery limitations, then an alternative plan will be developed to ensure the adequate characterization of natural yearling spring-run Chinook salmon can still be achieved that year.
- Young-of-year spring-run Chinook salmon surrogates: WOMT, with input from SaMT, will select six in-river releases comprised of spring-run and fall-run Chinook salmon from the Feather River Fish Hatchery and fall-run Chinook salmon from the Coleman National Fish Hatchery from March through May to use as young-of-year spring-run Chinook salmon surrogates. Input from SaMT could include a proposal with several alternatives. If six in-river releases appropriately distributed from March through May are not achievable in a given year because of hatchery limitations, then an alternative plan will be developed to ensure the adequate characterization of natural origin young-of-year spring-run Chinook salmon can still be achieved that year.

The surrogate methods are intended to be an interim measure that will be replaced with a measure as described in Section 3.11.2, *Spring-Run Juvenile Production Estimate and Life Cycle Model*.

3.7.4.6 Storm-Flex

During the OMR management season, Reclamation and DWR, through WOMT, may prepare an assessment to evaluate operating to an OMR index no more negative than -6,250 cfs between the start of OMR management season and the larval and juvenile Delta Smelt Protection Action onramp, or the last day of February, whichever occurs first, to capture peak flows during storm-related events when:

1. The Delta is in excess conditions as defined in the 1986 Coordinated Operations Agreement, as amended in 2018; and
2. QWEST is greater than +1,000 cfs; and
3. X2 is <81km; and
4. The daily average turbidity at the Holland Cut (HOL), Old River at Bacon Island (OBI), and Old River at Highway 4 (OH4) sensors are < 12 Formazin Nephelometric Units (FNU) at each station; and
5. A measurable precipitation event has occurred in the Central Valley; and
6. Reclamation and DWR determine that the net Delta outflow index indicates a higher level of outflow available for diversion due to peak storm flows; and
7. None of the additional real-time OMR protections are controlling Project operations; and

8. Cumulative loss of the CVP and SWP export facilities of yearling Coleman National Fish Hatchery late-fall run chinook salmon (yearling spring run chinook salmon surrogate) is less than 0.5% within any of the release groups.

If the criteria above are met, WOMT will decide whether to request that DWR and Reclamation use estimates of the real-time distribution of listed-species from SMT and SaMT, as well as PTM and prediction tool output to assess potential listed-species entrainment risk differences using OMR inputs of -5000 and –6250 cfs. If the assessment indicates that no additional real-time OMR protections for the upcoming week are likely to be triggered, Reclamation and DWR will bring a request back to WOMT for approval to operate to OMR no more negative than -6,250 cfs and will update the assessment no less than weekly.

If conditions indicate an additional real-time OMR protection is likely to trigger, Reclamation and DWR will reduce south Delta exports to achieve a 14-day average OMR index no more negative than -5,000 cfs, unless a further reduction in exports is required. If an entrainment protection condition is triggered, Reclamation and DWR will cease storm-flex and implement the entrainment protection condition. Storm flex decisions will be re-evaluated weekly by WOMT.

3.7.4.7 End of OMR Management Season

OMR Management season for Delta smelt and Longfin smelt will conclude when the three consecutive days of water temperature at Clifton Court Forebay (CLC) is 77.0°F (25°C) or higher, or on June 30, whichever occurs first.

Reclamation and DWR will conclude the management of OMR for salmonids on June 30 or when the following conditions have occurred, whichever occurs first:

- Daily mean water temperature at Mossdale has exceeded 71.96°F (22.2°C) for 7 non-consecutive days (does not have to be consecutive) in June; and
- Daily mean water temperature at Prisoner’s Point has exceeded 71.96°F (22.2°C) for 7 non-consecutive days (does not have to be consecutive) in June.

3.7.4.8 End of Year Evaluation

Each year, DWR and Reclamation, in coordination with the SMT, will conduct an annual assessment of OMR protection measures for Delta smelt and longfin smelt, which will include an evaluation of salvage, management actions, and physical conditions in a seasonal report. This seasonal report may support improvements, if necessary, to the OMR Guidance Document, and may also guide operations in the future. This seasonal report will fulfill commitments under the Record of Decision (ROD) that will be signed by Reclamation on the Consultation on the Coordinated Long-Term Operation of the CVP and SWP to produce a seasonal report each year. Additionally, this seasonal report will be used to support the development of Reclamation’s Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project. Finally, this seasonal report will inform any Four-Year Review Panels adopted under the ROD. The purpose of the independent review will be to evaluate the efficacy of actions undertaken to reduce the adverse effects on listed species.

Each year, DWR and Reclamation, in coordination with the SaMT, will conduct an annual assessment of OMR protection measures for winter-run Chinook salmon, spring-run Chinook salmon, and steelhead, which will include an evaluation of salvage, management actions, and physical conditions. in a seasonal report. This seasonal report may support improvements, if necessary, to the OMR Guidance Document, and may also guide operations in the future. This seasonal report will fulfill commitments under the Record of Decision (ROD) that will be signed by Reclamation on the Consultation on the Coordinated Long-Term Operation of the CVP and SWP to produce a seasonal report each year. Additionally, this seasonal report will be used to support the development of Reclamation's Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project Finally, this seasonal report will inform any Four-Year Review Panels adopted under the ROD. The purpose of the independent review will be to evaluate the efficacy of actions undertaken to reduce the adverse effects on listed species.

3.7.5 Spring Delta Outflow

Reclamation and DWR will take actions intended to supplement Delta outflow per the terms of the Voluntary Agreements (VAs). Actions that will support the additional Delta outflow include: Reclamation and DWR south of Delta export modifications; Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds; and passing Delta inflow from water made available by VA Parties. Actions to result in increased Delta outflow are shown in Table 3-12. These volumes (and associated footnotes) are reflected in the Memorandum of Understanding signed by VA parties in March 2022.

Table 3-12. Water Made Available by the CVP and SWP[5]

	Critical (TAF)	**Dry (TAF)**	**Below Normal (TAF)**	**Above Normal (TAF)**	**Wet (TAF)**
SWP and CVP Forgone Exports[6]	0	125	125	175	0
SWP Flow Purchases Implemented through Forgone SWP exports	0	30	30	30	0
SRSC Fallowing[7]	2	102	100	100	0
Sac. Valley Purchase[8]	0	10	10	10	0

[5] These numbers are set forth in the Term Sheet, Appendix 1. Flow Tables

[6] Subject to Public Health and Safety exports of 1,500 cfs.

[7] SRSC will fallow 25,000 acres of rice which is credited with 110 TAF, which includes 10 TAF of fixed price purchase water. Dry year water may be held in Shasta for storage to improve temperature management in the current or future years. 2TAF in Critical and Dry years are contributions from Mill/Cow Creek.

[8] The new flow contributions from the Sacramento River Basin identified in this Table 1a, plus new flow contributions resulting from the below-referenced PWA Water Purchase Program, Permanent State Water Purchases, and PWA Fixed Price Water Purchase Program line items in Tables 1a and 1b, are not intended to result in idling more than 35,000 acres of rice land in the Sacramento River Basin.

	Critical (TAF)	Dry (TAF)	Below Normal (TAF)	Above Normal (TAF)	Wet (TAF)
American River Groundwater and Reoperation of Upstream Reservoirs[9]	30	40	10	10	0
CVP SOD Purchase[10]	0	12.5	24.5	35	0
Westlands Contract Assignment Purchase[11]	3	6	15	19.5	27
Additional CVP SOD[12]	0	5	5	5	0
San Joaquin River Flows above Tributary VAs	0	50	50	50	0
Flow Purchases Acquired Through SWP Diversion Fees (implemented through tributary inflow from the fallowing program)[13]	0	45	45	45	0
Total CVP and SWP Outflow Potentially through CVP and SWP Operations[14]	33	423.5	414.5	478.5	27
Additional Feather River Actions accounted for under Total VA Outflow (below)		60	60	60	
Total VA Outflow by All VA Parties	155	825.5	750.5	824.5	150

Reclamation and DWR will operate consistent with the Voluntary Agreements approved by the SWRCB and executed agreements by VA Parties.

- Early Implementation: Reclamation and DWR, after coordination through WOMT, will provide the SWP and CVP Foregone Exports, along with other VA parties taking actions similar to those contemplated by the VAs only if (i) Reclamation issues a Record of Decision for the coordinated operation of the CVP and SWP that are the subject of the consultation, and (ii) the SWRCB has not updated the WQCP. These early implementation actions are intended to develop data that could assist decisions whether to implement the VAs or decisions how to implement the VAs. Delta outflow from DWR

[9] Contingent on public funding of groundwater substitution infrastructure to be completed by a subsequent year, and compensation of upstream surface storage releases on a per acre-foot basis. These flows are included in the Year 1 subtotal. Only implementable in 3 of 8 Dry or Critical years and 3 of 8 Above Normal or Below Normal years.
[10] Subject to CVP SOD Agricultural Allocation.
[11] Quantity of water made available will be based on the maximum or a portion of the entitlement under certain assignment contracts and only that which is allocated to CVP SOD Agriculture.
[12] If flows are not obtained through this source, the equivalent volume would be obtained at market price or otherwise obtained through other mechanisms.
[13] The VA's governance program will be used to determine the use of available funding to provide additional outflow in AN, BN, or W years. If DWR is called upon to provide the water by foregoing SWP exports, such call will be handled through a separate agreement between DWR and its contractors. The numbers for "Flow Purchases Acquired Through SWP Diversion Fees (implemented through tributary inflow from the fallowing program)" are the SWP's partial contributions to the total values set forth in the Term Sheet, Appendix 1 under the PWA Water Purchase Program's fallowing contributions for AN, BN and D years.
[14] The volumes identified in this row represent the CVP and SWP contributions. Additional flows from other VA parties and Permanent State Water Purchases will increase Delta Outflow.

and Reclamation actions described above would be in March through May and prioritized during the period of April 1 through May 31 [*]. These early implementation actions will continue until the SWRCB updates the WQCP or for two years, whichever occurs first.

- Post Early Implementation: After the early implementation period:
    - Reclamation and DWR will operate consistent with the VAs only if (a) the SWRCB incorporates the VAs, as proposed by the VA parties, into the WQCP, and (b) the VA parties execute the agreements contemplated by the VAs, or
    - Reclamation and DWR will operate as described by the Proposed Action but without any of the actions contemplated for "early implementation" or the VAs if (i) the SWRCB does not incorporate the VAs, as proposed by the VA parties, into the WQCP, or (ii) the VA parties do not execute the agreements contemplated by the VAs.

3.7.6 Delta Smelt Summer and Fall Habitat

3.7.6.1 Fall X2

To increase the amount of low salinity zone habitat for Delta Smelt, in Wet and Above Normal hydrologic year types, Reclamation and DWR will maintain a 30-day average X2 $\leq$ 80km for September through October.

3.7.6.2 Suisun Marsh Salinity Control Gate

To address effects to critical habitat for juvenile delta smelt and increase habitat and food access for delta smelt in summer and fall (June through October) in Suisun Marsh and Grizzly Bay during above normal, below normal years, and dry years following wet or above normal years, DWR will 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. Operation of the SMSCG will end by December 1. 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. DWR and Reclamation, through the Delta Coordination Group (DCG), may prepare an assessment to propose an alternative gate operation if modeling of hydrological and/or existing D-1641 conditions indicate the action can achieve the same habitat benefits in an equal or better manner within the range of effects analyzed. Reclamation and DWR, through the DCG, will develop an annual monitoring plan that responds to uncertainties in the performance metrics to evaluate action performance. DWR and Reclamation will also produce an annual report that summarizes monitoring findings and assess action performance. The Summer-Fall Habitat Action shall be included in Independent Reviews under the Adaptive Management Program.

3.7.7 Tracy Fish Collection Facility

The Tracy Fish Collection Facility addresses the entrainment stressor. Reclamation will operate the Tracy Fish Collection Facility to screen fish from Jones Pumping Plant. The primary channel is a behavioral barrier with effectiveness that depends on the pumping Jones Pumping Plant. The secondary channel is a positive fish barrier. When south Delta hydraulic conditions allow and conditions are within the original design criteria for the Tracy Fish Collection Facility, the secondary channel is operated to achieve water approach velocities for striped bass of approximately 1 to 2.5 feet per second from June 1 through October 31 and for salmon of approximately 3 feet per second from November 1 through May 31.

Salvage of fish at the Tracy Fish Collection Facility occurs 24 hours per day, 365 days per year. Fish are salvaged in flow-through holding tanks, monitored by a 30-minute fish count every 120 minutes, and transported by truck to release sites near the confluence of the Sacramento and San Joaquin Rivers. Larval smelt sampling commences upon detection of a spent female at Tracy Fish Collection Facility or Skinner Delta Fish Protective Facility or when a temperature trigger of 53.6°F (12°C) at nearby California Data Exchange Center stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m. The standard operating procedures for the Tracy Fish Collection Facility are included in Attachment [TBD].

To seek additional improvements to the operating procedures and reporting of the Tracy Fish Collection Facility; Reclamation proposes to develop the Alternative Loss Pilot Study Implementation Plan (ALPS-IP) and implement the resulting pilot study, which would include consideration of additional salvage facility loss parameterization and study or further procedural modifications if identified and prioritized through the ALPS-IP SDM results and would result in demonstrated improvements to the accuracy and reliability of data and fish survival.

3.7.7.1 Maintenance and Repair

Reclamation will provide the fish agencies notification of salvage disruption (salvage outage) due to planned facility maintenance at least 24 hours in advance. To minimize and avoid salvage disruptions, Reclamation conducts most planned outages during shutdowns of Jones Pumping Plant, typically in the spring and continuing into the summer and fall months. For unplanned facility maintenance, Reclamation will provide notice as soon as practicable and minimize the duration of the salvage outage. Reclamation, through technical assistance with the fishery agencies, will develop an appropriate loss factor for these outages.

Reclamation is required to maintain the Tracy Fish Collection Facility and may not have discretion over when the maintenance must occur.

3.7.8 John E. Skinner Delta Fish Protective Facility

John E. Skinner Delta Fish Protective Facility (Skinner Delta Fish Protective Facility) addresses the entrainment stressor. DWR will operate the facility to screen fish from Banks Pumping Plant. Salvage of fish occurs at the Skinner Delta Fish Protective Facility whenever Banks Pumping Plant is pumping. Fish are salvaged in flow-through holding tanks, monitored by a 30-minute fish count every 120 minutes, and transported by truck to release sites near the confluence of the Sacramento and San Joaquin Rivers. Larval smelt sampling commences upon detection of a spent female at Tracy Fish Collection Facility or Skinner Delta Fish Protective Facility or when a temperature trigger of 53.6°F (12°C) at nearby California Data Exchange Center stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m. The standard operation procedures for the Skinner Delta Fish Protective Facility are included as Attachment [TBD].

To seek additional improvements to the Skinner Fish Facility; DWR proposes to develop the Alternative Loss Pilot Study Implementation Plan (ALPS-IP) and implement the resulting pilot study, which would include consideration of additional salvage facility loss parameterization and study or further procedural modifications if identified and prioritized through the ALPS-IP SDM results and would result in demonstrated improvements to the accuracy and reliability of data and fish survival.

3.7.8.1 Maintenance and Repair

DWR will provide Reclamation and the fish agencies notice of salvage disruptions due to planned facility maintenance (planned outages) at least 24 hours in advance. To minimize and avoid salvage disruptions, DWR conducts most planned outages during full shutdowns of Banks Pumping Plant, frequently in the spring. Further, the modular design of the Skinner Delta Fish Protective Facility in conjunction with total export capacity reductions is used to avoid salvage disruptions for maintenance and repair activities. For unplanned facility maintenance, notice will be provided as soon as practicable. In the event of an unplanned outage (e.g., power disruption) extending beyond one hour, DWR will stop pumping, but may continue to operate the Clifton Court Forebay radial gates.

3.7.8.2 Fish Protection Facility Operations Manual

DWR proposes to develop and implement a revised written training curriculum as identified in section IV: Fish Identification, of the 2021 DWR CDFW Interagency Agreement for Fish Facilities Operation. Additionally, DWR proposes to annually review and update the revised SFF Operations Manual after WY 2023 as specified in the manual. Skinner Delta Fish Protective Facility will have access to a staff biologist for consultation to support salvage staff, research studies, and special handling of tagged fish.

3.7.9 Tidal Habitat Restoration

DWR and Reclamation have or will carry out tidal habitat restoration acre targets identified from the 2008 and 2019 FWS Biological Opinions (8,000 acres) and the 2020 State Incidental Take Permit (396.3) to complete mitigation requirements for delta smelt and longfin smelt (per the 2020 ITP). Currently, twelve restoration projects have been identified to satisfy the total acreage requirement of 8,396.3 acres (Table 3-13). The twelve projects are in different phases of completion: 1) constructed (3,584 acres), 2), in construction (3.490 acres) or 3) planned (1,662 acres). All twelve restoration projects are located in the northern arc of the upper estuary (area of highest delta smelt occupation) and are designed to enhance food production and rearing habitat for delta smelt and longfin smelt (per the 2020 ITP). DWR and Reclamation will complete its 8,396.3 acre restoration requirements by 2026.

Table 3-13. Tidal Habitat Restoration

Project	Estimated Acres	Phase
Arnold Slough	138	Constructed
Decker Island	113	Constructed
Lower Yolo Ranch	1713	Constructed

Project	Estimated Acres	Phase
Tule Red	590	Constructed
Winter Island	544	Constructed
Wings Landing	190	Constructed
Yolo Flyway Farms	296	Constructed
Bradmoor Island	490	Under construction
Lookout Slough	3000	Under construction
Prospect Island	1,500	Planning, construction planned in 2024
Chipps Island	687	Planning; construction planned in 2023

The process and documentation for design, protection and long-term management of these sites is described in Attachment [TBD].

3.7.10 Delta Smelt Supplementation

Delta smelt supplementation addresses the Allee effect in the baseline status of wild delta smelt. Too few delta smelt remain for effective breeding in the wild. In water year 2022, the FCCL raised 55,733 fish that were released into the wild as part of experimental releases. Experimental releases are currently planned through water year 2024.

USFWS ran a simulation using an updated version of the life cycle model described by Smith et al. (2021) to estimate the probability that different release levels would result in wild Delta smelt populations high enough to support FCCL's broodstock collection efforts. Results indicate that an annual release of 150,000–175,000 fish is needed to have a greater than 50% chance of meeting the collection target. Reclamation and DWR will support a minimum production of 125,000 fish by water year 2024, a minimum of 150,000 fish by water year 2025, and a minimum of 200,000 fish by water year 2026, if feasible, that are at least 200 days post-hatch or equivalent.

Reclamation and DWR, through the Culture and Supplementation of Smelt (CASS) Steering Committee, will continue to collaborate with USFWS and CDFW on the development of a program to conduct supplementation of the wild Delta smelt population with propagated fish consistent with USFWS' Supplementation Strategy (U.S. Fish and Wildlife Service 2020). The USFWS and CDFW may update the Supplementation Strategy in coordination with Reclamation and DWR. The Supplementation Strategy currently uses the UC Davis Fish Conservation and Culture Laboratory (FCCL).

The Supplementation Strategy also identifies a need for additional facilities and evaluation of new approaches to maintain these fish, support supplementation, improve transportation and release of fish, maximize genetic diversity, and minimize domestication effects. An existing Master Plan for a Delta Smelt Conservation Facility Fish Technology Center (U.S. Fish and Wildlife Service 2018) is currently being revisited and further developed to a 35% design-level plan, with completion expected 2023. Additional facilities would require a subsequent set of environmental compliance for their construction and eventual operation. Reclamation and DWR will collaborate with USFWS and CDFW for the additional development of this planning effort, incorporation into the Supplementation Strategy, and the construction and operational needs of facilities capable of meeting production of 400,000–500,000 fish that are at least 200 days post-hatch (dph) by water year 2030.

3.7.11 Water Transfers

Water transfers assist California urban areas, agricultural water users, and others in meeting their water needs. Reclamation and DWR will 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.

Seasonal operations describe deliveries up to contract totals. Included in this consultation is transfers of water, up to contract totals, between CVP contractors within counties, watersheds, or other areas of origin (e.g., Accelerated Water Transfers). These transfers do not require demonstration of that water being consumptively used or irretrievably lost to beneficial use.

Transfers not meeting these requirements, including Out of Basin transfers (e.g., Long Term Water Transfer Program (North to South-of-Delta Transfers, Long Term San Joaquin River Exchange Contractor Transfers, "Warren Act Transfers"), follow the *Draft Technical Information for Preparing Water Transfer Proposals, as updated in 2019* (Water Transfers White Paper) . The actions taken by contractors to make water available for these transfers (i.e., reducing consumptive use by crop idling, contractor reservoir releases or groundwater substitution) have separate ESA section 7 consultation (see Programs in the Environmental Baseline for additional information), and are not part of this consultation. However, the specific timing and operations associated with the movement of the water to be transferred is a component of this Proposed Action and, thus, covered by this consultation. Updated in 2019, the paper provides detailed information on establishing transfers and how to complete a particular transfer and document it in a way to prevent harm to other legal users of water. The following is a brief summary from the Water Transfers White Paper on making water available for transfer. Making water available for transfer is not a part of this Proposed Action:

- **Cropland Idling/Crop Shifting Transfers:** Water from idling cropland or growing lower-water-use crops. The seller reduces surface water diversion from their normal operations.
- **Groundwater Substitution Transfers:** Water from reducing surface water diversions and replacing that like amount water with groundwater pumping.
- **Reservoir Storage Release:** Water from seller releasing stored water from their reservoir in excess of what would be released annually under their normal operations (e.g., reservoir storage targets, historical operation patterns, instream flow requirement, conveyance losses, refill, and other downstream obligations).

Reclamation and DWR will provide a transfer window across the Delta from July 1 through November 30. When pumping capacity is needed for CVP or SWP water, Reclamation and DWR may restrict transfers. Maximum transfers are shown in Table 3-14.

Table 3-14. Proposed Annual North to South (out of basin) Water Transfer Volume

Water Year Type	Maximum Transfer Amount North to South (TAF)
Critical	Up to 600
Dry (following critical)	Up to 600
Dry (following dry)	Up to 600
All other years	Up to 360

TAF = thousand acre-feet.

In general, a north to south water transfer involves an agreement between a willing seller and a willing buyer to use available infrastructure capacity to convey water between the parties. To make water available for transfer, the willing seller must take an action to reduce the consumptive use of water or release additional water from reservoir storage (i.e. Water Transfers White Paper). This water is then conveyed to the buyers' service area for beneficial use.

Programs to make transfer water available not included in this consultation include:

- Long Term Water Transfer Program (North to South-of-Delta Transfers)
- Long Term San Joaquin River Exchange Contractor Transfers
- Non-Project Transfers, e.g. "Warren Act Transfers"

Reclamation and DWR frequently transfer project and non-project water supplies through CVP and SWP facilities, including in-basin and out of basin transfers. The quantity and timing of a specific water transfer may or may not require operational changes to both CVP and SWP reservoir releases and CVP and SWP facilities pumping.

3.7.12 Agricultural Barriers

Agricultural barriers maintain water levels for south Delta agricultural diverters. DWR is in the process of renewing permits from the USACE for the installation of three agricultural barriers in the south Delta for 2023-2027. DWR may install barriers as early as May 1 in Old River near Tracy 0.5 mile upstream of the Tracy Fish Collection Facility; in Middle River 0.5 mile upstream of the junction with Victoria Canal; and in Grant Line Canal, about 400 feet upstream of the Tracy Boulevard Bridge. All barriers will be removed by November 30 each year.

Operation of the Agricultural Barriers is part of the long-term operation of the CVP and SWP. Upon completion of installation, DWR will allow the barriers to operated tidally depending on stage conditions, except for one culvert at each of the three agricultural barriers. These culverts will remain open beyond June 1 if water levels for diversion in the south Delta is not a concern and the mean daily water temperature at Mossdale is less than 71.6°F (22°C).

3.7.13 Barker Slough Pumping Plant

DWR, at its sole expense, will operate the Barker Slough Pumping Plant to an annual maximum diversion of 125 TAF and a maximum daily diversion rate of 175 cfs. The Barker Slough Pumping Plant is a SWP screened diversion that pumps water through the North Bay Aqueduct, via an underground pipeline, to Cordelia Forebay outside of Vallejo. The North Bay Aqueduct serves Napa County, Vallejo, Benicia, and Travis Air Force Base.

3.7.13.1 Maximum Spring Diversions

DWR operates the Barker Slough Pumping Plant (BSPP) to divert water from the North Delta into the North Bay Aqueduct (NBA). Longfin Smelt are attracted to the favorable habitat conditions in the North Delta and can potentially inhabit this area during their spawning period in drier years. The operation of the BSPP in combination with other diversions and losses can result in the net negative flow of water from the North Delta into Barker Slough, and these hydrodynamic conditions can lead to the entrainment of larval Longfin Smelt when they are present. Cumulative BSPP diversions for the January 1 to March 31 period, at design capacity, are limited to approximately 26 thousand acre-feet (TAF). The incidental take of larval Longfin Smelt at the BSPP is expected to be low due to 1) generally minimal diversion rates during periods when larval Longfin Smelt presence is expected to be greatest (February and March) and 2) BSPP utilizing a positive barrier fish screen making the injury or death of adult and juvenile Longfin Smelt unlikely. However, a small number of larval Longfin Smelt may be entrained during BSPP operations when larvae are present in the area.

Barker Slough Pumping Plant Protections for Larval Delta Smelt

Barker Slough Pumping Plant maximum spring diversions addresses the entrainment risk and transport direction stressor for Delta smelt. Cumulative Barker Slough Pumping Plant diversions for the March to June period, at design capacity, is 42 TAF.

The incidental take of larval Delta smelt at the Barker Slough Pumping Plant is expected to be low due to (1) generally low diversion rates during periods when larval Delta smelt presence is expected to be greatest (March and April) and (2) Barker Slough Pumping Plant utilizing a positive barrier fish screen making the injury or death of adult and juvenile Delta smelt unlikely. However, a small number of larval Delta smelt may be entrained into Barker Slough during Barker Slough Pumping Plant operations.

Barker Slough Pumping Plant Conservation Measures

Larval Longfin Smelt

DWR proposes to operate the BSPP to protect larval Longfin Smelt from January 1 to March 31 of dry and critical water years. If the water year type changes after January 1 to below normal, above normal, or wet, this action will be no longer in effect. If the water year type changes after January 1 to dry or critical, DWR proposes to operate according to this measure.

From January 1 to March 31 of dry and critical water years, DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 100 cfs.

Larval Delta Smelt

DWR proposes to operate the BSPP to protect larval Delta Smelt from March 1 to June 30 of dry and critical water years. If the water year type changes after March 1 to below normal, above normal, or wet, this action will be no longer in effect. If the water year type changes after March 1 to dry or critical, DWR proposes to operate according to this measure.

DWR, at its sole expense, from March 1 to April 30 of dry and critical water years, if catch of larval Delta Smelt (length less than 25mm) in 20mm Survey at station 718 exceeds 14% of the total catch of larval Delta Smelt across the North Delta (20mm Survey stations 716, 718, 719, 720, 723, 724, and 726), then DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 60 cfs.

DWR, at its sole expense, from May 1 to June 30 of dry and critical water years, if catch of larval Delta Smelt (length less than 25mm) in 20mm Survey at station 716 exceeds 5% of the total catch of larval Delta Smelt across the North Delta (20mm Survey stations 716, 718, 719, 720, 723, 724, and 726), then DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 100 cfs.

3.7.13.2 Maintenance

Fish screen cleaning, sediment removal, and aquatic weed removal at the Barker Slough Pumping Plant is needed year-round to maintain operation of the Barker Slough Pumping Plant. Raising and cleaning of the fish screens is necessary to prevent excessive head loss and minimize localized approach velocities.

Sediment removal from the trap and concrete apron in front of the facility is necessary to prevent accumulation and clogging of the screens and facility. Removal of aquatic weeds is necessary to avoid blocking flow and causing water levels to drop in the pump wells behind the screens, triggering automatic shutoffs to protect the pumps from cavitation. Attachment [TBD] provides the operating manual and details for Barker Slough Pumping Plant maintenance, including best management practices to minimize adverse effects to listed species.

3.7.14 Clifton Court Forebay Weed Management

Aquatic weed management is needed year-round to prevent potential damage to SWP equipment through cavitation at the pumps and excessive weight on the fish protection louver array. Excessive weed mats entrained into the fish holding tanks and collection baskets in Skinner Fish Protection Facility reduce the efficiency of fish salvage, affect the ability of staff to conduct fish counts, and smother fish. Dense stands of aquatic weeds additionally provide cover for predators that prey on listed species within the Clifton Court Forebay. Algal blooms degrade drinking water quality through production of taste and odor compounds or algal toxins. DWR will apply herbicides and algaecides or will use mechanical harvesters on an as-needed basis to control aquatic weeds and algal blooms in the Clifton Court Forebay. Attachment [TBD] provides the operations manual and details for Clifton Court Forebay Weed Management, including best management practices to minimize adverse effects to listed species.

3.7.15 B.F. Sisk Dam Raise and Reservoir Expansion

Upon completion of construction, Reclamation and DWR will operate Delta facilities with an expanded San Luis Reservoir. The raising of Bernice Frederick Sisk Dam will increase reservoir storage capacity by 130 TAF. Reclamation and DWR completed a final EIS/Environmental Impact Report in September 2019 for the addition of shear keys and downstream stability berms to provide seismic stability for the embankment during a large earthquake and to raise the dam crest by 12 feet. Reclamation consulted with the USFWS on construction. This Proposed Action consults on the operational effects from increased exports with an expanded San Luis Reservoir.

3.8 Stanislaus River

Reclamation operates and maintains the Eastside Division of the CVP for flood control, M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and water quality. Reclamation’s facilities include the New Melones Dam, Reservoir (2.4 MAF capacity), and Powerplant.

The Tri-Dam Project, a partnership between the Oakdale Irrigation District and South San Joaquin Irrigation District, consists of Donnells and Beardsley Dams, located upstream of New Melones Reservoir on the middle fork Stanislaus River, and Tulloch Dam and Powerplant, located approximately six miles downstream of New Melones Dam on the mainstem Stanislaus River. Releases from Donnells and Beardsley Dams affect inflows to New Melones Reservoir. The main water diversion point on the Stanislaus River is Goodwin Dam, an impassable barrier for fish migration approximately two miles downstream of Tulloch Dam.

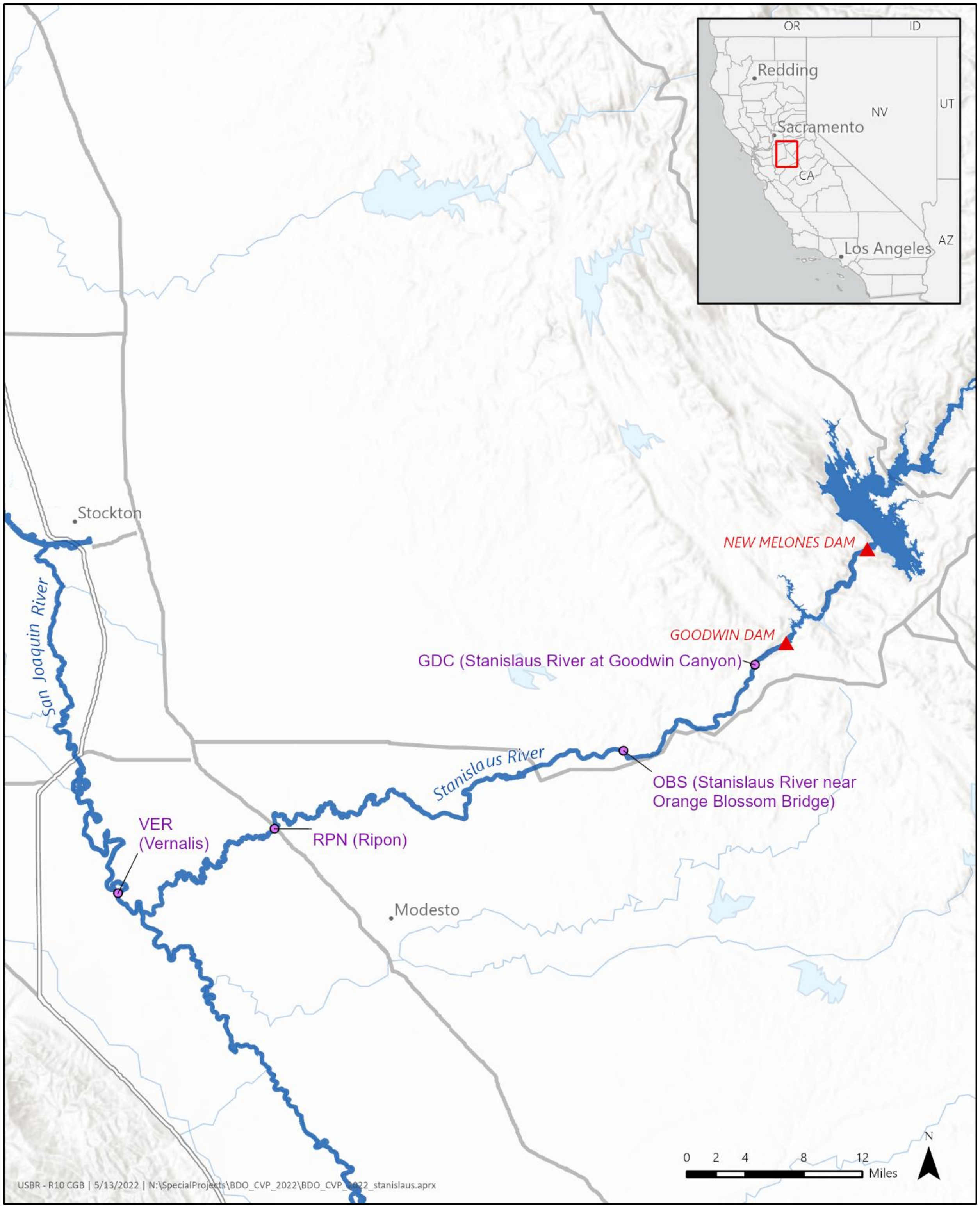


Figure 3-7. Map of the Stanislaus River and Eastside Division

Statutory and Regulatory Requirements, see Appendix A:

- USACE Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California (April 1959)
- Public Law 87-874 Flood Control Act of 1962
- USACE Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California (April 1959)
- Minimum flow standards below Goodwin Dam: "Interim Instream Flows and Fishery Studies in the Stanislaus River Below New Melones Reservoir" (1987 Agreement between Reclamation and CDFG)
- Minimum Dissolved Oxygen standards: State Water Board D-1422
- State Water Board D-1641, D-1422, D-1616, Bay-Delta Plan flow objectives and subsequent assignment of responsibility
- 1992 CVPIA 3406(b)(2)
- Agreements and Contracts
- 1988 Agreement and Stipulation with Oakdale Irrigation District and South San Joaquin Irrigation District
- Water Service Contracts
- Tri-Dam Agreement

Programs in the environmental baseline to highlight:

- Spawning and Rearing Habitat Restoration
- Temperature Modeling Platform

3.8.1 Seasonal Operations

In the winter and spring, Reclamation will operate to D-1641 and for flood control in accordance with the USACE Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California (April 1959). Operating to flood control constraints is relatively infrequent because New Melones is a larger reservoir relative to its annual inflow. However, Tulloch Lake 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 but are generally of a short duration. Reclamation seeks to minimize potential redd dewatering, redd scouring, and juvenile stranding for steelhead.

Reclamation is required to maintain applicable dissolved oxygen standards on the lower Stanislaus River for species protection. The 7.0 milligrams per liter (mg/L) dissolved oxygen requirement at Ripon applies year-round, but is most often controlling (requiring additional releases from Goodwin Dam) from June 1 to September 30.

In the fall, Reclamation operates to a D-1641 fall pulse flow requirement at Vernalis in October for fish attraction. Otherwise, Reclamation operates to base flow requirements in order to rebuild storage. If necessary, releases might be made for dissolved oxygen at Ripon or EC concerns at Vernalis, but these are rare.

3.8.2 Ramping Rates

Ramping rates address the stranding risk stressor. Reclamation will coordinate releases on the Stanislaus River as shown in Table 3-15. For determining the water year type, Reclamation will use the San Joaquin Valley “60-20-20” Water Year Hydrologic Classification (60-20-20) developed for D-1641 implementation and based on a 90% exceedance forecast.

Table 3-15. Goodwin Dam Ramping Rates

Goodwin Release Range (cfs)	Standard Rate of Increase (cfs per 2 hours)	Standard Rate of Decrease (cfs per 2 hours)	C and D Water Year Type Rate of Increase (cfs per 2 hours)	C and D Water Year Type Rate of Decrease (cfs per 2 hours)
At or above 4,500	250	250	250	250
2,000 to 4,499	500	250	500	250
500 to 1,999	250	100	500	200
300 to 499	100	50	200	100

cfs = cubic feet per second; C = critical (60-20-20 San Joaquin Index); D = dry (60-20-20 Index).

Reclamation, through the Stanislaus Watershed Team, may develop a faster down ramping rate on a case-by-case basis to implement temporary flow reductions for critical monitoring or maintenance needs. For winter instability flows, Reclamation, through the Stanislaus Watershed Team, may implement faster ramping rates in critical and dry water year types provide more flexibility for shaping flow volumes of water for the purposes of improving biological benefits. Ramping rates that promote recruitment of native riparian vegetation on floodplain surfaces should be considered when instream flow budgets are sufficient. Reclamation may vary from these ramping requirements during flood control.

3.8.3 Minimum Instream Flows

Minimum instream flows (i.e., Goodwin Dam releases) will be in accordance with the 2023 New Melones Stepped Release Plan (2023 SRP, Figure 8 Attachment TBD (excel sheet). The 2023 SRP increases the potential outmigration response of juvenile steelhead and increases the annual total volume of water for all year types. Modifications would use a single pulse and increase peak releases from 400 cfs to 1,500 cfs in the default schedule (Figure 3-8).

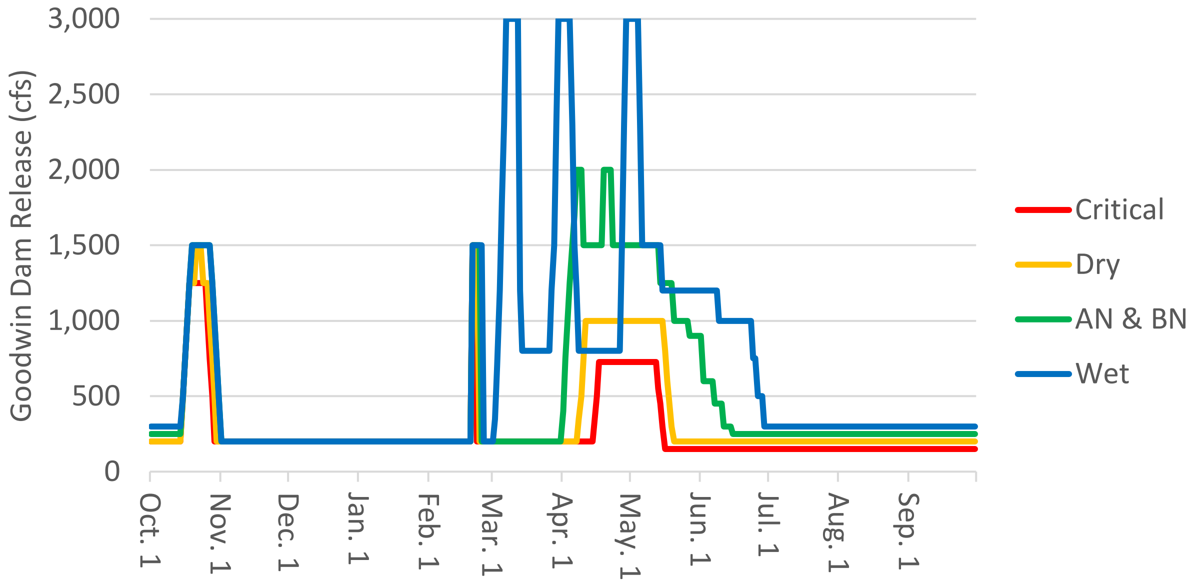


Figure 3-8. 2023 New Melones Stepped Release Plan with Modified Winter Instability Flows

For determining the water year type, Reclamation will use the San Joaquin Valley "60-20-20" Water Year Hydrologic Classification (60-20-20) developed for D-1641 implementation and based on a 90% exceedance forecast. The 2023 SRP includes the ability to shape monthly and seasonal flow volumes as described below:

3.8.3.1 Winter Instability Flows

Winter instability flows address the outmigration and juvenile habitat stressors. Reclamation releases additional flow in February, as provided in the 2023 SRP, to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats. Reclamation, through the Stanislaus Watershed Team, schedules the winter instability flow volume. Whenever possible the pulse is scheduled to coincide with a natural storm event, which may naturally cue outmigration. In some years, natural rain events may provide sufficient natural variability in the hydrograph and an additional pulse may be determined to necessary. Reclamation, through the Stanislaus Watershed Team, will prepare an assessment when rain events meet the need for winter instability flows and not require additional releases.

3.8.3.2 Spring Pulse Flows

Spring pulse flows address the outmigration and juvenile habitat stressors. Reclamation will release additional flows starting as early as March through as late as June. Reclamation, through the Stanislaus Watershed Team, will schedule spring pulse flow volumes consistent with volumes in the SRP.

3.8.3.3 Fall Pulse Flows

Fall pulse flows improve instream conditions and provide an attraction cue for adult salmonids returning to spawn. Reclamation will release additional flows in October and/or November.

Reclamation, through the Stanislaus Watershed Team, will schedule fall pulse flow volumes consistent with the volumes in the SRP and considering other system objectives.

3.9 San Joaquin River

Reclamation operates the Friant Division for flood control, M&I and agricultural water supplies, and fish and wildlife purposes. Friant Dam provides flood control on the San Joaquin River, downstream releases to meet senior water rights requirements above Gravelly Ford, Restoration Flows under Title X of Public Law 111-11, and diversions into the Madera and Friant-Kern Canals.

The Friant Division facilities include Friant Dam, Millerton Reservoir, and the Friant-Kern and Madera Canals. Water is delivered to about one million acres of agricultural land in Fresno, Kern, Madera, and Tulare Counties in the San Joaquin Valley via the Friant-Kern Canal south into Tulare Lake Basin and via the Madera Canal north to Madera and Chowchilla Irrigation Districts.

Statutory, Regulatory, and Contractual Requirements

- Public Law 74-392 CVP Re-Authorization Act
- Public Law 111-11 (San Joaquin River Restoration Settlement Act)
- State Water Board D-1641
- 1995 Bay Delta Water Quality Control Plan (Bay-Delta Plan)
- USACE Public Notice 5820A Amended
- Friant Division Riparian Holding Contracts
- Friant Division Water Service Contracts

Programs in the environmental baseline to highlight

- San Joaquin River Restoration Program

Reclamation would operate the Friant Division consistent with the San Joaquin River Restoration Program Record of Decision, which is a related action not included in this consultation.

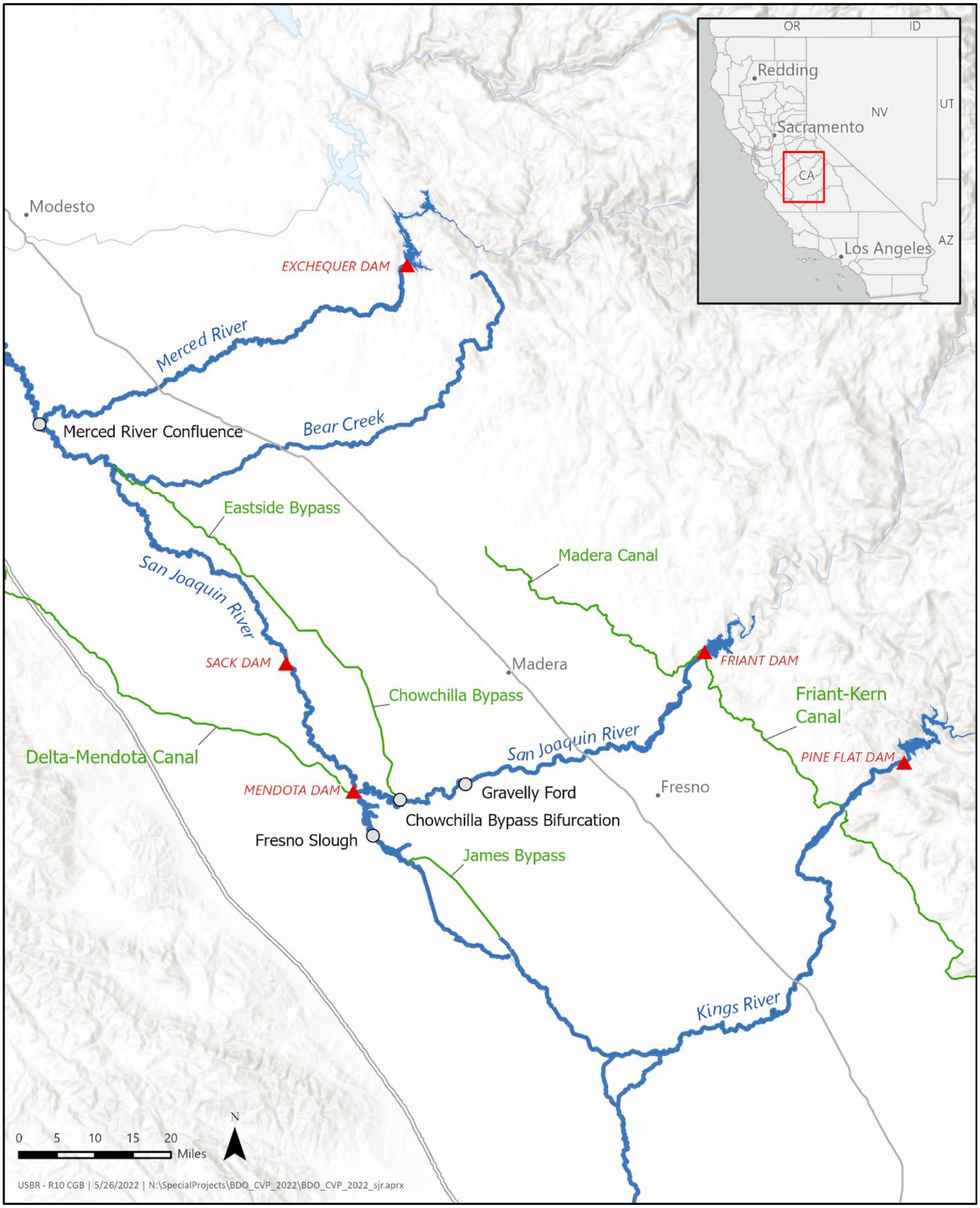


Figure 3-9. Map of the Friant Division and San Joaquin River

3.10 Monitoring

Reclamation and DWR would undertake monitoring to inform long-term operations associated with this Proposed Action. Monitoring is necessary to determine and help avoid and minimize the effects of the Proposed Action, including minimizing anticipated incidental take, and informing specific real-time actions.

Because of the ongoing nature of the Proposed Action, ongoing monitoring efforts to inform operational actions and effects of those actions are currently occurring under existing and separate Section 7 consultations and section 10(a)(1)(A) permits and are described in the Baseline. Potential future changes to monitoring programs associated operation of the CVP and SWP will be addressed as a Framework Programmatic consultation.

Some programs in the environmental baseline currently provide incidental take coverage for monitoring associated with the Coordinated Operation of the CVP and SWP. Active ESA-listed species take permits and consultations cover real-time monitoring surveys, status and trend surveys, and current special studies. Please refer to Section [TBD] of Chapter 2 for more detail on these ongoing monitoring efforts, including regulatory mechanisms that are in place to exempt take from these efforts.

Reclamation and DWR propose a Framework Programmatic consultation approach to include as part of this Proposed Action that addresses future changes to monitoring associated with the Proposed Action. Subsequent changes to existing monitoring programs would be coordinated and included in future consultations of the long-term operation of the CVP and SWP to allow for a more uniform analysis and improved accounting of incidental take coverage associated with the operation of the CVP and SWP. The Framework Programmatic consultation approach specifies that material changes to monitoring efforts and/or ESA compliance would require subsequent consultation.

Reclamation and DWR provide funding to various partners for ongoing monitoring efforts associated with the long-term operation of the CVP and SWP. Section 7 compliance and incidental take coverage would continue to be provided by the existing consultations and permits outlined in the environmental baseline section until and if Reclamation and DWR complete a subsequent consultation with FWS and NMFS on changes to monitoring. Changes outside the scope and effects in the existing consultations and permits are not authorized to commence until the subsequent consultation is completed.

The Framework Programmatic consultation approach for monitoring includes the following principles which would be incorporated into any future changes to monitoring programs addressed in a subsequent consultation:

- Ensure monitoring will be beneficial to long-term operation of the CVP and SWP for:
    - minimizing effects to listed species and habitat (informing real-time operations, understanding species status, etc.)

- understanding if various operational objectives are met (e.g., effectiveness and validation monitoring); and
- measuring if and when the reinitiation trigger associated with amount or extent of incidental take has been met.

- Confirm that data collected should meet data quality objectives and open data practices;
- Establish multi-agency collaborative approach including management structure for decision-making;
- Ensure scientific rigor of new or modified monitoring and achieving objectives of new or modified monitoring;
- Develop and test mechanisms for learning and adopting new technologies, while maintaining comparability and continuity to historical information on fish and the environment;
- Incorporate a fish, aquatic habitat, and ecosystem monitoring enterprise for the long-term operations of the CVP and SWP should effectively measure physical conditions, water quality, primary and secondary production; abundance, distribution, and production of ESA-listed species (natural and hatchery origin); Delta and tributary fish assemblages; and salvage at the CVP/SWP fish collection facilities;
- Establish mechanisms for close coordination with any existing or future adaptive management program; and
- Provide for robust synthesis of monitoring data to incorporate results and lessons learned.

Monitoring of the LTO operations is subject to change over time by implementing these principles to improve monitoring where incorporating the best available scientific information indicates such change is appropriate. If and when Reclamation and DWR decide changes to a given monitoring program is necessary, Reclamation will provide the supporting information to USFWS and NMFS to support subsequent section 7 consultation as outlined in 50 CFR 402.14.

3.11 Special Studies

Special studies address areas of scientific uncertainty on the reasonable balance among competing demands for water, including the requirements of fish and wildlife, M&I, agricultural, and power contractors. While special studies do not avoid, minimize, or mitigate adverse effects on federally listed species, over time they may inform the effectiveness of measures taken to avoid, minimize, or mitigate incidental take. Studies are incorporated for the following reasons:

1. The study design is complete, implementation is needed to authorize the LTO, and success is not reliant on requiring flexibility to make future changes.
    2. Incidental take is likely required: This consultation seeks the necessary incidental take coverage, if not already covered.

3. The new information may reveal effects and/or warrant a modification of the Proposed Action in a manner or to an extent not previously considered: Analysis could consider a broader potential range of operations and/or different confidence in likelihood of effects from operations.

The criteria for identification of a special study in the Proposed Action balances uncertainty and flexibility. Reclamation would not rely on uncertain outcomes from a study but may require direct or incidental take to conduct the study. Requiring modifications to this Proposed Action to change special studies may impose unnecessary administrative delays or risk an unnecessary need for reinitiation of consultation.

Special studies in the Proposed Action are described below.

3.11.1 Steelhead Juvenile Production Estimate

Reclamation and DWR will propose an expanded steelhead Juvenile Production Estimate (JPE) framework for the San Joaquin and Sacramento River Basins. Based on data generated from the San Joaquin and Sacramento River Basins, JPE, and feedback from an independent review of progress after 2025, Reclamation and DWR will update the JPE framework including steelhead telemetry, steelhead lifecycle monitoring, and a steelhead JPE.

3.11.1.1 Steelhead Telemetry Research:

Reclamation and DWR will implement Steelhead telemetry research on routing and survival of hatchery- and wild-origin steelhead through the San Francisco Bay-Delta. This research will provide information on how CVP and SWP operations impact steelhead routing and survival through different routes, the facilities, and to Chipps Island. In addition, the steelhead telemetry research may enable through Delta survival estimates for juvenile steelhead tagged in the Stanislaus River or Clear Creek as part of the life-cycle monitoring and juvenile production estimate (JPE) development in these tributaries.

3.11.1.2 Steelhead Lifecycle Monitoring

Reclamation will maintain the infrastructure supporting the Stanislaus River steelhead life cycle monitoring program and develop infrastructure that will support a life cycle monitoring program in Clear Creek. In addition, Reclamation and DWR will support genetic and age-structure monitoring of juvenile steelhead collected at state and federal salvage facilities to facilitate identification of brood year and natal origin. The goal of this research and monitoring in the San Joaquin and Sacramento Rivers is to provide the data necessary to develop a basin-specific steelhead JPE. In addition, the goal of this research and monitoring is to provide the basis for evaluating how actions related to stream flow enhancement, habitat restoration, and/or water export restrictions affect biological outcomes including juvenile and adult population abundance, age structure, growth and smoltification rates, and anadromy and adaptive potential in Sacramento- and San Joaquin-origin steelhead.

3.11.1.3 Steelhead JPE

Reclamation proposes to develop a steelhead JPE for tributaries with CVP facilities that will focus on the annual production of outmigrating juvenile steelhead. Data used in the JPE will inform the status and trends of Sacramento and San Joaquin basin steelhead and may also help inform actions that will increase steelhead abundance and improve steelhead survival through the Delta. Reclamation and DWR, in coordination with FWS, NMFS, and CDFW, will create or use an existing technical team to use the Southern Sierra Nevada Diversity Group Steelhead Science Plan, which describes the JPE framework, to identify infrastructure and monitoring needs in tributaries with CVP or SWP facilities and a method for expanding the JPE framework from the tributary to basin levels.

Reclamation and DWR propose to conduct the first independent panel review from data generated from the Stanislaus River steelhead life-cycle monitoring program. Reclamation and DWR anticipate the independent panel will provide feedback on the scientific merits of the JPE framework and recommendations for improving the JPE framework. Reclamation and DWR will work with the technical team to incorporate review panel feedback and recommendations on the JPE framework, as appropriate.

Beginning Fall 2025, Reclamation and DWR will work with the technical team to consider implementing an expanded JPE framework to the San Joaquin and Sacramento basins. By summer 2026, Reclamation and DWR will decide to address deficiencies in the JPE framework and/or expand the JPE framework to remaining CVP or SWP tributaries.

Reclamation and DWR anticipate conducting the second independent panel review from data generated from the San Joaquin and Sacramento basins JPE. Reclamation and DWR anticipate the independent panel will provide further feedback on the scientific merits of the JPE framework and further recommendations for improving the JPE framework. Reclamation and DWR will work with the technical team to incorporate review panel feedback and recommendations on the JPE framework, as appropriate.

3.11.2 Spring-Run Juvenile Production Estimate and Life Cycle Model

3.11.2.1 Spring-run Chinook salmon Juvenile Production Estimate (SR-JPE)

Reclamation and DWR will support continued development of a SR-JPE framework for CVP and SWP tributaries and the Delta, and propose a framework for implementation, including an approach for modeling a SR-JPE and the monitoring program to support that approach. The SR-JPE framework will incorporate independent review and will be the basis for consideration of updated entrainment minimization measures, including updating hatchery surrogate measures. The process to develop the framework will continue the ongoing effort to develop a SR-JPE initiated in 2020 and outlined in the SR-JPE Science Plan (California Department of Water Resources et al. 2020), the SR-JPE Interim Monitoring Plan (Allison et al. 2021), the SR-JPE Run Identification Research and Initial Monitoring Plan (Bedwell et al. 2021), the SR-JPE Data Management Strategy (Harvey et al. 2022), and the SR-JPE Decision Charter (Horndeski 2022). These plans describe the decision processes, research, monitoring, and data management infrastructure that will be needed to meet the goal of developing a SR-JPE ready for implementation in 2025, including guidance by an interagency Core Team using structured decision-making principles, rapid and coordinated reporting of new data onto a publicly accessible repository, routine and rapid genetic testing, and additions to existing and/or new monitoring programs at Delta entry and in representative spring-run streams: Clear Creek, Battle Creek, Mill Creek, Deer Creek, Butte Creek, Yuba River, and Feather River.

3.11.2.2 Spring-run Chinook Salmon Lifecycle Model (SR-LCM)

DWR and USBR will support the development of a SR-LCM for the purpose of informing management actions to improve Central Valley spring-run population status. DWR and Reclamation will assemble an interagency management team including representatives from Reclamation, DWR, CDFW, NMFS, and USFWS, to define the specific management issues and objectives to be addressed by the SR-LCM. Because of the close link between SR-LCM and SR-JPE development through a shared use of historical and newly generated data, the SR-JPE Core Team will be responsible for guiding the development of the SR-LCM to address the management objectives, and for determining whether the required modeling can be accomplished through an update of one or more existing Central Valley Chinook salmon modeling efforts, such as the SR-JPE, the NMFS spring-run lifecycle model, and the CVPIA Science Integration Team salmon lifecycle models. The Core Team will use structured decision-making principles when appropriate. The Core Team will develop and submit a modeling plan and timeline to the SR-LCM management team for approval, and guide implementation of the plan. To facilitate open communication between the lead life-cycle modeler and agency staff, a Lifecycle Model Subteam will be established. Throughout the process to develop and implement the SR-LCM, the lead lifecycle modeler will collaborate with the Lifecycle Model Subteam through regular meetings to solicit feedback and integrate that feedback into model development iteratively, in a manner similar to the SR-JPE Modeling Subteam described above.

Required actions in 2024:

1. Under the guidance of the Core Team, the Modeling Team will develop an initial JPE model based on available spring-run data and provide the model to the Core Team for review. The Core Team will recommend an SR-JPE framework, composed of the initial SR-JPE model and the monitoring program required to provide data to calculate an annual JPE.

Required actions in 2025:

1. The Core Team will review the spring-run hatchery surrogate minimization measure.
    2. DWR, CDFW, USBR, and NMFS will meet to contemplate development of a new or modified spring-run minimization measure informed by peer review panel input, historical spring-run data, new data obtained from SR-JPE monitoring program, Core Team review of the hatchery surrogate measure, and other relevant information (for example Georgiana Slough monitoring data). Any new minimization measure approach for spring-run will:
        - Take into account the limitations of the initial SR-JPE model
        - Be an interim approach to be refined as the SR-JPE model evolves and the spring-run life cycle model is completed
        - Anticipate future iterations and refinements of SR-JPE model
        - Rely less on salvage data and more on monitoring data (be more proactive, less reactive)

3. In collaboration with the Core Team, DWR and Reclamation will prepare a draft plan in collaboration with CDFW, NMFS and USFWS, that describes the approach to calculating a SR-JPE and the monitoring and special studies needed to collect the data to calculate a SR- JPE annually. The draft plan will be guided by the Core Team SDM process and SR-JPE framework recommendation, and by the independent peer review panel. DWR and Reclamation will submit the draft plan to the Core Team for review and work collaboratively to incorporate Core Team comments into the final draft. DWR and Reclamation will submit the final plan to CDFW and NMFS for approval no later than six months after the independent peer review and spring-run hatchery surrogate measure review are completed, whichever is later.
4. After the final SR-JPE Plan is approved by CDFW and NMFS, DWR and Reclamation will convene the Core Team and subteams to provide an annual SR-JPE estimate, implement the final Spring-run JPE Plan (including monitoring), and ensure all data obtained through long-term monitoring programs is stored in a publicly accessible repository.

Required actions in 2026 and 2027:

1. If approved by NMFS and CDFW, DWR and Reclamation will implement the new "interim" Spring-run minimization measure based on the initial SR- JPE model.
2. DWR and Reclamation will implement changes to monitoring if recommended by the SDM process and approved by CDFW and NMFS, when appropriate take authorization for monitoring activities are obtained and contingent on stakeholder participation from non-CVP or SWP tributaries.
3. The Modeling Subteam will continue to develop and refine the SR-JPE model by integrating new data as it becomes available and adjusting the modeling approach in collaboration with the Core Team and in response to SDM processes conducted by the Core Team.

3.11.3 Tidal Habitat Restoration Effectiveness

DWR and Reclamation will use the adaptive management program to evaluate and identify actions that may improve the effectiveness of its restoration projects. Adaptive management actions will be focused on a comprehensive understanding of how all restoration projects function across the landscape and in consideration of other conservation measures (e.g., Yolo Notch Project, etc.). that may enhance food web production and rearing habitat for Delta smelt.

3.11.4 Tributary Habitat Restoration Effectiveness

The Upper Sacramento River Anadromous Fish Habitat Restoration Project Monitoring Plan and Protocols (2017) are designed to determine the effectiveness of the Upper Sacramento River Anadromous Fish Habitat Restoration Project in meeting identified objectives and to validate the linkage between restoration actions and the biologic response to those actions. This monitoring plan follows the framework for detecting biological responses to flow management described by Souchon et al. (2008). Monitoring methods structured as field protocols are described in the Plan and Protocols including control site selection, longitudinal profile and cross sections, juvenile habitat mapping protocols, snorkel survey protocols, seining, enclosure studies, invertebrate drift sampling, redd surveys, and stream temperatures. The existing CVPIA Upper Sacramento River Habitat Restoration Technical Team includes Reclamation, USFWS, NMFS, CDFW, consultants (e.g., Chico State University, PSMFC), and recipients of competitive funding for habitat restoration will be utilized as the AMT for this action.

3.11.5 Winter-Run Early Life Stage Studies

Sacramento River winter-run Chinook salmon (winter-run) are exposed to a variety of stressors throughout their lifecycle that impair their survival, reproduction, and the ability of the population to rebound from periods of low abundance. Survival during early life stages—spawning success, egg incubation, emergence, and juvenile rearing and migration—is affected by various environmental factors. Understanding the relative contribution of different stressors, particularly those that we can manage through water operations and other actions, will improve our ability to manage water and improve winter-run early life stage survival.

The Early Life Stage Survival Science Action aims to address two distinct knowledge gaps:

1. Reducing uncertainty around the effects of water temperature and other factors (e.g. dissolved oxygen, spawning habitat and flow) on egg-fry-survival
2. Improving understanding of juvenile survival during rearing and migration, including reducing uncertainties in the field monitoring data

3.11.6 Shasta Spring Pulse Studies

Reclamation and DWR, through the SRG, will support hindcast evaluation of action effectiveness that includes technical review of the functional elements of the pulse flow (i.e., timing, magnitude, duration, and frequency) as well as an evaluation of criteria used to support beneficial use decisions.

3.11.7 Delta Route Selection and Survival

These studies involve an acoustic receiver network and associated real-time and retrospective modeling of the data. The objectives are to provide real-time estimates of reach-specific survival and route entrainment for juvenile salmonids in the Sacramento River and Delta.

3.11.8 Delta Smelt Summer and Fall Habitat

DWR and Reclamation will consider food subsidy measures to augment the Summer-Fall Habitat Action (SFHA). Food subsidy actions are hypothesized to increase localized prey availability for delta smelt in the north Delta and Suisun Marsh, resulting in opportunities for higher growth and survival of juvenile and sub-adult life stages. DWR and Reclamation will decide which of the following food subsidy actions are most appropriate given hydrologic conditions (i.e., water year type), logistical constraints, and information needs: one of several variations of the North Delta Food Subsidy (NDFS) Action, one of several variations of Managed Wetland reoperation in Suisun Marsh, and/or the Sacramento Deepwater Ship Channel Food Subsidy Action. For any year when one or more of the food subsidy actions is implemented, an action plan, science and monitoring plan, and monitoring report will be produced to evaluate action effectiveness. Monitoring plans and reports will also be produced in years actions are not implemented to serve as contrasts to baseline conditions. Food subsidy action plans, monitoring plans, and reports will be developed in collaboration with, and reviewed by the DCG. Food subsidy action research results will be included in seasonal reporting and adaptive management reviews of the Summer-Fall Habitat Action to evaluate the science and monitoring, efficacy of actions, hypothetical alternative strategies and/or actions, and potential inclusion of food subsidy actions as potential permanent action elements of the SFHA, or if appropriate, termination of actions deemed ineffective.

3.11.9 Longfin Smelt Science Plan

DWR and Reclamation will implement science activities identified in the 2020 ITP Longfin Smelt Science Plan [cite ITP Longfin Science Plan]; including the development of mathematical life cycle model. The life cycle model will be used as a quantitative tool to characterize the effects of abiotic and biotic factors on Longfin Smelt populations. [cite Dec. 8, 2020 Longfin Smelt Science Plan, p18.]. Additional Longfin smelt science and monitoring informed by the life cycle modeling efforts will be implemented as needed through the Adaptive Management process.

3.11.9.1 Longfin Smelt Science and Monitoring Initiatives

DWR and Reclamation will support the implementation of the Longfin Smelt Science Plan (LFSSP). DWR and CDFW, in collaboration with the State Water Contractors and the US Fish and Wildlife Service, developed the LFSSP to meet a requirement in the 2020 ITP, and the LFSSP was finalized on December 8, 2020. The purpose of the LFSSP is to provide a framework for Longfin Smelt science investments through 2030, including seven key priority areas. Longfin Smelt science and monitoring informed by the life cycle modeling efforts will continue beyond 2030, as appropriate.

Science priority areas in the LFSSP:

1. Life cycle modeling
2. Factors affecting abundance, growth, and survival
3. Improved distribution monitoring
4. Improved larval entrainment monitoring
5. Longfin Smelt culture
6. Fish migration and movements
7. Spawning and rearing habitats for Longfin Smelt

The Longfin Smelt Technical Team is charged with the implementation and refinement of the science conducted under the LFSSP. Additionally, the Longfin Smelt life cycle model, prioritized in the LFSSP and currently under development, will highlight critical gaps in our current understanding of Longfin Smelt ecology and will guide implementation of core elements of the LFSSP, particularly with respect to new and expanded monitoring.

3.11.10 Management of Winter-run Spawning Location and Timing

Reclamation will study how flow and temperatures can be used to manage SRWC spawning on the Sacramento River. Reclamation will support the applicable costs and implement the results of the studies, contingent on available appropriations, to improve future management as applicable. This action does not specify the funding level for this project, only the commitment to fund as appropriations are available. The goal of this management action is to ensure a resilient portfolio of life history strategies by supporting a diversity of spawn timings and locations in the population.

Modeling indicates that the peak spawn timing of SRWC may be influenced by water management decisions that are intended to conserve cold water for use during the summer temperature management season (Johnson et al. 2017; Windell et al. 2017). Annually, the start timing of SRWC spawning is relatively constant while the peak varies year to year – with cool springtime water temperatures associated with earlier peak spawning, and warm springtime temperatures associated with later peak spawning (Hendrix et al. 2017; Jennings and Hendrix 2020). Specifically, there is evidence that higher April and May water temperatures correspond to increased and delayed peak spawning in July and August. The model using both April and May temperatures as cofactors had the best fit to the observed female spawner data (Jennings and Hendrix 2020). In their historic spring-fed stream habitat, cool spring temperatures are hypothesized to trigger earlier peak in spawning to ensure sufficient time for egg maturation. Conversely, historically (pre-dam), later peak spawning in warm years could have resulted in later peak emergence; this could mean the juvenile fish experienced lower temperatures upon emergence reducing egg and alevin mortality.

However, a cause-and-effect relationship between water temperatures during pre-spawn staging and the timing of peak spawning has not been demonstrated. Randomized experimentation should be used to determine whether manageable changes in water temperatures during the period of pre-spawn staging directly cause changes in the spawn timing of winter-run Chinook salmon and, if so, the level of covariation between these variables. Findings from these investigations may explain a direct linkage between temperature management and SRWC reproductive performance on the Upper Sacramento River (National Marine Fisheries Service 2014; U.S. Bureau of Reclamation 2019), as evidence suggests reproductive success is variable (Blankenship et al. 2020). In light of this potential relationship, two possible management strategies are suggested by Jennings and Hendrix (2020):

To mitigate winter-run Chinook Salmon egg and alevin mortality during drought years, two possible strategies for cool-water management are: (1) release cool water early (April-May) to drive the peak of winter-run spawning earlier in an attempt to achieve emergence from gravel before temperatures increase; or (2) hold cool water until later in the season, when the bulk of spawners begin to deposit eggs… ultimately, models that combine reservoir management dynamics with SRWC spawning and egg incubation will be necessary to understand how reservoir management might affect spawn timing, egg and alevin development, and egg-to-fry survival under various climate conditions.

This research strategy recommends a phased approach to better understanding the relationship between water temperatures during winter-run Chinook salmon staging and the timing of peak spawning.

1. Implement necessary studies to determine whether a functional (cause and effect) relationship exists and what is the nature and strength (variability) of that relationship.
2. Develop analytical tools to evaluate potential management opportunities that could use the functional relationship (if it exists) to benefit the reproductive success of winter-run Chinook salmon. This phase of the investigation may involve assessments of the interaction between multiple life stages runs, and species with different water operation scenarios. For example, early warm water could also affect *O. mykiss* egg survival or influence the distribution of spring run Chinook Salmon by altering the river's temperature relative to that of Clear Creek.

The first phase of the research strategy could include a literature review or analysis of temperature data and information to assess effects to Chinook Salmon migration timing. Another initial step could include manipulative, randomized experimentation to evaluate the relationship between water temps during adult staging and spawn timing. Such a study's objective would be to demonstrate a cause-and-effect relationship through a controlled, manipulative experimentation in a captive environment, such as a hatchery, where individual fish can be randomly assigned to treatment groups consisting of different water temperatures.

The second strategy was implemented in the river in 2021 when we bypassed power production to release warmer water in April and May, saving the cooler water till later in the season. The effectiveness of this action can still be evaluated using the data collected over that season.

Modeling will be an important tool for the second phase of the proposed research strategy. Modeling operational scenarios will help plan the action by estimating the potential effect(s) of operational actions on smolts survival across different hydrological conditions. Modeling will also be used to evaluate any potential increases to winter-run Chinook Salmon temperature-dependent mortality (TDM) and estimate potential decreases in the Shasta Reservoir Cold Water Pool (CWP) as a result of different operational actions. The modeling may also consider possible impacts to pre-spawn mortality from running warmer earlier in the season. An evaluation of the modelling tools will be assessed by comparing predictions with monitoring data which will be documented in Reclamation's Shasta Cold Water Pool Seasonal Report or/and Shasta Storage Rebuilding Seasonal Report.

During the second phase of the research strategy, hypothetical tradeoff scenarios may include preserving cold water until peak spawning and emergence occurs to reduce TDM impacts to early life stages. At certain warm temperatures, pre-spawn mortality may occur.

Annually, real-time operations monitoring will be implemented to measure biological and operational responses relevant to evaluating the relationship between spring water temperatures and spawning timing and location. These include spawning timing, spawner condition, redd location, water temperatures, and egg-to-fry survival.

Reports as part of this multiyear Research Strategy will communicate the operational effects of the water and temperature management actions taken for managing WRC spawning and other observed biological and ecological responses. Modeling and decision support tools can highlight the magnitude of uncertainty related to mechanisms behind spawn timing that may warrant experiments to better understand the potential impacts of managing spawning behavior.

The primary objective of these activities will determine if keeping water colder earlier induces earlier spawning, or if keeping April/May Sacramento River temperatures warmer induces later spawning. It would be valuable to be able to identify and quantify if spawning timing contributes to or limits reproductive success to better assess proportional sources of mortality by separating pre-spawning water temperature effects from other variables (e.g., thiamine deficiency, incubation temperatures, redd superimposition, habitat restoration, water quality, hatchery effects, etc.). The research strategy may support learning about reproductive success, more broadly, as an additional objective.

No later than one year after completion of consultation, Reclamation will submit to NMFS for approval a report that identifies technical team membership, provide a final list of study topics and alternatives for agency management review, and committed funding levels, contingent on available appropriations, to implement the action. When research actions are completed, Reclamation will report the result to the SRTTG for potential implementation into temperature management.

Potential research actions may include:

- Summarize available literature on thermal tolerance for adult SRWC to understand drivers of spawning behavior, gamete viability, epigenetics, and prespawning stress/mortality.
- Controlled experimentation (e.g. in a laboratory or hatchery setting) to evaluate effects of water temperatures on spawning timing of winter-run Chinook salmon.
- Review available data and/or measure historic Shasta spring operations effects of temperatures on adult Chinook salmon (e.g., pre-spawning stress/mortality, changes in spatial and temporal spawning distribution). May include acoustic telemetry study of adult behavior or observations from carcass survey. " Analyze spawn timing has shifted in the past 20 or so years and how that relates to flows before and during spawning to determine if management recently has shifted spawning behavior.
- Calculate SRWCS birth date distributions, which could be accomplished by otolith analyses of juvenile Chinook salmon collected at Red Bluff Diversion Dam (RBDD). This would provide information on whether there was disproportionate survival of progeny from the temporal distribution of adult spawners (e.g., early vs. late spawning). Genetic method could also help test for disproportionate survival of progeny from early vs late spawning females.
- Genetic analyses (i.e., parentage and relatedness approaches of adults and juveniles) to see which juveniles survive from which spawning adults (specifically associated with spawning location, time, sex, and origin).
- Reconstruction of temperature histories of juveniles at RBDD or returning adults to assess the temperatures individuals experienced at emergence. Oxygen isotope measurements in otoliths can provide this temperature reconstruction. Paired with thermal landscapes, one can assess mortality (lack of representation) of individuals sampled at a later point in time.

Previous efforts for this action are described in the Spring Management of Spawning Locations Research Strategy (cite TBD).

3.11.11 Alternative Loss Estimation Pilot Study

DWR, in coordination with Reclamation has completed a draft updated Alternative Loss Equation (ALE-22) software tool for estimating losses at the SWP and CVP export facilities to quantify incidental take of winter-run and spring-run Chinook Salmon, and Central Valley steelhead. DWR, in coordination with Reclamation proposes to further refine the parameters of this tool by developing an Alternative Loss Pilot Study Implementation Plan (ALPS-IP) to implement this tool in parallel with current loss estimation methods. The goal of this pilot study is to provide a more accurate estimates of loss, and loss parameters, at the SWP and CVP export facilities while understanding the utility of the new alternative method relative to the existing method.

DWR and Reclamation propose to collaborate on the following actions:

- Within 6 months of the latest effective date of the ROD or ITP, DWR in collaboration with Reclamation shall conduct a knowledge transfer and methods workshop for the ALE-22 tool. Participants may include representatives from NMFS, USFWS, CDFW, DWR, State and Central Valley Water Contractor representatives, and Reclamation.
- Within 6 months of the completed ALE-22 workshop DWR, in collaboration with Reclamation, shall convene the ALE Technical Team (ALE-TT), a sub-team of the Central Valley Fish Facilities Review Team (CVFFRT), and DWR shall submit a draft ALPS-IP to the ALE-TT for review and comment.
    - The draft ALPS-IP shall include:
        - Structured Decision Making (SDM) process outline
        - Interim, draft, and final reporting protocols
        - Pilot Study design
        - Procedures, and timelines (e.g., start and stop dates)
        - Target species (e.g., winter-run and spring-run Chinook Salmon, and California Central Valley steelhead)
        - Assessment of multiple parameters to account for losses including, but not limited to: salvage facility outages during louver cleaning or mechanical failure; post release survival on salvaged fish
- Within 4 months of receiving ALE-TT review comments DWR would submit the final draft ALPS-IP to the CVFFRT, SaMT, and the agency sub-directors for comment/approval.
- Within 1 month of receiving CVFFRT, SaMT review, and subsequent agency sub-director comments/approval DWR would finalize the ALPS-IP.

- Within 1 year of the finalization of the ALPS-PS DWR would utilize the ALE-TT and the defined SDM procedures to complete a prioritization of the ALPS-IP recommendations for further implementation.
    - The ALE-TT may utilize an independent science panel review to further enhance the SDM prioritization process.
- Within 4 months of completing the prioritized ALPS-IP final recommendations DWR shall submit them to the agency sub-directors for approval.

3.11.12 Georgiana Slough Migratory Barrier Effectiveness

Operation of the salmonid migratory barrier should improve the seasonally averaged through-Delta survival probability to Chipps Island compared with survival probability if the salmonid barrier were not in operation. Barrier operations and monitoring details are defined in the Georgiana Slough Salmonid Migratory Barrier (GSSMB) Operations and Monitoring Plans developed by the GSSMB Coordination Group. To further maximize seasonal survival benefits to migrating salmonids, DWR and Reclamation will continue leading the GSSMB Coordination Group, with membership comprised of DWR, Reclamation, CDFW, USFWS, NMFS, and State/Federal Water Contractors representatives. DWR and Reclamation, working with the GSSMB Coordination Group, will provide at least a triennial report and review and update, as necessary, the GSSMB Operations and Monitoring Plans.

3.12 Drought

Starting each October, Reclamation and DWR, through the DRY Team, will meet at least monthly to determine whether it would be appropriate to pursue actions to respond to current or anticipated drought and dry year conditions. At each meeting, Reclamation and DWR will review the actions in the Drought Toolkit, Attachment [TBD], and determine if it would be appropriate to pursue any of them, and evaluate the effectiveness of those actions. The Drought Toolkit will list the minimum decisions required each month and Reclamation and DWR expect a more focused review of the Drought Toolkit in times when resources to meet required operations and goals are limited. These limited resources may include, but are not limited to hydrology, current and projected reservoir storages, facility limitations and fish conditions . These decisions will be documented monthly or more often if necessary in the WOMT notes.

Reclamation and DWR, through the DRY Team, may update the Drought Toolkit. Reclamation and DWR, through the DRY Team, will evaluate drought actions taken to reduce drought impacts related to CVP and SWP operations described in the Drought Toolkit. This evaluation will provide additional information on the effectiveness of drought response so as to support updates to the Drought Toolkit. This evaluation will be included in the annual Drought Report.

3.13 Governance

3.13.1 CVP/SWP Governance

CVP/SWP Governance identifies ongoing engagement by participating State and Federal Agencies (collectively the "Agencies"), interested parties, and/or the public following completion of the Biological Opinions and Record of Decision. Governance describes the system-wide organization of technical groups, group membership, activities that are subject to governance, and decision-making approaches and protocols.

The purposes of CVP/SWP Governance are to:

- Identify the roles and responsibilities of the agencies that are part of real time operations
- Establish that the agencies will work together in good faith
- Identify the governance principles agreed to by the participating agencies
- Identify operations that are subject to Governance
- Identify the implementation teams that are part of governance, and processes for technical collaboration and elevating issues for resolution
- Incorporate learning and adopt new technologies from monitoring, adaptive management and ongoing science
- Describe relationships between technical and policy groups
- Describe Reporting and Outreach

The Agencies are committed to communicate each organization's respective interests and recognize the intent to work together in a good faith effort to resolve issues through the groups described in this governance document. Every member is committed to identifying potential issues and communicating these issues to the relevant technical or policy team as soon as possible. Representatives who participate on technical and policy teams are clear about their ability to represent agency decisions. Representatives who participated on technical and policy teams are empowered to represent their agency and make decisions appropriate for that level. Each representative is representing the science, policy and management based on the best of their ability and current knowledge. Representatives come understanding their authority (not agency authority but representatives' authority). Representatives are aware and clear about their role with other members. Representatives will either be able to make decisions on other parts of the system or have an avenue for doing that quickly.

CVP/SWP Governance is framed around the following principles:

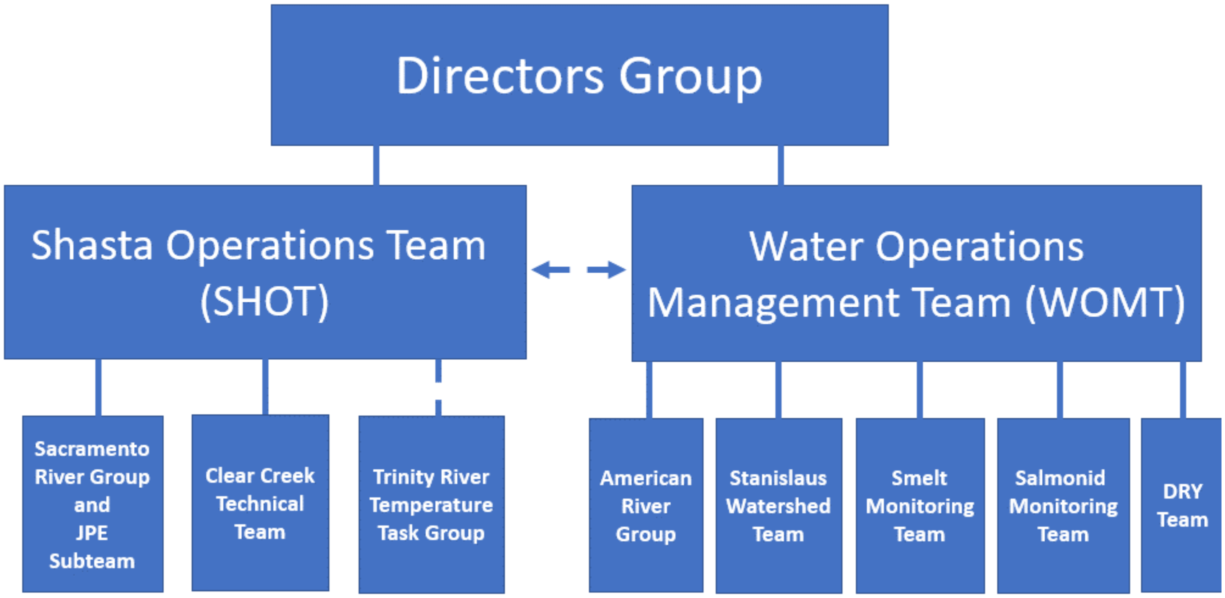
- **Collaboration—**The leading principle of CVP/SWP Governance is collaborative, science-based decision making. CVP/SWP governance is structured to seek consensus across scientific, technical and policy levels, with elevation and decision-making processes in place when consensus cannot be reached.

- **Effectiveness—**It is workable and efficient. Effectiveness considers what information is available and when. Effective CVP/SWP governance recognizes that there is more uncertainty early in the year and that uncertainty may change as the year progresses.
- **Accountability—**Operational, regulatory, proactive, and addresses long-term planning.
- **Inclusiveness—**Collaborative and cooperative. The elevation and decision-making structure maintains accountability at all levels.
- **Transparency—**The processes are not ambiguous. They are open for others to see and understand through implementation of a communication plan.
- **Communication—**Be aware and clear about roles. If you spot a potential issue, communicate it.

3.13.2 Organizational Structure and Description of Collaborative Teams by Division

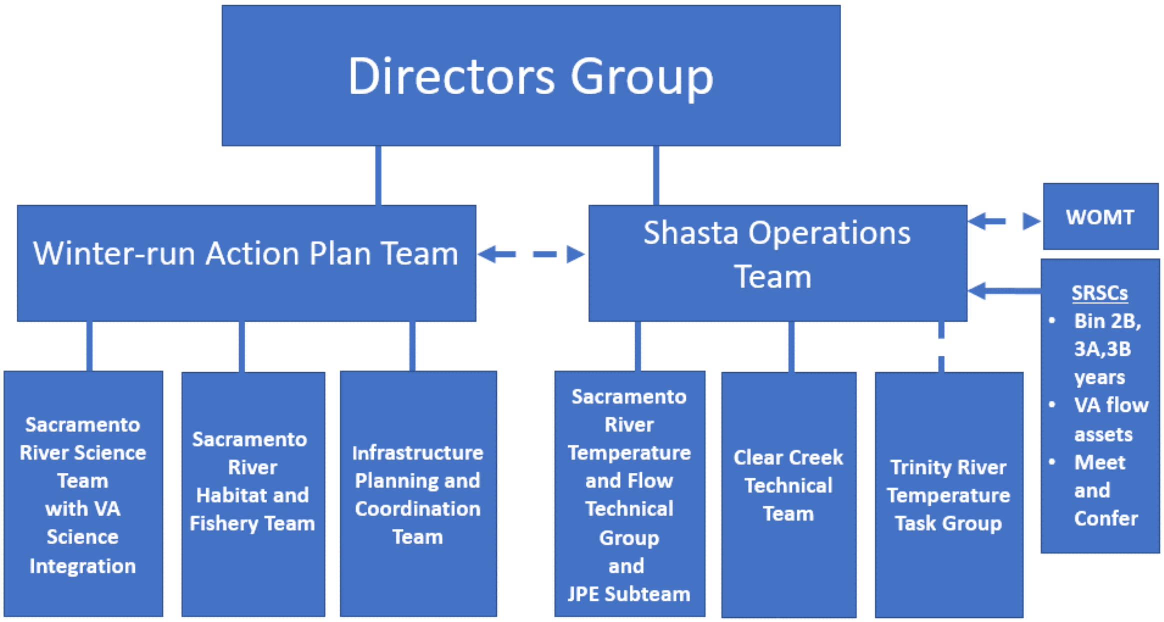
CVP/SWP Governance is structured such that a 5 Agency Directors Group oversees the ongoing authorities of each respective agency and serves as the final decision-making body for operational matters. The Directors Group directly interfaces with two management and policy level groups (SHOT and WOMT), whose Federal and State agency representatives discuss the actions described in the proposed action when implementation may have biological, system conditions or water supply impacts or tradeoffs. These policy groups work with numerous technical groups that coordinate on seasonal and real-time operations for specific divisions or watersheds. Figure 3-10 illustrates the CVP/SWP structure for water operations.

Figure 3-11 illustrates the more specific governance structure for Shasta and Sacramento River activities, including direct coordination between SHOT and WOMT. The organizational structure for Shasta and Sacramento River activities integrates the Winter-run Action Plan to advance specific science, habitat and infrastructure initiatives.



Solid lines indicate a direct relationship for elevation and decision making, the dashed arrow between WOMT and SHOT indicates a direct line of communication and regular coordination, the dashed line between SHOT and the Trinity River Temperature Task Group indicates seasonal communication and coordination on an as-needed basis.

Figure 3-10. Governance Structure for CVP and SWP Water Operations



Solid lines indicate a direct relationship for elevation and decision making, the dashed arrow between Winter-run Action Plan Team and SHOT indicates a direct line of communication and regular coordination, the dashed arrow between WOMT and SHOT indicates a direct line of communication and regular coordination, the dashed line between SHOT and the Trinity River Temperature Task Group indicates seasonal communication and coordination on an as-needed basis. The solid arrow between SHOT and the SRSCs indicates SRSC integration into SHOT.

Figure 3-11. Governance Structure for Shasta and Sacramento River Activities

3.13.3 Chartering Teams

Teams and groups involved in planning and providing input regarding water operations are described below for each division of the CVP and SWP. Team membership, roles, and processes will be described in team charters, as specified for each division below. Some teams may already have charters in place which will continue to be followed until and if replaced in the future. These charters may be supplemented by guidance documents which further elaborate roles, responsibilities, and process for these teams. These guidance documents will be updated as needed by mutual agreement.

External participants are also included in many of the Collaborative Teams to provide technical expertise and allow sharing and communication of operational decisions. The expectations and group norms for the external participants will be described in team charters.

3.13.3.1 Sacramento River Division – Water Operations

For the Sacramento River and Shasta Reservoir water operations there are three main coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the Shasta Operations Team (SHOT), Sacramento River Group (SRG) and the Winter-run JPE SubTeam. The SHOT is a policy level group that discusses water operations actions described in this proposed action when implementation may have biological, system conditions or water supply impacts or tradeoffs. The SHOT also discusses activities from the Winter-run Action Plan Team that may affect water operations. It is composed of management and policy staff from participating agencies including the SRSCs. The SRG is a technical group to discuss pulse flow shaping, temperature management, fall flow smoothing and fall/winter base flows. It is composed of technical staff from Reclamation, DWR, NMFS, USFWS, CDFW, SRSCs, WAPA, SWRCB and Native American Tribes. The Winter-run JPE SubTeam is a technical group tasked with development of the winter-run JPE each year and the winter-run broodstock assessment. It is composed of technical staff from the 5 Agencies. Generally, topics will be discussed at a technical level through SRG with agency feedback provided prior to being discussed at the SHOT. The SHOT will coordinate regularly with WOMT and other work groups as appropriate. Sacramento River Governance will use a collaborative approach to planning and decision-making.

Shasta Operations Team

A Shasta Water Operations Team (SHOT) consisting of Agency subdirectors and managers will serve as the management and policy group for decisions related to Shasta operations. The team will develop a charter to describe membership and process. The purpose of the SHOT is to ensure agency interaction and coordination on the Sacramento River and also with the broader CVP/SWP system, including downstream demands that affect Shasta releases.

The SHOT Team will coordinate with WOMT as needed on operational issues and decisions that have implications for both of their respective purviews, including but not limited to drought toolkit implementation and Voluntary Agreement asset management. A summary of Shasta Reservoir operations will be communicated at WOMT meetings and documented in WOMT meeting notes.

The SHOT will meet year-round and hold monthly meetings, or as needed to coordinate on Shasta Reservoir operations and potential system-wide management actions and risks. Reclamation will provide operational outlooks and the applicable drought and dry year actions from the drought toolkit or other relevant drought planning documents. The SHOT may convene relevant technical teams to support Shasta or system-wide policy decisions. Reclamation will provide updates from the SHOT relevant technical teams. Each of the 5 Agencies is responsible for being informed of conditions and communicating with their respective representatives on other teams.

Consistent with the Shasta Division part of the Proposed Action, the SHOT will work together, with input from the Sacramento River Temperature and Flow Task Group (SRG), to manage Sacramento River Basin Voluntary Agreement (VA) assets. Relevant operational actions that VA assets are intended to support include Shasta Reservoir cold water pool management, seasonal pulse flows planning and fall flow management. The SHOT will consider the contribution of these assets to conditions that contribute toward maintaining flows and temperatures that support viable Chinook salmon populations by enhancing spawning, rearing, growth and migration corridors and make decisions about their deployment.

Sacramento River Temperature and Flow Technical Group

The Sacramento River Temperature and Flow Technical Group (SRG) is a multiagency and stakeholder group established to provide technical and scientific information regarding temperature management and instream flows. The SRG will be composed of representatives from Reclamation, DWR, USFWS, CDFW, NMFS Central Valley Office, NMFS Southwest Fisheries Science Center, the SWRCB, WAPA, the Yurok Tribe, the Hoopa Tribe and the Sacramento River Settlement Contractors. The team will develop a charter to describe membership and process. The SRG develops temperature and flow plans for implementation of temperature management, fall and winter refill and redd maintenance actions, flow smoothing for rice decomposition, spring and seasonal pulse flows, winter base flow management, ramping rates, Shasta Reservoir storage planning and relevant fishery monitoring. The SRG will work closely with Reclamation and the SHOT and will use the best available science including current hydrologic forecasts, operational outlooks, fishery information, and modeling information.

The SRG will begin meeting no later than March to develop a Draft Sacramento River Temperature Management Plan and will meet at least monthly through the temperature management and the winter-run Chinook salmon redd maintenance season to coordinate during implementation. The SRG may update the Final Temperature Management Plan at the request of the SHOT. At the conclusion of the temperature management season, the SRG will develop a summary report pursuant to seasonal and annual reporting requirements for fall and winter refill and redd maintenance actions, flow smoothing for rice decomposition, spring or other seasonal pulse flows, winter base flow management, ramping rates and relevant fishery monitoring.

Reclamation will coordinate through SRG to develop a protocol for agency collaboration regarding temperature and flow models and will strive to create shared understanding of model constraints, uncertainties, limitations, applied assumptions and interpretations; develop management questions and scenarios that may benefit from modeling support; develop and review early season operational scenarios to support temperature management and flow planning.

Meet and Confer Group

The SRSCs approved "A Resolution Regarding Salmon Recovery Projects in the Sacramento River Watershed, Actions Related to Shasta Reservoir Annual Operations, and Engagement in the Ongoing Collaborative Sacramento River Science Partnership Effort" (June 12, 2019). Pursuant to the resolution, during drier water years, the SRSCs will meet and confer with Reclamation, NMFS, and other agencies, as appropriate, to determine if there is any role for the SRSCs in connection with Reclamation's operational decision-making for Shasta Reservoir annual operations in those years. This determination will include consideration of what actions are feasible, consistent with the terms of the SRS Contracts. In addition to the 25% reduction during Shasta Critical Years as set forth in the SRS Contracts, the types of actions that may be considered include, but are not necessarily limited to: (1) the scheduling of spring diversions by the SRSCs; (2) voluntary, compensated water transfers by the SRSCs subject to Reclamation approval; and (3) delayed SRSC diversion for rice straw decomposition during the fall months. Any mutually agreeable operations resulting from meet and confer discussions must be consistent with the terms of the SRS Contracts and may also be subject to other regulatory approvals.

The Meet and Confer group will be convened at the request of Reclamation, NMFS or the SRSCs at any time during the winter or spring months. According to the SRSC's resolution, this group may agree to invite the USFWS, CDFW, and/or the SWRCB at their discretion. As part of

Upper Sacramento River Governance, SHOT managers will represent the agencies at Meet and Confer meetings. The group will establish their own meeting frequency. Agency representatives from the Meet and Confer Group will communicate discussions and voluntary SRSC actions with the SPG.

3.13.3.2 Sacramento River Division– Winter-run Action Plan

For the Winter-run Action Plan, there are four main coordination forums that will meet regularly to discuss the following collaborative science, habitat and fisheries and infrastructure programs:

- The Winter-run Action Plan Team is a policy level group that discusses and coordinates the actions and milestones for the three key programs of the Winter-run Action Plan. The Winter-run Action Plan Team will also coordinate with the SHOT on science, habitat and fisheries and infrastructure actions that may affect water operations.
- The Sacramento River Science Team will work collaboratively to advance science actions identified as highest priority to be included in a science plan.
- The Sacramento River Habitat and Fishery Team will work collaboratively to advance key fishery and habitat restoration actions.
- The Infrastructure and Planning Team will work collaboratively to engage in planning and implementing key infrastructure improvements at Shasta Dam and the Livingston Stone National Fish Hatchery.

3.13.3.3 Trinity River Division – Clear Creek

The Clear Creek component of the Trinity River Division includes the Clear Creek Technical Team and SHOT. The Clear Creek Technical Team will provide technical input to Reclamation on habitat restoration, the shaping and timing of flows released from Whiskeytown Dam to optimize biological benefits downstream, and providing recommendations on operations to meet temperature criteria. SHOT will coordinate with the Clear Creek Technical Team, as needed regarding Clear Creek operations that affect Shasta Operations. Trinity River Governance on Clear Creek will use a collaborative approach to planning and decision-making.

Clear Creek Technical Team

The Clear Creek Technical Team is comprised of a group of agency representatives and interested parties who will use the best available science to provide technical input to Reclamation on habitat restoration, the shaping and timing of flows released from Whiskeytown Dam to optimize biological benefits downstream, and providing recommendations on operations to meet temperature criteria. The CCTT meets quarterly, or more frequently as needed. The CCTT develops a flow schedule every year, and may adjust the schedule using recent monitoring information.

3.13.3.4 Delta Division

For the Delta Division water operations there are three main agency coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the Water Operations Management Team (WOMT), the Smelt Monitoring Team (SMT) and the Salmonid monitoring Team (SaMT). WOMT is a policy level group that discusses the operations actions in the Delta, American River Division and the Stanislaus/East Side Division. The SMT is a technical group that discusses Delta Operations and smelt protections. The SaMT is a technical group that discusses Delta Operations and salmon and steelhead protections. WOMT will coordinate regularly with SHOT and other work groups as appropriate. Delta Governance will use a collaborative approach to planning and decision-making.

Water Operations Management Team

A Water Operations Management Team (WOMT) will coordinate on overall water operations to oversee the implementation of various real-time provisions for the Delta and the tributaries. The purpose of WOMT is to discuss and resolve operational questions and technical issues, as requested or elevated from Delta and tributary technical teams, and to elevate unresolved operational issues to the Directors Group. The team will develop a charter to describe membership and process. The WOMT will coordinate with the SHOT as needed on operational issues and decisions that have implications for both of their respective purviews, including but not limited to drought toolkit implementation and Voluntary Agreement asset management.

WOMT will meet weekly during the Old and Middle River Flow Management season (October through June), and otherwise as needed. Any agency can request a WOMT meeting outside of the OMR season for discussion or elevation items. For OMR management, Reclamation will provide operational outlooks and Proposed Action assessments on a weekly basis to WOMT, the SMT and the SaMT. WOMT will be provided the opportunity to review and discuss any applicable drought and dry year actions from the drought toolkit or other relevant drought planning documents. For all other assessments or elevation issues, supporting materials will be provided to WOMT by designated representatives of the applicable technical teams.

Smelt and Salmonid Monitoring Teams

The Smelt and Salmonid Monitoring Teams (SMT and SaMT, respectively) includes participants from Reclamation, USFWS, NMFS, DWR, CDFW, and State Water Resources Control Board. The SMT and SaMT review hydrologic, operational, fishery, and water quality data, and provide opportunities for engagement and discussion among biologist and operators on relevant information and issues associated with the Proposed Action and risk assessments.

Agency team leads: (1) notify their agency’s WOMT representative(s) if a Proposed Action/ITP identified trigger/threshold is or will be met; (2) provide input on the Proposed Action assessment and advice on the ITP risk assessment: and (3) discuss and document differing perspectives (i.e. non-consensus) on the relevant assessments.

In addition, there are also two additional groups that discuss operations that include other interested parties:

Delta Monitoring Workgroup

The Delta Monitoring Workgroup (DMW) will include technical representatives from federal and state agencies and stakeholders who can provide information to DWR and Reclamation on species abundance, species distribution, life stage transitions, and relevant physical parameters. The federal and state participants will be the agency leads and/or alternates from the SaMT and SMT. Similar to the federal and state agencies, the SWP and CVP contractors shall identify a lead and alternate participant, who are knowledgeable and have expertise in water operations, monitoring, and fish biology. The main focus of the DMW meetings is to: 1) review hydrologic, operational, fishery, and water quality data; 2) provide opportunities for engagement and discussion among biologist and operators on relevant information and issues; and, 3) review the Proposed Action Assessment and ITP Risk Assessment. The results of the DMW discussions will be captured in meeting notes for consideration by DWR and Reclamation.

Delta Coordination Group

The Delta Coordination Group (DCG) is comprised of two representatives each from Reclamation, NMFS, USFWS, DWR and CDFW, and one representative each from the CVP water contractors and SWP water contractors. The DCG may prepare an assessment to propose an alternative gate operation to the Suisun Marsh Salinity Control Gate action and will develop an annual monitoring plan for the action. The DCG will participate in the development of food subsidy action plans, monitoring plans, and reports.

3.13.3.5 American River Division

For the American River Division water operations there are two main coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the Water Operations Management Team (WOMT) and the American River Group (ARG). The ARG is a technical group that discusses reservoir and storage planning, forecasting and seasonal operations, flow and water temperature management and monitoring programs. American River Governance will use a collaborative approach to planning and decision-making.

American River Group

A group of federal, state, and local agencies, water users, and NGOs makes up the ARG to coordinate the shaping of releases including spring pulse flow timing and longevity, communicate upcoming releases, discuss water operations, fisheries, and other environmental concerns and to share operational and biological information with the goal of improving the technical understanding of Lower American River (LAR) temperature needs and operational constraints and considerations.

The ARG meets monthly, or more frequently as needed. The ARG will (a) evaluate the equations used to calculate the Minimum Release Requirements (MRRs) in November through December to consider whether an adjustment to the maximum MRR is warranted based on habitat improvements and other relevant information, and (b) submit a recommendation to Reclamation. The ARG will provide technical input on shaping Flow volumes, with the final timing determined by CDFW, FWS, and NMFS. The ARG will provide technical input on shaping Redd Dewatering Projective Adjustments. The draft Temperature Management Plan will be shared with the ARG, and Reclamation will consider feedback from ARG participants before finalizing the plan by June 15. During plan implementation, if the water temperature threshold is exceeded for three consecutive days, or is exceeded by more than 3°F for a single day, Reclamation will notify NMFS and the ARG, and outline steps being taken to bring the water temperature back into compliance.

3.13.3.6 East Side Division - Stanislaus River

For the East Side Division – Stanislaus River there are two main coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the Water Operations

Management Team (WOMT) and the Stanislaus Watershed Team (SWT). The SWT is a technical group that discusses reservoir and storage planning, forecasting and seasonal operations, flow and water temperature management and monitoring programs. The SWT will coordinate with other groups as appropriate. East Side - Stanislaus River Governance will use a collaborative approach to planning and decision-making.

Stanislaus Watershed Team

The Stanislaus Watershed Team (SWT) is a group of agency representatives and local interested parties (including conservation groups and other organizations working directly on Stanislaus River issues) having direct interest on the Stanislaus River. The SWT will provide technical input to Reclamation on the shaping and timing of monthly or seasonal flow volumes to optimize biological benefits. The SWT will meet at least monthly to share operational information and improve technical dialogue on the implementation of the New Melones SRP.

In addition, there is one additional group that discusses operations that includes other interested parties:

Stanislaus River Forum

The SRF is an open forum for all interested stakeholders to receive Stanislaus River Operations updates and to provide feedback for SWT and Reclamation consideration. The SRF will meet at least monthly and prior to the SWT meeting to share operational information and improve technical dialogue on the implementation of the New Melones SRP.

3.13.4 Collaborative Decision Making

This section describes the representatives and the process for elevation, decision making, and communication. More information on the types of decisions and process for each Division can be found in the corresponding section of the LTO proposed action.

3.13.4.1 Directors

Directors from Reclamation, DWR, USFWS, NMFS and CDFW will meet as requested by the WOMT or the SHOT when consensus cannot be reached on operations. The team that is the lead for the elevation issue will notify the other team prior to elevating to the Directors to ensure full transparency.

Director Decision Making for Shasta and Tributaries

The Regional Director for Reclamation will confer with the other Directors to determine if there is an alternative action that will be mutually agreeable. If consensus is reached, Reclamation will implement the alternative action. If the Directors do not reach a resolution on operations, Reclamation will make a decision and notify the other Directors in writing. Any Director has the opportunity to dispute a decision within 2 days, providing a written explanation of the nature of the dispute. Reclamation will respond in writing within 2 days after receiving the explanation for the disputed action and before taking an action. Any Director may request a follow-up Directors meeting if necessary.

If there is disagreement on an operational action that Reclamation determines may create a potentially high risk to CVP infrastructure or liability to the United States, then Reclamation will make the final decision as to whether or not to implement that action.

Director Decision Making for the Delta

The Regional Director of Reclamation or DWR (proposing agency or agencies) will confer with the fish agency Directors/Regional Administrator to determine if there is an alternative action that will be mutually agreeable for specific areas that rely on a risk assessment, following elevation by WOMT. If consensus is reached, the proposing agencies will implement the alternative action. If the Directors do not reach a resolution on operations, the proposing agencies will meet and confer to prioritize alignment between the SWP and CVP operations, in consideration of operational and regulatory constraints affecting either project, will make a decision and notify the other Directors in writing. Any Director has opportunity to dispute a decision within 2 days, providing a written explanation of the nature of the dispute. The proposing agencies will respond in writing within 2 days after receiving the explanation for the disputed action and before taking an action. Any Director may request a follow-up Directors meeting if necessary.

If there is disagreement on an operational action that the proposing agency determines may create a potentially high risk to Project infrastructure or liability to the United States or State of California, then the proposing agency will make the final decision as to whether or not to implement that action.

Once a decision has been resolved following any of the procedures described above, the Directors will designate a representative or representatives to communicate the decision to relevant parties, including operators, technical team representatives, and/or other interested parties.

3.13.4.2 Water Operations Management Team

Each agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If issues that are elevated to WOMT are resolved by WOMT, an agency representative will be designated by WOMT to communicate the decision via email to relevant technical team representatives. If the WOMT cannot reach consensus on an operational issue, the issue will be elevated to the Directors through the subdirectors. Similarly, if the SHOT or WOMT have an operational disagreement, the issue will be elevated to the Directors through the subdirectors. The elevation process will be managed collaboratively by the WOMT.

3.13.4.3 Shasta Water Operations Team

Each agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If issues that are elevated to SHOT are resolved by SHOT, an agency representative will be designated to communicate the decision via email to relevant technical team representatives. If the SHOT cannot reach consensus on an operational issue, the issue will be elevated to the Directors through the subdirectors. Similarly, if the SHOT or WOMT have an operational disagreement, the issue will be elevated to the Directors through the subdirectors. The elevation process will be managed collaboratively by the SHOT.

Consistent with the Proposed Action for the Shasta Division, the SHOT will work together, with input from the Sacramento River Settlement Contractors, to manage Sacramento River Basin Voluntary Agreement (VA) assets. The SHOT will consider the contribution of these assets to conditions that contribute toward maintaining flows and temperatures to support viable Chinook salmon populations by enhancing spawning, rearing, growth and migration corridors. Relevant operational actions that VA assets will support include, but are not limited to, Shasta cold water pool management, seasonal pulse flows and fall flow management. Fish agencies will be the final decision makers on deployment of VA assets based on what provides the best protection for the species.

3.13.4.4 Sacramento River Temperature and Flow Technical Group

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. SRG will seek to reach consensus. If consensus is not reached, at the close of SRG meetings, there will be an Agency resolution session to discuss and compose an e-mail to SHOT, summarizing the elevation topic and any supporting information and recommendation, and report the details of the elevation issue to SHOT. Each of the 5 agency representatives are individually responsible for communicating the issue and any background information to their SHOT representative. The decision-making process will then follow the procedure described in the SHOT section above and, if necessary, the procedure in the Directors section above.

3.13.4.5 Winter-run Action Plan Team

Reclamation is committed to support a separate Winter-Run Action Plan with NMFS, FWS, CDFW, DWR and SRSCs to pursue a science and monitoring plan, winter-run habitat and infrastructure actions, and water operations.

3.13.4.6 Clear Creek Technical Team

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. CCTT proposed flows will be routed to CVO, who will implement the flows as proposed. If there is an operational issue that the CCTT cannot resolve, the Agency representatives will compose an e-mail to SHOT, summarizing the elevation topic and any supporting information and recommendations. Each of the agency representatives are individually responsible for communicating the issue and any background information to their SHOT representative. The decision-making process will then follow the procedure described in the SHOT section above and, if necessary, the procedure in the Directors section above.

3.13.4.7 American River Group

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If there is an operational issue that the ARG cannot resolve, the Agency representatives will compose an e-mail to WOMT, summarizing the elevation topic and any supporting information and recommendations. Each of the Agency representatives are individually responsible for communicating the issues and any background information to their WOMT representative. The decision-making process will follow the procedure described in the WOMT section above and, if necessary, the procedure in the Directors section above.

3.13.4.8 Smelt and Salmonid Monitoring Teams

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. Agency team leads: (1) notify their agency's WOMT representative(s) if a Proposed Action/ITP identified trigger/threshold is or will be met; (2) provide input on the Proposed Action assessment and advice on the ITP risk assessment: and (3) discuss and document differing perspectives (i.e. non-consensus) on the relevant assessments. If there is an operational issue that the team cannot resolve, the Agency representatives will compose an e-mail to WOMT, summarizing the elevation topic and any supporting information and recommendations. Each of the Agency representatives are individually responsible for communicating the issues and any background information to their WOMT representative. The decision-making process will follow the procedure described in the WOMT section above and, if necessary, the procedure in the Directors section above.

3.13.4.9 Stanislaus Watershed Team

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If there is an operational issue that the SWT cannot resolve, the Agency representatives will compose an e-mail to WOMT, summarizing the elevation topic and any supporting information and recommendations. Each of the Agency representatives are individually responsible for communicating the issues and any background information to their WOMT representative. The decision-making process will follow the procedure described in the WOMT section above and, if necessary, the procedure in the Directors section above.

3.14 Adaptive Management

Adaptive management is a structured, iterative process for decision making when confronted with uncertainty. It emphasizes learning through management where knowledge is incomplete and provides a process for building knowledge through monitoring and science, reducing uncertainty, and improving management over time in a goal-oriented and structured way. Key components of adaptive management are establishing clear and measurable objectives, identifying action goals, and determining management options for best achieving those desired goals.

Decision support tools can be used within the adaptive management framework to identify the uncertainties that are most influential in a decision-making process (management), which in turn can guide the scientific approaches deployed to reduce those uncertainties and allow better informed subsequent decisions. When correctly designed and executed, adaptive management provides a means to develop and evaluate the expected outcomes of proposed management actions, to compare actual outcomes of actions to those expectations, and to make evidence-based adjustments to future actions to improve their effectiveness if warranted. The adaptive management approach can provide a transparent and documented scientific basis for continuing, modifying, or implementing an alternative action.

The Department of Water Resources (DWR), the Department of Fish and Wildlife (CDFW), Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service (USFWS), and National

Marine Fisheries Service (NMFS) (collectively, "the Implementing Entities") intend to utilize adaptive management to inform the long-term operations of the State Water Project (SWP) and the Central Valley Project (CVP) and related activities described herein. The Implementing Entities will approach adaptive management in an open, participatory framework. The Implementing Entities will establish the Adaptive Management Steering Committee (AMSC) to coordinate through individual Adaptive Management Teams (AMT) responsible for evaluating each Adaptive Management Action, utilizing decision support tools such as structured decision making.

Working through the collaborative process outlined in this document, the Implementing Entities commit to reach consensus within the AMSC to the maximum extent possible, while still retaining individual agency discretion to make decisions (as appropriate). To that end, the Implementing Entities seek to use the potential flexibility provided by an adaptive management approach in a way that balances gaining knowledge to improve future management decisions while taking actions in the face of uncertainty to improve the operation of the CVP and SWP for their project purposes.

The Adaptive Management Program is described in Appendix X of the document. Appendix A to the AMP describes the steps required to implement the adaptive management process and explains how the process links to the operations of the SWP and CVP. Appendix B to the AMP includes a list of actions and programs in the Proposed Action (listed below), and additional details regarding the timeframe of evaluation of each action and the AMT responsible for implementing them:

- Winter-run Chinook Salmon OMR Management
- Spring-run Chinook Salmon OMR Management
- Summer-Fall Habitat Action for Delta Smelt
- Tidal Habitat Restoration Effectiveness for Smelt Fishes
- Tributary Habitat Restoration Effectiveness for Salmonid Fishes
- Shasta Spring Pulse Flow Studies
- Winter-run Chinook Salmon Through Delta Survival Targets
- Longfin Smelt Science Plan Actions
- Delta Smelt Supplementation
- Steelhead JPE
- Alternative Salmonid Loss Estimation Pilot Study
- Shasta Cold Water Pool Management
- Georgiana Slough Migratory Barrier Effectiveness for Salmonid Fishes
- Spring Outflow

- Clear Creek

3.15 Framework Programmatic Outline for Sites Reservoir Project and Delta Conveyance Project

The Long-Term-Operations consultation (LTO) is a mixed programmatic action, as defined in 50 CFR 402.02[15]. This consultation includes a mix of standard consultation and programmatic consultation (which can include an ITS or defer the ITS to a later time associated with subsequent Federal actions). All activities addressed programmatically will be subject to a subsequent consultation in order to proceed. Additionally, some project elements and their effects on listed species or critical habitat may change as the United States Bureau of Reclamation (Reclamation) and the Department of Water Resources (DWR) continue to develop the Proposed Action (PA) for the programmatic elements and may require reinitiation of consultation.

This PA provides a framework for the development of future Federal actions that will be authorized, funded, or carried out at a later time and will be subject to future project-specific consultations because of these subsequent Federal actions. Reclamation will initiate these future consultations and will provide sufficient information as outlined in 50 CFR 402.12(t). The Services will complete these future consultations and that additional review will be informed by sufficient detail to allow the development of incidental take statements for each of these activities.

This PA includes a programmatic framework consultation for the operations of the Sites Reservoir Project (Sites) and the operations of the proposed Delta Conveyance Project (DCP). The use of a mixed programmatic framework consultation for these two projects provides information, to the extent possible given the information available today, to assess how these projects would operate in the context of the LTO PA along with broadly assessing the impacts of the operations of these projects in the context of the LTO PA. The use of a mixed programmatic framework consultation for these two projects provides information, to the extent possible, on how these key projects would be implemented, if approved after completing compliance with the California Environmental Quality Act (CEQA), in conjunction with the LTO operations in the future and will support subsequent regulatory processes and coordinated operations planning.

Reclamation proposes to initiate section 7 consultation for the non-operational construction and maintenance components of Sites and U.S. Army Corps of Engineers proposes to initiate section 7 consultations for the non-operational construction and maintenance components of the DCP,

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[15] Mixed programmatic action means, for purposes of an incidental take statement, a Federal action that approves action(s) that will not be subject to further section 7 consultation, and also approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time and any take of a listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further section 7 consultation.

both separately from LTO. These construction-focused consultation efforts will proceed in-parallel with this PA.

In the future, Reclamation also proposes to initiate section 7 consultation for the operational components of Sites and DCP. As these separate future consultations are completed for each project and as Reclamation makes a decision regarding each project, each will become part of the Environmental Baseline and will need to be incorporated into the modeled baseline condition for subsequent projects, including any future reinitiations of consultation for LTO. In order to ensure effects of Sites and DCP are sufficiently addressed, those separate section 7 consultations, including construction-focused consultation efforts noted above, will reference this framework when addressing the effects of operations of each of these projects. Reclamation will ensure that section 7(d) is adhered to by ensuring operations will not commence before completion of project-specific section 7 consultation for operations. In addition, implementation of any potential construction-related activities prior to completion of the future section 7 operations consultation would not affect the requirement for Reclamation to implement, if necessary, Reasonable or Prudent Alternatives identified during subsequent consultation.

Project descriptions for the proposed Sites and DCP, as well as the proposed approach for considering operational effects of Sites and DCP in relation to the updated LTO Proposed Action, are provided below and are proposed to be addressed programmatically.

3.15.1 Future Project Considerations and Regulatory Processes

Both the Sites and DCP projects are subject to future consultations under Section 7 of the Endangered Species Act (ESA). Both projects are subject to the requirements of Section 2081 of the California Endangered Species Act (CESA) and future coordination with the California Department of Fish and Wildlife (DFW) will likely be required to ensure consistency with compliance under both the ESA and CESA. Since it will be several years before these projects become operational, there are other factors (e.g., climate change) that will need to be addressed in future project design modifications, as feasible, and operational criteria refinements. In addition, there are other regulatory processes and approvals that could influence final operation of these projects or final design. These potential changes would need to be addressed in the future ESA consultations. These future processes include, but are not necessarily limited to:

- Completion of CEQA and a decision on whether to approve Sites, or an alternative, by the Sites Authority and the DCP, or an alternative, by DWR; additional CEQA compliance may be necessary where additional discretionary decisions require review of new information, a change in circumstances, or change in the project.
- the water rights process administered by the State Water Resources Control Board (SWRCB) for both Sites and DCP, which is expected to result in separate water rights orders that may limit how water will be diverted from the Sacramento River. DWR is not proposing to increase the existing State Water Project (SWP) water right for DCP and will only request a change in point of diversion for the SWP water rights. Sites is petitioning the SWRCB to obtain new water rights for diversion and storage;
- updates to the Bay-Delta Water Quality Control Plan by the SWRCB, which may result in changes in the operational parameters for both Sites and DCP;

- consistency with the Delta Plan for DCP per the requirements of the Delta Reform Act;
- coordinated operations agreement(s) between Reclamation and DWR (and Sites for Sites operations) which will need to incorporate DCP and Sites into the existing CVP and SWP coordinated operations system and would specify how water will be transferred, exchanged, and exported;
- Authorizations from the U.S. Army Corps of Engineers under the Clean Water Act and Rivers and Harbors Act for certain aspects of each project.

3.15.2 Qualitative Project Descriptions

Qualitative descriptions of the proposed projects and potential operational effects for both Sites and DCP individually, as well as combined, are included in this framework. Potential for effects to storage in upstream reservoirs, potential for changes in flows and temperatures upstream of Sites and DCP, changes in flows adjacent to Sites and DCP facilities, and changes in flows and hydrodynamics through, and downstream of, the Delta are all addressed at a programmatic level. These operationally driven changes in flows will be considered in the context of the Sacramento River, Delta, and downstream aquatic ecosystems, and specifically in relation to ESA listed aquatic species.

3.15.3 Sites Reservoir

Sites would involve the construction, operation, and maintenance of an 1.5 million acre-foot offstream surface water reservoir to provide direct and real benefits to instream flows, the Sacramento-San Joaquin Delta (Delta) ecosystem, and water supply reliability. The reservoir inundation area would be in rural, unincorporated areas of Glenn and Colusa Counties, and project components would be located in Tehama, Glenn, Colusa, and Yolo counties.

The Project would use existing infrastructure to divert unregulated and unappropriated flow from the Sacramento River at Red Bluff and Hamilton City and convey the water to a new offstream reservoir west of the community of Maxwell, California. New and existing facilities would move water into and out of the reservoir. Releases from Sites Reservoir would be used locally, be conveyed to the Yolo Bypass for ecosystem benefits, or ultimately return to the Sacramento River system via existing canals and a new pipeline located near Dunnigan. Water released from the reservoir would be used to benefit local, state, and federal water use needs, including public water agencies, anadromous fish species in the Sacramento River watershed, wildlife refuges and habitats, and the Yolo Bypass to help supply food for delta smelt (*Hypomesus transpacificus*). The Authority would own and operate all newly constructed project facilities that are not already owned by another entity. There are currently 22 Storage Partners representing local and regional water delivery agencies that serve over 24.5 million people and over 500,000 acres of farmland that are paying for the Project and would receive the resulting water supply benefits. In addition, the State of California, through the California Water Commission, and the Bureau of Reclamation are also envisioned to be Storage Partners and receive water supply benefits.

The objectives of the project are as follows:

- Improve water supply reliability and resiliency to meet Storage Partners' agricultural and municipal long-term average annual water demand in a cost-effective manner for all Storage Partners, including those that are the most cost-sensitive.
- Provide public benefits consistent with Proposition 1 of 2014 and use WSIP funds to improve statewide surface water supply reliability and flexibility to enhance opportunities for habitat and fisheries management for the public benefit through a designated long-term average annual water supply.
- Provide public benefits consistent with the WIIN Act by using federal funds, if available, provided by Reclamation to improve CVP operational flexibility in meeting CVP environmental and contractual water supply needs and improving cold-water pool management in Shasta Lake to benefit anadromous fish.
- Provide surface water to convey biomass from the floodplain to the Delta to enhance the Delta ecosystem for the benefit of pelagic fishes in the north Delta (e.g., Cache Slough).
- Provide local and regional amenities, such as developing recreational facilities, reducing local flood damage, and maintaining transportation connectivity through roadway modifications.

Reclamation's role in the Sites Reservoir Project is as a funding partner. Reclamation would acquire a water storage account in Sites Reservoir and an additional water supply it may use to supplement its existing supplies. Reclamation's purposes for the project include the following:

- Increased water supply and improved reliability of water deliveries
- Increased CVP operational flexibility
- Benefits to anadromous fish by improving CVP operations consistent with the laws, regulations, and requirements in effect at the time of operation
- Incremental Level 4 water supply for CVP Improvement Act refuges
- Delta ecosystem enhancement by providing water to convey food resources

The operational components of the Sites Project are listed in Table 3-16. The Sites Project is sufficiently developed for consideration at a framework level consistent with the 1992 CVPIA and 2016 WIIN Act. Reclamation and the Sites Project Authority recently completed the Sites Reservoir Project Final Environmental Impact Report/Environmental Impact Statement that analyzes the impacts of the project and is included in this biological assessment by reference.

Table 3-16. Operational Programmatic Components of Proposed Sites Project

Sites Project Activity	Description
Diversions to Sites Reservoir, Operating Criteria, and Diversion Criteria	All aspects of diversion of water at Red Bluff Pumping Plant, Hamilton City Pump Station, Stone Corral Creek, and Funks Creek, including the use of excess capacity in the Tehama-Colusa Canal and Glenn-Colusa Irrigation District Main Canal to convey water to the reservoir and storage of water in

Sites Project Activity	Description
	Sites Reservoir. Specific descriptions of pulse protection at Bend Bridge, bypass flows at Red Bluff, Hamilton City and Wilkins Slough, and other diversion criteria are specified in Chapter 2, Section 2.5.2.1, page 2-78 through page 2-86 of the Sites Project Final EIR/EIS.
Water Conveyance and Releases from Sites Reservoir	Releases of water from Sites Reservoir into the Tehama-Colusa Canal, Glenn-Colusa Irrigation District Main Canal, Stone Corral Creek, and Funks Creek. Conveyance of water from the Tehama-Colusa Canal into the Dunnigan Pipeline and subsequent release into the Colusa Basin Drain and ultimately into the Sacramento River or Yolo Bypass. Releases from Sites Reservoir are described in Chapter 2, Section 2.5.2.1, page 2-86 through 2-88 and page 2-90 through 2-91 of the Sites Project Final EIR/EIS.
Coordination with CVP and SWP	Exchanges with Shasta Lake and Lake Oroville, including Reclamation's investment in Sites Reservoir as described in Chapter 2, Section 2.5.2.1, page 2-88 through 2-90 of the Sites Project Final EIR/EIS.
Flood Control	Flood control benefits to the communities of Maxwell and Colusa, local agricultural lands, rural residences, and Interstate 5 by impounding Funks Creek and Stone Corral Creeks as described in Chapter 2, Section 2.5.2.1, page 2-91 through 2-92 of the Sites Project Final EIR/EIS
Emergency Releases	Operation of facilities to meet Division of Safety of Dams criteria and requirements for emergency reservoir drawdown as described in Chapter 2, Section 2.5.2.1, page 2-92 of the Sites Project Final EIR/EIS
Energy Generation and Energy Use	The as described in Chapter 2, Section 2.5.2.2, page 2-92 through 2-93 of the Sites Project Final EIR/EIS generation of energy in operations and use of energy for operations
Aquatic Monitoring and Adaptive Management	Implementation of an aquatics monitoring and adaptive management plan to (1) integrate the Project's adaptive management program with existing monitoring and science programs; (2) provide the proposed framework and governance, and (3) include the process for adaptive management, including operational criteria and conservation measures as described in various spots in Chapter 2 and Appendix 2D (2D.4, 2D.5, 2D.6) of the Sites Project Final EIR/EIS
Compensatory Mitigation for Temporary and Permanent Impacts	Species-specific compensatory mitigation actions that would be completed prior to operations as may be required in the projects permits and approvals

Construction of Sites Reservoir is expected to take approximately 7 years, beginning in 2026 and concluding in 2032. Currently, the reservoir is expected to be substantially completed in 2032 with filling beginning in 2033. The amount of time it would take to fill Sites Reservoir would depend greatly on hydrology and how Storage Partners choose to use their water during initial filling. Initial filling could range from approximately 2 years to over 10 years.

3.15.4 Delta Conveyance Project

On April 29, 2019, Governor Newsom signed Executive Order N-10-19 directing the California Natural Resources Agency, California Environmental Protection Agency, and California Department of Food and Agriculture to develop a comprehensive strategy to build a climate-resilient water system and ensure healthy waterways through the twenty-first century. After a public input period, Governor Newsom released the California Water Resilience Portfolio on July 28, 2020. The Water Resilience Portfolio identifies a suite of complementary actions to ensure safe and resilient water supplies, flood protection and healthy waterways for the state's communities, economy, and environment. One of the projects identified in the portfolio is new diversion and conveyance facilities in the Delta to safeguard the SWP, which is now proposed as the Delta Conveyance Project. DWR proposed and is evaluating the project consistent with the portfolio approach and is currently reviewing the proposed project under CEQA with a Final Environmental Impact Report and decision on approval expected by the end of 2023.

DWR's fundamental purpose in proposing the DCP is to develop new intake and conveyance facilities in the Delta is to restore and protect the reliability of SWP water deliveries and, potentially, Central Valley Project (CVP) water deliveries south of the Delta, consistent with the State's Water Resilience Portfolio in a cost-effective manner. This purpose, in turn, gives rise to the following project objectives.

- To help address anticipated rising sea levels and other reasonably foreseeable consequences of climate change and extreme weather events.
- To minimize the potential for public health and safety impacts from reduced quantity and quality of SWP water deliveries, and potentially CVP water deliveries, south of the Delta as a result of a major earthquake that could cause breaching of Delta levees and the inundation of brackish water into the areas where existing SWP and CVP pumping plants operate in the southern Delta.
- To protect the ability of the SWP, and potentially the CVP, to deliver water when hydrologic conditions result in the availability of sufficient amounts of water, consistent with the requirements of state and federal law, including the CESA and ESA and Delta Reform Act, as well as the terms and conditions of water delivery contracts and other existing applicable agreements.
- To provide operational flexibility to improve aquatic conditions in the Delta and better manage risks of further regulatory constraints on project operations.

The proposed DCP project includes the construction and operation of new water intake facilities on the Sacramento River in the north Delta and a single main tunnel to divert and move water entering the north Delta from the Sacramento Valley watershed to existing SWP facilities in the south Delta, which would result in a dual conveyance system for the SWP in the Delta (see Table 3-17 for additional details on operations of the proposed project [i.e. PDEIR Alternative 5, Bethany Reservoir Alignment]). DWR is not seeking to increase its existing water rights, nor is it proposing any operational changes upstream of the Delta. The DCP, if approved, would be a part of the SWP's integrated water delivery system and, therefore, would be considered within the SWP and Central Valley Project (CVP) Long-Term-Operations. If the DCP is approved and implemented by DWR, it would be a part of the SWP Delta operations and subject to Reclamation and DWR Coordinated Operations Agreement (COA).

DWR would implement “dual conveyance” by operating the proposed north Delta diversion in conjunction with the existing south Delta diversion system for the SWP. During winter and spring, operations of existing south Delta water export facilities would be prioritized up to what is permitted under the existing water rights and all applicable state and federal law and regulations, before operating the proposed north Delta intakes. During summer/fall, operations would be focused on more efficient Delta salinity management. The south Delta exports and the north Delta diversions would be balanced and adjusted to meet the SWRCB D-1641 salinity requirements at the western Delta stations on the Sacramento and San Joaquin Rivers (e.g., increasing salinity at Jersey Point would cause a shift in diversions from south Delta to north Delta, whereas increasing salinity at Emmaton would cause a shift from north Delta to south Delta). This operation is expected to result in a more efficient system operation.

For purposes of the USACE DCP BA, project-specific effects associated with construction and placement of DCP facilities, including in-water work, as well as both temporary and permanent impacts, will be covered under the USACE’s section 7 consultation. All effects associated with the north Delta diversion intake operations, including near- and far-field effects within the river as well as potential associated effects to aquatic biological resources, are assessed through the Programmatic LTO analysis. Table 3-17 describes key operational programmatic components of the Proposed Project.

Table 3-17. Operational Programmatic Components of Delta Conveyance Project

DCP Project Activity	Description
North Delta Intake Diversions	The proposed intakes would augment the ability to capture excess flows and improve the flexibility of SWP operations (e.g. improved salinity management during the summer/fall). New operational criteria would govern the diversions at the proposed north Delta intakes to minimize effects near and downstream of the new intakes. See Section 3.16 of the DCP Public Draft EIR for additional details on project operations.
SWP Integration	The north Delta intakes would operate in conjunction with the existing SWP south Delta intakes. For example, during the winter and spring, the SWP would first use south Delta facilities to export water up to what is permitted under the existing water rights and all applicable state and federal law and regulations before diverting from the new north Delta intakes. Upstream SWP storage operations would continue to be managed to the existing and future regulatory and contractual obligations of the SWP in determining the amount of stored water available for exports. The DCP would not change operational criteria associated with upstream reservoirs (Section 3.16.3, DCP Public Draft EIR).
Coordination with CVP	Continued SWP coordination with CVP through the Coordinated Operations Agreement, consistent with applicable regulatory requirements (Section 3.16, DCP Public Draft EIR).

DCP Project Activity	Description
Adaptive Management and Monitoring Program	The Adaptive Management and Monitoring Program would be used to evaluate and consider changes in operational criteria, if necessary, based on information gained before and after the new facilities become operational. This program would be used to consider and address scientific uncertainty regarding the Delta ecosystem and potential effects of the project. In addition, an adaptive management and monitoring plan would be prepared for each mitigation site to help ensure habitat creation goals are met. (Section 3.18, DCP Public Draft EIR).
Conservation Measures	Included to avoid, minimize, and offset effects of the proposed action on listed species. This includes compensatory mitigation to be completed prior to operations at the acreages identified for each species. (Appendix 3F, DCP Public Draft EIR).

3.15.5 Combined Qualitative Description

Both DCP and Sites are designed to improve water management capabilities for SWP and CVP and collectively respond to challenges associated with future climate change. In particular, the projects would provide for facility updates and improve the ability for SWP and CVP to respond to more extreme weather, driven by climate change, by improving the ability to capture, store, and convey water associated with flashier flow events, as well as a predicted general shift in hydrograph with relatively higher flows in winter months and reductions in the spring. As described qualitatively above, both DCP and Sites incorporate operational criteria to minimize potential effects to the environment and aquatic resources both at the facilities (near-field) as well as downstream (far-field). While these criteria have been designed to integrate with existing regulations and reduce potential effects of each project individually, there are potential interactive effects which are important to further investigate and account for, mainly associated with changes to Sacramento River flows upstream of, in, and through the Delta. Potential effects to aquatic resources associated with these changes include:

- Changes to timing, magnitude, and duration of flows along the Sacramento River/Delta corridor;
- Subsequent changes to important aquatic constituents (e.g. suspended sediment, nutrients, lower trophic production) associated with the flow modifications;
- Potential changes to quantity/quality of habitat supporting listed species spawning, rearing, and migration;
- Potential changes in production of listed aquatic species.

Additionally, upstream changes (i.e. Shasta reservoir storage, upper Sacramento River flows – for Sites; Oroville reservoir storage, upper Feather River flows – indirectly for DCP) may have non-intuitive interactive effects of the combined projects and will also be explored. Generally, the effects to these locations would be improvements in upstream storage and cold-water flexibility, relative to no action, based on the projects' objectives.

3.15.6 Quantitative Project Descriptions

This section contains quantitative descriptions of the modeled results comparing Sites and DCP operational effects relative to the updated LTO. The quantitative effects analysis will focus on key indicators of biological/ecological relevance such as storage, flows, and temperatures at key locations on the Sacramento River, as well as through and downstream of the Delta.

3.15.7 Analysis and Comparative Modeling Results

Sites and DCP have assessed their operations as part of their CEQA (and also NEPA for Sites) compliance efforts. This quantitative information helps inform the programmatic consideration of this framework. These analyses have led to the development of detailed operational criteria to reduce or avoid operational effects to sensitive species, and these criteria are described further below.

3.15.7.1 Sites Reservoir

Sites Reservoir would be filled through the diversion of Sacramento River water that generally originates from unregulated tributaries to the Sacramento River downstream from Keswick Dam. Diversions to Sites Reservoir could also come from flood releases from Shasta Lake. Diversions to Sites Reservoir would be made from the Sacramento River at the existing RBPP (River Mile [RM] 243) near Red Bluff into the TC Canal and at the existing GCID Hamilton City Pump Station (RM 205) near Hamilton City into the GCID Main Canal. Water could be diverted to storage in Sites Reservoir from September 1 to June 14. Diversions would occur only when all of the following conditions are met:

- Flows in the Sacramento River exceed the minimum diversion criteria (described in Table 3-18 below);
- The Delta is in "excess" conditions as determined by Reclamation and DWR and would remain in excess conditions during diversions;
- Senior downstream water rights, existing CVP and SWP and other water rights diversions including Section 215 of the Reclamation Reform Act of 1992, Article 3(f) water, and SWP Article 21 (interruptible supply), and other more senior flow priorities have been satisfied;
- Flows are available for diversion above flows needed to meet all applicable laws, regulations, biological opinions and incidental take permits, and court orders in place at the time that diversion occurs. This would include but is not limited to any flow requirements in Water Right Decision 1641 (State Water Resources Control Board 2000), the 2019 biological opinions for the reinitiation of consultation on coordinated long-term operations of the CVP and SWP (ROC on LTO BiOps) (U.S. Fish and Wildlife Service 2019; National Marine Fisheries Service 2019) and any future related BiOps, and the State incidental take permit (California Department of Fish and Wildlife 2020); and
- There is available capacity at the RBPP and in the TC Canal and GCID facilities to divert and convey water to Sites Reservoir, above the capacity needed for deliveries to existing TC Canal users and within the GCID service area.

The RBPP would serve as the primary diversion location and would divert water from the Sacramento River to Funks Reservoir through the TC Canal and into the Sites Reservoir through the Funks Pumping and Generating Plant and the Inlet/Outlet Works. A maximum of approximately 2,120 cfs would be diverted at the RBPP for the project. The Hamilton City Pump Station would serve as the secondary diversion location and would divert water from the Sacramento River to the new Terminal Regulating Reservoir through the GCID Main Canal and into the Sites Reservoir through the Terminal Regulating Reservoir Pumping and Generating Plant and the Inlet/Outlet Works. A maximum of approximately 2,070 cfs would be diverted at the Hamilton City Pump Station for the project. Although the RBPP would be the primary diversion point, both diversion facilities would be operated simultaneously when river conditions and capacity are available for a maximum combined diversion rate of about 4,200 cfs (3,900 cfs, plus losses). Table 3-18 provides a summary of the Sites project minimum diversion criteria.

Table 3-18. Summary of Project Diversion Criteria (this is Table 2-5 from the Final EIR/EIS)

Location (Listed from North to South)	**Criteria**
Bend Bridge Pulse Protection	Protection of all qualified precipitation-generated pulse events (i.e., peaks in river flow rather than scheduled operational events) from October to May based on predicted hydrology and monitoring. A criterion based on the detection of migrating fish may be added if a fish monitoring method can be demonstrated as effective and reliable. A qualified precipitation-generated pulse event is determined based on forecasted flows, and pulse protection may cease after 7 days or earlier if flows at Bend Bridge exceed 29,000 cfs and Project diversions subtracted from Bend Bridge flows continue to be at least 25,000 cfs.
Minimum Bypass Flows in the Sacramento River at the RBPP	3,250 cfs minimum bypass flow at all times; rate of diversion controlled by fish screen design
Minimum Bypass Flows in the Sacramento River at the Hamilton City Pump Station	4,000 cfs minimum bypass flow at all times; rate of diversion controlled by fish screen design
Minimum Bypass Flows in the Sacramento River at Wilkins Slough	10,700 cfs from October 1 to June 14; 5,000 cfs in September (no diversions to Sites Reservoir from June 15 to August 31)
Freeport, Net Delta Outflow Index, X2, and Delta Water Quality	Operations consistent with all applicable laws, regulations, biological opinions and incidental take permits, and court orders in place at the time that diversion occurs

cfs = cubic feet per second; RBPP = Red Bluff Pumping Plant.

The Sites project diversion criteria have been analyzed extensively and are not expected to change substantially. However, criteria may be refined in actual project operations through adaptive management and in coordination with the fisheries agencies. In particular, adaptive management actions would focus on the following: Bend Bridge Pulse Protection; the Minimum

Bypass Flows in the Sacramento River at Wilkins Slough; Fremont Weir Notch Protections (Big Notch Project); sediment monitoring, modeling and reintroduction; and fish monitoring and technical studies related to near-field effects.

3.15.7.2 Delta Conveyance Project

As described in the qualitative discussion, the DCP would function as a dual-conveyance SWP facility in conjunction with existing SWP Delta facilities through construction and operation of two new north Delta intakes with a combined diversion capacity of 6,000 cfs on the Sacramento River near the town of Hood. The north Delta diversions (NDD) would not alter operating criteria for existing facilities (e.g. upstream reservoirs or south Delta diversions), would be subject to existing and updated Delta water quality requirements (e.g. D-1641), and would not alter SWP/CVP water right permits (beyond the addition of new points of diversions). Existing south Delta diversions would be operated preferentially, with use of the NDDs focused on periods of excess flow conditions in the Delta and to optimize salinity management in the summer and fall. Specific operational criteria focusing on minimizing potential effects to aquatic resources and listed fish would further govern NDD operations. Table 3-19 and Table 3-20 describe the proposed DCP operational criteria.

Table 3-19. Delta Conveyance Project Preliminary Proposed Operations Criteria (North Delta Diversion Operations)

Parameter	Delta Conveyance Project Criteria
North Delta diversion operations	• Bypass Flow [a] Criteria (specifies bypass flow required to remain downstream of the north Delta intakes): • October through November: Minimum flow of 7,000 cfs required in river after diverting at the north Delta intakes. • December through June: Once the pulse protection (see below) ends, north Delta diversions would not exceed Level 1 pumping unless specific criteria have been met to increase to Level 2 or Level 3. If those criteria are met, operations can proceed as defined in the following table. Allowable diversion would be the greater of the following options: low-level pumping or the diversion allowed by the bypass flow rules in the following table. • July through September: Minimum flow of 5,000 cfs required in river after diverting at the north Delta intakes. • Pulse Protection Criteria (October through June): • Low-level pumping is allowed when river conditions are adequate during the pulse protection period. • Definition: Low-level pumping of up to 6% of total Sacramento River flow at Freeport such that diversions would not reduce bypass flow below 5,000 cfs. No more than a total of 900 cfs can be diverted by all the intakes combined. Low-level pumping can occur in October–November during a pulse protection event and in December–June as defined in the following table. In addition, north Delta diversion levels at all the intakes would be subject to a maximum approach velocity of 0.2 feet per second and a minimum sweeping velocity of 0.4 feet per second at the proposed fish screens. Velocity compliance would be informed by real-time hydrological data measured at the intake locations.

Parameter	Delta Conveyance Project Criteria
	• Pulse triggering, duration, and conclusion is determined based on the criteria defined in the following table. • If the initial pulse begins before December 1, the bypass flow criteria for the month (October and November) when the pulse occurred would take effect, following a pulse protection period. On December 1, the Level 1 rules defined in the following table apply unless a second pulse occurs. • Real-Time Operations: The proposed operations criteria and tidal restoration mitigation are intended to minimize and fully mitigate the potential impacts of the NDD operations. The real time decision-making specific to the NDD operations would be mainly associated with reviewing real-time abiotic and fish monitoring data and ensuring proposed weekly, daily and sub-daily operations are consistent with the permitted criteria and within the effects analyzed in the permits. • Adaptive Management: The Operations Adaptive Management and Monitoring Program would be used to evaluate and consider changes in operational criteria based on information gained before and after the new facilities become operational. This program would be used to consider and address scientific uncertainty regarding the Delta ecosystem and to inform project operations.

cfs = cubic feet per second; NDD = north Delta diversion.
a Sacramento River flow upstream of the intakes to be measured flow at Freeport. Bypass flow is the 3-day tidally averaged Sacramento River flow computed as flow measured at Freeport minus the diversion rate. Sub-daily north Delta intakes' diversion operations would maintain fish screen approach and sweeping velocity criteria.

Table 3-20. Proposed North Delta Diversion Bypass Flow and Pulse Protection Requirements

North Delta Diversion Bypass Flow and Pulse Protection Requirements **This table further details a few of the criteria for the north Delta diversion operations**
Pulse Protection • Low-level pumping would be allowed when river conditions are adequate during the pulse protection period. Initiation of the pulse protection is defined by the following criteria: (1) Sacramento River daily average flow at Wilkins Slough increase by more than 45% within a 5-day period and (2) flow on the 5th day greater than 12,000 cfs. • The pulse protection continues until either (1) Sacramento River flow at Wilkins Slough returns to pre-pulse flow level (flow on first day of 5-day increase), or (2) Sacramento River flow at Wilkins Slough decreases for 5 consecutive days, or (3) Sacramento River flow at Wilkins Slough is greater than 20,000 cfs for 10 consecutive days. After pulse period has ended, operations would return to the bypass flow table (Sub-Table A). • If the initial pulse period begins before Dec 1, then any second pulse that may occur during December through June would receive the same protection, i.e., low-level pumping, resulting in up to two pulses which would receive this protection per water year.
Bypass Flow Criteria • After initial pulse(s), allowable diversion would be subject to Level 1 bypass flow criteria (Sub-Table A) until 15 total days of bypass flows above 20,000 cfs occur. Then allowable diversion

North Delta Diversion Bypass Flow and Pulse Protection Requirements **This table further details a few of the criteria for the north Delta diversion operations**
would be subject to the Level 2 bypass flow criteria until 30 total days of bypass flows above 20,000 cfs occur. Then allowable diversion would be subject to the Level 3 bypass flow criteria.

Sub-Table A. North Delta Diversion Bypass Flow Criteria [a]

Level 1 Bypass Flow Criteria			**Level 2 Bypass Flow Criteria**			**Level 3 Bypass Flow Criteria**		
If Sacramento River flow is over…	**But not over…**	**The bypass is…**	**If Sacramento River flow is over…**	**But not over…**	**The bypass is…**	**If Sacramento River flow is over…**	**But not over…**	**The bypass is…**
DECEMBER THROUGH APRIL ***(Allowable diversion would be greater of the low-level pumping or the diversion allowed by the following bypass flow rules)***								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after low-level pumping	5,000 cfs	11,000 cfs	Flows remaining after low-level pumping	5,000 cfs	9,000 cfs	Flows remaining after low-level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 80% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 60% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 50% of the amount over 9,000 cfs
17,000 cfs	20,000 cfs	16,600 cfs plus 60% of the amount over 17,000 cfs	15,000 cfs	20,000 cfs	13,400 cfs plus 50% of the amount over 15,000 cfs	15,000 cfs	20,000 cfs	12,000 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	18,400 cfs plus 30% of the amount over 20,000 cfs	20,000 cfs	no limit	15,900 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	13,000 cfs plus 0% of the amount over 20,000 cfs

Level 1 Bypass Flow Criteria			Level 2 Bypass Flow Criteria			Level 3 Bypass Flow Criteria		
If Sacramento River flow is over...	**But not over...**	**The bypass is...**	**If Sacramento River flow is over...**	**But not over...**	**The bypass is...**	**If Sacramento River flow is over...**	**But not over...**	**The bypass is...**
MAY ***(Allowable diversion would be the greater of the low-level pumping or the diversion allowed by the following bypass flow rules)***								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after low-level pumping	5,000 cfs	11,000 cfs	Flows remaining after low-level pumping	5,000 cfs	9,000 cfs	Flows remaining after low-level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 70% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 50% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 40% of the amount over 9,000 cfs
17,000 cfs	20,000 cfs	16,400 cfs plus 50% of the amount over 17,000 cfs	15,000 cfs	20,000 cfs	13,000 cfs plus 35% of the amount over 15,000 cfs	15,000 cfs	20,000 cfs	11,400 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	17,900 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	14,750 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	12,400 cfs plus 0% of the amount over 20,000 cfs
JUNE ***(Allowable diversion would be the greater of the low-level pumping or the diversion allowed by the following bypass flow rules)***								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs

Level 1 Bypass Flow Criteria			Level 2 Bypass Flow Criteria			Level 3 Bypass Flow Criteria		
If Sacramento River flow is over…	**But not over…**	**The bypass is…**	**If Sacramento River flow is over…**	**But not over…**	**The bypass is…**	**If Sacramento River flow is over…**	**But not over…**	**The bypass is…**
5,000 cfs	15,000 cfs	Flows remaining after low-level pumping	5,000 cfs	11,000 cfs	Flows remaining after low-level pumping	5,000 cfs	9,000 cfs	Flows remaining after low-level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 60% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 40% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 30% of the amount over 9,000 cfs
17,000 cfs	20,000 cfs	16,200 cfs plus 40% of the amount over 17,000 cfs	15,000 cfs	20,000 cfs	12,600 cfs plus 20% of the amount over 15,000 cfs	15,000 cfs	20,000 cfs	10,800 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	17,400 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	13,600 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	11,800 cfs plus 0% of the amount over 20,000 cfs

BYPASS FLOW CRITERIA FOR JULY THROUGH NOVEMBER		
If Sacramento River flow is over…	But not over…	The bypass is…
July through September		
0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	No limit	A minimum of 5,000 cfs
October and November		
0 cfs	7,000 cfs	100% of the amount over 0 cfs
7,000 cfs	No limit	A minimum of 7,000 cfs

cfs = cubic feet per second.
[a] Level 1, Level 2 and Level 3 Bypass Flow Criteria do not apply July through November. Minimum Bypass Flow Criteria are applicable July through November as described in the table.

3.15.8 Guiding Principles

To ensure that future authorizations of Sites and DCP are consistent with DWR and Reclamation's polices, guidelines, and procedures for its authorization, funding, and operation of water projects, Reclamation and DWR propose the following guiding principles to avoid, minimize and offset adverse effects of the proposed operations to listed species and critical habitat.

Guiding principles inform the upfront development of operational criteria and measures to avoid or minimize effects to listed species and critical habitat, including possible adjustment through adaptive management, that would be analyzed in the subsequent consultations. Current proposed operational criteria will be included and considered through quantitative assessments, as applicable. Potential operational refinements will be informed by the programmatic analysis (e.g., potential need for changes to the DCP Bypass Flow criteria), which will guide subsequent project-level consultations. Adaptive Management is intended to further address outstanding uncertainties up to, and throughout, the operations phase. Implementation goals are included to provide the necessary level of information to inform the programmatic section 7 analysis.

The following guiding principles are relevant to both projects, with some specific application to each project noted. Note that DCP would not create changes to baseline SWP or CVP upstream reservoir operational criteria. The DCP would be operated in a manner that does not impact either DWR or Reclamation's ability to operate upstream reservoirs to meet existing and future criteria and regulations. The guiding principles for regions upstream from the Delta are therefore specific only to Sites.

3.15.8.1 Upper Sacramento River (Sites Only)

Utilize the additional water supply provided by the Sites Project to address adverse effects of the CVP on salmonid and sturgeon habitat in the Sacramento River above the Red Bluff Pumping Plant by:

1. Optimizing the use of Reclamation's storage to facilitate the following:
    a. Enhancing conservation of the cold-water pool in Shasta Lake for use in managing temperatures in salmonid spawning habitat downstream of Keswick Dam particularly in dry water year types;
    b. Enhancing pulse flows envisioned in the biological assessment at appropriate times, particularly in years when natural pulse events are minimal, to stimulate migration of juvenile salmon downstream toward the Delta; and
    c. Stabilizing flow to minimize or preclude losses of salmon redds due to flow fluctuations associated with management of Shasta Lake for fall storage.
2. Implementing additional mitigation actions as necessary and appropriate to improve spawning and rearing habitat for anadromous fish in the Upper Sacramento River.

3.15.8.2 Sacramento River from Red Bluff Pumping Plant to Knights Landing (Sites Only)

1. Implement actions necessary to minimize potential impacts to listed species exposed to diversion facilities.

2. Implement pulse flow criteria to provide migrating anadromous fish an opportunity to migrate past the diversion locations with minimum exposure to diversions.
3. Utilize best available science to establish flow levels necessary to provide migratory and rearing habitat to minimize effects to juvenile anadromous fish survival and facilitate their movement out of the river toward the delta and bays.
4. Find opportunities to develop and/or restore additional side channel habitat to offset adverse effects to salmonid migratory and rearing habitat associated with diversions of flow to Sites Reservoir.

3.15.8.3 Below Knights Landing and in the Delta

1. Operate projects consistent with existing and/or future regulatory requirements in the Delta.
    2. Implement pulse flow criteria to provide migrating anadromous fish an opportunity to migrate past the diversion locations with minimum exposure to diversions and further minimize effects to through-Delta survival.
    3. Utilize best available science to establish flow levels necessary to provide migratory and rearing habitat to minimize effects to juvenile anadromous fish survival and facilitate their movement out of the river toward the delta and bays.
    4. Monitor and mitigate effects of diversions on habitat for Delta pelagic fish species through identification and implementation of opportunities to develop additional habitat (i.e. tidal habitat restoration) to improve productivity of those fish populations.
    5. Monitor and mitigate effects of diversions on migrating anadromous species and their habitat through identification of opportunities to develop additional habitat (i.e. tidal and channel margin restoration) to improve productivity of those fish populations.
    6. Protect habitat conditions supporting listed pelagic and anadromous species, mitigate potential flow related effects of Sites and DCP with habitat restoration developed in coordination with National Marine Fisheries Service (NMFS), Fish and Wildlife Service (FWS), and California Department of Fish and Wildlife (CDFW) to improve productivity of those fish populations.

Sites:

1. Cooperate in the monitoring of the Fremont Weir Big Notch Project to assess what effect, if any, diversions of flow to Sites Reservoir have on the effectiveness of the Big Notch Project in the entrainment of juvenile anadromous fish through the notch on the floodplain habitat in the Yolo Bypass and the passage of anadromous fish from the Yolo Bypass into the Sacramento River. If necessary, implement operational measures to avoid diminishing the performance of the Big Notch Project.

DCP:

1. Implement project operations and maintenance consistent with the proposed project description, as an integrated component of the SWP.

a. Future consultation on Delta Conveyance Project Operations and Maintenance is envisioned to update and align elements of project description with conditions (e.g. regulatory, climate, status of species) in advance of operations of the north Delta diversions.

3.15.8.4 Suisun Bay, San Pablo, and San Francisco Bay

Cooperate with the fisheries resource agencies to monitor effects of diversions to the Sites Reservoir and DCP on the location of X2 and Delta outflow and, as appropriate, identify opportunities to offset adverse effects to critical habitat through appropriate mitigation measures or adaptive management actions.

3.15.9 Adaptive Management

Both Sites and DCP would have adaptive management programs that integrate with the Long-Term Operations adaptive management program and include these general principles:

1. Cooperate with and, as appropriate, participate in ongoing and planned habitat and population monitoring programs conducted by the resource agencies to ensure attainment of information pertinent to assessing the effects on endangered and threatened fish in the action area.
2. Design studies, in cooperation with resource agencies, to test modifications to operations that may be implemented to remedy or lessen unanticipated effects identified by the monitoring program.
3. Cooperate with the resource agencies to evaluate results of studies and determine whether changes in project operations are necessary and appropriate to address unanticipated adverse effects.
4. To the maximum extent possible/appropriate, integrate Sites and DCP adaptive management and monitoring with existing and proposed special studies, monitoring programs, technical teams, adaptive management and structured decision-making processes associated with Long-Term-Operations.
5. Ongoing commitment to collaborative decision-making processes consistent with the LTO adaptive management effort, including reliance on the LTO adaptive management wheel and structured decision-making framework.

Project specific compliance efforts and monitoring would be the responsibility of the individual projects, but there would be a commitment to ongoing coordination and information sharing to support the broader monitoring and adaptive management processes.

The adaptive management program would document all activities associated with the planning phase of adaptive management and describe the process to be followed during the implementation and evaluation and response phases. Project objectives were taken into consideration in identifying where adaptive management would be most effective and applicable for the project. If the proposed project is approved, as appropriate, mitigation measures identified, such as implementation of the habitat creation and restoration actions, would integrate the concept of adaptive management in mitigation plan design, stand-alone site and/or resources specific adaptive management plans.

3.16 Other Activities

Other Activities include action components that are not specifically proposed by Reclamation but would not occur but for the action and that are reasonably certain to occur. These kinds of activities were previously referred to as “interrelated or interdependent” activities. Under the 2019 ESA regulations governing interagency coordination, a proposed action may cause other associated or connected actions, that are now called “other activities” to distinguish them from the proposed Federal action. These activities and their consequences must pass a two-part test of causation and foreseeability, meaning that they would not happen “but for” a Federally proposed action and that they are “reasonably certain to occur”.

Portions of the Winter-run Action Plan (WRAP) meet the two-part test of “but for” and “reasonably certain to occur” for the following reasons: First, the Winter-run Action Plan is a result of agency discussions with the Sacramento River Settlement Contractors for the operations of Shasta Reservoir. Without the new Shasta Operations framework, elements of the WRAP would not have been proposed, thus it meets the “but for” standard. Next, the elements of the WRAP are reasonably certain to occur because the parties to the WRAP have a long history, either individually or together, of advancing science, implementing habitat restoration, reintroducing fish to historic habitats, improving system infrastructure and adaptively managing hatcheries for long-term species needs.

3.16.1 Winter Run Action Plan

3.16.1.1 Introduction

Sacramento River winter-run Chinook Salmon (winter-run) are an iconic species on the Sacramento River, beloved by a wide variety of communities with deep connections to the Sacramento Valley, including local landowners and residents, fishing groups, Native American tribes, and environmental non-governmental organizations (NGOs). Historically, winter-run migrated into the upper Sacramento River and spawned in high elevation tributaries with consistently cold water temperatures throughout the spring, summer, and fall. Prior to the construction of Shasta and Keswick dams, upper tributary dams and diversions above Shasta Dam and Battle Creek were constructed for power generation that limited access to parts of these high-elevation habitats. Construction of Shasta and Keswick dams and changes on Battle Creek further limited access through impaired passage, and only a single population of winter-run remains to spawn at much lower elevations on the Sacramento River below Keswick Dam. Currently, one remaining population of winter-run persists on the Sacramento River downstream of Shasta Dam and is exposed to a wide variety of stressors, including limitations of the availability of cold-water release from Shasta Reservoir during the summer and fall spawning and rearing seasons. Winter-run have been selected as a “species in the spotlight” by the National Marine Fisheries Service (NMFS) to highlight their status among protected species with the greatest risk of extinction in the near future.

The challenges and threats faced by winter-run are diverse and complex. Some of the threats to the species include: changes in flow regime, climate variability, lost and degraded spawning habitat, removal/lack of access to rearing habitat (along the Sacramento River and in the Sacramento-San Joaquin Delta), recurring droughts and related impacts on reservoir storage and temperature management, thiamine deficiency, entrainment into water diversions, pathogens, predation by non-native species, and commercial and recreational fisheries. The extent of threats to winter-run is such that even under periods with good storage and favorable water temperatures, juvenile survival in the Sacramento River can be poor.

This Winter-run Action Plan has been developed collaboratively among representatives from the U.S. Bureau of Reclamation (Reclamation), NMFS, U.S. Fish and Wildlife Service (USFWS), California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), and the Sacramento River Settlement Contractors as an integrated plan to improve the survival and viability of winter-run that functions alongside planned operation of Shasta Reservoir. The intention is to implement the Winter-run Action Plan with other partners including Native American Tribes and NGOs.

3.16.1.2 Plan Priorities

Inspired by the list of threats above, this plan prioritizes implementation of six actions to reduce stressors to the species through a combination of science, fishery actions, infrastructure improvements, and improved habitat quality and access:

1. Thiamine Deficiency Complex Management
2. Reintroduction into Battle Creek and McCloud River,
3. Early Life Stage Survival Science,
4. Temperature Control Device Infrastructure Improvement at Shasta Dam,
5. Modernization of the Livingston Stone National Fish Hatchery, and
6. Habitat restoration and facility improvements.

These high priority actions are described in additional detail in Appendices 1-6. Each appendix provides a brief description of the action, a statement of purpose, an overview of past and current work potential challenges for implementation, milestones, deliverables, permitting requirements, resource needs and commitments, and funding sources. To avoid duplicating effort and maximize efficiency, each of the appendices draws upon existing plans and implementation processes and identifies relevant areas of expertise. These priorities represent the current thinking on actions to reduce winter-run stressors. However, the Winter-run Action Plan is intended to adapt and address other stressors and threats that are identified in the future. The expectation is that collectively these actions will improve the status of winter-run over the next ten years.

3.16.1.3 Goals

The Winter-run Action Plan has been developed as an interdisciplinary and collaborative approach to addressing some of the priority threats to the species. The overarching goals of this plan are:

- Develop a structured and collaborative partnership that includes State and Federal agencies (Reclamation, NMFS, USFWS, DWR, and CDFW), the Sacramento River Settlement Contractors, non-governmental conservation and fishery groups, tribes, and universities;
- Elevate the prominence of priority actions, in addition to operations of Shasta Dam, that are expected to enhance our understanding of winter-run ecology, address key threats to the species, and move forward key infrastructure improvements to support the species;
- Increase abundance, improve population growth rates, maximize diversity, improve resiliency, and prevent extinction of winter-run through implementation of identified actions;
- Collaboratively assess funding needs to implement each of the priority actions, identify available funding sources, and pursue additional funding sources, as needed;
- Work together at a technical and project management level develop plans and implement each priority action, meet the established milestones, and provide timely deliverables.
- Identify resource needs to actively engage and make progress on each identified action according to milestones;
- Communicate early about permitting needs anticipated for each priority action and coordinate throughout permitting processes; and
- Consider links and potential co-benefits to other Chinook salmon runs, as well as other native fishes, during the process to plan and implement priority actions.

3.16.1.4 Partnerships and Governance

As described in Section 3.13, *Governance*, the agencies and partners will dedicate managers from each organization to participate on a Winter-run Action Plan policy team that will coordinate on plan implementation. The purpose of the policy team is to establish policy level coordination and processes for tracking plan goals, priorities, funding, resource needs, milestones and deliverables. The Winter-run Action Plan recognizes that some of the action plan components may be part of separate planning processes and the policy team will evaluate opportunities to utilize existing efforts.

3.16.1.5 Winter-run Action Plan Policy Team

A Winter-run Action Plan Policy Team (WRAP Policy Team) consisting of Agency subdirectors and Partner managers will serve as the policy group for implementing the Winter-run Action Plan. The purpose of the WRAP Policy Team is to establish policy level coordination, leadership and direction for tracking plan goals, priorities related to the WRAP, coordination on resource needs, milestones and deliverables. The WRAP Policy Team will do the following:

1. Coordinate efforts for consultation and/or coordination agreements with Tribes, NGOs and Universities on WRAP action components.
2. Identify opportunities to leverage the ongoing work of existing scientific, habitat and fishery management teams and programs.

3. Review budget annually to identify potential gaps in funding.
4. Track and meet established milestones and deliverables.
5. Track and adjust, as necessary, plan goals and priorities.
6. Identify where sub-teams require additional guidance so that managers may that provide that direction to their participating staff where appropriate.
7. Participants are responsible SHOT members are aware of activities under the WRAP.
8. Coordinate on alternative actions to evaluate.
9. Provide quarterly updates to agency Directors and partner Principals and elevate matters as described under Collaborative Decision Making (separate section of governance TBD).

3.16.1.6 Science Facilitation and Program Support

The WRAP Policy Team will work together to hire a program manager and an independent scientific facilitator to promote scientific collaboration and to address scientific debate and divergent scientific perspectives related to implementation of the WRAP. The WRAP program manager and scientific facilitator will have strong program management skills and a scientific background and/or understanding of the scientific matters related to water resource and protected species management.

The WRAP program manager with direction from the WRAP Policy Team will:

- Implement the WRAP
- Track milestones and deliverables
- Manage meeting schedules and logistics
- Coordinate WRAP-specific working groups
- Identify and track the implementation through existing working groups

The scientific facilitator will work with the WRAP Policy Team to:

- Develop processes to help streamline the development of research proposals and study plans,
- Foster an environment of scientific coordination and knowledge exchange between researchers, agencies, and partners
- Organize and facilitate regular meetings, workshops, and seminars to promote scientific discussions and idea exchange.
- Coordinate the development of briefing materials by researchers
- Identify and bridge gaps between scientific research and effective collaboration
- Summarize the status of discussions by researchers for the WRAP Policy Team

- Help the WRAP Policy Team coordinate with other science programs to leverage opportunities and avoid duplication.
- Coordinate independent review of work products

Chapter 4 California Clapper Rail

4.1 Status of the Species

4.1.1 Legal Status

The California clapper rail (*Rallus longirostris obsoletus*) was federally listed as endangered in 1970 (35 FR 16047).

4.1.2 Critical Habitat

Critical habitat has not been proposed or designated for this species.

4.1.3 Recovery Plan

The Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (U.S. Fish and Wildlife Service 2013b) comprises the most recent recovery plan for California clapper rail. To achieve recovery of California clapper rail, the plan focuses on the restoration and management of restored tidal marshes within four recovery units where the species is known to occur: Suisun Bay Area, San Pablo Bay, Central/South San Francisco Bay, and Central Coast. Downlisting criteria include reducing threats to the species' habitat across the four recovery units, such as through management of invasive plant species and reduction of human disturbance; reducing predation; and protecting the species from other natural or human-made factors known to affect its continued existence by achieving a natural distribution of rails over the entire recovery unit and protecting suitable high marsh/upland habitat. Delisting criteria consist of meeting downlisting habitat protection criteria, implementing Suisun Marsh, San Pablo Bay, and South Bay tidal restoration and conservation plans; meeting downlisting predation criteria; and meeting the downlisting criteria for protecting the species from other natural or human-made factors, revising the Sector San Francisco – Area Contingency Plan to minimize impacts from oil spills, and remediating mercury exposure.

4.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the California clapper rail in 2020 (U.S. Fish and Wildlife Service 2020). The document is incorporated by reference to provide additional information relevant to the status of the species.

4.1.5 Natural History/Biology

This subspecies is one of three in California listed as endangered under the Act. The other subspecies are the light-footed Clapper rail (*R. l. levipes*), which is found in tidal marshes in southern California and northwestern Baja California, and the Yuma Clapper rail (*R. l. yumanensis*), which is restricted to the Colorado River Basin. A detailed account of the taxonomy, ecology, and biology of the California clapper rail can be found in the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013b).

California clapper rails occur almost exclusively in tidal salt and brackish marshes with unrestricted daily tidal flows, adequate invertebrate prey food supply, well-developed tidal channel networks, and suitable nesting and escape cover for refuge during extreme tides. They exhibit strong site fidelity and territorial defense and are considered sensitive to disturbance. They tend to have relatively small average home ranges of 4.7 hectares (11.6 acres) and core use areas of 0.9 hectare (2.2 acres).

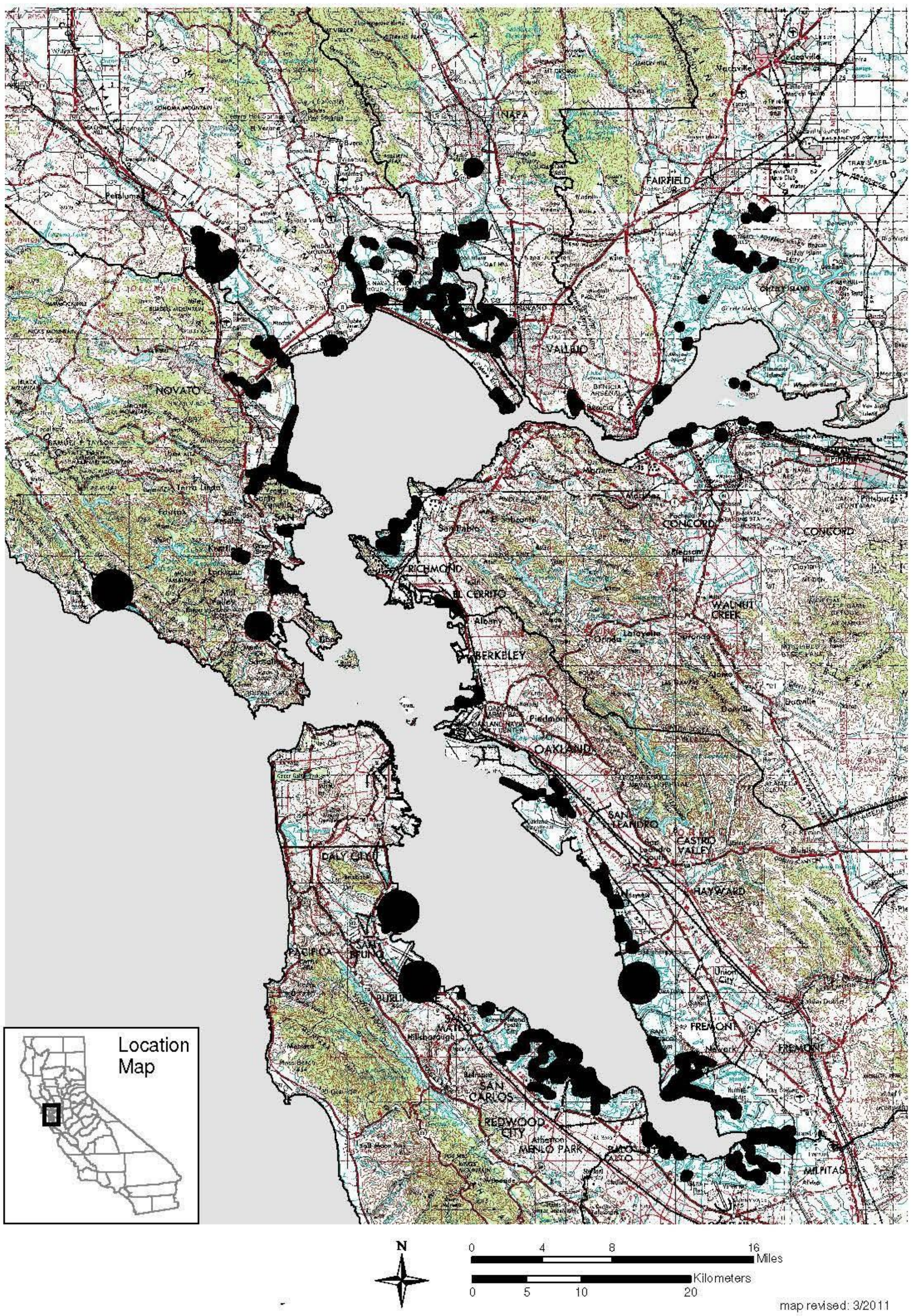
California clapper rail. Source: U.S. Fish and Wildlife Service 2011.

4.1.6 Range-wide Status and Distribution

A five-year review was completed in 2020 (U.S. Fish and Wildlife Service 2020). Historically, the California clapper rail was abundant in all tidal salt and brackish marshes in the San Francisco Bay vicinity, as well as in all of the larger tidal estuaries from Marin to San Luis Obispo counties. Current distribution is restricted almost entirely to the marshes of the Bay Area and where the only known breeding populations occur (U.S. Fish and Wildlife Service 2013b; Figure 4-1).

California clapper rail population numbers have generally fluctuated over time and have never improved to a level warranting consideration for upgrading the status of the species since its original listing as endangered in 1970. Citing various sources, the 2013 five-year review of the California clapper rail reported a population estimated at 4,200 to 6,000 birds between 1971-1975, at only 1,500 birds between 1981-1987, and reaching an estimated all-time historical low of about 500 birds in 1991. The five-year review noted that California clapper rail numbers have rebounded slightly since the early 1990s, but that substantial increases in population may be difficult to achieve due to the current disjunct distribution of their habitat (U.S. Fish and Wildlife Service 2013c). The 2020 five-Year Review estimated range-wide California clapper rail population has increased since the 2013 five-Year Review with an estimated range-wide annual population of 1,192 rail in 2018 (U.S. Fish and Wildlife Service 2020).

The Invasive Spartina Project, a multi-partner, regional non-native Spartina control program, conducts annual San Francisco Bay Estuary-wide California clapper rail surveys at program-associated sites. Annual Invasive Spartina Project California clapper rail surveys at 30 sites across the estuary from 2005-2010 showed an increase from 80 birds in 2005, to 140 birds in 2007, before declining to below 60 birds in 2010 (McBroom et al. 2011). The Invasive Spartina Project has expanded the number of sites included in its rail surveys, and for 158 sites across the estuary from 2010-2015, the project reported fluctuating numbers with 577 rails in 2010, a low of 498 in 2013, and a rebound to 670 birds in 2015 (McBroom 2016).



Source: U.S. Fish and Wildlife Service 2013b.

Figure 4-1. Known Current Distribution of California Clapper Rail.

4.1.7 Threats

Threats to this species include, but are not limited to, habitat destruction and modification, low adult survivorship (ranging from 0.49 to 0.52), and predation of adults and eggs/nestlings (U.S. Fish and Wildlife Service 2013b).

4.2 Environmental Baseline

On-going rail monitoring in the Suisun Marsh by the CDFW has shown sporadic detections (16 individuals sighted during the 2002 – 2019 timeframe) of California clapper rails within the Action Area. This species has been detected at several locations in Suisun Marsh, including occurrences along Suisun Slough, Cutoff Slough, Hill Slough, Goodyear Slough, Rush Ranch, and Ryer Island (U.S. Fish and Wildlife Service 2013a). The USFWS Suisun may represent crucial habitat for this critically endangered subspecies of clapper rail (U.S. Fish and Wildlife Service 2019). According to the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California*, one of the criteria for California clapper rail to be downlisted is to have a minimum of 5,000 acres of contiguous high quality tidal marsh habitat with well- developed channel systems and high-tide refugial/escape cover at the high marsh/upland transition zone and or inner-marsh of the Western Grizzly and Suisun Bays and marshes of Suisun Hill and Cutoff Slough (within the Suisun Bay Recovery Unit) (U.S. Fish and Wildlife Service 2013a, 2013b).

Tidal marshes are fragmented throughout Suisun. The historical tidal marshes in the Suisun Marsh have been leveed and drained for various use over the last 100 years. Out of 70,000 acres (28,330 hectares) of land in Suisun, about 63,260 acres (25,600 hectares) are managed or leveed marshes and 6,670 acres (2,700 hectares) are tidal or muted (restricted) tidal marshes (U.S. Fish and Wildlife Service 2019). These tidal marshes are divided into several larger marshes, such as tidal portions of Solano Land Trust's Rush Ranch (1,040 acres, 420 hectares), CDFW's Hill Slough Wildlife Area (865 acres, 350 hectares), and CDFW's Peytonia Slough Ecological Reserve (520 acres, 210 hectares), as well as many smaller marsh fragments (U.S. Fish and Wildlife Service 2019). The vast majority of California clapper rails do not move more than one kilometer, though post-breeding dispersal may occur in fall and early winter (Albertson and Evens 2000). A California clapper rail was detected by CDFW surveys in 2011 at Rush Ranch (U.S. Fish and Wildlife Service 2019). The vast majority of the California clapper rails are found in the San Pablo and San Francisco Bay, downstream of Suisun Marsh, where water salinities are higher. Salinity influences other variables, such as vegetation and invertebrates. Suisun Marsh is generally too fresh to support vegetation, such as *Spartina foliosa*, which may also contribute to low California clapper rail densities. The USFWS has consulted on numerous consultations in the Suisun Marsh in the Action Area with a majority of the consultations being related to on-going maintenance activities or conversion of managed marsh to another use, such as tidal marsh restoration. The June 2013 *Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and Project-Level Actions in Solano County, California* (File No. 08ESMF00-2012-F- 0602-2) was issued to the U.S. Army Corps of Engineers (USACE) to cover projects that fall under USACE's Regional General Permit, its Letters of Permission, or individual permits in the Suisun Marsh.

4.2.1 Tidal Habitat Restoration

Two thousand acres of tidal habitat restoration have been constructed by DWR. All proposed tidal restoration projects identified by prior consultations on operations have completed site-specific formal consultation; see projects and references below in Table 4-1.

Table 4-1. Tidal habitat restoration projects in the Delta and Suisun Marsh.

Project Name	Number of Acres	Section 7 Consultation	Built
Bradmoor Island and Arnold Slough Restoration Project	Approximately 476 and 141 of restored tidal acres	USFWS 2020 Biological Opinion (File No. 08FBDT00-2020-F-0211) – *Formal Consultation on the Bradmoor Island and Arnold Slough Restoration Projects, Solano County, California* (USACE File No. SPN-2018-00115) and Appending to the June 10, 2013, *Formal Programmatic Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions* (USFWS File No. 08ESMF00-2012-F-0602-2)	In Construction
Decker Island Restoration Project	Approximately 140 of restored tidal acres	USFWS 2018 Biological Opinion (File No. 08FBDT00-2017-F-0042) – *Biological Opinion on Decker Island Tidal Habitat Restoration Project, Solano County, California*	Yes
Lookout Slough Restoration Project	Approximately 3,164 of restored tidal acres	USFWS 2020 Biological Opinion (File No. 08FBDT00-2020-F-0181) – *Formal Consultation on the Lookout Slough Tidal Habitat Restoration and Flood Improvement Project, Solano and Yolo Counties, California* [USACE File No. 408 Permission Section (19477)] USFWS 2021 Biological Opinion (File No. 08FBDT00-2020-F-0181-R001) – *Reinitiation of Formal Consultation on the Lookout Slough Tidal Habitat Restoration and Flood Improvement Project, Solano and Yolo Counties, California* [USACE File No. 408 Permission Section (19477)]	In Construction
Lower Yolo Ranch Restoration Project	Approximately 1,681 of restored tidal acres	USFWS 2019 Biological Opinion (File No. 08FBDT00-2019-F-0276) – *Formal Consultation on the Lower Yolo Restoration Project, Yolo County, California* (USACE File No. SPK-2010-01035)	Yes
Prospect Island Restoration Project	Approximately 1,600 of restored tidal acres	USFWS 2018 Biological Opinion (File No. 08FBDT00-2018-F-0069) – *Formal Consultation on the Prospect Island Tidal Restoration Project, Solano County, California* (USACE File No. SPK-2013-00085) Incidental take associated with the proposed monitoring activities for Prospect Island Restoration Project could result in the harm or mortality of 10 larval, 1 juvenile, and 1 adult delta smelt annually.	In Planning (Construction Start 2024)

Project Name	Number of Acres	Section 7 Consultation	Built
Tule Red Restoration Project	Approximately 420 of restored tidal acres	USFWS 2016 Biological Opinion (File No. 08FBDT00-2016-F-0071) – *Formal Consultation on the Tule Red Tidal Restoration Project, Solano County, California* (USACE File No. 2014-00131S) and Appending to the June 10, 2013, *Formal Programmatic Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions* (USFWS File No. 08ESMF00-2012-F-0602-2)	Yes
Wings Landing Restoration Project	267.02 of restored tidal acres	USFWS 2020 Biological Opinion (File No. 08FBDT00-2020-F-0177) – *Formal Consultation on the Wings Landing Tidal Habitat Restoration Project, Solano County, California* (USACE File No. SPN-2018-00344)	Yes
Winter Island Restoration Project	Approximately 384.4 of restored tidal acres	USFWS 2019 Biological Opinion (File No. 08FBDT00-2019-F-0079) – *Biological Opinion for the Winter Island Tidal Habitat Restoration Project, Contra Costa County, California* (USACE File No. SPN-2017-00146)	Yes
Yolo Flyway Farms Restoration Project	Approximately 278 of restored tidal acres	USFWS 2017 Biological Opinion (File No. 08FBDT00-2016-F-0101) – *Formal Consultation on the Yolo Flyway Farms Restoration Project, Sacramento County, California*	Yes

Across the tidal habitat restoration projects in the Delta and Suisun Marsh listed above, approximately 3,170.42 acres of tidal habitat have been restored, approximately 3,781 acres are in construction, and approximately 1,600 acres are in planning. The total acreage of all stages of tidal habitat restoration is approximately 8,551.42 acres.

The overall primary purpose of these restoration projects is to protect, restore, and enhance intertidal and associated subtidal habitat to benefit listed fishes through increased food web production. Restoration projects result in short term construction related effects and may result in permanent habitat loss for upland terrestrial species. However, as the restored areas evolve over time into a functioning tidal marsh, restoration projects are expected to provide benefits through increased exports of nutrients and food to adjacent open water, and potentially provide physical delta smelt rearing habitat.

The Suisun Marsh Habitat Management, Preservation and Restoration Plan (SMP) is a comprehensive plan designed to address the various conflicts regarding use of Marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and wetland activities. The SMP is intended to guide near-term and future actions related to restoration of tidal wetlands and managed wetland activities.

The following Biological Opinion documents the impacts to federally listed terrestrial species:

- USFWS 2013 Biological Opinion (File No. 0SESMF00-2012-F-0602)–-Transmittal of Final Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California

The USFWS SMP Biological Opinion described the tidal wetland restoration actions, specifically levee breaching, initially would result in the establishment of tidal open water habitat. Tidal wetland vegetation would establish as sediment accrues over time. Effects of tidal marsh restoration will be dispersed in space and time. As the restored area evolves into a functioning, vegetated tidal wetland, it is expected to provide permanent suitable and sustainable habitat for federally listed species in Suisun Marsh. Specifically, as the restored area evolves into a functioning tidal marsh, it is expected to provide indirect benefits to fish species through increased exports of nutrients and food to adjacent open water areas. SMP Restoration activities would benefit the actual or available primary productivity of Suisun Marsh as a whole by increasing nutrient exchange and nutrient turnover rates. Restoration activities would include the construction of habitat levees that include benches or berms, which would provide opportunities for the establishment of high marsh/upland transition habitat. Ground disturbing activities, such as levee maintenance and dredging, may result in the harassment, harm, injury, or death of federally listed species within Suisun Marsh. Also, there could be a temporary loss of foraging habitat as a result of construction-related activities throughout the Marsh.

4.3 Effects of the Proposed Action

4.3.1 Suisun Marsh Salinity Control Gates (Proposed Flow Changes)

The Suisun Marsh Salinity Control Gates (SMSCG) are being proposed to direct more fresh water in the Suisun Marsh to improve habitat conditions for Delta smelt in the region. Depending on the timing of the proposed operations (up to 120 days between June 1st and December 1st), SMSCG operations may overlap with the California clapper rail late breeding season and potential presence in the Suisun Marsh. California clapper rails can breed from late February to August (U.S. Fish and Wildlife Service 2013c). California clapper rails hunt mussels, crabs, and clams (U.S. Fish and Wildlife Service 2013b) whose distribution and abundance could be influenced by large changes in salinity over an extended period of time. SMSCG reoperations are expected to temporarily lower marsh salinities in action years (example of change in salinity for below normal year is shown in Figure 4-2 through Figure 4-7) which may, to an unknown extent, create a potential shift in clapper rail prey base availability and distribution in Suisun Marsh. Due to the limited temporal scale of the Proposed Action (60-120 days), the variability of existing salinities, as well as the variability created between years when the Proposed Action is implemented and years when it is not, the effects from SMSCG operations are presumed discountable due to the minimal impacts to the prey base for this species.

7/01/2012 to 7/14/2012

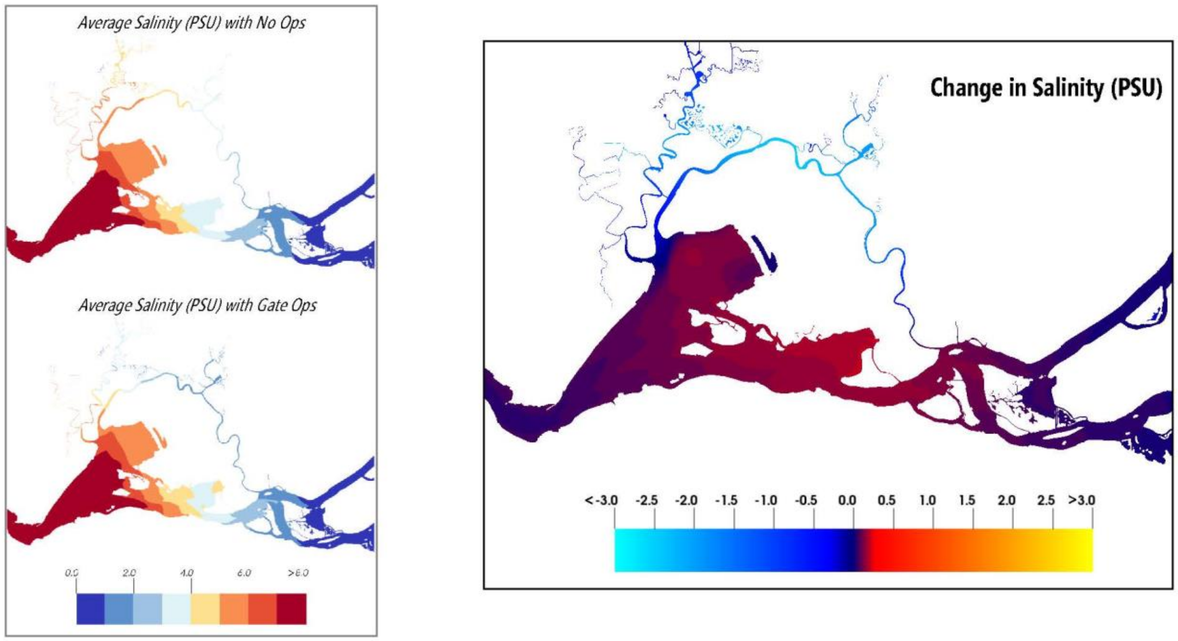


Figure 4-2. SMSCG Operation 2012 Example - BN Year (1/6)

7/15/2012 to 7/28/2012

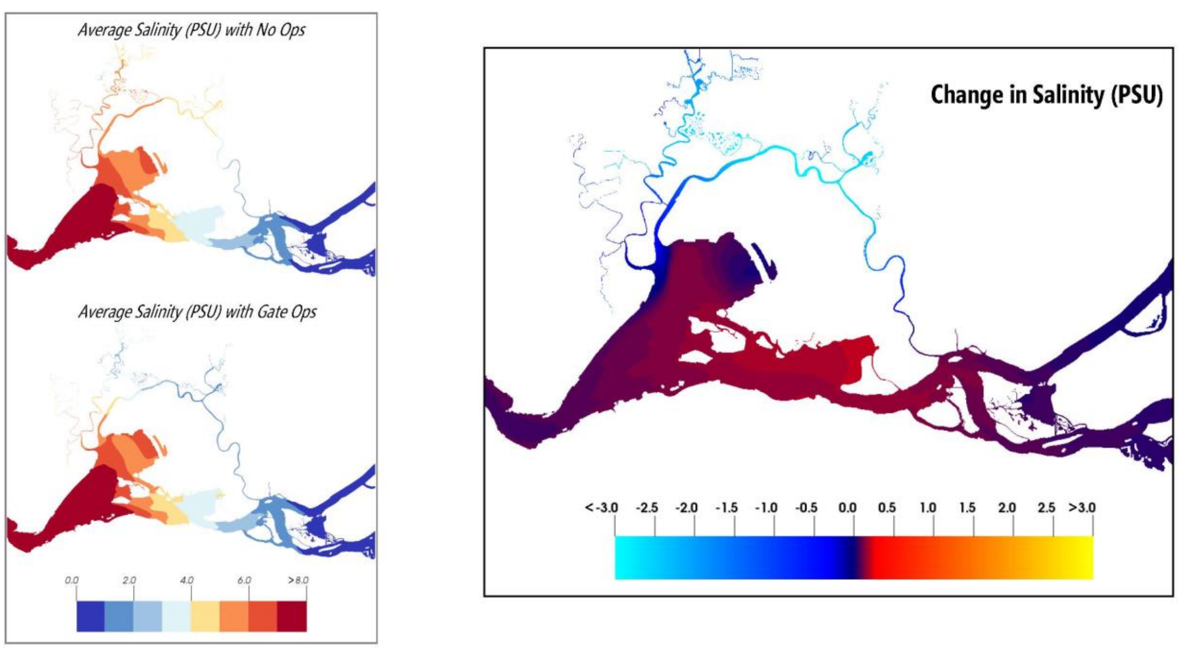


Figure 4-3. SMSCG Operation 2012 Example - BN Year (2/6)

7/29/2012 to 8/11/2012

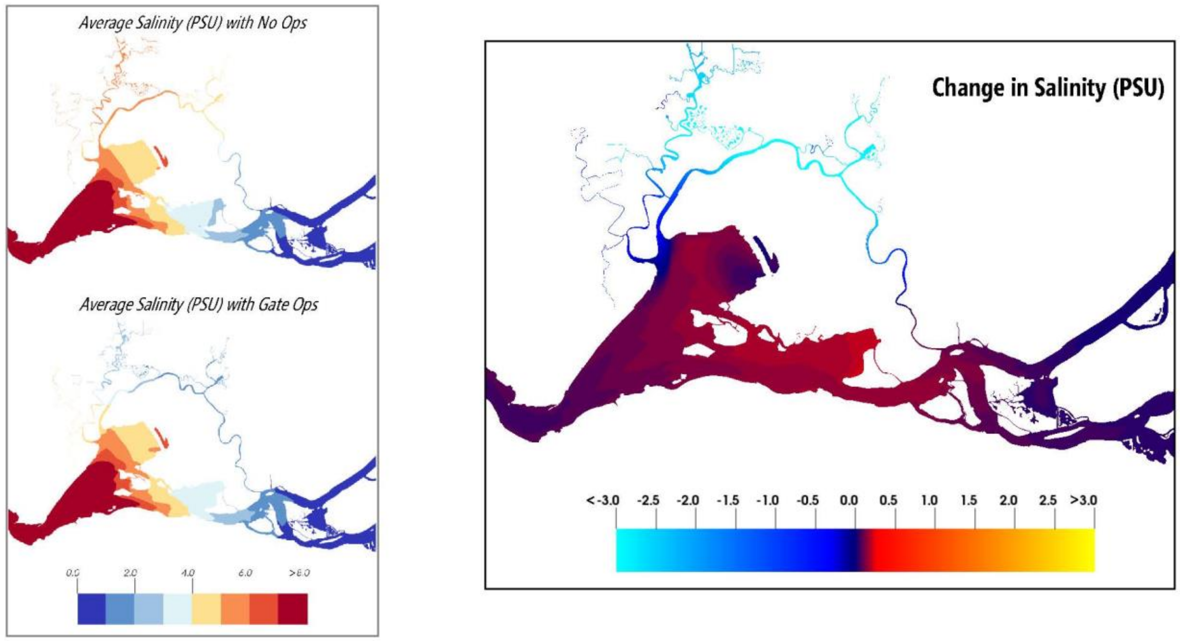


Figure 4-4. SMSCG Operation 2012 Example - BN Year (3/6)

8/12/2012 to 8/25/2012

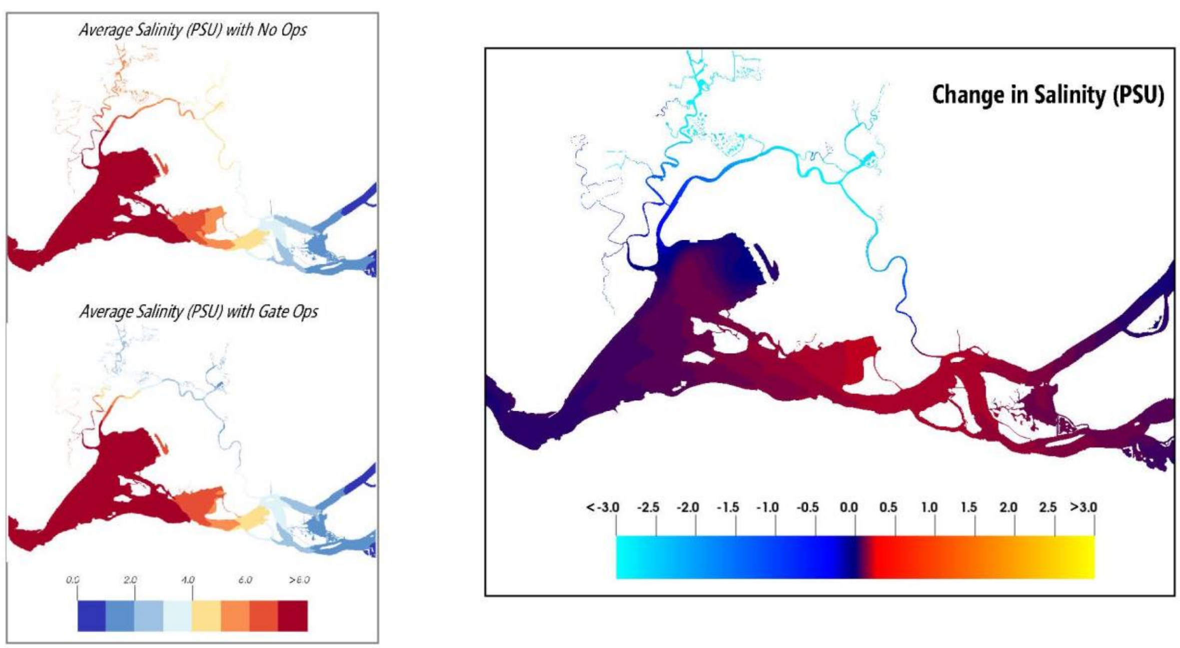


Figure 4-5. SMSCG Operation 2012 Example - BN Year (4/6)

8/26/2012 to 9/08/2012

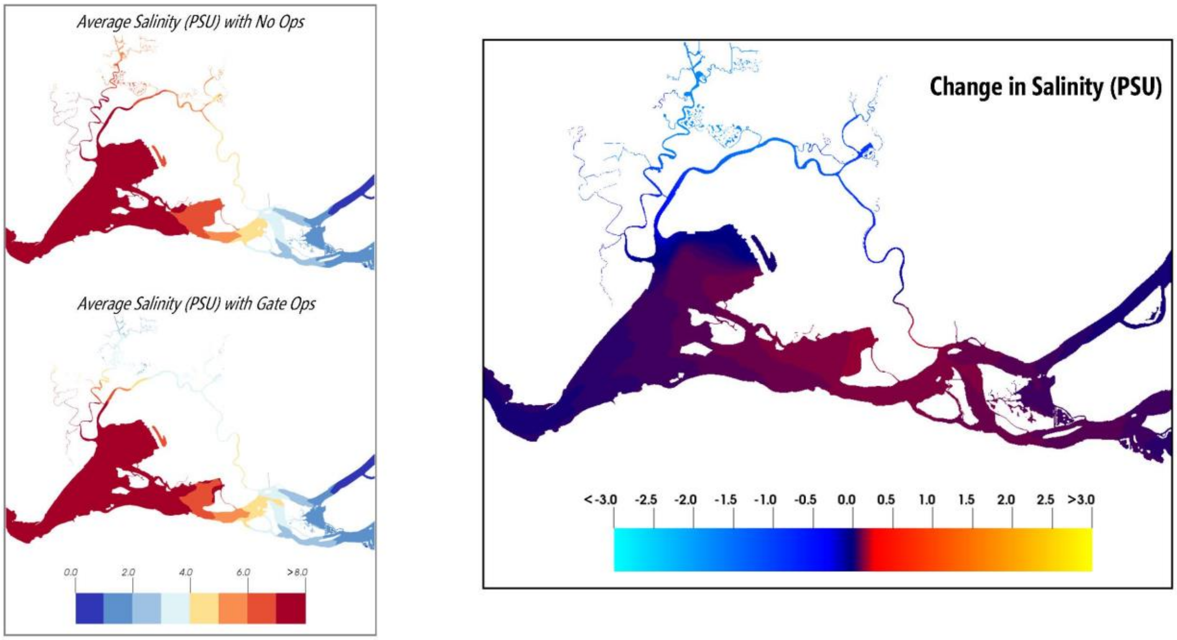


Figure 4-6. SMSCG Operation 2012 Example - BN Year (5/6)

9/09/2012 to 9/22/2012

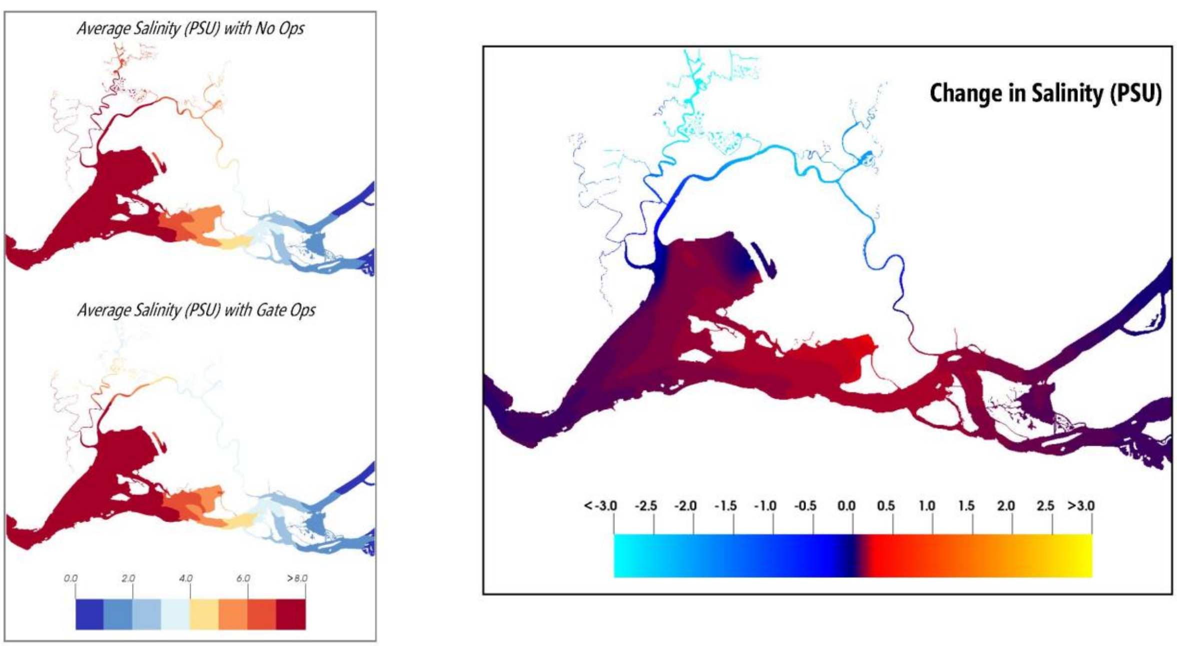


Figure 4-7. SMSCG Operation 2012 Example - BN Year (6/6)

4.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the California clapper rail and are reasonably certain to occur in the Action Area.

4.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" California clapper rail. The proposed flow changes to the SMSCG may result in a shift in the prey base within the Suisun Marsh but this is a speculative risk and thought to result in discountable impacts that would not result in the incidental take of individuals of this species. The risk is considered speculative due to the limited temporal scale of the Proposed Action (60-120 days), the variability of existing salinities in the Suisun Marsh, as well as the variability created between years when the Proposed Action is implemented and years when it is not.

4.6 References

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Chapter 5 California Least Tern

5.1 Status of the Species

5.1.1 Legal Status

The USFWS listed the California least tern as endangered on June 2, 1970 (35 FR 8491 8498).

5.1.2 Critical Habitat

Critical habitat has not been proposed or designated for this species.

5.1.3 Recovery Plan

The USFWS issued a revised recovery plan for the species in 1985 (U.S. Fish and Wildlife Service 1985). The primary goals outlined in the 1985 Recovery Plan for the California least tern are to prevent extinction and return the California least tern population to a stable, non-endangered status (U.S. Fish and Wildlife Service 1985). The USFWS stated that reclassification to threatened status may be considered if 1,200 breeding pairs in California occur in 15 secure management areas with a 3-year mean reproduction rate of 1.0 (one fledgling per breeding pair) (U.S. Fish and Wildlife Service 1985).

5.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the California least tern in 2020 (U.S. Fish and Wildlife Service 2020). The document is incorporated by reference to provide additional information relevant to the status of the species.

The California Least Tern five-year review recommendation was that the California least tern be reclassified from endangered to threatened due to some reduction of impacts of threats and increase in population, recognizing that threats had not been reduced to the point that California least terns would be secure without intensive, site-specific management. (U.S. Fish and Wildlife Service 2006).

5.1.5 Natural History/Biology

A detailed account of the taxonomy, ecology, and biology of the California least tern is presented in the approved recovery plan for this species (U.S. Fish and Wildlife Service 1985).

California least terns forage in nearshore oceans, harbors, marina channels, tidal estuarine channels, and sheltered shallow bays (Atwood and Kelly 1984). Adults forage mostly within 2 miles of breeding colonies, and at many sites foraging is primarily in nearshore ocean waters less than 60 feet deep (U.S. Fish and Wildlife Service 1985). They feed on small fish that they catch by plunging into the water from flight. In a study of fish dropped by California least tern at 10 nesting areas, researchers found 49 species of fish, all individuals less than one year old.

Northern anchovy (*Engraulis mordax*) and silverside species (*Atherinidae*) represented 67 percent of the total sample (Atwood and Kelly 1984).

California least terns are migratory colonial nesters, usually arriving in breeding areas by late April and departing again in August (Massey 1974). After the initial nesting period that begins on their arrival in April, a second wave of nesting may occur from mid-June to early August. These are mainly re-nests after initial failures and second year birds nesting for the first time (Massey and Atwood 1981). Nesting California least terns usually occupy a sand-shell beach relatively free of plant growth (Massey 1974). The nest is typically a shallow, round depression, constructed by a bird sitting and kicking its feet backwards while rotating its body. This may occur several times before an egg is laid (Massey 1974; Wolk 1974). Terns may use “sideways building” after scrape construction, which consists of the sitting bird reaching out with its bill to pick up additional nest material, such as small shells and shell fragments, and depositing them into the nest (Wolk 1974).

Early in the breeding season, California least terns display night roosting behavior. Prior to incubation, terns will sleep at night at varying distances from the nesting sites. Once incubation begins, birds roost at night on the nest. Terns use roosting sites away from breeding colonies prior to egg laying, apparently for predator avoidance. By not sleeping within the colony until eggs are laid, the terns may delay the colony being discovered by a nocturnal predator by 2 to 3 weeks (U.S. Fish and Wildlife Service 1985). California least terns begin incubation after laying the first egg. Both parents participate in incubation, which lasts 20 to 25 days (Massey 1974). Clutch size ranges from one to three eggs, with two eggs being most common (Massey 1974; Ehrlich et al. 1988).

Least tern chicks are semi-precocial (capable of a high degree of independent activity from birth) and are fed small fish by parents within hours of hatching (Massey 1974; Ehrlich et al. 1988). Chicks will begin leaving the nest in one to two days (Massey 1974) and fledge at approximately 20 days. Juveniles and adults will fish, loaf, preen, and roost together for several weeks after fledging; adults will continue to feed juveniles during this period (Massey 1974).

California least terns leave nesting areas by August to spend winter months along the west coast of Baja California, the west coast of Mexico, and further south, possibly from the Gulf of California to Guatemala (American Ornithologists’ Union 1957; U.S. Fish and Wildlife Service 1985; Thompson et al. 1997).

California least tern. Source: U.S. Fish and Wildlife Service 2004.

5.1.6 Range-wide Status and Distribution

For the most recent comprehensive assessment of the species' range-wide status and distribution, please refer to the California Least Tern (*Sterna antillarum browni*) Five-Year Review: Summary and Evaluation (U.S. Fish and Wildlife Service 2020). Additionally, in 2009 the USFWS published a Spotlight Species Action Plan for the California least tern (U.S. Fish and Wildlife Service 2019).

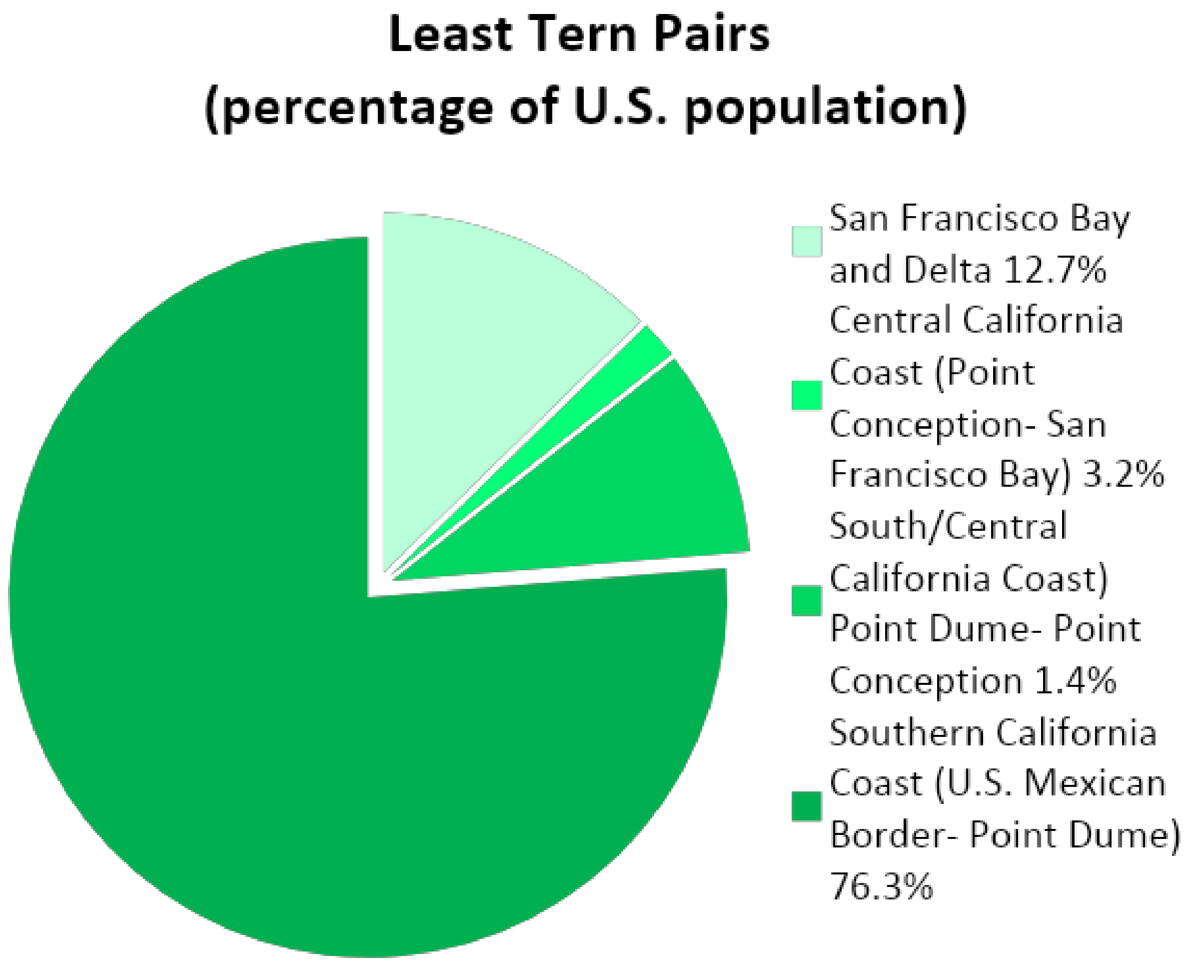
Least terns nest along the California coast and the Pacific coast of the Baja California Peninsula, Mexico (Figure 5-1). On the Baja California Peninsula, least terns nest at sites from Ensenada de la Paz in the north to San José del Cabo in the south (Patten and Erickson 1996).

Wintering grounds remain poorly described, but include coastal mainland Mexico, Guatemala, Baja California, Costa Rica, and possibly Peru (Atwood and Minsky 1983; Howell and Webb 1995; Vaucher 1988; U.S. Fish and Wildlife Service 2019; Schulenberg et al. 1987).

The least tern population has not been intensively studied in Mexico; however, surveys of the Pacific coast of the Baja California Peninsula between 2006 and 2008 did document breeding activity at eight colonies estimating 261 adults and 141 nests (Rosemartin and Van Riper III 2012).

Source: U.S. Fish and Wildlife Service 2019.
Note: Multiple nest sites may be used within the depicted nesting areas.

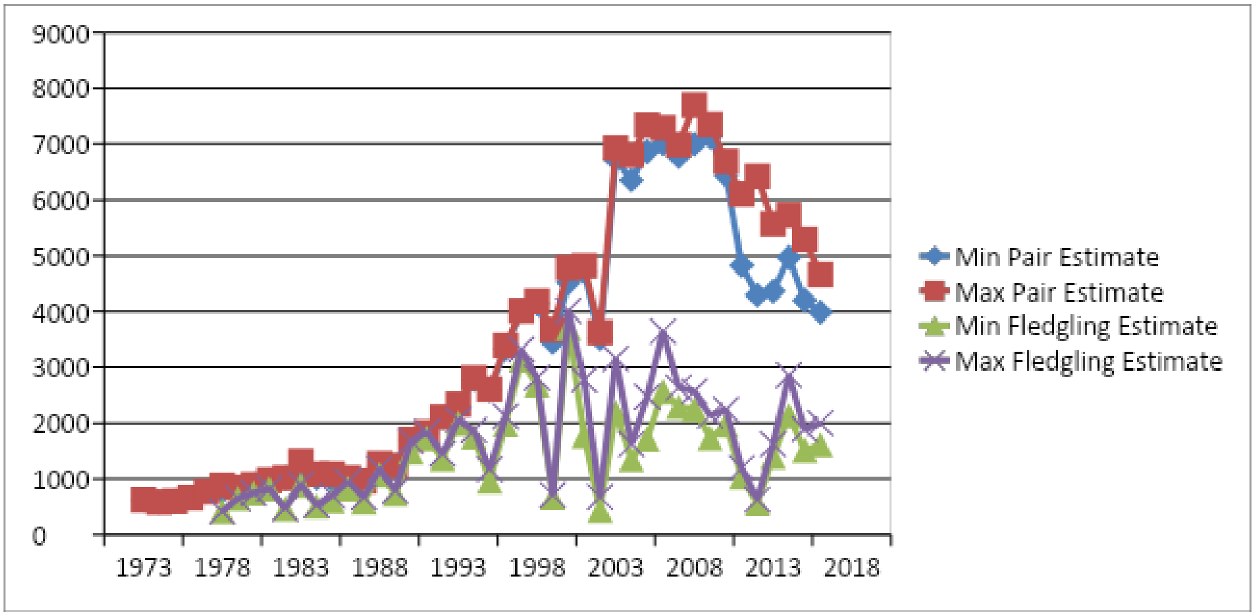
Figure 5-1. United States Nesting Areas of the California Least Tern (*Sternula antillarum browni*), 2016.



Source: Frost 2016.
Note: Data derived from minimum pair estimates in Frost 2016. Southern California includes San Diego, Orange, and Los Angeles Counties.

Figure 5-2. 2016 Distribution of California Least Tern (*Sternula antillarum browni*) Nesting Pairs by Region.

United States surveys from 1971 to 1973 found 624 pairs of least terns at 19 nesting areas in California (Bender 1974a, 1974b). As conservation measures were implemented throughout the 1970s, 1980s, and into the 1990s, the number of least terns increased, peaking at an estimated 7,100 least tern pairs in 2009 (Marschalek 2010). An abundant food supply and active conservation measures, particularly predator management, likely contributed to the observed population growth. Between 2010 and 2016, there was a significant decline in the number of least terns observed. The estimated number of least terns decreased to 6,437 pairs in 2010 (Marschalek 2011), and by 2016 had dropped to estimated 3,989 to 4,661 pairs (Frost 2017), just over half of the 2010 population estimate. The cause of the population decline appears to be reduced productivity, which had been reported beginning in approximately 2001 (Figure 5-3).



Source: California Department of Fish and Wildlife annual reports (Bender 1974a, 1974b; Atwood et al. 1977; Atwood et al. 1979; Gustafson 1986; Massey 1988, 1989; Johnston and Obst 1992; Obst and Johnston 1992; Caffrey 1993, 1994, 1995, 1997, 1998; Keane 1998, 2000, 2001; Patton 2002; Marschalek 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012; Frost 2014, 2015, 2016).
Note: Statewide surveys with unified methods began in 1973; reliable chick counts began in 1978.

Figure 5-3. Minimum and Maximum Estimations of Breeding Pairs and Fledglings Produced for the California Least Tern (*Sternula antillarum browni*) in the United States.

5.1.7 Threats

At the time of listing, scientists recognized destruction and degradation of nesting habitat as two of the primary threats facing the California least tern (Craig 1971). While many least tern nest sites are now afforded protection, some remain vulnerable to destruction associated with development pressure, and many suffer degradation as a result of close proximity to urbanization (U.S. Fish and Wildlife Service 2006). Threats identified in the California Least Tern: Five-Year Review include coastal development, human population growth, and intensified use of beaches, which increase the potential for human activities and disruption in the vicinity of nest sites. The best available scientific and commercial data indicate that the magnitude of these threats will continue to increase as the population in California continues to grow. In addition, climate change, changes in vegetation cover on nesting sites, limited food availability, and predation can result in direct and indirect impacts to the least tern.

Additionally, since the issuance of the five-year status review, studies and observations continue to see the effects of lower forage fish supply and reduced numbers of breeding pairs and productivity due to El Niño Southern Oscillation Events. With larger storms and tides, loss of breeding areas and washed out nests are likely to increase in the future.

5.2 Environmental Baseline

Nesting has occurred sporadically with an increase in inland sites from the Bay Area toward the Delta and Central Valley (U.S. Fish and Wildlife Service 2006). Low detections of California least terns have been documented in the Action Area within Suisun Marsh (California Department of Fish and Wildlife 2023). A breeding colony has been documented on the east side of Montezuma Slough near Collinsville in 2006, at a Montezuma Wetlands dredge disposal site. After initially being sighted at Montezuma in 2005, California least terns nested at the site in 2006 and 2007. In summer 2005, approximately 15 to 20 California least terns were observed on a shell mound in Cell 3/4. The next year, California least terns nested on another shell mound in Cell 3/4. The California least terns nested successfully at the project site in 2006 and have nested each year since then. Table 5-1 below presents the number of breeding California least terns observed at the site between 2006 and 2018. More recent observations, including in 2023, of California least terns at Montezuma Wetlands indicate that the species continues to breed at this location (eBird 2023).

Table 5-1. California Least Terns Observed at Montezuma Wetlands Dredge Disposal Site.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Nests	45	31	35	27	17	15	31	29	16	16	6	9	18
Chicks	not counted	16	24	17	23	1	42	19	4	21	5	8	17
Fledglings	not counted	6	11	7	5	0	18	2	1	0	1	5	0

The USFWS has consulted on numerous consultations in the Suisun Marsh in the Action Area with a majority of the consultations being related to on-going maintenance activities or conversion of managed marsh to another use, such as tidal marsh restoration. The June 2013 *Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and Project-Level Actions in Solano County, California* (File No. 08ESMF00-2012-F- 0602-2) was issued to the USACE to cover projects that fall under the USACE's Regional General Permit, its Letters of Permission, or individual permits in the Suisun Marsh.

5.2.1 Tidal Habitat Restoration

Across the tidal habitat restoration projects in the Delta and Suisun Marsh listed in Table 4-1, approximately 3,170.42 acres of tidal habitat has been restored, approximately 3,781 acres are in construction, and approximately 1,600 acres are in planning. The total acreage of all stages of tidal habitat restoration is approximately 8,551.42 acres.

The overall primary purpose of these restoration projects is to protect, restore and enhance intertidal and associated subtidal habitat to benefit listed fishes. Restoration projects result in short term construction related effects and permanent habitat loss for upland terrestrial species. However, as the restored areas evolve over time into a functioning tidal marsh, restoration projects are expected to provide benefits through increased exports of nutrients and food to adjacent open water, and provide potential physical delta smelt rearing habitat.

The SMP is a comprehensive plan designed to address the various conflicts regarding use of Marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and managed wetland activities. The SMP is intended to guide near-term and future actions related to restoration of tidal wetlands and managed wetland activities.

The following Biological Opinion documents the impacts to federally listed species:

- USFWS 2013 Biological Opinion (File No. 0SESMF00-2012-F-0602) – Transmittal of Final Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California

The USFWS SMP Biological Opinion described the tidal wetland restoration actions, specifically levee breaching, initially would result in the establishment of tidal open water habitat. Tidal wetland vegetation would establish as sediment accrues over time. Effects of tidal marsh restoration will be dispersed in space and time. As the restored area evolves into a functioning, vegetated tidal wetland, it is expected to provide permanent suitable and sustainable habitat for federally listed species in Suisun Marsh. Specifically, as the restored area evolves into a functioning tidal marsh, it is expected to provide indirect benefits to fish species through increased exports of nutrients and food to adjacent open water areas. SMP Restoration activities would benefit the actual or available primary productivity of Suisun Marsh as a whole by increasing nutrient exchange and nutrient turnover rates. Restoration activities would include the construction of habitat levees that include benches or berms, which would provide opportunities for the establishment of high marsh/upland transition habitat. Ground disturbing activities, such as levee maintenance and dredging, may result in the harassment, harm, injury, or death of federally listed species within Suisun Marsh. Also, there could be a temporary loss of foraging habitat as a result of construction-related activities throughout the Marsh.

5.3 Effects of the Proposed Action

5.3.1 Suisun Marsh Salinity Control Gates (Proposed Flow Changes)

The SMSCG are being proposed to direct more fresh water in the Suisun Marsh to improve habitat conditions for Delta smelt in the region. Depending on the timing of the proposed operations (up to 120 days between June 1st and December 1st), SMSCG operations may overlap with the California least tern late breeding season and potential presence in the Suisun Marsh to forage. California least terns are migratory colonial nesters, usually arriving in breeding areas by late April and departing again in August (Massey 1974). California least terns hunt smaller fish such as silversides, perch, anchovies, small crustaceans, and other smaller fish (U.S. Fish and Wildlife Service 1985) whose distribution and abundance could be influenced by large changes in salinity over an extended period of time. SMSCG reoperations are expected to temporarily lower marsh salinities (example of change in salinity for below normal year is shown in Figure 4-2 through Figure 4-7) creating a potential shift in the prey base availability in Suisun Marsh (U.S. Fish and Wildlife Service 2019). However, foraging is readily available in the Suisun

Marsh to the California least tern. Adverse effects to California least terns are not expected to occur due to the minor anticipated change in prey base and the readily available forage.

5.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the California least tern and are reasonably certain to occur in the Action Area.

5.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" California least tern. The proposed flow changes to the SMSCG may result in a shift in the prey base within the Suisun Marsh, but this is a speculative risk and thought to result in discountable impacts that would not result in the incidental take of individuals of this species. The risk is considered speculative due to the limited temporal scale of the Proposed Action (60-120 days), the variability of existing salinities in the Suisun Marsh, as well as the variability created between years when the Proposed Action is implemented and years when it is not.

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Chapter 6 Least Bell's Vireo

6.1 Status of the Species

6.1.1 Legal Status

The USFWS listed the least Bell's vireo as endangered on May 2, 1986 (51 FR 16474).

6.1.2 Critical Habitat

Critical habitat was designated for least Bell's vireo on February 2, 1994, consisting of ten units across Santa Barbara, Ventura, Riverside, and San Diego counties (59 FR 4845). Critical habitat does not occur within the Action Area; therefore, it will not be addressed further in this Biological Assessment.

6.1.3 Recovery Plan

The draft recovery plan for the least Bell's vireo (U.S. Fish and Wildlife Service 1998) describes a strategy for securing and managing riparian habitat within its historical breeding range; the USFWS also recommended annual monitoring, range-wide surveys, and research to monitor and guide recovery. Specifically, the draft recovery plan recommends the criteria for achieving threatened status as stable or increasing populations or metapopulations, each consisting of several hundred or more breeding pairs that are protected and managed at 11 sites along the central and southern California coast and in the vicinity of Anza Borrego in the desert. Recommended delisting criteria include meeting the goal for threatened status, establishing increasing populations or metapopulations along the Salinas River and in the San Joaquin and Sacramento valleys, and a reduction or elimination of threats to the point where least Bell's vireo populations can persist without significant human intervention.

6.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the least Bell's vireo in 2006 (U.S. Fish and Wildlife Service 2006). The document is incorporated by reference to provide additional information relevant to the status of the species. The following paragraphs provide a summary of the relevant information in the five-year review. Unless otherwise noted, all of the following information is from the five-year review.

In the five-year review, the USFWS recommended revising the status of the species from endangered to threatened because of a ten-fold increase in abundance since listing, expansion of breeding locations throughout southern California, and conservation and management of suitable breeding habitat throughout its range. By 2005, the USFWS was aware of approximately 2,968 known territories in the United States with the greatest increases in San Diego and Riverside counties. The number of pairs in Orange, Ventura, San Bernardino, and Los Angeles counties also increased substantially; a few isolated individuals and breeding pairs have also been observed in Kern, Monterey, San Benito, and Stanislaus counties. Since publication of our five-year review, surveys have detected breeding territories along the Amargosa River in the northern

Mojave Desert (U.S. Fish and Wildlife Service 2019) and Whitewater Canyon, Chino Canyon, and Mission Creek in the Coachella Valley (Hargrove et al. 2014). According to the USFWS, the increase in the abundance of least Bell's vireos since the listing is primarily due to efforts to reduce threats such as loss and degradation of riparian habitat and parasitism by brown-headed cowbirds. The control of invasive plants has also increased the amount of suitable habitat available for nesting.

The five-year review also contained several recommendations for future management of the least Bell's vireo. These recommendations are to finalize a recovery plan for the least Bell's vireo with realistic, objectively based recovery goals; provide funding and technical support for further studies investigating continuing threats from parasitism by brown-headed cowbirds and invasion of riparian habitats by exotic plants, and potentially elevated predation pressures due to habitat fragmentation or presence of exotic predators; develop and implement a systematic program to survey the Salinas, San Joaquin, and Sacramento Valleys and inform future management; and develop systematic survey programs for watersheds in southern California that are not regularly surveyed within a given five-year period.

Since the completion of the five-year review, the USFWS has issued numerous Biological Opinions that addressed effects of Federal actions on the least Bell's vireo; the Biological Opinions concluded that the actions were not likely to jeopardize the continued existence of the least Bell's vireo primarily due to avoidance of construction impacts during the breeding season. Most of these Biological Opinions addressed effects from urban development, transportation, military readiness, and utility transmission projects. Five Biological Opinions addressed regional-scale habitat conservation plans (HCPs) regarding urban development and conservation of listed species using an ecosystem-level planning approach. These regional plans identify conservation targets, monitoring needs, and adaptive management strategies for the least Bell's vireo. These plans are expected to provide long-term protection, monitoring, and management of core occurrences of vireos in Kern, Riverside, Orange, and San Diego counties. The five-year review does not discuss water infrastructure projects such as dams, in-channel diversions, or flow alternation with regard to the threats it may pose to least Bell's vireos. The five-year review noted that in many situations where riparian habitat is impacted by authorized Federal and State actions, an equal or greater amount of riparian habitat is restored (i.e., through active planting and maintenance of riparian habitat) or enhanced (i.e., through giant reed [*Arundo donax*] and other exotic plant removal) to offset the impacts. Development adjacent to riparian zones is a threat to the species. Vireo territories bordering on agricultural and urban areas are less successful in producing young than territories bordering on native upland plant communities (Kus 2002).

West Nile virus may affect some groups of birds disproportionately, either temporarily or persistently (George et al. 2015). For example, George et al. (2015) found that red-eyed vireos (*Vireo olivaceus*) "experienced significant declines in survival associated with the arrival of [West Nile virus], followed by recoveries to pre-[West Nile virus] levels. Conversely, warbling vireos (*Vireo gilvus*) experienced smaller annual declines in survival than red-eyed vireos after the arrival of West Nile virus but the survival rate continued to decline in subsequent years. We do not know how West Nile virus would affect the least Bell's vireo over time.

6.1.5 Natural History/Biology

Least Bell's vireo is one of four subspecies of Bell's vireo and is the only subspecies that breeds entirely in California and northern Baja California. All *Vireo bellii* individuals in California (aside from the far southeastern edge of the state) are reasonably certain to be members of the Federal and State protected least Bell's vireo subspecies (Klicka et al. 2016). Large-scale loss of habitat reduced the number of sites where it breeds and curtailed its numbers; nest parasitism by the brown-headed cowbird (*Molothrus ater*) reduced nesting success within much of the remaining breeding habitat. At the time of listing, the USFWS estimated that 300 territorial males remained in the United States.

Least Bell's vireo. Source: USFWS 2010.

6.1.6 Reproduction

The main impediments to successful reproduction for least Bell's vireos are nest parasitism by brown-headed cowbirds and availability of suitable breeding habitat. Continued management of brown-headed cowbirds and restoration of riparian habitat is likely to allow for the continued successful reproduction of the least Bell's vireo within its current breeding range in southern California.

Brown headed cowbirds are abundant throughout the Central Valley where there is an ample supply of ruderal habitat and the nests of host bird species. Brown-headed cowbirds are an invasive species and were not recorded west of the Colorado River before 1870. Their range expanded west and north at a rapid rate through the early 1900s (Laymon 1987). The extent of cowbird management in the Central Valley and its effectiveness is unknown.

There are two necessary habitat features for least Bell's vireo to breed: (1) the presence of dense cover within 1-2 meters of the ground, where nests are typically placed; and (2) a dense, stratified canopy for foraging (Goldwasser 1981; Gray and Greaves 1981; Salata 1983; USFWS 2019). Least Bell's vireo will nest in a variety of plant species, provided that the overall habitat structure is present. A major component of habitat structure is willow species of various ages across the landscape. Young willows and sandbar willows provide dense cover from the ground up to several meters. As Goodding's black willow (*Salix gooddingii*), red willow (*Salix laevigata*), and arroyo willow (*Salix lasiolepis*) grow, larger branches lift the canopy over California wild rose (*Rosa californica*), poison oak, California blackberry, and California grape creating a layered structure for nesting and foraging. Least Bell's vireo may attempt as many as five nests in a breeding season (March 15 to July 15), although most fledge young from only one or two nests. The likelihood of re-nesting depends on the time of season, the pair's previous reproductive effort, the success of previous efforts, and other factors. Few nests are initiated after mid-July.

The recent invasion of the polyphagous shot hole boring beetle (*Euwallacea fornicates*) into southern California riparian habitats is a new threat that could adversely affect the recovery of least Bell's vireo. The boring beetle and its fungal associates in the genus *Fusarium* have decimated the structural component of least Bell's vireo habitat by targeting black willow, red willow, and arroyo willow stems over one-inch diameter. Sprouting willow shoots provide vireo habitat structure, but are recolonized by the beetle when stems resprout from the roots. Least Bell's vireo occupancy has declined in riparian habitats decimated by the shot hole boring beetle (U.S. Fish and Wildlife Service 2019). Birds were not previously banded in areas with significant habitat reduction, thus there is no record of where displaced vireos dispersed. Although the boring beetle has impacted high quality riparian habitat throughout San Diego County, the least Bell's vireo population in southern California has remained somewhat stable.

6.1.7 Numbers

Intensive surveys for least Bell's vireo have not been conducted across the Central Valley in recent years. The USGS collects data from biologists conducting surveys for the least Bell's vireo; various workers survey some areas regularly and other results are acquired from surveys that are conducted in support of other activities (e.g., monitoring, preparation of environmental documents for development reviews, etc.). Additionally, not all sites are surveyed every year and the precise locations of surveys may vary from year to year. Consequently, the numbers of territorial males in the following table (Table 6-1) do not represent a trend; they do, however, indicate that least Bell's vireos have greatly increased in abundance since the time of listing.

Table 6-1. Estimated Number of Territorial Male Least Bell's Vireos Based on Survey Data Compiled by the Riparian Birds Working Group.

Year	Number of Territorial Males
2003	1,604
2004	2,098
2005	2,068

Year	Number of Territorial Males
2006	1,823
2007	2,088
2008	2,521
2009	3,075
2010	3,280
2011	2,917
2012	2,455
2013	2,597
2014	2,477
2015	2,833
2016	2,844

Source: U.S. Fish and Wildlife Service 2019.

Extensive riparian habitat exists on private lands throughout the Sacramento River Watershed within the Central Valley that is not regularly monitored by avian ecologists; therefore, the numbers and distribution of least Bell's vireo in the Central Valley is relatively unknown. Vireos were observed nesting at the San Joaquin River National Wildlife Refuge (SJRNWR) in 2005 and 2006 (Wood et al. 2006; Howell et al. 2010), and were observed attempting to establish territory in lower Putah Creek in 2011 (U.S. Fish and Wildlife Service 2019), but no populations are known to have established.

6.1.8 Distribution

Least Bell's vireo had a historical distribution that extended from coastal southern California through the San Joaquin and Sacramento Valleys as far north as Tehama County near Red Bluff (Kus 2002). The Sacramento and San Joaquin Valleys were the center of the historical breeding range supporting 60 to 80% of the population (51 FR 16474). At the time of Federal listing in 1986, over 99% of the least Bell's vireo population was found south of Santa Barbara County (U.S. Fish and Wildlife Service 2006) and limited to only 300 breeding pairs (U.S. Fish and Wildlife Service 1998).

Historically, the least Bell's vireo was a common breeder in riparian habitat throughout coastal southern California and the Central Valley, including the San Joaquin Valley to the south and the Sacramento Valley to the north (U.S. Fish and Wildlife Service 2019; Grinnell and Miller 1944). Although once one of the most abundant species in California, measurable population declines were observed in the Sacramento and San Joaquin valleys as early as the 1930s (Grinnell and Miller 1944). Data on least Bell's vireos from the 1940s through the 1960s are lacking, but extensive surveys of the Central Valley in the late 1970s did not detect a single individual (Goldwasser et al. 1980).

The current distribution of the least Bell's vireo has increased to some degree since its listing in 1986, although it remains absent from large parts of its former range in the Central Valley. Least Bell's vireos have spread through riparian habitat in southern California and small numbers of birds have begun to venture into central coastal California, the southern Central Valley, and the Mojave Desert. Distribution of least Bell's vireos is likely to continue to increase slowly in the future.

6.2 Environmental Baseline

The species is beginning to recolonize its historic range in central and northern California and is known to occupy habitat within the Action Area (Table 6-2).

The drastic decline of the species in the Action Area is likely a direct result of habitat loss. From the 1800s to the 1970s, there was a 95% loss of riparian habitat in the Central Valley (Katibah 1984). Current estimates for riparian vegetation within the Central Valley are still fractions of historic totals despite restoration and enhancement projects. The Sacramento Valley region currently contains 67,897 acres (27,477 hectares) of riparian vegetation (15.9% of the pre- 1900 riparian area). The Yolo-Delta region currently contains 32,870 acres (13,302 hectares) (13.9% of the pre-1900 area). The San Joaquin Valley region currently contains 24,948 acres (10,096 hectares) (12.6% of the pre-1900 area) (Dybala et al. 2017). Major contributing factors to the loss of riparian habitat throughout the Action Area include hydrologic regulation and decreased flows in rivers from dams, in-channel water diversions, and groundwater pumping, construction of flood control levees and bank protection, conversion of riparian zones to agriculture and grazing, timber harvest, mining, and urbanization (Katibah 1984; Dybala et al. 2016).

The disturbances that led to the current state of riparian forests in the Action Area are not limited to discrete events resulting in immediate and drastic changes to the system, but also include actions that result in continuous, on-going effects with compounding impacts to riparian ecosystems. When the system has a long history of human alteration, the environment slides farther from historical conditions into the future. Without addressing these effects over time, environments with a long history of human alteration will incrementally lose natural attributes and move closer to a more completely human-dominated landscape that lacks the structure or function to support natural ecosystem processes (Fremier et al. 2014). This transition has been observed and modeled in rivers within the Action Area. While major changes were reported during the construction and initial operation of major CVP projects in the mid 1900s, continued shifts in vegetation community composition in terms of dominant species, age, canopy height, and patch sizes (Greco et al. 2007; Greco 2013) and changes in channel morphology (U.S. Fish and Wildlife Service 2019) have been documented in recent decades. The effects of dam-induced reduction of mean annual peak discharge flow (CALFED Bay-Delta Program 2000), reduction of flood discharge volume (Greco 2013), reduction in stream power (U.S. Fish and Wildlife Service 2019), sediment starvation (U.S. Fish and Wildlife Service 2019), and reduced bank erosion rates and overbank deposition (U.S. Fish and Wildlife Service 2019) all contribute to changes to successional riparian forest ecosystems. As the ability of the river channel to migrate laterally is restricted by reductions in stream power from dams and water diversions (Larsen et al. 2006; Fremier et al. 2014) and the quantity of new land production is continuously reduced, the amount of new pioneer riparian forests is subsequently decreased (Greco et al. 2007; Greco 2013; Dufour et al. 2014). This is evident by the lower fraction of early successional riparian vegetation, which the least Bell's vireo is dependent upon for breeding, along the Sacramento and San Joaquin rivers in areas where restoration or active management actions have not been undertaken to maintain plant diversity (U.S. Fish and Wildlife Service 2019; Howell et al. 2010; Greco 2013; Dufour et al. 2014).

In recent years, there have been a number of observations of adult least Bell's vireos and nesting activity in central and northern California, indicating the species is attempting to recolonize the Central Valley. Additionally, recent modeling of habitat suitability suggests that parts of the Central Valley are highly suitable for least Bell's vireos (Klicka et al. 2016). However, the least Bell's vireo population in Central and Northern California has remained very low. Limited suitable habitat between the species' stronghold in the riparian corridors of southern California and suitable restored habitats in the Central Valley may be limiting the ability of the species to disperse and recolonize the northern extent of its historic range.

From 1993 to 2016, there was an average of 1.3 least Bell's vireo observations in Central and Northern California per year (Howell et al. 2010). Table 6-2 contains a summary of all confirmed occurrences of least Bell's vireos within the counties included in the Action Area. The only place within the Action Area with confirmed successful nesting is the SJRNWR in Stanislaus County. In restored riparian habitat in SJRNWR, there were successful nesting events by a pair of vireos in 2005 and 2006, along with an unsuccessful nesting attempt in 2007 (Howell et al. 2010). A single male exhibiting territorial breeding behavior was observed in the refuge on multiple occasions in 2012 and 2016. The bird observed in 2016 was documented utilizing both restored riparian habitat and non-restored habitat including the edges of a dirt road and almond orchard. Two singing males were detected in the Yolo Bypass Wildlife Area (YBWA) in mid-April 2010, and again in 2011 (U.S. Fish and Wildlife Service 2019). No least Bell's vireos have been detected in the Yolo Bypass since 2011, although a single individual was detected southeast of the Yolo Bypass in the Bufferlands – Upper Beach Lake in 2013 (eBird 2023) Based on these recent observations, the USFWS has updated the current mapped range of the species to include the breeding areas in Yolo County and the SJRNWR (U.S. Fish and Wildlife Service 2019).

Table 6-2. Summary of Records of Least Bell's Vireo in Counties in or Abutting the Action Area, 1985–2023.

County	Year	Count	Months Present	Notes	Source
Marin	1985	1	Non-breeding season		USFWS 2019
Sacramento	1993	1	Non-breeding season		USFWS 2019
Sacramento	1995	1	Non-breeding season		USFWS 2019

County	Year	Count	Months Present	Notes	Source
Santa Cruz	1996	1	May		eBird 2023
Santa Clara	1997	2	Breeding season (April–August)	Breeding pair, success of nest unknown	USFWS 2019
Santa Clara	2001	3	May	Same area as 1997 observation	California Department of Fish and Wildlife 2023
Merced	2004	1	Non-breeding season		USFWS 2019
Solano	2005	1	Breeding season (April–August)		USFWS 2019
Stanislaus	2005	4	June	Breeding pair and two fledglings in SJRNWR	Howell et al. 2010
Contra Costa	2005	1	May		eBird 2023
San Francisco	2005	1	November		eBird 2023
Stanislaus	2006	5	July	Breeding pair and three fledglings in SJRNWR	Howell et al. 2010
Sacramento	2006	1	August		eBird 2023
Fresno	2006	1	January	Lost Lake Recreation Area	eBird 2023 (unpublished Point Reyes Bird Observatory data)
Santa Clara	2006	1	May	Pajaro River estuary	USFWS 2019
San Joaquin	2006	1	August	Dry Creek	eBird 2023
Stanislaus	2007	1	May	Unsuccessful breeding attempt in SJRNWR	Howell et al. 2010
San Francisco	2009	1	June	Southeast Farallon Island	eBird 2023
Merced	2010	1-2	May–July	San Luis National Wildlife Refuge	eBird 2023
San Mateo	2010	1-2	May, June	Bedwell Bayfront Park- Menlo Park	eBird 2023
Yolo	2010	2	April–August	YBWA, Putah Creek. 2 singing males, birds observed carrying nesting materials.	eBird 2023, California Department of Fish and Wildlife 2023
Yolo	2011	2-3	May – June	YBWA, Putah Creek	eBird 2023

County	Year	Count	Months Present	Notes	Source
Santa Cruz	2011	1	September	Natural Bridges State Park (coast)	eBird 2023
Merced	2012	2	May–July	Merced National Wildlife Refuge	eBird 2023
Stanislaus	2012	1	May–July	SJRNWR	eBird 2023
Sacramento	2013	1	April	Bufferlands- Upper Beach Lake	eBird 2023
Sonoma	2015	1	October	Campbell Cove	eBird 2023
Kings	2015	1	May	Lockhart's Corner (next to canal)	eBird 2023
Santa Clara	2016	1	May	Gold Street Ponds (next to Bay)	eBird 2023
Stanislaus	2016	1	June	SJRNWR	Howell et al. 2010
San Joaquin	2017	1	May	Near Mokelumne River	eBird 2023
Contra Costa	2018	2	June	Bradford Island, multiple sightings. Confirmed 1 male bird, sex of 2nd bird unconfirmed	eBird 2023
Merced	2018	1	May	Los Banos Waterfowl Management Area	eBird 2023
Contra Costa	2019	1	June–July	Bradford Island, multiple sightings.	eBird 2023
Contra Costa	2020	1	May, August	Bradford Island, multiple sightings. August sighting noted adult with begging young	eBird 2023
Contra Costa	2023	1	May	Bradford Island, multiple sightings.	eBird 2023

Conservation actions have been undertaken within the Action Area to improve habitat for least Bell's vireos. The specific habitat needs of least Bell's vireos for nesting, including willow-dominated riparian woodland with dense understory vegetation maintained, in part, in a non-climax stage by periodic floods or other agents (U.S. Fish and Wildlife Service 2019), are not addressed in all riparian restoration projects. A habitat suitability model developed for least Bell's vireos identified that nesting birds typically use riparian vegetation with dense and layered canopy over 26 feet (8 meters) tall, with highest foliage density within 3-6 feet (1-2 meters) of the ground where they place their nests (Kus 1998). In evaluating riparian restoration sites in southern California, Kus (1998) found that many restoration sites only partially matched the habitat suitability model, including sites with patches that were suitably dense but failed to meet the canopy height requirement or sites where trees were suitably tall but lacked sufficient understory. Without active management (e.g., occasional mowing, burning, flooding, etc.) or restoration of natural ecological processes, such as hydrological and fire regimes, to maintain appropriate successional stages of riparian vegetation restoration projects may not provide suitable habitat for least Bell's vireos long-term (Howell et al. 2010; Dybala et al. 2016). The design and implementation of the restoration sites utilized for nesting by least Bell's vireos in SJRNWR incorporated recommendations from the Riparian Bird Conservation Plan (Riparian Habitat Joint Venture 2004), the Endangered Species Recovery Program (California State University–Stanislaus), and the SJRNWR comprehensive conservation plan (U.S. Fish and

Wildlife Service 2006) for providing suitable habitat for riparian nesting songbirds (Howell et al. 2010).

The least Bell's vireo is a priority species for the Central Valley Project Conservation Program (CVPCP). The CVPCP is managed by Reclamation to support projects to protect, restore, and enhance special-status species and their habitats affected by the CVP (U.S. Fish and Wildlife Service 2019). One example of a CVPCP funded restoration project designed to provide nesting habitat is Dos Rios Ranch, however no least Bell's vireos have been observed in the project area since implementation (Dybala et al. 2016). The USFWS also supports conservation efforts for least Bell's vireo with grants made from the Cooperative Endangered Species Conservation Fund's ESA grants. At least one project within the Action Area has received grant funding through the USFWS to support least Bell's vireo recovery. In 2016, the Yolo County HCP received a $820,660 Habitat Conservation Planning Assistance Grant from the USFWS to protect and enhance land within the Action Area for the conservation of least Bell's vireo, along with 11 other species (U.S. Fish and Wildlife Service 2019). The Yolo County HCP was signed in 2018 and is now being implemented.

Riparian corridors within the Action Area currently have the potential to support populations of least Bell's vireo during breeding and migration (Howell et al. 2010; Klicka et al. 2016). Least Bell's vireos rarely over-winter in California and are not anticipated to regularly occupy habitat in the Action Area between November and March. Based on recent observations of attempted and successful breeding, restored and managed riparian habitats along the San Joaquin and Sacramento Rivers are currently playing an important role in the dispersal of the species from southern California back into its historic range in the Central Valley. While the species does not have a final recovery plan, the USFWS has established delisting criteria, including "stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, having become established and are protected and managed at the following sites: Salinas River, a San Joaquin metapopulation, and a Sacramento Valley metapopulation" (U.S. Fish and Wildlife Service 1998, 2006). While it is possible that a few more least Bell's vireo breeding territories are dispersed across the region than what has been reported, this delisting criterion is far from being met. The USFWS has not yet completed a population viability analysis for least Bell's vireo, nor a final recovery plan. However, researchers have attempted to model the potential response of the least Bell's vireo population within the Action Area to large-scale riparian restoration. Dybala et al. (2017) estimated that the population of least Bell's vireos across the Sacramento Valley, San Joaquin Valley, Tulare Basin, and Yolo Basin-Delta could increase to between 1,000 and 10,000 individuals within 10 years if 31,923 acres (12,919 hectares) of riparian habitat were restored. The researchers also predicted the species could be become resilient within 100 years if 460,848 acres (186,499 hectares) were restored (Dybala et al. 2017). Within the Action Area, the least Bell's vireo is likely in the beginning phases of reoccupation of its Central Valley breeding habitat from which it has been extirpated since the 1970s.

6.2.1 San Joaquin River Restoration Program

The San Joaquin River Restoration Program (SJRRP) is a multi-agency effort to restore self-sustaining fish populations to the San Joaquin River, focusing on threatened spring-run Chinook salmon. The restoration area stretches for 150 miles of the San Joaquin River, from the base of

Friant Dam to the confluence with the Merced River. The SJRRP was established in late 2006 to implement the Stipulation of Settlement in *Natural Resources Defense Council et al. v. Kirk Rodgers et al.* Authorization for implementing the Settlement is provided in the San Joaquin River Restoration Settlement Act (Public Law 111-11).

The following Biological Opinion documents the impacts to terrestrial federally listed species:

- USFWS 2012 Biological Opinion (File No. 08ESMF00-2012-F-0125) – Formal Consultation and Conference Report Under Section 7(a)(2) of the Endangered Species Act on the San Joaquin River Restoration Program

6.3 Effects of the Proposed Action

6.3.1 Sacramento River

6.3.1.1 Seasonal Operations

Least Bell's vireo does not currently occupy breeding habitat in the upper Sacramento River and is unlikely to recolonize the area during the timeframe of the Proposed Action. However, changes to the riparian habitat throughout the vireo's historic breeding range in central California may affect the population's ability to disperse and colonize new areas beyond the current breeding habitats occupied in southern California.

The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the Sacramento River (Figure 6-1). Periodic flooding and erosion are important to maintaining non-climax stage willow-dominated riparian woodlands. Seasonal operations may reduce natural variability beyond major flood events. Figure 6-2 shows the probability that a particular peak flow rate will be exceeded in a given year based on the action taken. Seasonal operations under the Proposed Action will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable vireo habitat over time. Additionally, the proposed seasonal operations may increase the likelihood that invasive riparian plants will survive dry summer and fall conditions and persist long-term.

Changes in flow and operations may result in indirect impacts to least Bell's vireo through changes in riparian habitats if the species recolonizes the Sacramento River Valley during the Proposed Action's timeframe. However, the proposed changes are unlikely to produce a measurable change in quantity or quality of least Bell's vireo habitat in the upper Sacramento watershed due to the minimal change in hydrological conditions associated with the Proposed Action, and there is no apparent mechanism by which these changes could result in harm to individual least Bell's vireos. In addition, the Proposed Action may provide benefits to the species through high fall flows, avoiding drought stress in riparian or wetland vegetation, and by keeping more constant spring flows and avoiding erosion at restoration sites.

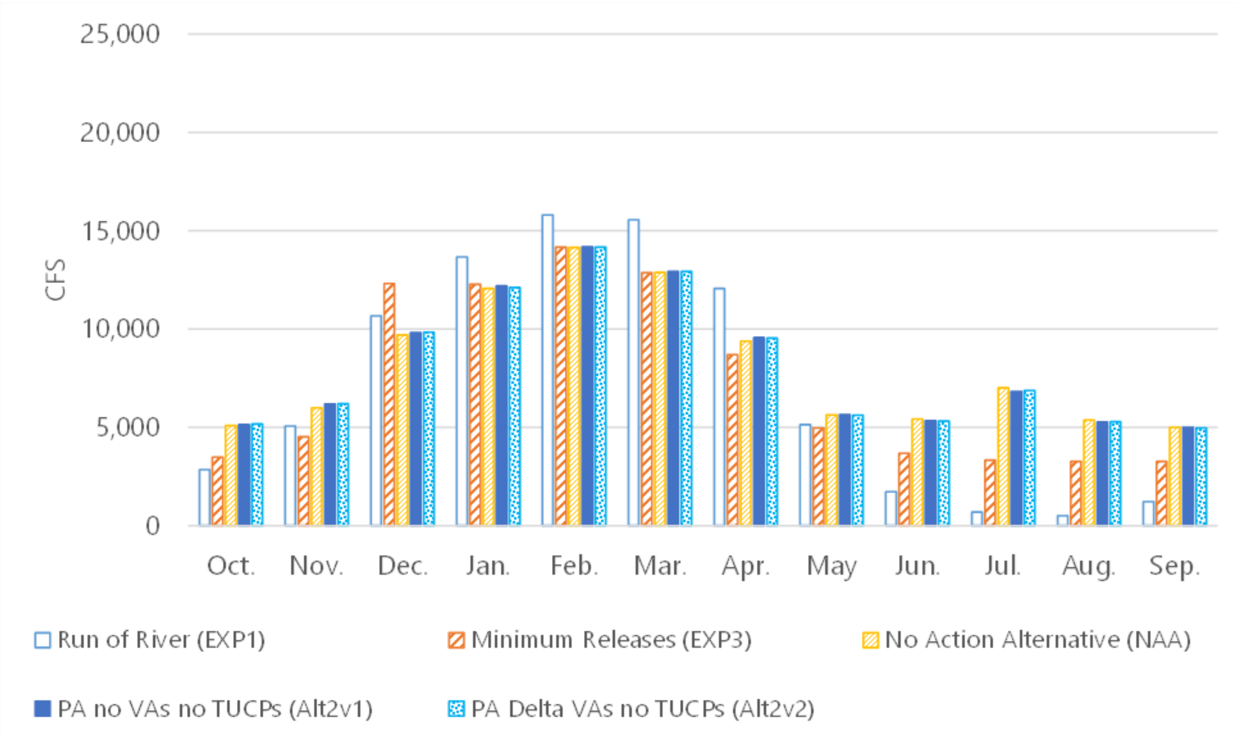

Figure 6-1. Sacramento River at Wilkins Slough Monthly Flows, All Water Year Types

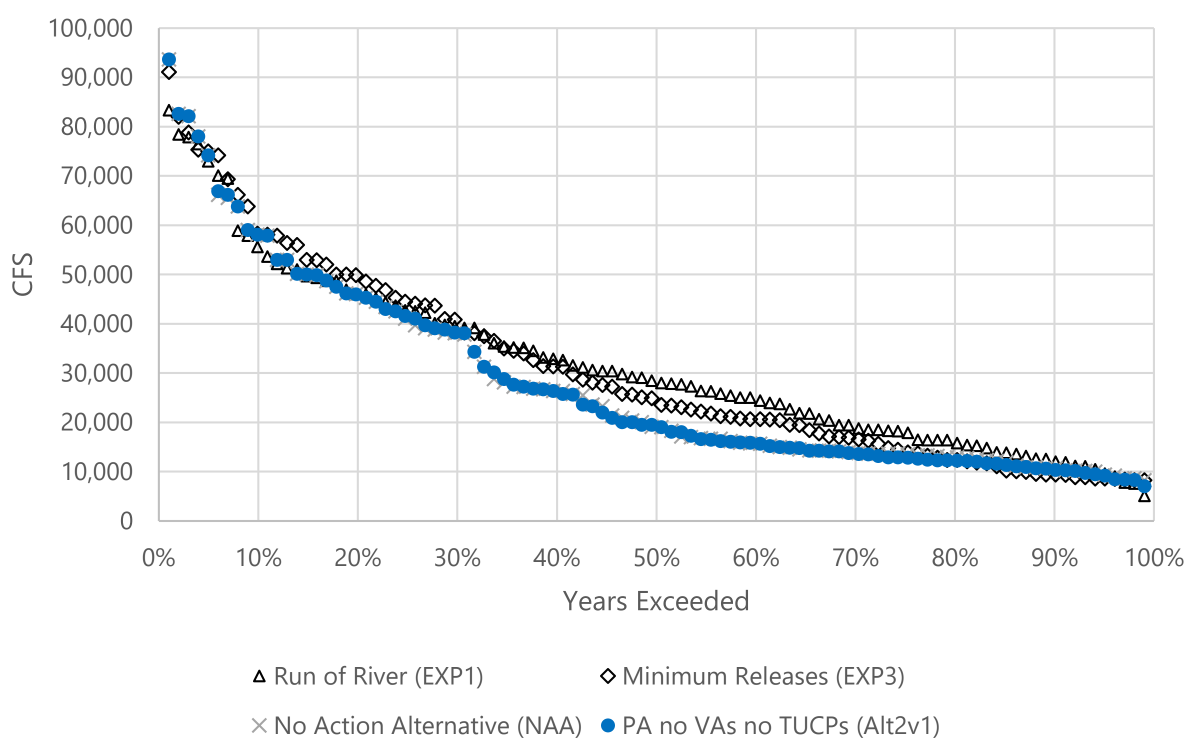

Figure 6-2. Sacramento River at Bend Bridge Annual Peak Flow Frequency

6.3.2 Stanislaus River

6.3.2.1 Seasonal Operations

Least Bell's vireo does not currently occupy breeding habitat in the Stanislaus River. However, the USFWS believes there is a moderate-to-high potential for the species to recolonize the area during the timeframe of the Proposed Action based on past successful breeding in the SJRNWR near the confluence of the San Joaquin and Stanislaus Rivers (U.S. Fish and Wildlife Service 2019). Changes to the riparian habitat throughout the vireo's historic breeding range in central California may affect the population's ability to disperse and colonize new areas beyond the current breeding habitats occupied in southern California.

The Proposed Action includes proposed summer flow changes on the lower Stanislaus River (Figure 6-3). Periodic flooding and erosion are important to maintaining non-climax stage willow-dominated riparian woodlands. The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. Seasonal operations may reduce natural variability beyond major flood events. Figure 6-4 shows the probability that a particular peak flow rate will be exceeded in a given year based on the action taken. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable vireo habitat over time. Additionally, proposed seasonal operations may increase the likelihood that non-native invasive plant species will survive and persist.

Changes in flow and operations associated with the Proposed Action may result in indirect impacts to least Bell's vireo through changes in riparian habitats if the species recolonizes the Central Valley during the Proposed Action's timeframe. However, the proposed seasonal operations are unlikely to produce a measurable change in quantity or quality of least Bell's vireo habitat in the upper Stanislaus watershed due to the minimal change in hydrological conditions associated with the Proposed Action, and there is no apparent mechanism by which these changes could result in harm to individual least Bell's vireos. In addition, the Proposed Action would provide benefits to the species' habitat by avoiding drought stress in riparian or wetland vegetation, and by keeping more constant spring flows and avoiding erosion at restoration sites.

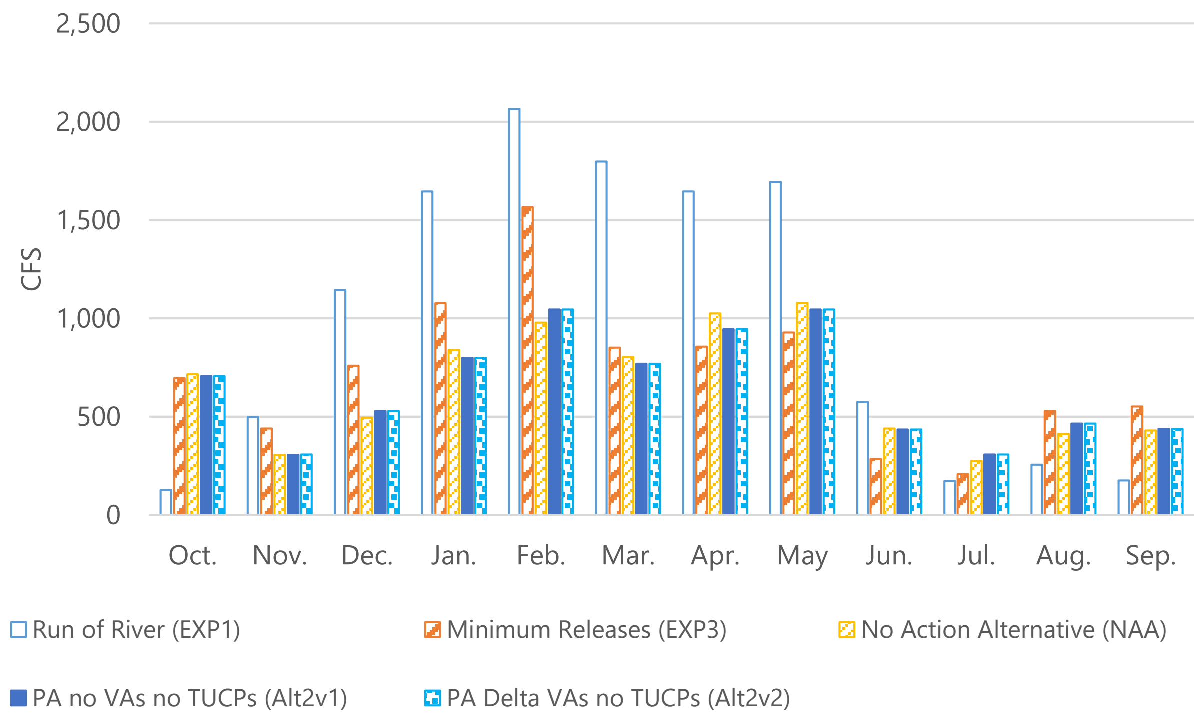

Figure 6-3. Stanislaus River below Goodwin Dam Monthly Flows, All Water Year Types

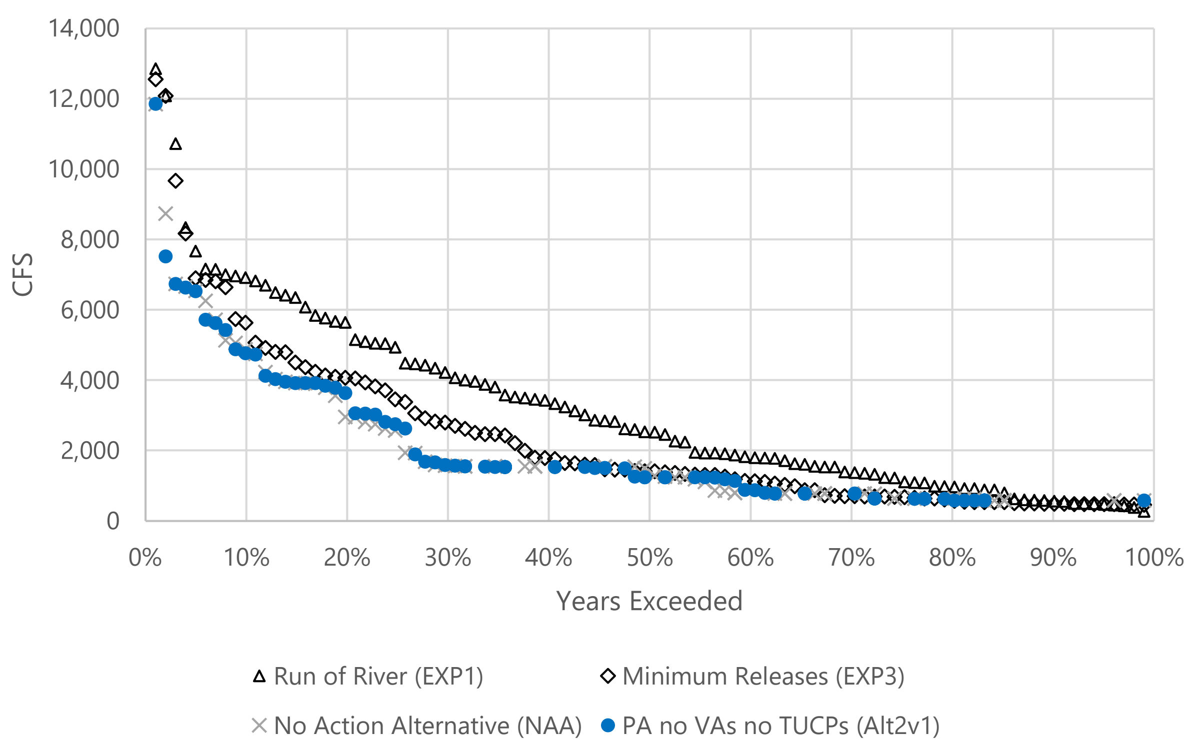

Figure 6-4. Stanislaus River below Goodwin Dam Annual Peak Flow Frequency

6.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Any future agriculture conversions that occur adjacent to riparian habitat that could be used by the least Bell's vireo has the potential to affect the species and its habitat through the use of pesticides and drift of pesticides damaging both the riparian vegetation as well as the prey base of the least Bell's vireo.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the least Bell's vireo and are reasonably certain to occur in the Action Area.

6.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" least Bell's vireo as the proposed seasonal operations in the Sacramento and Stanislaus Rivers will have insignificant impacts on existing, currently unoccupied riparian habitat. Additionally, elevated water flows are not anticipated to rise to the level that would cause impacts to nesting least Bell's vireos. The overall impacts on the species would not result in the incidental take of individuals of this species.

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Chapter 7 Salt Marsh Harvest Mouse

7.1 Status of the Species

7.1.1 Legal Status

The salt marsh harvest mouse (*Reithrodontomys raviventris*) was federally listed as endangered in 1970 (35 FR 16047). The list at the species level includes two subspecies: the northern salt marsh harvest mouse (*R. r. halicoetes*), found in San Pablo and Suisun Bays, and the southern salt marsh harvest mouse (*R. r. raviventris*), found in the marshes of Corte Madera, Richmond, and South San Francisco Bay.

7.1.2 Critical Habitat

Critical habitat has not been proposed or designated for this species.

7.1.3 Recovery Plan

The *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013b) comprises the most recent recovery plan for salt marsh harvest mouse. To achieve recovery of salt marsh harvest mouse, the plan focuses on the restoration and management of restored tidal marshes within three recovery units where the species is known to occur Suisun Bay Area, San Pablo Bay, and Central/South San Francisco Bay. Downlisting criteria include reducing threats to the species' habitat across the three recovery units, such as management of the invasive *Lepidium latifolium*; and protecting the species from other natural or human-made factors known to affect its continued existence by meeting occupancy targets and protecting suitable high marsh/upland habitat. Delisting criteria consist of meeting downlisting habitat protection criteria, completing Suisun Marsh, San Pablo Bay, and South Bay tidal restoration and conservation plans; meeting an increased occupancy target; and revising the Sector San Francisco – Area Contingency Plan to minimize impacts from oil spills.

7.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the salt marsh harvest mouse in 2021 (U.S. Fish and Wildlife Service 2021). The document is incorporated by reference to provide additional information relevant to the status of the species.

7.1.5 Natural History/Biology

A detailed account of the taxonomy, ecology, and biology of the salt marsh harvest mouse can be found in the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013b).

The salt marsh harvest mouse is restricted to saline or brackish marsh habitats, with *Sarcocornia*-dominated (pickleweed) marsh plain middle zone, as well as and a high marsh zone being important features. Telemetry studies found mean home ranges to be approximately 0.21 hectare

(0.52 acre) for the northern subspecies and approximately 0.15 hectare (0.37 acre) for the southern subspecies (U.S. Fish and Wildlife Service 2010). Shellhammer (2009 in USFWS 2010) identified that generally salt marsh harvest mice do not cross large areas of open habitat (i.e., open space or unvegetated habitat).

Salt marsh harvest mouse. Source: U.S. Fish and Wildlife Service 2013c.

7.1.6 Range-wide Status/Distribution

A five-year review was completed in 2010 where no change of status was recommended (U.S. Fish and Wildlife Service 2010). An additional five-year review was completed in 2021 and again no change of status was recommended (U.S. Fish and Wildlife Service 2021). Data are limited for estimating historical range-wide population and distribution. The salt marsh harvest mouse probably occupied most of the middle tidal, or *Sarcocornia*-dominated (pickleweed), marsh plains and high marsh zones of San Francisco Bay, San Pablo Bay, and Suisun Marsh prior to the significant marsh reclamation of the 1840s. However, by the time of listing, it is likely that populations of the species range-wide had fallen to low levels (U.S. Fish and Wildlife Service 2010).

Survey data for the species is generally sparse, with most surveys having been site-specific and relatively short term. For the northern population, the fringing salt marshes along northern San Pablo Bay (Petaluma River to Mare Island Strait), particularly the Highway 37/Mare Island Marsh and additional tidal/microtidal marshes, do support fluctuating populations of salt marsh harvest mice. Due to its large size and deep (broad) suitable salt marsh habitat, Suisun Marsh is an important site for the northern subspecies population and may contain the largest population for the species in the entire remaining range (U.S. Fish and Wildlife Service 2010). Standardized annual surveys conducted there since 1997 by CDFW and DWR have demonstrated fluctuations, but also have shown high and increasing capture efficiencies of 10.0-11.5%, indicating the population may be increasing. Surveys at other sites in the northern population’s range have demonstrated similar capture efficiencies. Similarly, research about demography and habitat use in Suisun Marsh (Sustaita et al. 2011) captured 1,191 individual salt marsh harvest mice in 28,104 trap nights, for an estimated density of 2.5-3.4 mice/hectare.

In general, the status of the southern population is currently considered to be more precarious than the northern population. Few major, resilient, or secure populations persist and those that do are very small and isolated compared with the historical pattern of distribution and abundance (U.S. Fish and Wildlife Service 2010). Studies by Shellhammer (U.S. Fish and Wildlife Service 2010) indicate that population size is generally correlated with the depth of the Sarcocornia plain (i.e., the middle zone of tidal marshes). Shellhammer further noted that most of the marshes of the South San Francisco Bay are strip- like marshes and, as such, support few salt marsh harvest mice.

7.1.7 Threats

The most fundamental reason for the decline of the salt marsh harvest mouse is loss of habitat through filling (i.e., destruction), subsidence, and vegetation change (U.S. Fish and Wildlife Service 1984; Shellhammer 2000). Predation has also been identified as an influential threat (U.S. Fish and Wildlife Service 2013b).

7.2 Environmental Baseline

There are numerous documented California Natural Diversity Database occurrences of salt marsh harvest mouse in the Suisun Marsh portion of the Action Area (CDFW 2023). This species has been observed in tidal wetlands and along sloughs as well as within managed wetlands. Salt marsh harvest mouse use of managed wetlands has been documented to be as high, or higher than, tidal wetland use (Sustaita et al. 2011). Wetlands in Suisun Marsh support patchy and unstable, but sometimes sizeable populations of salt marsh harvest mice with fairly high densities (U.S. Fish and Wildlife Service 2013b). Salt marsh harvest mice are also sometimes found in significant numbers in grasslands at the upper edge of diked marshes in the Suisun Bay (Zetterquist 1976; Shellhammer et al. 1988).

Perennial pepperweed (*Lepidium* latifolium) is an aggressive, non-native herbaceous weed displacing native vegetation in the Suisun Marsh and other locations throughout California. Pepperweed occurrence within the Action Area is high. Pepperweed can be problematic to control because of its underground rhizomes that are difficult to kill with broad-spectrum herbicides. Limited success has occurred in the Action Area to control and manage the overtaking of pepperweed long-term. Pepperweed poses a serious threat to many native ecosystems and can displace threatened and endangered species, like the salt marsh harvest mouse, or interfere with the regeneration of important plant species.

Downlisting criteria of the salt marsh harvest mouse include achieving, within the Suisun Bay Recovery Unit, conservation of 1,000 or more acres of muted or tidal marsh in the Western Suisun/Hill Slough Marsh Complex, 1,000 or more acres of muted or tidal marsh in the Suisun Slough/Cutoff Slough Marsh Complex, 1,500 or more acres of diked or tidal marsh in the Grizzly Island Marsh Complex, 1,000 or more acres of muted or tidal marsh in the Nurse Slough/Denverton Slough Marsh Complex, and 500 or more acres of muted or tidal marsh in the Contra Costa County Marsh Complex. As of 2013, 2,500 acres of suitable habitat throughout the Marsh had been conserved as salt marsh harvest mouse habitat. The salt marsh harvest mouse Conservation Areas are Peytonia Slough; Hill Slough West Ponds 1, 2, 4, and 4A; Hill Slough East Areas 8 and 9; a portion of Joice Island. Crescent Unit, a portion of Lower Joice Island; Blacklock; and Grizzly Island Ponds 1 and 15. Mitigation areas are Island Slough Ponds 4 and 7 (U.S. Fish and Wildlife Service 2013a). The amount of restored habitat suitable for salt marsh harvest mouse within Suisun Marsh and elsewhere within the species' range was not assessed in the 2021 five-year review (U.S. Fish and Wildlife Service 2021).

The USFWS has consulted on numerous consultations in the Suisun Marsh in the Action Area with a majority of the consultations being related to on-going maintenance activities or conversion of managed marsh to another use, such as tidal marsh restoration. The June 2013 *Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and Project-Level Actions in Solano County, California* (File No. 08ESMF00-2012-F- 0602-2) was issued to the USACE to cover projects that fall under the USACE' Regional General Permit, their Letters of Permission, or individual permits in the Suisun Marsh.

7.2.1 Tidal Habitat Restoration

Across the tidal habitat restoration projects in the Delta and Suisun Marsh listed in Table 4-1, approximately 3,170.42 acres of tidal habitat has been restored, approximately 3,781 acres are in construction, and approximately 1,600 acres are in planning. The total acreage of all stages of tidal habitat restoration is approximately 8,551.42 acres.

Restoration projects result in short term construction related effects and permanent habitat loss for upland terrestrial species. However, as the restored areas evolve over time into a functioning tidal marsh, restoration projects are expected to provide benefits through increased exports of nutrients and food to adjacent open water, and potentially provide potential physical delta smelt rearing habitat.

The SMP is a comprehensive plan designed to address the various conflicts regarding use of Marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and managed wetland activities. The SMP is intended to guide near-term and future actions related to restoration of tidal wetlands and managed wetland activities.

The following Biological Opinions document the impacts to terrestrial federally listed species:

- USFWS 2013 Biological Opinion (File No. 0SESMF00-2012-F-0602) – Transmittal of Final Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California

The USFWS SMP Biological Opinion described the tidal wetland restoration actions, specifically levee breaching, initially would result in the establishment of tidal open water habitat. Tidal wetland vegetation would establish as sediment accrues over time. Effects of tidal marsh restoration will be dispersed in space and time. As the restored area evolves into a functioning, vegetated tidal wetland, it is expected to provide permanent suitable and sustainable habitat for federally listed species in Suisun Marsh. MP Restoration activities would benefit the actual or available primary productivity of Suisun Marsh as a whole by increasing nutrient exchange and nutrient turnover rates. Restoration activities would include the construction of habitat levees that include benches or berms, which would provide opportunities for the establishment of high marsh/upland transition habitat. Ground disturbing activities, such as levees maintenance and dredging, may result in the harassment, harm, injury, or death of federally listed species within Suisun Marsh.

7.3 Effects of the Proposed Action

7.3.1 Suisun Marsh Salinity Control Gates (Proposed Flow Changes)

The SMSCG are being proposed to direct more fresh water into the Suisun Marsh to improve habitat conditions for Delta smelt in the region. Salt marsh harvest mice are assumed to be present during the times of the year in which operations will be occurring in the Suisun Marsh. SMSCG reoperations are expected to temporarily lower marsh channel salinities (example of change in salinity for below normal year is shown in Figure 4-2 through Figure 4-7).

Initial Bay-Delta SCHISM modeling of the proposed operation of the SMSCG associated with the Proposed Action found salinity decreases up to 5 practical salinity units (PSU) on a three day running average of salinity at Belden’s landing from June through October in above-normal, below-normal, and dry years following wet or above-normal water years (Ateljevich 2022). The effects from SMSCG operations are presumed insignificant to the vegetation community due to the:

- Limited temporal scale of the Proposed Action (60-120 days)
- Limited temporal overlap between the Proposed Action and the typical flooding regime for diked wetlands
- Variability of existing salinities as well as the variability created between years when the Proposed Action is implemented and years when it is not
- Variability in salinity in the winter and spring when there are no effects from the Proposed Action, but when diked wetland flooding occurs, and
- Adherence to Regional Water Quality Control Board water quality requirements.

Thus, effects on all life stages of the salt marsh harvest mouse are also considered insignificant. That is, effects to the vegetation community as a result of reduced salinities by no more than 5%

in action years are not expected to affect salt marsh harvest mouse habitat to the extent that take would occur.

7.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the salt harvest mouse and are reasonably certain to occur in the Action Area.

7.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" salt marsh harvest mouse as the proposed flow changes to the SMSCG are presumed insignificant to the vegetation community and the salt marsh harvest mouse. Effects to the vegetation community as a result of reduced salinities by no more than 5% in action years are not expected to affect salt marsh harvest mouse habitat to the extent that incidental take would occur.

7.6 References

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Chapter 8 Soft Bird's-Beak and Suisun Thistle

8.1 Status of the Species

8.1.1 Status of the Suisun Thistle

8.1.1.1 Legal Status

Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*) was listed as endangered in its entire range on November 20, 1997 (62 FR 61916).

8.1.1.2 Recovery Plan

The *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013) comprises the most recent recovery plan for Suisun thistle. To achieve recovery of Suisun thistle, the plan focuses on the restoration and management of restored tidal marshes within the one recovery unit where the species is known to occur: Suisun Bay Area. Downlisting criteria include reducing threats to the species' habitat within the recovery unit, such as through maintenance of at least 2,000 acres inhabited by the species over five years and management of invasive plant species, and protecting the species from other natural or human-made factors known to affect its continued existence by meeting population size and plant number requirements. Delisting criteria consist of reducing or removing threats to the species' habitat including that from invasive plant species and feral pigs; reducing or removing seed predation by thistle weevil; and protecting the species from other natural or human-made factors known to affect its continued existence by meeting increased population size and number requirements, seed banking, ongoing research, revising the *Sector San Francisco – Area Contingency Plan* to minimize impacts from oil spills, and preserving high marsh/upland habitat.

8.1.1.3 Five-Year Review

The USFWS completed a five-year review of the status of the Suisun thistle in 2021 (U.S. Fish and Wildlife Service 2021). The document is incorporated by reference to provide additional information relevant to the status of the species.

8.1.1.4 Natural History/Biology

Suisun thistle is associated with the upper intertidal marsh plain along the steep, peaty banks of natural, mature, small tidal creeks, banks, ditches, and marsh edges that are very infrequently flooded but generally not along gently sloping terrestrial edges (U.S. Fish and Wildlife Service 2013). All Suisun thistle populations today occur in peaty organic marsh soils, old bay muds of fine estuarine sediments (silty clays) with relatively high organic content in the upper horizons, and increasing mineral content with depth (Joice series soils).

Suisun thistle is known to be restricted to freshwater-influenced brackish marshes, and is absent in the freshwater tidal marshes of the west Delta and the tidal marshes of central San Pablo Bay to the west.

Suisun thistle is typically an annual plant, dying after one year of seed reproduction. Its vegetative period is usually one year, but if small vegetative plant size or unfavorable environmental conditions delay flowering, it may regenerate from the central root crown for more than one year. Flowering occurs throughout the summer in most years, and continues through production of ripe seedheads (U.S. Fish and Wildlife Service 2013).

The status of the Suisun thistle and information about its biology, ecology, distribution, and current threats is available in the *Recovery Plan for the Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013).

Suisun thistle. Source: U.S. Fish and Wildlife Service n.d.-a.

8.1.1.5 Range-wide Status and Distribution

There is scarce information on the historical distribution of the Suisun thistle. At the time of listing, two populations, one at Peytonia Slough Ecological Reserve and one at Rush Ranch, were the only known populations (U.S. Fish and Wildlife Service 2021). During subsequent surveys, four potential populations were thought to exist: Rush Ranch, Grizzley Island (including Joice Island), Peytonia Slough, and Hill Slough populations. Both Peytonia Slough and Hill Slough populations were well-removed from the Rush Ranch population, but the Grizzly Island population was thought to potentially overlap with that of Rush Ranch (U.S. Fish and Wildlife Service 2021). In the 2021 five-year review, the USFWS confirmed that there are likely three distinct populations comprised of currently known occurrences. These three populations are Rush Ranch, Peytonia Slough, and Hill Slough (U.S. Fish and Wildlife Service 2021).

8.1.1.6 Threats

The soft bird's-beak and Suisun thistle are threatened by similar factors because they occupy the same tidal marsh ecosystem. These general threats are covered in the *Status of the Soft Bird's-beak*.

8.1.2 Status of the Soft Bird's-beak

8.1.2.1 Legal Status

The Soft bird's-beak (*Chloropyron molle* ssp. *molle*) was federally listed as endangered in its entire range on November 20, 1997 (62 FR 61916).

8.1.2.2 Recovery Plan

The *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (U.S. Fish and Wildlife Service 2013) comprises the most recent recovery plan for soft bird's-beak. To achieve recovery of soft bird's-beak, the plan focuses on the restoration and management of restored tidal marshes within the two recovery units where the species is known to occur: Suisun Bay Area, and San Pablo Bay. Downlisting criteria include reducing threats to the species' habitat across the two recovery units such as through management of invasive plant species and maintaining a minimum number of acres inhabited and preserved; and protecting the species from other natural or human-made factors known to affect its continued existence by meeting population size, plant number, and seed production requirements. Delisting criteria consist of reducing or removing threats to the species' habitat such as through management of invasive plant species, maintaining a minimum number of acres inhabited and preserved, protecting plants from trampling by cattle and feral pigs, and developing reintroduction methods; reducing or removing seed predation from moth larvae; and meeting the downlisting criteria for protecting the species from other natural or human-made factors by meeting population size, plant number, and seed production and banking requirements, revising the *Sector San Francisco – Area Contingency Plan* to minimize impacts from oil spills, and preserving high marsh/upland habitat.

8.1.2.3 Five-Year Review

The USFWS completed a five-year review of the status of the soft birds-beak in 2009 (USFWS 2009). The document is incorporated by reference to provide additional information relevant to the status of the species.

8.1.2.4 Natural History/Biology

The principal habitat of the soft bird's-beak is the high marsh zone or upper middle marsh zone of brackish marshes with full tidal range (Peinado et al. 1994). It is rarely found in non-tidal conditions. Abundance is usually greatest in or near the upper-marsh upland ecotone (USFWS 2013, Ruygt 1994). Large, dense patches are sometimes found along the margins of emergent salt pans, or scalds (Ruygt 1994).

Soft bird's-beak is an annual plant that evidently regenerates from a persistent dormant seed bank. The longevity of the seed bank is unknown. However, some colonies have failed to emerge for several years and then reappeared. Population densities vary from isolated individuals (less than 0.5 per square meter to more than 450 per square meter), with densities of 100 to 200 per square meter common (Ruygt 1994).

Branching and flower development begin as early as May (Ruygt 1994) and continue throughout the summer. Flower production correlates with the degree of branching and plant size (Ruygt 1994, Grewell et al. 2003, Grewell 2004). Fruits and seeds mature from July to November. Flowering has been known to occur, however, as late as November, indicating a significant overlap between flowering and fruiting (seed production) time. Some fruits begin to mature around early July.

The status of the soft bird's-beak and information about its biology, ecology, distribution, and current threats are available in the *Recovery Plan for the Tidal Marsh Ecosystems of Northern and Central California* (USFWS 2013).

Soft bird's-beak. Source: U.S. Fish and Wildlife Service n.d.-b.

8.1.2.5 Range-wide Status and Distribution

No recent comprehensive range-wide status survey has been conducted for the soft bird's-beak (USFWS 2009, 2013). Understanding of the soft bird's-beak is based on limited and opportunistic survey data. As of 2013, there were 11 populations of soft bird's-beak with documented occurrences in nine general areas: Rush Ranch, Hill Slough, Joice Island, Benicia State Recreation Area, Point Pinole, Concord Naval Weapons Station, Fagan Slough, McAvoy Boat Harbor, and Denverton (USFWS 2013). The largest populations were located mostly in old relict tidal marshes in Suisun Marsh. The most recent near-comprehensive census was conducted in 2000 (USFWS 2013). The census covered Hill Slough Marsh and Rush Ranch, both in Suisun Marsh, Solano County. The largest population was found at Hill Slough Wildlife Area and covered approximately 2 hectares (4.7 acres) (USFWS 2013). Since then, experimental reintroductions at Rush Ranch have occurred.

Population size and distribution are extremely variable among years for this species. Each population of soft bird's-beak is comprised of many shifting colonies or subpopulations. Because colonies may fail to emerge in some years, it can be difficult to determine with confidence when a population has become extirpated.

8.1.2.6 Threats

The USFWS January 2009 five-year review for the soft bird's-beak recommended the soft bird's-beak remain listed as endangered due to the continuation of threats from muting (damping) of tides and salinity, invasive non-native plants, seed predation, sea level rise predicted to result from global climate change, mosquito abatement, oil spills, and (for these small populations) random events (USFWS 2009).

8.2 Environmental Baseline

8.2.1 Soft Bird's-beak Environmental Baseline

Soft bird's-beak is thought to be limited to three general locations in the Suisun Marsh portion of the Action Area: Rush Ranch, CDFW's Joice Island Unit of the Grizzly Island Wildlife Management Area, and the Hill Slough Marsh (California Department of Water Resources 2001; USFWS 2013). However, this species also occurs on Luco Slough, east of Bradmoor Island, and on the eastern side of Point Pinole Regional Shoreline (CDFW 2023). In 2013, the Hill Slough population accounted for more than 80% of the occurrences of this species in the Action Area (USFWS 2013).

8.2.1.1 Tidal Habitat Restoration

Across the tidal habitat restoration projects in the Delta and Suisun Marsh listed above, approximately 3,170.42 acres of tidal habitat has been restored, approximately 3,781 acres are in construction, and approximately 1,600 acres are in planning. The total acreage of all stages of tidal habitat restoration is approximately 8,551.42 acres (See Table 4-1).

The overall primary purpose of these restoration projects is to protect, restore and enhance intertidal and associated subtidal habitat to benefit listed fishes. Restoration projects result in short term construction related effects and permanent habitat loss for upland terrestrial species. However, as the restored areas evolve over time into a functioning tidal marsh, restoration projects are expected to provide benefits through increased exports of nutrients and food to adjacent open water, and potentially provide potential physical Delta smelt rearing habitat.

The SMP is a comprehensive plan designed to address the various conflicts regarding use of Marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and managed wetland activities. The SMP is intended to guide near-term and future actions related to restoration of tidal wetlands and managed wetland activities.

The following Biological Opinion documents the impacts to federally listed species:

- USFWS 2013 Biological Opinion (File No. 0SESMF00-2012-F-0602) – Transmittal of Final Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California

The USFWS SMP Biological Opinion described the tidal wetland restoration actions, specifically levee breaching, initially would result in the establishment of tidal open water habitat. Tidal wetland vegetation would establish as sediment accrues over time. Effects of tidal marsh restoration will be dispersed in space and time. As the restored area evolves into a functioning, vegetated tidal wetland, it is expected to provide permanent suitable and sustainable habitat for federally listed species in Suisun Marsh. Specifically, as the restored area evolves into a functioning tidal marsh, it is expected to provide indirect benefits to fish species through increased exports of nutrients and food to adjacent open water areas. SMP Restoration activities would benefit the actual or available primary productivity of Suisun Marsh as a whole by increasing nutrient exchange and nutrient turnover rates. Restoration activities would include the construction of habitat levees that include benches or berms, which would provide opportunities for the establishment of high marsh/upland transition habitat. Ground disturbing activities, such as levees maintenance and dredging, may result in the harassment, harm, injury, or death of federally listed species within Suisun Marsh.

8.2.2 Suisun Thistle Environmental Baseline

This species is known to exist only in Suisun Marsh and typically is found in the Action Area in the middle to high marsh zone along tidal channels and in irregularly flooded estuarine wetlands (DWR 2001; USFWS 2021). Three populations of Suisun thistle are known (USFWS 2021), and as of 2023, there are three occurrences in the Action Area (CDFW 2023). One documented population occurs on CDFW's Peytonia Slough Ecological Reserve. The second documented population is associated with the Cutoff Slough tidal marshes and CDFW's Joice Island Unit of the Grizzly Island Wildlife Management Area, and the third documented population is located on CDFW’s Hill Slough Wildlife Area.

8.2.2.1 Tidal Habitat Restoration

Across the tidal habitat restoration projects in the Delta and Suisun Marsh listed in Table 4-1, approximately 3,170.42 acres of tidal habitat has been restored, approximately 3,781 acres are in construction, and approximately 1,600 acres are in planning. The total acreage of all stages of tidal habitat restoration is approximately 8,551.42 acres.

The SMP is a comprehensive plan designed to address the various conflicts regarding use of Marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of wetlands and their functions. The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and managed wetland activities. The SMP is intended to guide near-term and future actions related to restoration of tidal wetlands and managed wetland activities.

The following Biological Opinion documents the impacts to federally listed terrestrial species:

- USFWS 2013 Biological Opinion (File No. 0SESMF00-2012-F-0602) – Final Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California

The USFWS SMP Biological Opinion described the tidal wetland restoration actions, specifically levee breaching, initially would result in the establishment of tidal open water habitat. Tidal wetland vegetation would establish as sediment accrues over time. Effects of tidal marsh restoration will be dispersed in space and time. As the restored area evolves into a functioning, vegetated tidal wetland, it is expected to provide permanent suitable and sustainable habitat for federally listed species in Suisun Marsh. SMP Restoration activities would benefit the actual or available primary productivity of Suisun Marsh as a whole by increasing nutrient exchange and nutrient turnover rates. Restoration activities would include the construction of habitat levees that include benches or berms, which would provide opportunities for the establishment of high marsh/upland transition habitat. Ground disturbing activities, such as levees maintenance and dredging, may result in the harassment, harm, injury, or death of federally listed species within Suisun Marsh. Also, there could be a temporary loss of foraging habitat as a result of construction-related activities throughout the Marsh.

8.2.3 Previous Consultations in the Action Area

The USFWS has consulted on numerous occasions in the Suisun Marsh in the Action Area with a majority of the consultations being related to on-going maintenance activities or conversion of managed marsh to another use, such as tidal marsh restoration. The USFWS issued a Biological Opinion in June 2013, Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and Project-Level Actions in Solano County, California (File No. 08ESMF00-2012-F-0602-2), to the USACE to cover projects that fall under the USACE' Regional General Permit, their Letters of Permission, or individual permits in the Suisun Marsh. Example tidal marsh restoration projects that have been consulted on in the Action Area include Tule Red (USFWS File No. 08FBDT00-2016-F-0071), Blacklock (1-1-06-I-1880), and Montezuma Wetlands (1- 1-99-F-12).

8.3 Effects of the Proposed Action

8.3.1 Suisun Marsh Salinity Control Gates (Proposed Flow Changes)

The SMSCG are being proposed to direct more fresh water into the Suisun Marsh to improve habitat conditions for Delta smelt in the region. SMSCG reoperations are expected to lower marsh salinities, creating a potential vegetation shift in Suisun Marsh (example of change in salinity for below normal year is shown in Figure 4-2 through Figure 4-7). Effects on soft bird's-beak and Suisun thistle from changes in tidal stage, flow, or erosion are uncertain at this time.

Initial Bay-Delta SCHISM modeling of the proposed operation of the SMSCG found salinity decreases up to 5 PSU on a three-day running average of salinity at Belden's landing from June through October in above-normal, below-normal and dry years following wet or above-normal water years (Ateljevich 2022). The effects from SMSCG operations are presumed insignificant to the vegetation community due to the:

- Limited temporal scale of the Proposed Action (60-120 days),
- Limited temporal overlap between the Proposed Action and the typical flooding regime for diked wetlands,
- Variability of existing salinities as well as the variability created between years when the Proposed Action is implemented and years when it is not,

- Variability in salinity in the winter and spring when there are no effects from the Proposed Action, but when diked wetland flooding occurs, and
- Adherence to Regional Water Quality Control Board water quality requirements.

Because salinity levels of the habitat in which soft bird's-beak or Suisun thistle are found would not be substantially altered, the proposed operation of the SMSCG associated with the Proposed Action would likely result in insignificant effects to either soft bird's beak or Suisun thistle.

8.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the soft bird's-beak or Suisun thistle and are reasonably certain to occur in the Action Area.

8.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" the soft bird's-beak or Suisun thistle as the proposed operation of the SMSCG would not be likely to affect either soft bird's beak or Suisun thistle due to the insignificant alteration of the salinity levels in soft bird's-beak and Suisun thistle habitat. The overall impacts on the two species would not result in the incidental take of individuals of these species.

8.6 Critical Habitat

8.6.1 Status of Soft Bird's-beak Critical Habitat

The USFWS designated critical habitat for soft bird's-beak on April 12, 2007 (72 FR 18518). The primary constituent elements (PCEs) defined for soft bird's-beak were derived from its biological needs. Based on current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, the PCEs that are essential to the conservation of the soft bird's-beak are:

- Persistent emergent, intertidal, estuarine wetland at or above the mean high-water line (as extended directly across any intersecting channels);
- Rarity or absence of plants that naturally die in late spring (winter annuals); and
- Partially open spring canopy cover (approximately 790 nMol/m^2/s) at ground level, with many small openings to facilitate seedling germination.

Five units have been designated as critical habitat for soft bird's-beak in Contra Costa, Napa, and Solano Counties, California. Contra Costa, Napa, and Solano Counties have approximately 22 acres, 384 acres, and 1,870 aces of critical habitat, respectively. Common threats that may require special management considerations or protections of the PCEs for soft bird's-beak in all five units include: (1) mosquito abatement activities (ditching, dredging, and chemical spray operations), which may damage the plants directly by trampling and soil disturbance, and indirectly by altering hydrologic processes and by providing relatively dry ground for additional foot and vehicular traffic; (2) general foot and off-road vehicle traffic through soft bird's beak populations that could result in their damage and loss in impacted areas; (3) increases in the proliferation of nonnative invasive plants from human-induced soil disturbances leading to the invasives outcompeting soft bird's beak; (4) control or removal of nonnative invasive plants, especially *Lepidium latifolium*, which, if not carefully managed, can damage soft bird's beak populations through the injudicious application of herbicides, by direct trampling, or through the accidental transport of invasive plant seeds to new areas; and (5) presence of *Lipographis fenestrella* (a moth) larvae that could reduce the reproductive potential of soft bird's beak through flower, fruit, and seed predation.

8.6.2 Status of Suisun Thistle Critical Habitat

The USFWS designated critical habitat for Suisun thistle on April 12, 2007 (72 FR 18518). The PCEs defined for Suisun thistle were derived from its biological needs. Based on current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, the USFWS determined that the PCEs essential to the conservation of the Suisun thistle are:

1. Persistent emergent, intertidal, estuarine wetland at or above the mean high-water line (as extended directly across any intersecting channels);
    2. Open channels that periodically contain moving water with ocean derived salts in excess of 0.5 %; and
    3. Gaps in surrounding vegetation to allow for seed germination and growth.

The three units designated as critical habitat for Suisun thistle comprise 2,052 acres of Solano County. Common threats that may require special management considerations or protections of the PCEs for Suisun thistle in all three units include: (1) alterations to channel water salinity and tidal regimes from the operation of the SMSCG that could affect the depth, duration, and frequency of tidal events and the degree of salinity in the channel water column; (2) mosquito abatement activities (dredging, and chemical spray operations), which may damage the plants directly by trampling and soil disturbance, and indirectly by altering hydrologic processes and by providing relatively dry ground for additional foot and vehicular traffic; (3) rooting, wallowing, trampling, and grazing impacts from livestock and feral pigs that could result in damage or loss to C. *hydrophilum* var. *hydrophilum* colonies, or in soil disturbance and compaction, leading to a disruption in natural marsh ecosystem processes; (4) the proliferation of nonnative invasive plants, especially *Lepidium latifolium*, leading to the invasives outcompeting C. *hydrophilum* var. *hydrophilum*; and (5) programs for the control or removal of non-native invasive plants, which, if not conducted carefully, can damage C. *hydrophilum* var. *hydrophilum* populations through the injudicious application of herbicides, by direct trampling, or through the accidental transport of invasive plant seeds to new areas. An additional threat that may require special management considerations or protection of the PCEs in Units 1 and 2 includes urban or residential encroachment from Suisun City to the north that could increase stormwater and wastewater runoff into these Units.

8.6.3 Soft Bird's-Beak Environmental Baseline

Three critical habitat units identified for soft bird's-beak occur in the Action Area. These units are Unit 2, Hill Slough Wildlife Management Area (Solano County); Unit 4, Rush Ranch/Grizzly Island Wildlife Management Area (Solano County); and Unit 5, Southampton Marsh (Solano County). Soft bird's-beak occurs in each of these Units.

8.6.4 Suisun Thistle Environmental Baseline

Three critical habitat units have been identified for Suisun thistle in the Action Area. These units are Unit 1, Hill Slough Wildlife Management Area (Solano County); Unit 2, Peytonia Slough Ecological Reserve (Solano County); and Unit 3, Rush Ranch/Grizzly Island Wildlife Management Area (Solano County). Suisun thistle occurs in each of these Units.

8.6.5 Previous Consultations in the Action Area

The USFWS has consulted on numerous consultations in the Suisun Marsh in the Action Area with a majority of the consultations being related to on-going maintenance activities or conversion of managed marsh to another use, such as tidal marsh restoration. The USFWS issued a Biological Opinion in June 2013, Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and Project-Level Actions in Solano County, California (File No. 08ESMF00-2012-F-0602-2), to the USACE to cover projects that fall under the USACE' Regional General Permit, their Letters of Permission, or individual permits in the Suisun Marsh. Example tidal marsh restoration projects that have been consulted on in the Action Area include Tule Red (USFWS File No. 08FBDT00-2016-F-0071), Blacklock (1-1-06-I-1880), and Montezuma Wetlands (1- 1-99-F-12).

8.6.6 Effects of the Proposed Action on Soft Bird's-beak and Suisun Thistle Critical Habitat

8.6.6.1 Suisun Marsh Salinity Control Gates (Proposed Flow Changes)

The SMSCG are being proposed to direct more fresh water into the Suisun Marsh under the Proposed Action to improve habitat conditions for Delta smelt in the region. SMSCG reoperations are expected to lower marsh salinities, creating a potential vegetation shift in Suisun Marsh (example of change in salinity for below normal year is shown in Figure 4-2 through Figure 4-7).

Initial SCHISM modeling of the proposed operation of the SMSCG found salinity decreases up to 5 PSU on a three day running average of salinity at Belden's landing from June through October in above-normal, below-normal and dry years following wet or above-normal water years (Ateljevich 2022). The first PCE identified for each species' critical habitat is persistent emergent, intertidal, estuarine wetland at or above the mean high-water line (as extended directly across any intersecting channels). The proposed flow changes are not expected to affect this PCE, as water will still be allowed into the marsh and effects on wetland vegetation are presumed insignificant due to the minor expected reduction in salinity, limited timeframe of the Proposed Action (60-120 days), and the inherent variability of existing salinities within the marsh between winter and spring when there are no effects from the Proposed Action, but when diked wetland flooding occurs. Therefore, wetland habitat within Suisun Marsh will not be modified or destroyed as a result of the proposed flow changes associated with the Proposed Action and potential effects on this PCE are presumed insignificant.

The second and third PCEs for soft bird's-beak are rarity or absence of plants that naturally die in late spring (winter annuals); and partially open spring canopy cover (approximately 790 $nMol/m^2/s$) at ground level, with many small openings to facilitate seedling germination. The proposed flow changes under the Proposed Action are not expected to cause premature plant death and/or affect canopy cover, due to the minor expected reduction in salinity (no more than 5 PSU on a three day running average of salinity), limited timeframe of the Proposed Action (60-120 days), and the inherent variability of existing salinities within the marsh between winter and spring when there are no effects from the Proposed Action, but when diked wetland flooding occurs. Thus, potential effects on these PCEs from the proposed flow changes are presumed insignificant.

The second and third PCEs for Suisun thistle are open channels that periodically contain moving water with ocean derived salts in excess of 0.5 %; and gaps in surrounding vegetation to allow for seed germination and growth. The proposed flow changes associated with the Proposed Action will not prevent periodic salinities in excess of 0.5%, as salinity within the marsh will only be reduced for a total of 60-120 days between June through October, During the remainder of the year, the SMSCG will be operated solely to meet D-1641 water quality standards in Montezuma Slough, which includes salinity concentrations above 0.5%. The proposed flow changes under the Proposed Action are not expected to reduce gaps in the vegetation that would subsequently prevent seed germination and growth, as potential effects on the vegetation community are presumed insignificant due to the minor expected reduction in salinity (no more than 5 PSU on a three day running average of salinity), limited timeframe of the Proposed Action

(60-120 days), and the inherent variability of existing salinities within the marsh between winter and spring when there are no effects from the Proposed Action, but when diked wetland flooding occurs. Thus, potential effects on these PCEs from the proposed flow changes under the Proposed Action are presumed insignificant.

Because the PCEs for both soft bird's-beak critical habitat and Suisun thistle critical habitat would not be substantially altered and would remain intact, the proposed operation of the SMSCG under the Proposed Action would not be likely to affect critical habitat for either species and potential effects are presumed to be insignificant. Maintaining intact PCEs for each species will contribute to the high conservation value of each critical habitat unit and each critical habitat as a whole, and will sustain each unit's role in the conservation and recovery of soft bird's-beak and Suisun thistle.

8.6.7 Cumulative Effects for Soft Bird's-beak and Suisun Thistle Critical Habitat

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the soft bird's-beak or Suisun thistle's critical habitat and are reasonably certain to occur in the Action Area.

8.6.8 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" critical habitat for soft bird's-beak or Suisun thistle. The effects from the proposed flow changes through the SMSCG under the Proposed Action are likely insignificant to soft bird's-beak and Suisun thistle critical habitat, as salinity of the surrounding habitat would not be substantially altered. Potential effects on the PCEs for each species are insignificant as described above. Thus, the PCEs will remain intact, contributing to the high conservation value of each critical habitat unit and each critical habitat as a whole, and sustaining each unit's role in the conservation and recovery of soft bird's-beak and Suisun thistle.

8.7 References

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Chapter 9 Valley Elderberry Longhorn Beetle

9.1 Status of the Species

9.1.1 Legal Status

The valley elderberry longhorn beetle was listed as threatened throughout its range and critical habitat was designated on August 8, 1980 (45 FR 52803-52807).

The status of the valley elderberry longhorn beetle has been assessed in the *Recovery Plan for Valley Elderberry Longhorn Beetle* (USFWS 1984) and the five-year review (USFWS 2006). For the most recent comprehensive assessment of the range-wide status of the valley elderberry longhorn beetle, refer to the *Withdrawal of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (79 FR 55874) (withdrawal notice).

In 2012, the USFWS recommended the delisting of the valley elderberry longhorn beetle (77 FR 60238). The proposal to delist the valley elderberry longhorn beetle was withdrawn on September 17, 2014 (79 FR 55874), and further analysis resulted in a range modification for the species in the Environmental Conservation Online System (USFWS 2019), and prompted the USFWS to develop a new *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (USFWS 2017).

9.1.2 Critical Habitat

Critical habitat, designated at the time of listing in 1980 (45 FR 52803), includes two locations in Sacramento County along the American River where the densest known populations of the beetle occur. These areas are within the Action Area.

9.1.3 Recovery Plan

The USFWS finalized the initial recovery plan for the species in 1984. However, when the *Recovery Plan for Valley Elderberry Longhorn Beetle* was developed, limited information regarding the beetle's life history, distribution, and habitat requirements was available to develop specific recovery objectives. The recovery plan did not include recovery criteria, but did include primary interim objectives that include increased surveys, management of additional areas where the beetles have been identified, and some protections afforded to habitat areas (77 FR 60238).

A *Revised Recovery Plan for Elderberry Longhorn Beetle* was published in 2019 (USFWS 2019). The recovery strategy consists of establishing populations throughout the species' range that are large enough to withstand stochastic events such as drought and fires, maintaining genetic and ecological diversity to support the species' ability to adapt to environmental changes, and establishing enough local- and meta-populations throughout the species' range so that the species can withstand catastrophic events. The USFWS does not outline a specific population size needed to maintain a resilient population due to a lack of available literature, but does discuss elderberry bush quantity and quality and connectivity between habitats as key habitat elements (USFWS 2019). Three management units were identified: (1) Sacramento River; (2) San Joaquin River; and (3) Putah Creek. The management units are further divided into the U.S. Geological Survey hydrological unit code 8 subbasin mapping units, which correspond to the major river systems.

Recovery objectives to meet the species' recovery goal consist of maintaining occupancy in at least 80% of the hydrological unit code eight subbasins and maintaining connected habitat patches along each river or major drainage within each subbasin. Delisting criteria include reducing threats to habitat, reducing predation by Argentine ants, and reducing other natural or human-caused threats such as from climate change and agricultural vegetation management (USFWS 2019).

9.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the valley elderberry longhorn beetle in 2006 (USFWS 2006). The species was recommended for delisting due to sufficient recovery of the species, although the proposal was subsequently withdrawn in 2012 the USFWS reassessed the status of the species (79 FR 55874) after. The document is incorporated by reference to provide additional information relevant to the status of the species.

9.1.5 Historical and Current Distribution and Abundance

The valley elderberry longhorn beetle is endemic to the Central Valley of California in moist valley oak woodlands along the margins of rivers and streams in the lower Sacramento and San Joaquin Valleys where its obligate larval host plant, elderberry (*Sambucus* spp.) grows (USFWS 1984). The historic distribution of the beetle closely matched the distribution of the elderberry host plant, which was patchily found throughout the Central Valley riparian forests and occasionally adjacent uplands (non-riparian). At the time of listing in 1980, the beetle was known from 10 observations on the American River, Putah Creek, and Merced River (USFWS 2019). Subsequent surveys have documented a broader distribution of the species and now it is known to occur from Shasta County in the north to Madera County in the south, including the valley floor and lower foothills, and is generally found below 500 feet (152 meters) above mean sea level (USFWS 2019).

In the withdrawal notice, the USFWS reevaluated all available spatial data and provided an updated historical distribution map based on surveys conducted since 1997. The USFWS described the species' distribution in the context of a metapopulation structure, or discrete subpopulations that exchange individuals through dispersal or migration, and fragmented habitat (USFWS 2017; Collinge et al. 2001). The subpopulations may shift spatially and temporally within riparian drainages, resulting in a patchwork of occupied and unoccupied habitat (USFWS 2017). The valley elderberry longhorn beetle remains localized in its distribution (low local numbers within a population structure), with limited dispersal ability, and the USFWS estimates it occupies less than 25% of the remaining elderberry habitat found within fragmented riparian areas. There has been nearly 90% loss of riparian vegetation in the Central Valley, and the fragmentation of this habitat that has resulted in a locally uncommon or rare and patchy distribution (clustered in regional aggregations) of the valley elderberry longhorn beetle within its remaining presumed historical range in the Central Valley (patchy distribution from Tehama County to Fresno County).

The USFWS reevaluated the valley elderberry longhorn beetle occurrence records, location, and occupancy data described the proposed rule, and incorporated new information received since the proposed delisting rule was published (77 FR 60238). The valley elderberry longhorn beetle is a habitat specialist, with limited dispersal ability and a short adult lifespan, and is found in low numbers within a population structure that has become fragmented within its historical range, and continues to be fragmented further by ongoing impacts to its habitat. The valley elderberry longhorn beetle's vulnerable developmental stages (i.e., exposure of eggs and larvae) and its rarity (i.e., low local numbers, low occupancy within its range) are important elements of the metapopulation structure of the species. The USFWS concluded that in 2014 there were extant occurrences of the valley elderberry longhorn beetle at 36 geographical locations in the Central Valley (these locations were based in large part on observations of exit holes, which may not be an accurate depiction of occupancy). However, the USFWS acknowledged that there were no current estimates of population size or trends in population numbers for the valley elderberry longhorn beetle (77 FR 60238).

9.1.6 Reproduction and Habitat Requirements

The valley elderberry longhorn beetle is closely associated with elderberry, as these plants are an obligate host plant for larvae and are necessary for the completion of the life cycle (Eng 1984; Barr 1991; Collinge et al. 2001). Elderberry shrubs are common in the Central Valley where they grow naturally in a variety of riparian and non-riparian vegetative communities (Vaghti and Greco 2007). Most elderberry presence within the Central Valley is determined by broad scale hydrologic regimes such as the relative elevation of floodplain and floodplain width, and secondarily by sediment texture and topography (Fremier and Talley 2009). The two main species of elderberry used by this species are the blue elderberry (*Sambucus nigra* subsp. *caerulea*, formerly *S. mexicana*) and red elderberry (*S. racemosa*). Blue elderberry is a component of riparian habitats throughout the Central Valley. Elderberry shrubs are most common on higher and older riparian terraces, where the roots of the plant are able to reach the water table and where the plants are not inundated for long periods (Talley 2005; Vaghti et al. 2009). Elderberry shrubs supporting the greatest beetle densities are located in areas where the shrubs are abundant and interspersed in significant riparian zones (Talley et al. 2006). The USFWS recognizes habitat for beetle as including both riparian and nonriparian areas where elderberry shrubs are present.

Notes: Archive photo from 1997 showing valley elderberry longhorn beetle pupae and frass in a live elderberry stem.

Valley elderberry longhorn beetle exit holes in elderberry shrubs, 1997. Source: Nagarajan et al. 2020.

Notes: New (current year) exit hole in elderberry stem from field survey/sampling performed by Nagarajan et al. 2020

Valley elderberry longhorn beetle exit holes in elderberry shrubs. Source: Nagarajan et al. 2020.

Adult valley elderberry longhorn beetles live for a few days to a few weeks between mid-March and mid-May and are most active from late April to mid-May. The adult beetles feed on the elderberry foliage and possibly its flowers. During this time of activity, the beetles mate, and the female lays eggs on the living elderberry plant host. The eggs are typically placed individually or in small clusters within crevices in the bark or junctions of the stem and trunk or leaf petiole and stem. Eggs hatch within a few days and soft-bodied larvae emerge. The larvae are on the surface of the elderberry from a few minutes to several hours or a day and then bore to the center of the elderberry stems where they create a feeding gallery in the pith at the center of the stem. The larvae develop for 1 to 2 years feeding on pith. The late instar larvae chew through the inner bark, all or most of the way to the surface, then return inside plugging the holes with wood shavings. The larvae move back down the feeding gallery to an enlarged pupal chamber packed with frass. Here the larvae metamorphose into pupae between December and April (Talley et al. 2006).

Valley elderberry longhorn beetle. Source: U.S. Fish and Wildlife Service 2022.

The length of pupation is thought to be about one month with the emergent adult remaining in the chamber for up to several weeks. Adults complete the hole in the outer bark and emerge during the flowering season of elderberry shrubs. The exit holes are circular to oval and range in size from 4 to 10 millimeters in diameter (Talley et al. 2006).

Shrub characteristics and other environmental factors appear to have an influence on use by the valley elderberry longhorn beetle, with more exit holes found in shrubs in riparian than in nonriparian habitat types (Talley et al. 2006). Occupancy of elderberry shrubs varies based on elderberry condition, water availability, elderberry density, and the health of the riparian habitat, indicating that healthy riparian systems supporting dense elderberry clumps are the primary habitat of the beetle (Barr 1991; Talley et al. 2006; Talley et al. 2007). However, some studies have demonstrated that valley elderberry longhorn beetles prefer elderberry shrubs with low to moderate levels of damaged stems (79 FR 55874).

9.1.7 Limiting Factors, Threats, and Stressors

Threats, such as the loss of riparian habitat due to development, infrastructure construction and land conversion to agriculture, and the effects of nonnative invasive species have greatly contributed to the loss and fragmentation of the valley elderberry longhorn beetle metapopulations, including the construction of roads and pipelines.

During the last 150 years California's Central Valley riparian forests have experienced extensive vegetation loss due to expansive agricultural and urban development (Katibah 1984), and in many places, have dwindled to discontinuous, narrow corridors. In recent decades, riparian areas in the Central Valley have continued to decline as a result of ongoing agricultural conversion, urban development, stream channelization and channel hardening. Due to the beetle's limited physical dispersal capability, the fragmentation of riparian forests decreases the likelihood of successful colonization of unoccupied habitat (Collinge et al. 2001). As a consequence, the subpopulations are more vulnerable to stochastic events (e.g., removal of vegetation for construction projects, fires, large floods, pesticide applications) that may reduce or eliminate the subpopulation. The loss of multiple subpopulations can have an adverse impact on the long-term persistence and health of the metapopulation of beetles in the Central Valley. Therefore, maintaining contiguous areas of suitable habitat is critical for the survival of the species.

Habitat loss continues to exacerbate the highly fragmented distribution of the valley elderberry longhorn beetle. Direct habitat loss irreversibly damages riparian habitat, specifically to elderberry (*Sambucus* spp.) shrubs. The alteration and destruction of habitat surrounding riparian habitat may disrupt the physical processes conducive to functional riparian ecosystems and further fragment the habitat.

9.2 Environmental Baseline

The riparian range of the valley elderberry longhorn beetle largely overlaps with the Action Area. However, the current distribution of species in the Action Area is largely unknown. Comprehensive surveys for the species or its host plant, elderberry (*Sambucus* spp.), have not been conducted and thus the population size and location of the species in the Action Area is unknown.

The beetle's distribution is typically based on the occurrence of elderberry shrubs, which are known to occur along riparian corridors throughout the Action Area, including the Sacramento River, American River, Feather River, Stanislaus River, San Joaquin River, and along smaller natural and channelized drainages, as well as in upland habitats. Valley elderberry longhorn beetle is likely to occupy suitable habitat within the riparian areas of the Action Area. However, occupancy in the Bay-Delta watershed is anticipated to be low as few elderberry shrubs exist in the region aside from isolated patches where suitable conditions exist (Calflora 2023). There are no reported occurrences of valley elderberry longhorn beetle in the deltaic wetlands within the Action Area (California Department of Fish and Wildlife 2023; 79 FR 55874).

Valley elderberry longhorn beetle populations and their habitat within the Action Area face the same threats the species faces range-wide. Rapid and widespread development of the Central Valley beginning in the mid-19th century contributed to the loss of nearly 95% of the wooded riparian habitat in the region (Katibah 1984), resulting in the long-term loss and fragmentation of valley elderberry longhorn beetle habitat and decline of the species (USFWS 2017). Despite gaining protection under the ESA in 1980, habitat loss continues to be a primary threat to survival of the species (79 FR 55874). The losses of riparian habitat due to development, infrastructure construction, land conversion to agriculture, stream channelization, channel hardening, and the effects of nonnative invasive species have greatly contributed to the direct loss of elderberry shrubs and the fragmentation of the valley elderberry longhorn beetle metapopulations along the major rivers of the Central Valley included in the Action Area. The alteration of riparian ecosystems due to damming and the introduction of invasive species has been found to impair blue elderberry recruitment along Action Area rivers (Vaghti et al. 2009).

9.3 Effects of the Proposed Action

The life cycle of the valley elderberry longhorn beetle is such that it may be impossible to know whether an elderberry plant is occupied by larvae or not. Without visual verification of adult valley elderberry longhorn beetles being present, the only other indication of occupation is the presence of exit holes in the stems of elderberry shrubs. The presence of exit holes in elderberry shrub stems does translate to a higher likelihood that the shrubs in the general area are occupied, but the lack of exit holes does not indicate a lack of presence of the valley elderberry longhorn beetle. For that reason, the USFWS assumes that any elderberry plant within the range of the valley elderberry longhorn beetle might be occupied by larvae.

9.3.1 Sacramento River

9.3.1.1 Seasonal Operations

Implementation of the Proposed Action is unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle habitat in the upper Sacramento watershed. The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the Sacramento River (Figure 6-1). Periodic flooding and erosion are important to maintaining native riparian plant communities. Seasonal operations may reduce natural variability beyond major flood events. Figure 6-2 shows the probability that a particular peak flow rate will be exceeded in a given year based on the action taken. Seasonal operations under the Proposed Action will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable elderberry shrubs over time. Additionally, the proposed seasonal operations may increase the likelihood that invasive riparian plants will survive dry summer and fall conditions and persist long-term.

Changes in flow and operations may result in indirect impacts to valley elderberry longhorn beetles through changes in riparian habitats. However, the proposed changes are unlikely to produce a measurable change in quantity or quality of valley elderberry longhorn beetle habitat in the upper Sacramento watershed due to the minimal change in hydrological conditions associated with the Proposed Action. There is no apparent mechanism by which these changes could result in harm to individual valley elderberry longhorn beetles.

9.3.2 American River

9.3.2.1 Seasonal Operations

Implementation of the Proposed Action is unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle habitat in the American River watershed. The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the American River (Figure 9-1). Periodic flooding and erosion are important to maintaining native riparian plant communities. Seasonal operations may reduce natural variability beyond major flood events. Figure 9-2 shows the probability that a particular peak flow rate will be exceeded in a given year based on the action taken. Seasonal operations under the Proposed Action will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable elderberry shrubs over time. Additionally, the proposed seasonal operations may increase the likelihood that invasive riparian plants will survive dry summer and fall conditions and persist long-term.

Changes in flow and operations may result in indirect impacts to valley elderberry longhorn beetles through changes in riparian habitats. However, the proposed changes are unlikely to produce a measurable change in quantity or quality of valley elderberry longhorn beetle habitat in the American River watershed due to the minimal change in hydrological conditions associated with the Proposed Action. There is no apparent mechanism by which these changes could result in harm to individual valley elderberry longhorn beetles.

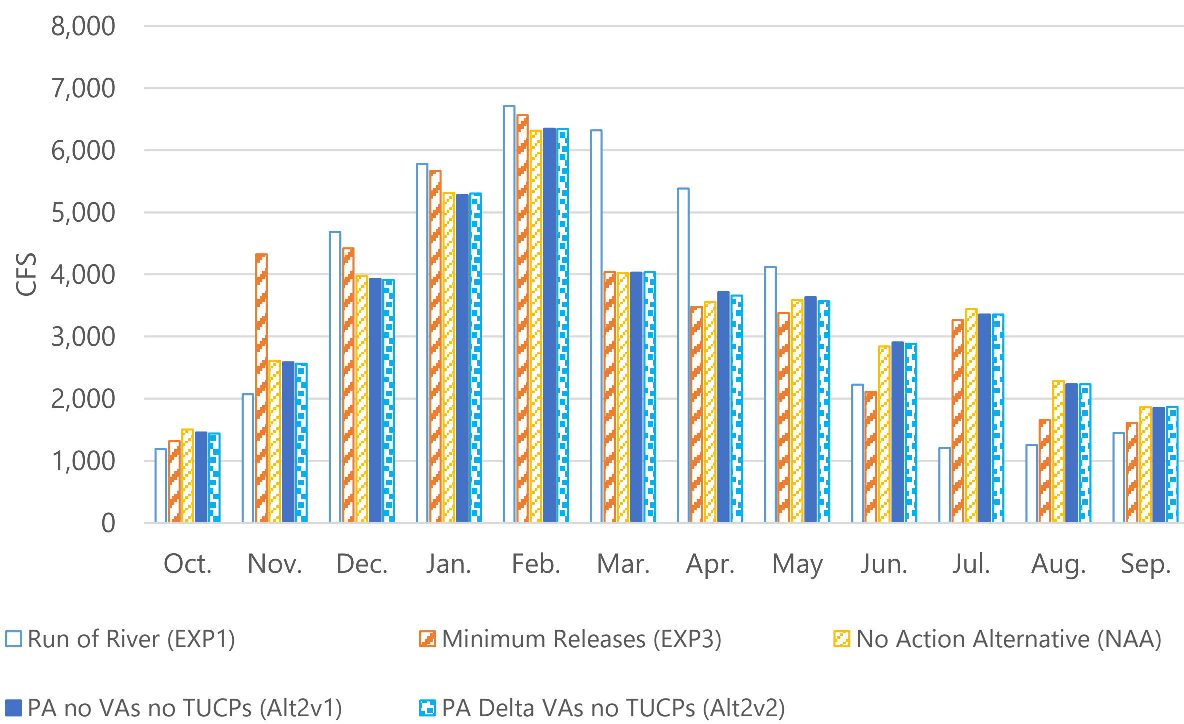

Figure 9-1 . American River below Nimbus Dam Monthly Flows, All Water Year Types

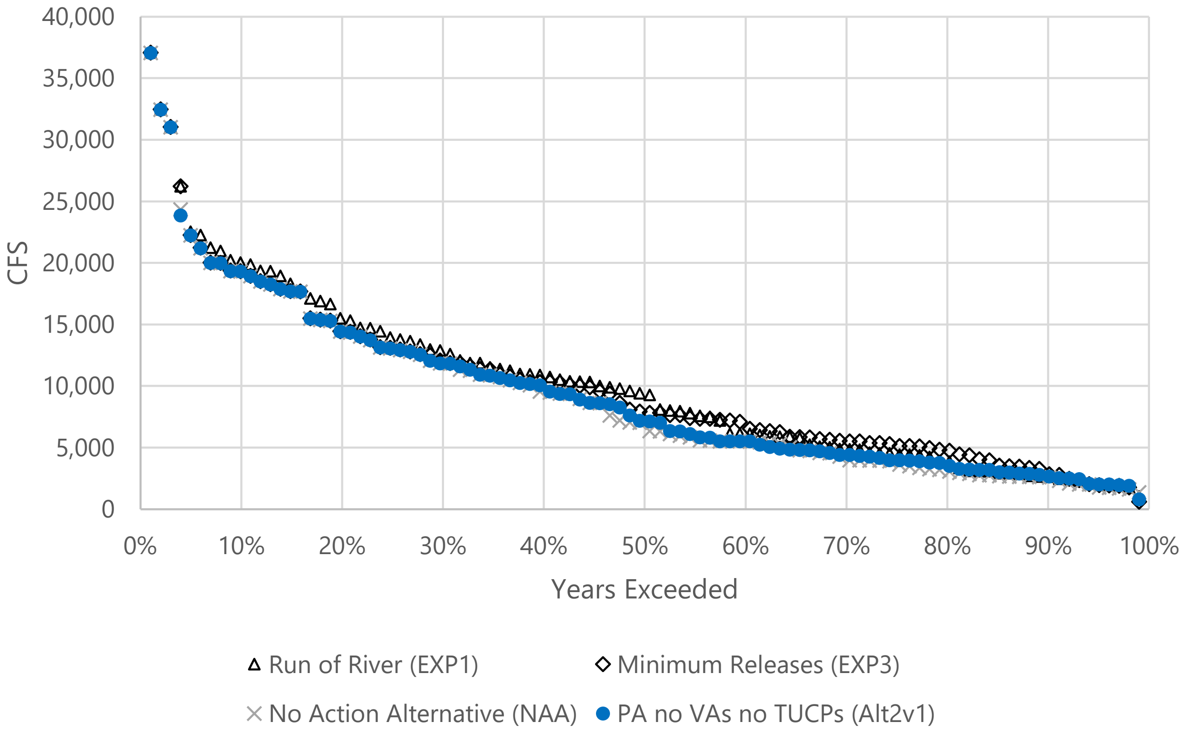

Figure 9-2. American River below Nimbus Dam Annual Peak Flow Frequency

9.3.3 Stanislaus River

9.3.3.1 Seasonal Operations

Implementation of the Proposed Action is unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle habitat in the Stanislaus River watershed. The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed summer flow changes on the lower Stanislaus River (Figure 6-3). Periodic flooding and erosion are important to maintaining native riparian plant communities. Seasonal operations may reduce natural variability beyond major flood events. Figure 6-4 shows the probability that a particular peak flow rate will be exceeded in a given year based on the action taken. Seasonal operations under the Proposed Action will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable elderberry shrubs over time. Additionally, the proposed seasonal operations may increase the likelihood that invasive riparian plants will survive dry summer and fall conditions and persist long-term.

Changes in flow and operations may result in indirect impacts to valley elderberry longhorn beetles through changes in riparian habitats. However, the proposed changes are unlikely to produce a measurable change in quantity or quality of valley elderberry longhorn beetle habitat in the Stanislaus River watershed due to the minimal change in hydrological conditions associated with the Proposed Action. There is no apparent mechanism by which these changes could result in harm to individual valley elderberry longhorn beetles.

9.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the valley elderberry longhorn beetle and are reasonably certain to occur in the Action Area.

9.5 Effect Determination

The Proposed Action “may affect, but is not likely to adversely affect” the valley elderberry longhorn beetle. Seasonal operations on the Sacramento, American, and Stanislaus rivers could reduce flooding and erosion through the storage and diversion of water under the Proposed Action; however these changes would result in insignificant changes to the quantity and quality of habitat for this species. The existing riparian vegetation communities will not be significantly altered due to the proposed seasonal operations in the relevant watersheds. The overall impacts on the species would not result in the incidental take of individuals of this species.

9.6 Critical Habitat

9.6.1 Status of Valley Elderberry Longhorn Beetle Critical Habitat

The USFWS designated critical habitat for valley elderberry longhorn beetle on August 8, 1980. No physical or biological features (PBFs) or PCEs essential for valley elderberry longhorn beetle critical habitat were included with the designation. Therefore, effects on valley elderberry longhorn beetle critical habitat are analyzed in relation to the habitat elements the USFWS determined were required for recovery of the species as discussed within the *Revised Recovery Plan for Valley Elderberry Longhorn Beetle* (USFWS 2019). The habitat elements are:

- **Elderberry quantity and quality –** density of host elderberry shrubs is generally higher in moist, riparian habitats, shrubs must be ≥2 cm diameter stems, and must be of suitable quality (what constitutes high quality plants and patches is still mostly undefined).
- **Connectivity –** elderberry plants that are in patches 10-50 meters in diameter, that are 200-300 meters apart, and that lack barriers to beetle movement (e.g., highways or pesticide use) are the most suitable for maintaining a resilient population due to the species' limited dispersal ability.

Two zones of critical habitat have been designated for valley elderberry longhorn beetle along the lower American River.

9.6.2 Valley Elderberry Longhorn Beetle Environmental Baseline

The two zones designated for valley elderberry longhorn beetle occur in the Action Area. Both zones occur along the lower American River and consist of the American River Parkway Zone and the Sacramento Zone.

The American River Parkway Zone consists of two areas directly on the American River. One area is in the vicinity of Ancil Hoffman Park, and the other is less than one mile northeast in the vicinity of Ambassador Park. The American River Parkway is a recreational area open to the public, with uses including biking, hiking, horseback riding, and river access. Utility maintenance activities (e.g., powerline maintenance) also occur. Impacts on habitat from public and maintenance use may occur, but likely do not contribute a significant amount of habitat loss (USFWS 2006). The Sacramento Zone is located just south of Highway 160/Lincoln Highway in the city of Sacramento, approximately 0.36 mile north of the American River. This zone is privately owned but is accessible to the public, and as a result the habitat is somewhat degraded and not as protected as the American River Parkway Zone (Talley et al. 2006).

Folsom Reservoir is situated upstream of both critical habitat zones on the American River. Flow releases from Folsom Reservoir are made for both flood control and to meet water quality objectives and demands in the Delta. This specific releases can result in rapid increases and decreases of flow along the American River during the winter and spring.

9.6.3 Previous Consultations in the Action Area

According to the ECOSphere – a Biological Opinion was issued for the "*Programmatic Formal Consultation on FEMA Programs, California (File No. 08ESMF00-2018-F-3331-1)*" that occurred within the designated critical habitat for this species. The Biological Opinion found that the project may only have minor adverse effects on critical habitat and that those minor effects were not expected to prevent the critical habitat from providing essential conservation values.

9.6.4 Effects of the Proposed Action on Valley Elderberry Longhorn Beetle

9.6.4.1 Seasonal Operations

The Proposed Action includes proposed flow changes in the American River resulting in variable flow ranges based on time of year, annual hydrology, and "planning minimum (flows)." The proposed changes are unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle critical habitat in the American River watershed, and there is no apparent mechanism by which these changes could result in harm to individual valley elderberry longhorn beetles. The impacts on each habitat element are discussed below:

- Habitat element 1 (elderberry quantity and quality) is unlikely to be significantly altered by the Proposed Action. The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the American River (Figure 9-1). Periodic flooding and erosion are important to maintaining native riparian plant communities. Seasonal operations may reduce natural variability beyond major flood events. Figure 9-2 shows the probability that a particular peak flow rate will be exceeded in a given year based on the action taken. Seasonal operations under the Proposed Action will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable elderberry shrubs over time. Additionally, the proposed seasonal operations may increase the likelihood that invasive riparian plants will survive dry summer and fall conditions and persist long-term.

  Changes in flow and operations may result in indirect impacts to valley elderberry longhorn beetles through changes in riparian habitats. However, the proposed change in flows associated with the Proposed Action is not expected to significantly reduce the moisture content of the soil or otherwise cause a shift in the riparian habitat along the American River, alter the stem diameter of shrubs, or affect the quality of individual plants and plant patches.

- Habitat element 2 (connectivity between elderberry patches) is unlikely to be significantly altered, as the proposed flow changes associated with the Proposed Action are not anticipated to affect elderberry shrubs due to the minimal impact on riparian vegetation associated with seasonal operations on the American River. Due to the lack of presumed reduction in elderberry shrubs there will be no change in habitat connectivity between populations of valley elderberry longhorn beetles. Thus, the population along the American River will have the ability to maintain resiliency under seasonal operations.

The habitat elements for valley elderberry longhorn beetle will remain intact under the proposed American River seasonal operations. Thus, implementation of the Proposed Action is unlikely to produce measurable changes in quantity, quality, and connectivity of valley elderberry longhorn beetle critical habitat within the American River watershed.

9.6.5 Cumulative Effects for Valley Elderberry Longhorn Beetle Critical Habitat

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the

Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the valley elderberry beetle's critical habitat and are reasonably certain to occur in the Action Area.

9.6.6 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" critical habitat for valley elderberry longhorn beetle. The effects from the proposed seasonal operations on the American River under the Proposed Action are likely insignificant to valley elderberry critical habitat. The impacts are insignificant due to a lack of reduction in expected elderberry quantity, quality, or connectivity between patches in either zone of critical habitat. Thus, the habitat elements will remain intact, sustaining each critical habitat zone's role in the conservation and recovery of valley elderberry longhorn beetle.

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Chapter 10 Riparian Brush Rabbit

10.1 Status of the Species

10.1.1 Legal Status

The USFWS listed riparian brush rabbit (Sylvilagus bachmani riparius) as endangered on February 23, 2000. The Final Rule to List the Riparian Brush Rabbit and the Riparian, or San Joaquin Valley, Woodrat as Endangered (65 FR 8881-8890) provides the most comprehensive assessment of the range-wide status of the riparian brush rabbit at the time of its listing. Since that time, additional private lands in San Joaquin County (referred to as the South Delta population) have been identified as having extant rabbit populations, and a re-introduced population has been established on the SJRNWR (Phillips et al. 2013). Currently, there are three known populations of riparian brush rabbits:

1. **Caswell Memorial State Park –** Caswell Memorial State Park is located at the confluence of the Stanislaus River and the San Joaquin River;
2. **South Delta populations –** these populations include the Paradise Cut, Faith Ranch, etc.; and,
3. **SJRNWR –** the SJRNWR is south of the Legal Delta. The population that exists within the SJRNWR is primarily made up of re-introduced individuals and their progeny.

The 2020 *Species Status Assessment for the Riparian Brush Rabbit* (USFWS 2020a) further divides the South Delta group into the South Delta and Oxbow Preserve populations for the purpose of the assessment. Reasons for the subsequent division include the recent genetic isolation of the Oxbow Preserve population, Bayesian analyses that determined that the two populations differed genetically, the status of the Oxbow Preserve population as protected and managed while the remainder of the South Delta population is not, and that unique history and status information exists that is specific to the Oxbow Preserve population.

10.1.2 Critical Habitat

Critical habitat has not been proposed or designated for this species.

10.1.3 Recovery Plan

The USFWS finalized the recovery plan for upland species of the San Joaquin Valley in 1998 (USFWS 1998), which includes the riparian brush rabbit. Additionally, the riparian brush rabbit has limited coverage under the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan.

No recovery criteria were included in the recovery plan for riparian brush rabbit, as the plan was completed before the species was listed as endangered. However, the following are important components of riparian brush rabbit habitat:

- Large patches of dense brush composed of riparian vegetation such as blackberry, California wild rose, and low-growing willows, or other dense shrub species;
- Ecotone edges of brushy habitat to grasses and herbaceous forbs;
- Scaffolding plants (dead or alive) for blackberry and rose to grow tall enough to withstand flood events;
- A tree overstory that is not closed, if present; and,
- High-ground refugia from flooding.

10.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the riparian brush rabbit in 2020 (USFWS 2020b). The document is incorporated by reference to provide additional information relevant to the status of the species.

10.1.5 Historical and Current Distribution

One of eight subspecies of brush rabbit in California, the riparian brush rabbit occupies a range that is disjunct from other brush rabbits, near sea level on the northwestern floor of the San Joaquin Valley (USFWS 1998). Populations are known to have historically occurred in riparian forests on the valley floor along the San Joaquin and Stanislaus Rivers and some tributaries of the San Joaquin River (USFWS 1998).

The riparian brush rabbit currently occurs only in southern San Joaquin and northern Stanislaus counties (USFWS 2020a). There are two remaining populations of riparian brush rabbits in San Joaquin County. One population is present on approximately 258 acres (104 hectares) in Caswell Memorial State Park on the Stanislaus River, 147 acres of which are considered riparian habitat. In January of 1997, Caswell Memorial State Park flooded, submerging most of the habitat of the riparian brush rabbit. Evidence of only three riparian brush rabbits was seen immediately following this flooding episode (USFWS 2019). In 1998, only one riparian brush rabbit was live-trapped (USFWS 2019). Another rabbit was trapped in 2007 following a 2006 flood, and additional surveys in 2008 and 2012 resulted in two captures each year; 2012 was the last year surveys took place (USFWS 2020a). The other population is located at several small, isolated or semi-isolated patches immediately west and southwest of Lathrop, totaling approximately 270 acres (109 hectares) along Paradise Cut and Tom Paine Slough, and channels of the San Joaquin River in the south Delta (Kelly 2015 pers comm.; Kelly et al. 2011; USFWS 2019). In addition, a captive breeding program has established a population on the Faith Ranch, which is owned by the wine-making Gallo family (USFWS 2019). In 2000, the South Delta population was estimated to be between approximately 25 to 100 rabbits, and in 2001 the population estimate was (anecdotally) a few hundred rabbits (USFWS 2020a).

The SJRNWR encompasses approximately 7,000 acres in Stanislaus County located where the Tuolumne, Stanislaus, and San Joaquin rivers join, creating a mix of habitats for terrestrial wildlife and plant species. Initially established to protect and manage habitat for the Aleutian Cackling Goose, the refuge is currently managed to provide habitat for migratory birds and endangered wildlife species (USFWS 2012). River Partners have been working on increasing riparian brush rabbit population size; their restoration actions continue today and are expected to be completed in 2025. Over 500,000 native trees and shrubs such as willow, cottonwood, oak, blackberry, and rose have been planted across 2,200 acres of river floodplain within the SJRNWR, creating the largest block of contiguous riparian woodland in the San Joaquin Valley. Endangered riparian brush rabbits have been reintroduced to this restored habitat from captive-reared populations. The goal is to have increased the available habitat for the riparian brush rabbit by more than 30 times its 1997 extent. The restored habitat will protect the population from nearing extinction in inevitable future flood events. Additionally, a wildfire event in 2004 and major flood events in 2006 and 2011 may have significantly affected the SJRNWR riparian brush rabbit population (Kelly et al. 2011).

The SJRNWR population of riparian brush rabbit is just outside of or adjacent to the Action Area with existing, but limited, connectivity. The most recent California Natural Diversity Database record for the riparian brush rabbit within the Action Area, dated 2020, was from trail camera detections on the SJRNWR and Dos Rios Ranch Preserve (California Department of Fish and Wildlife 2023). Previous recent occurrences included trapping efforts located at Caswell Memorial State Park between 1993 and 2008 (CDFW 2023), and at the SJRNWR which resulted in the capture of two rabbits in 2012 (Matocq et al. 2017). In addition, re-establishment efforts have been conducted south of the Delta on the SJRNWR, with 49 captive-bred rabbits released in 2002 and 187 released in 2003. The rabbit population on the SJRNWR was supplemented annually from 2005 to 2010. As a result of these re-establishment efforts as well as the on-site efforts to restore the contiguous riparian woodland habitat, the largest population of rabbit now resides on the SJRNWR. In 2017, following a flood lasting six months, the population estimate on the SJRNWR was 930 rabbits (USFWS 2020a).

Riparian brush rabbit. Source: U.S. Fish and Wildlife Service 2009.

10.1.6 General Life History and Habitat

Riparian brush rabbits prefer dense, brushy areas of valley riparian forests, marked by extensive thickets of wild rose (*Rosa* spp.), blackberries (*Rubus* spp.), and willows (*Salix* spp.). Riparian brush rabbits typically remain hidden under protective shrub cover and seldom venture more than a few feet from cover. Their response to a threat is to retreat back into cover rather than to be pursued in open areas (USFWS 1998).

Riparian brush rabbits feed at the edges of shrub cover rather than in large openings (e.g., along trails, fire breaks, edges of thickets). Their diet consists of herbaceous vegetation such as grasses, sedges, clover, forbs, buds, bark and leaves of woody plants, and vines (USFWS 1998). Kelt et al. (2014) found that rabbits on the SJRNWR consistently preferred vegetation communities dominated by sandbar willow (*Salix exigua*) and mixed with dense shrubs, such as California blackberry and rose, and exhibited secondary preferences for open grassland and dense riparian; home ranges of rabbits on the SJRNWR ranged from approximately 3.68 to 5.21 acres.

The approximate breeding season of riparian brush rabbits is from January to May. In favorable years, females may produce three or four litters. The young are born in a shallow burrow or cavity lined with grass and fur and covered by a plug of dried vegetation. Although these rabbits have a high reproductive rate, five out of six rabbits typically do not survive to the next breeding season (USFWS 1998).

10.1.7 Limiting Factors, Threats, and Stressors

The primary threats to the survival of riparian brush rabbit are the limited extent of its existing habitat, extremely low numbers of individual animals, and few extant populations. The small sizes of its remaining populations, the localization of the behavior of the subspecies, and the highly limited and fragmented nature of remaining habitat restrict natural dispersal and put the species at risk from a variety of environmental factors and stochastic events.

Flooding is a key issue for riparian brush rabbits and thought to be responsible for major population declines. Riparian brush rabbits are closely tied to brushy cover and will generally not cross large, open areas. Thus, they are unable to disperse beyond the dense brush, making them susceptible to mortality during flood events (Williams 1988; USFWS 1998). Climate change is likely to increase the severity of flooding, impacting riparian brush rabbit populations.

Periodic flooding events are likely to continue to occur along all major rivers in the Central Valley (Kindel 1984). With behavioral restrictions on its freedom of movement (low dispersal behavior) and the shortage of habitat that is suitably protected from frequent floods downstream of Caswell Memorial State Park, there are limited opportunities that individuals escaping drowning or predation would be able to find mates or reproduce successfully following dispersal events (USFWS 1998).

Wildfire poses a major threat. Long-term fire suppression combined with prolonged drought conditions can result in the buildup of high fuel loads from dead leaves, woody debris, and senescent flammable shrubs. The dense, brushy habitat to which the rabbits are restricted is thus highly susceptible to wildfire that would cause both high mortality and further loss of habitat.

The riparian brush rabbit is subject to a variety of contagious, and potentially fatal diseases that may be transmitted from neighboring populations of desert cottontails. For the small remnant brush rabbit populations, a disease event could result in extirpation of the entire population (Williams 1988; USFWS 1998).

A wide variety of aerial and terrestrial predators prey on riparian brush rabbit, including various raptors, coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), long-tailed weasel (*Mustela frenata*), mink (*Neovison vison*), raccoon (*Procyon lotor*), snakes, and feral dogs and cats (Kelly et al. 2011). A robust population of the riparian brush rabbit should be able to withstand predation, but habitat adjacent to residential properties or along public roads or waterways, or subject to human disturbance, can exacerbate predation risk (Kelly et al. 2011). The black rat (*Rattus rattus*) is an exotic invasive species that may be a threat to riparian brush rabbit populations by preying on offspring and competing for resources.

10.2 Environmental Baseline

The factors described in the *Status of the Species* section above, including habitat loss, fragmentation, and degradation due to urban and agricultural development, are factors which have in the past and still continue to affect the species within the Action Area.

The Caswell Memorial State Park population along the Stanislaus River is within the southern boundary of the Action Area. The South Delta populations of riparian brush rabbit, which includes Paradise Cut and Tom Paine Slough, are within the Action Area. There is little information available as to the recent status of these populations.

Although no rabbit surveys were conducted specifically for the Proposed Action, riparian woodland habitat is located within the Action Area and numerous sightings have been made in close proximity to the West Stanislaus Irrigation District intake canal. Approximately 0.84 acre of riparian woodland with thickets of willows and shrubs occur within the Action Area, with ruderal habitat comprising the majority of the balance of the upland areas within the Action Area. It is reasonable to assume that the riparian woodland present overlaps the home range of at least one rabbit.

As of 2019, the USFWS has formally consulted on two projects within the Action Area since 2015 that may adversely affect the rabbit; the West Stanislaus Fish Screen Intake Project, in Stanislaus County (File No. 08ESMF00-2018-F-0976), and the State Route 99 Ripon Bridge Rehabilitation Project in San Joaquin County (File No. 08ESMF00-201five-F-1164).

10.3 Effects of the Proposed Action

The riparian brush rabbit occurs in the Stanislaus River watershed.

10.3.1 Stanislaus River Watershed

10.3.1.1 Flow and Operations

The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action will include hydrologic changes associated with water operations (Figure 6-3). Implementation of the Proposed Action generally will result in minor changes to flow and likely will be small relative to normal month-to-month and year-to-year variability in the system. Changes in the natural flow regime of the river will likely result in an increase in non-native and invasive plant species and a reduction in native riparian vegetation recruitment (USFWS 2019). Some of the changes in the natural flow regime can be attributed to the construction of various dams that are not a part of this consultation. Seasonal operations within the discretion of Reclamation may reduce natural variability beyond major flood events (Figure 6-4). Lower flows in the spring under the Proposed Action are likely to result in less riparian vegetation recruitment which could result over the duration of the Proposed Action in less habitat used as cover for riparian brush rabbit. Lower flows in the spring and a more stable regime are likely to reduce the amount of surrounding suitable habitat over time. Changes to the habitat surrounding existing populations of riparian brush rabbits may affect their ability to disperse and colonize new areas beyond the current habitats occupied. However, it is not expected that the magnitude and rate of this changes will affect breeding, feeding, or sheltering during the timeframe of the Proposed Action. The Proposed Action is expected to result in similar habitat conditions that the riparian bush rabbit currently experience. The changes in flow are unlikely to result in direct harm to individual riparian brush rabbits.

10.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

Future effects from any new agricultural developments and/or practices will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the riparian brush rabbit and are reasonably certain to occur in the Action Area.

10.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" riparian brush rabbit. Seasonal operations within the Stanislaus River watershed may have an insignificant effect on riparian brush rabbit through a potential reduction of suitable habitat over time, but would not result in direct harm to individual rabbits. The overall impacts on the species would not result in the incidental take of individuals of this species.

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Chapter 11 Riparian Woodrat

11.1 Status of the Species

11.1.1 Legal Status

The USFWS listed riparian woodrat (*Neotoma fuscipes riparia*) as an endangered species under the ESA on February 23, 2000 (65 FR 8881).

The *Final Rule to List the* Riparian *Brush Rabbit and the Riparian, or San Joaquin Valley, Woodrat as Endangered* (65 FR: 8881-8890) provides the most comprehensive assessment of the range-wide status of the riparian woodrat at the time of its listing. For the most recent comprehensive assessment of the range-wide status of the riparian woodrat, refer to the *Riparian Woodrat Five-Year Review* (U.S. Fish and Wildlife Service 2020).

11.1.2 Critical Habitat

No critical habitat has been proposed or designated for this species.

11.1.3 Recovery Plan

The USFWS finalized the recovery plan for upland species of the San Joaquin Valley in 1998 (U.S. Fish and Wildlife Service 1998), which includes the riparian woodrat.

No specific conservation measures for the riparian woodrat are in place, but the species does receive some protection through the management plans for the riparian brush rabbit at the Caswell Memorial State Park and SJRNWR.

11.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the riparian woodrat in 2020 (U.S. Fish and Wildlife Service 2020). The document is incorporated by reference to provide additional information relevant to the status of the species.

11.1.5 Historical and Current Distribution and Abundance

Historical records for the riparian woodrat are similarly distributed along the San Joaquin, Stanislaus and Tuolumne rivers, and Corral Hollow, in San Joaquin, Stanislaus, and Merced Counties (Hooper 1938; U.S. Fish and Wildlife Service 2019). Thus, prior to the statewide reduction of riparian communities by nearly 90 percent (Katibah 1984), the riparian woodrat probably ranged throughout the extensive riparian forests along major streams flowing onto the floor of the northern San Joaquin Valley.

The range of the riparian woodrat is far more restricted today than it was in 1938 (Williams 1986). There are two remaining extant populations. The first population is restricted to about 250 acres (100 hectares) of riparian forest on the Stanislaus River in Caswell Memorial State Park, and the second population is approximately five miles away within the SJRNWR (U.S. Fish and

Wildlife Service 2019; Kelly et al. 2011). In 1993, Williams (1993) estimated the size of the Caswell Memorial State Park population at 437 individuals. In January of 1997, Caswell Memorial State Park flooded, submerging most of the habitat of the riparian woodrat. Evidence of only six riparian woodrats was seen immediately following this flooding episode (U.S. Fish and Wildlife Service 2019). In 1998, only nine riparian woodrats were live-trapped at Caswell Memorial State Park (U.S. Fish and Wildlife Service 2019). In 2012, six woodrats were trapped during survey efforts; no subsequent trapping efforts within the park have occurred since then (U.S. Fish and Wildlife Service 2020).

The Caswell Memorial State Park population along the Stanislaus River is within the southern boundary of the Action Area. No research has been conducted on the spatial distribution and habitat use of the riparian woodrat, but it likely has similar spatial distribution patterns of the dusky-footed woodrat, of which it is a subspecies. Territories of dusky-footed woodrats in the mixed conifer forests of the northern Sierra Nevada, California ranged from 0.14 to 18 acres (U.S. Fish and Wildlife Service 2019).

The SJRNWR population may be quite vulnerable: as of 2011, only 34 individuals had been captured (at different times) and no stick lodges had been observed anywhere on the refuge, although riparian woodrats are known to use downed trees, snags, or even buildings in place of constructing stick lodges (Kelly et al. 2011). Additionally, a wildfire event in 2004 and major flood events in 2006 and 2011 may have significantly reduced the SJRNWR riparian woodrat population (Kelly et al. 2011). In 2012, one riparian woodrat was trapped on the refuge during riparian brush rabbit reintroduction efforts (U.S. Fish and Wildlife Service 2020). In 2017, over 300 camera station pictures of riparian woodrats were captured across six sites on the refuge as part of a master's thesis study on riparian brush rabbit (U.S. Fish and Wildlife Service 2020).

The specimens from which the subspecies designation was described were collected about two miles (3 km) northeast of Vernalis, west of Modesto in Stanislaus County, California, approximately six miles (10 km) from Caswell Memorial State Park. Analysis of DWR land use maps indicate that there were approximately 50 acres (20 hectares) of "natural vegetation" present along the San Joaquin River near the locality in 1988, though no woodrats have been seen in that area. Today there is no habitat for riparian woodrats around El Nido, which is located about 5.5 miles (8.9 km) east of the San Joaquin River.

11.1.6 General Life History and Habitat

Riparian woodrats are most numerous where shrub cover is dense and least abundant in open areas. In riparian areas, the highest densities of riparian woodrats and their houses are often encountered in willow thickets with an oak overstory. They are common where there are deciduous valley oaks, but few live oaks.

Mostly active at night, the riparian woodrat's diet is diverse and principally herbivorous. Their diet consists of leaves, fruits, and terminal shoots of twigs, flowers, nuts, and fungi (65 FR 8881).

Riparian woodrats are well known for their large terrestrial stick houses some of which can last for 20 or more years after being abandoned. At Caswell Memorial State Park, riparian woodrats construct houses of sticks and other litter. No woodrat houses have been found at SJRNWR

(Kelly et al. 2011). Houses are usually placed on the ground or against/straddling a log or exposed roots of a standing tree, and typically located in dense brush. Houses also are placed in the crotches and cavities of trees and in hollow logs. Sometimes arboreal nests are constructed, but this behavior seems to be more common in habitat with evergreen trees such as live oak. With their general dependence on terrestrial stick houses, riparian woodrats can be vulnerable to flooding events.

Riparian woodrat stick house. Source: Randomtruth 2012.

Riparian woodrats live in loosely cooperative societies and have a matrilineal social structure. Unlike males, adjacent females are usually closely related and, unlike females, males disperse away from their birth den and are highly territorial and aggressive, especially during the breeding season. Consequently, populations are typically female-biased and, because of pronounced polygyny, the effective population size is generally much smaller than the actual population size. This breeding system in combination with the small size of the only known extant populations suggests that the riparian woodrat could be at an increased risk of extinction because of inbreeding depression.

11.1.7 Limiting Factors, Threats, and Stressors

Loss, fragmentation, and degradation of habitat are the principal reasons for the decline of the riparian woodrat (65 FR 8881). Threats evaluated in the initial five-year review (USFWS 2012) have continued to act on the species, with effects of stochastic events, inbreeding, disease, and predation the most significant. The most immediate threats to the two, small populations include naturally occurring events, such as drought, flooding, and wildfires. The lack of remnant habitat also continues to restrict and isolate the remaining two populations of riparian woodrat. All of these environmental stressors are likely to increase in severity with climate change as California's snowpack decreases and watersheds move toward more rain driven hydrology. In addition, riparian woodrats are threatened by disease, predation, competition, clearing of riparian vegetation, use of rodenticide, and loss of genetic variability. The continued persistence of these threats, and potential increase in certain risks such as wildfire, were confirmed in the most recent five-year review (USFWS 2020).

11.2 Environmental Baseline

The Caswell Memorial State Park population is within the Action Area. The factors described in the *Status of the Species* section above, including habitat loss, fragmentation, and degradation due to urban and agricultural development, are factors which have in the past and still continue to affect the species within the Action Area.

To date, the USFWS has formally consulted on one project within the Action Area since 2015 that may adversely affect the riparian woodrat; the State Route 99 Ripon Bridge Rehabilitation Project in San Joaquin County (File No. 08ESMF00-2016-F-1164). Surveys were not conducted for the State Route 99 Ripon Bridge Rehabilitation Project, but presence was assumed due to high quality habitat along the banks of the Stanislaus River within dispersal distance to Caswell Memorial State Park.

11.3 Effects of the Proposed Action

The riparian woodrat occurs in the Stanislaus River watershed.

11.3.1 Stanislaus River Watershed

11.3.1.1 Flow and Operations

The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action will include hydrologic changes associated with water operations (Figure 6-3). Implementation of the Proposed Action generally will result in minor changes and likely will be small relative to normal month-to-month and year-to-year variability in the system. Changes in the natural flow regime of the river will likely result in an increase in non-native and invasive plant species and a reduction in native riparian vegetation recruitment (USFWS 2019). Seasonal operations may reduce natural variability beyond major flood events (Figure 6-4). Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable riparian woodrat habitat over time. Lower flows in the spring under the Proposed Action are likely to result in less riparian vegetation recruitment which could result over the duration of the Proposed Action in less habitat used for cover for riparian woodrat. Changes to the habitat surrounding existing populations of riparian woodrats may impact the population's ability to disperse and colonize new areas beyond the current habitats occupied. However, the Proposed Action is not expected to result in different habitat conditions that currently being experienced by riparian woodrats. Additionally, the changes in flow are unlikely to result in direct harm to individual riparian woodrats.

11.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

Future effects from any new agricultural developments and/or practices will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the riparian woodrat and are reasonably certain to occur in the Action Area.

11.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" riparian woodrat. Seasonal operations within the Stanislaus River Watershed associated with the Proposed Action may have a discountable effect on riparian woodrat through a potential reduction of suitable habitat over time, but would not result in direct harm to individual woodrats. The overall impacts on the species would not result in the incidental take of individuals of this species.

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Chapter 12 Western Yellow-billed Cuckoo

12.1 Status of the Species

12.1.1 Current Legal Status

The USFWS listed the western distinct population segment (DPS) of the yellow-billed cuckoo as threatened on October 3, 2014 (79 FR 59992). The information in this section is from the final listing rule, the proposed critical habitat rule, review of the best available scientific and commercial information.

12.1.2 Critical Habitat

A final critical habitat determination was issued on April 21, 2021 (86 FR 20798), and identified sections of the Action Area along the Sacramento River from south of Red Bluff in Tehama County to Colusa, California

12.1.3 Recovery Plan

A recovery plan has not yet been developed for this species. In the absence of a recovery plan, we default to the general conservation needs of the species. For a species like the cuckoo that has lost much of its former known occupied habitat, recovery would necessitate the conservation of much of the remaining habitat that supports the species. In addition, restoration of suitable habitat that has been disturbed, but otherwise remains undeveloped, would be a priority. Lastly, efforts to establish the species in unoccupied, but otherwise suitable habitat, would contribute to its recovery.

12.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the yellow-billed cuckoo in 2020 in conjunction with their findings on the petition to delist the species (85 FR 57816; September 16, 2020). The document is incorporated by reference to provide additional information relevant to the status of the species.

12.1.5 Description and Life History

The western yellow-billed cuckoo (cuckoo) is a medium sized bird (Family Cuculidea) measuring approximately 12 inches (30 centimeters) in length and weighing about 2.1 ounces (60 grams). The plumage consists of a grayish-brown back and white chest, the tail is black and quite long with white spots. The upper mandible is dark, and the lower is typically yellow with a black tip. Cuckoos are fairly secretive in nature and call infrequently with “kowlp”, “coo”, “kuk” or “knocking” vocalizations.

Cuckoos are Neotropical migrant birds that winter in South America east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (78 FR 61622). Following migration from South America, cuckoos arrive in the southwest United States and northwestern Mexico in late May/early June with some as late as early July. They move about their breeding range in search of a riparian habitat block of sufficient size that has an abundance of prey. Breeding occurs when prey is sufficiently abundant to feed and fledge their precocial chicks. Breeding can occur from June through August with most cuckoos migrating south by mid-September. Nesting activity typically occurs between late June and late July and nest clutch size is typically between two and four eggs (Halterman et al. 2015). Cuckoos have a very short breeding season (14 to 20 days from nest construction to fledge) that is based on the availability of large insects that provide nutrition for quick growth. Fledglings are dependent on adults until 28-32 days old.

Western yellow-billed cuckoo. Source: USFWS n.d.

12.1.6 Habitat

The USFWS 2019 estimates of territory size for cuckoo are based on telemetry studies and modeling from Arizona and New Mexico, which found ‘suitable or moderately suitable habitat’ used for breeding consists of a core area of dense cottonwood-willow vegetation of at least 12 acres (4.5 hectares) in area and surrounded by large expanses of vegetation of at least 178 acres (72 hectares) for foraging that may be of lower quality than the core area (Johnson et al. 2017; Halterman et al. 2015; USFWS 2019). Similar telemetry studies to determine the average size of core areas used for breeding by cuckoos in California have not been completed. Past studies in California found cuckoos are most likely to be found in patches of willow–cottonwood riparian habitat greater than 200 acres (80 hectares) in size (79 FR 48547), and the species rarely uses small patches of habitat (under 50 acres [20 hectares] in size), particularly when patches were distant from other patches of riparian habitat (Laymon and Halterman 1989).

Breeding cuckoos are riparian obligates and nest in low to moderate elevation riparian woodlands with dense vegetation providing a thick canopy cover. Cuckoo habitat is dynamic and can change rapidly due to riverine processes of flooding, erosion, sediment deposition, and drought. Nesting habitat can mature as quickly as two-three years depending on conditions and vegetative species (Halterman et al. 2015). Cuckoos primarily use willow species such as Gooding's black willow (*Salix gooddingii*), red willow (*S. laevigata*), and coyote willow (*S. exigua*) for nesting and have open saucer type nests (similar to that of a Dove). Other tree species are occasionally used, including Fremont cottonwood (*Populus fremontii*) and alder. Along the Sacramento River, orchards of English walnut (*Juglans regia*), prune, and almond trees have also been reportedly used for nesting (Laymon 1980). Occupied habitat in Butte County was described by Halterman (1991) as great valley cottonwood riparian forest and great valley mixed riparian forest, including willows, box elder, and white alder. Potential habitat also occurs in valley marshland with willow riparian corridors, such as that found in the Llano Seco area of Butte County. Nests are built from 4 to 73 feet above the ground, and nest trees range from 10 to 98 feet in height (79 FR 48547).

Although cuckoos nest primarily in willow trees, Fremont cottonwood trees are important foraging habitat, particularly as a source of insect prey. All studies indicate a highly significant association with relatively expansive stands of cottonwood-willow forests; however, cuckoos will occasionally occupy a variety of marginal habitats, particularly at the edges of their range (Laymon 1998). Cottonwood trees have specific habitat needs to successfully germinate and grow. Cottonwood seedling roots grow from between 0.2 to 0.4 inch (0.5 to 1.0 cm) per day (Mahoney and Rood 1998), to a maximum growth of 1 inch (2.5 cm) per day (Stella et al. 2010) under cultivation. At 1 inch (2.5 cm) per day, recruitment begins to diminish (Rood et al. 1998). Adequate flow recessions are necessary for cottonwood germination and seedling survival.

Continuing habitat succession has also been identified as important in sustaining breeding populations (Laymon 1998). Riparian vegetation succession is dependent upon dynamic riverine processes (79 FR 48547).

To support or provide for dynamic riverine processes, riparian habitats must be dynamic, with natural processes that create, recycle, and maintain riparian habitat. Riparian habitat can quickly change and vary in suitability, location, use, and occupancy by cuckoo over time (79 FR 48547). Meandering streams with regular riparian floodplain activation that allows for constant erosional and depositional processes creates habitat for new rapidly growing young stands of willow, which create preferred nesting habitat conditions for cuckoo. Lateral channel migration and point bar deposition that create new floodplains and channel bend cut-offs that create floodplain lakes are important processes that create viable cuckoo habitat (Greco 2013). Loss of riparian floodplain activation and other factors can destroy or degrade breeding habitat, such that any given breeding habitat cannot be expected to remain suitable in perpetuity. In order to manage breeding habitat over time, it is necessary to have additional suitable habitat available to which cuckoos, displaced by such habitat loss or change, can readily move into and breed. If short-term losses of habitat and floodplain activation were never to occur, habitat would simply senesce or over- mature and no longer have the structure and foliage cover to accommodate nesting activity (USFWS 2016).

Cuckoos have a certain degree of breeding site fidelity. Where banding studies have taken place, returning cuckoos one or more years after initial capture were typically recaptured within 80 feet to 50 miles from their original banding location (McNeil et al. 2013; USFWS 2019; Halterman et al. 2015). Breeding pairs of banded cuckoos along the Lower Colorado River were found occupying the same territory for up to three years (Laymon 1998; Halterman et al. 2015). However, dramatic fluctuation in breeding pairs at long-term study sites at the South Fork Kern River and Bill Williams River indicates that year-to-year movement between potential breeding areas also occurs (78 FR 61622). Geolocator studies have found that cuckoos can make long-distance movements during the breeding season (Sechrist et al. 2012). Limited radio telemetry work has been conducted on the cuckoo populations in California and the findings were largely inconclusive. However, one cuckoo tagged in the Sacramento River Valley was later found breeding in the Kern River Valley (USFWS 2019). It is likely that cuckoos return to sites of previous successful breeding, but if the conditions are not suitable that year, they move to other potential breeding sites (78 FR 61622). The maximum distance individual cuckoos will travel from their natal habitat to find a new suitable breeding site is uncertain given the limited number of studies conducted to date.

Cuckoos may be found in a variety of vegetation types during migration, including coastal scrub, secondary growth woodland, hedgerows, humid lowland forests, and forest edges from sea level to 8,125 feet in elevation (Hughes 2015). Additionally, during migration they may be found in smaller riparian patches than those in which they typically nest. This variety of vegetation types suggests that the habitat needs of the cuckoo during migration are not as restricted as their habitat needs when nesting and tending young.

12.1.7 Numbers

The number of cuckoos in the western United States has "declined by several orders of magnitude over the past 100 years" (78 FR 61622), coincident with the widespread loss of riverine riparian woodlands as a result of the construction of dams, mining of groundwater, and development of urban and agricultural areas in the United States. This decline is continuing throughout the range of the species. Surveys from 2004 – 2019 have documented losses of breeding pairs in smaller isolated sites and at core breeding areas. The USFWS estimated the 2019 breeding population at 680 to 1,025 pairs, with 350 to 495 pairs north of the Mexican border and the remainder in Mexico. The estimated population in California once exceeded 15,000 pairs (Hughes 2015), declined to 122-163 pairs in 1977 (Gaines and Laymon 1984), further declined to an estimated 100 pairs in 2000 (USFWS 2019), and was estimated to be 40-50 pairs state-wide in 2013 (78 FR 61622).

Limited information is available regarding the current distribution and abundance of cuckoos range-wide. The estimated range-wide cuckoo population was summarized by the USFWS in 2013 and is provided in Table 12-1. The number of cuckoo territories in Arizona and New Mexico is estimated to be higher than in 2013 (USFWS 2019). While the species is responding positively to habitat restoration efforts in some areas, populations in other areas have decreased in size. In California, population declines in the Sacramento River Valley (Dettling et al. 2015) and Kern River Valley (Southern Sierra Research Station 2017) have been documented.

Table 12-1. Estimated Range-wide Cuckoo Territory Numbers.

State	Estimated Number of Territories
Arizona	170–250
California	40–50
Colorado	<10
Idaho	10–20
Nevada	<10
New Mexico	100–155
Northwestern Mexico	330–530
Utah	10–20
Western Texas	<10
Wyoming	<5
Total	**680–1025**

Source: 78 FR 61622.

12.1.8 Limiting Factors, Threats, and Stressors

The primary threats to cuckoos are the loss of extensive contiguous riparian habitat due to dams and the alteration of downstream channels by surface and groundwater diversion; encroachment of levees and flood control and bank stabilization structures into the river channel and floodplain; transportation systems; gravel mining; agriculture including ranching; and conversion to non-native invasive plant communities (79 FR 48547). Other threats come from the use of pesticides that reduce or eliminate prey during the breeding season. Very little is known about threats to cuckoos and their wintering habitat in South and Central America.

Dams and their ongoing operations are a threat to the cuckoo over most of its range. The initial damming damages riparian structure and functioning due to habitat displacement from dam construction and permanent flooding of upstream riparian areas. Current and future releases of water downstream from dams at flow rates or timing that differ from preconstruction hydrologic circumstances may lead to flooding or desiccation beyond the tolerance limits of the native riparian vegetation, resulting in habitat loss. Downstream effects include changes in sediment transport due to sediment retention behind dams so that channels become increasingly "sediment starved." This situation causes vertical erosion (downcutting), which can lead to loss of river terraces that sustain riparian vegetation (79 FR 48547).

The operation of dams result in a diminishment or loss of the natural hydrograph that provides the conditions needed for riparian vegetation growth, establishment, and succession. In California, winter and spring storms historically activated the riparian floodplain. The Sacramento River is lacking in the hydrograph components of winter mobilization flows, spring floodplain inundation, and spring snowmelt recession. The dampening of the magnitude of normal high flows can prevent cottonwood germination and the dewatering of downstream reaches causes declines of riparian forests. These impacts are happening now and are likely to continue without changes to water release strategies and management (79 FR 48547).

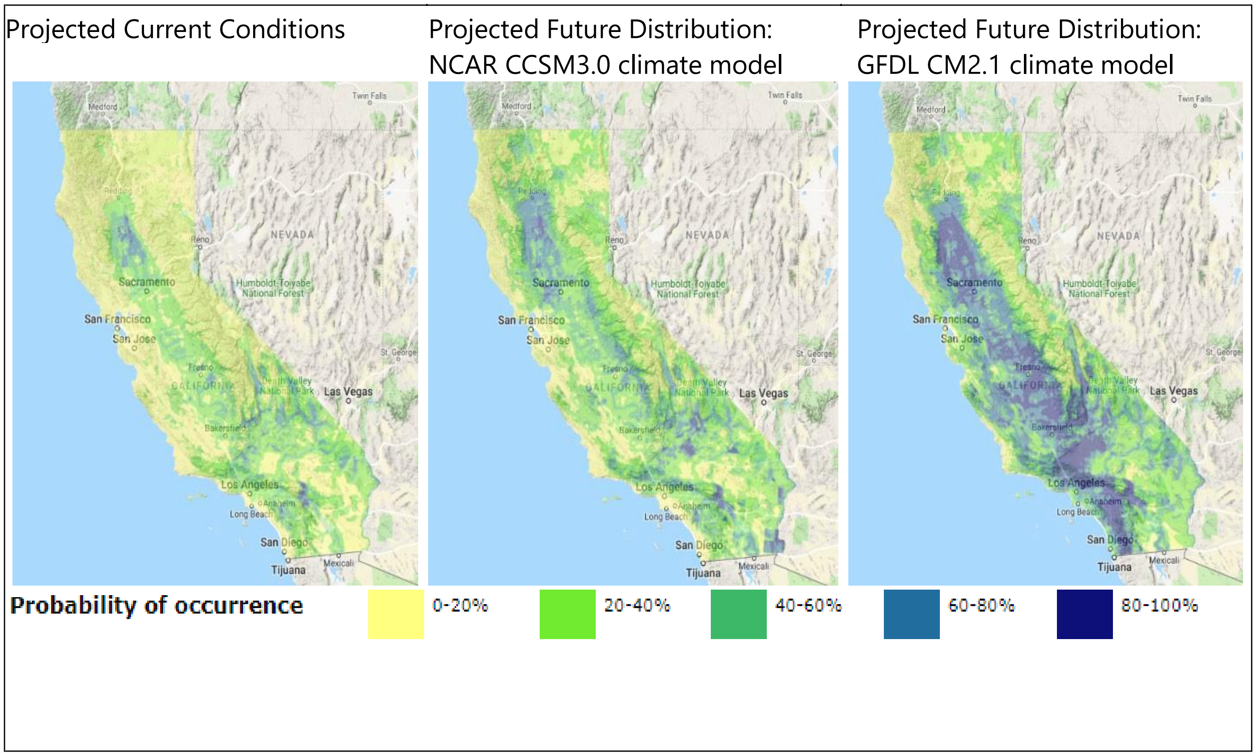
Conversion of native or mixed native and nonnative riparian woodlands to nearly monotypic stands of saltcedar (*Tamarix* spp.) and other nonnative vegetation, coupled with the inability of native vegetation to regenerate under altered hydrological conditions, is a significant threat to the cuckoo (79 FR 48547). Exotic vegetation does not appear to be preferred habitat by cuckoos, but will be utilized if available. From 2009-2019 along the Middle Rio Grande River, just over 4% of the cuckoo detections within woody riparian habitats were located in areas with an exotic canopy and an understory component, and approximately 16% of detections were in areas with a mixed native and exotic canopy and an understory component (White et al. 2020). However, 54% of detections within woody riparian habitat were in areas of native canopy cover (White et al. 2020). In Arizona on the lower Colorado River, the odds of cuckoo occurrence decreased rapidly as saltcedar presence increased (USFWS 2019). In central California, giant reed (*Arundo donax*), common edible fig (*Ficus carica*), and Himalayan blackberry (*Rubus discolor*) are some of the more conspicuous nonnative plants widely established along the Sacramento River. Cuckoo are far less likely to be detected in areas with an understory dominated by Himalayan blackberry and nesting has not been documented in areas dominated by these species that lack at least some native canopy trees (79 FR 48547).

Cuckoos prey on katydids, caterpillars, cicadas, and other large insects (Halterman et al. 2015). Targeted insecticide applications on agricultural land have reduced the cuckoo's preferred food resources such as sphinx moth caterpillars, giant grasshoppers, cicadas, and tree frogs. There have not been any studies directly linking cuckoo decline to the use of common pesticides. However, the global decline in insect biomass (Hallman et al. 2017) is a threat to many insectivorous bird species (Hallman et al. 2014). Pesticides, whether applied directly to riparian habitat or sprayed on adjacent areas, may affect the reproductive success of the cuckoo (79 FR 48547). A reduction in the availability of suitably sized prey may lead to nest failure and the abandonment of nesting areas.

The critical habitat rule described a study along the Snake River in Idaho and noted that, "compared to habitat patches surrounded by natural habitat, patches near agricultural lands supported more avian nest predators that prosper in human-altered landscapes and have a greater effect on the smaller, fragmented habitats" (79 FR 48547). The increase in predators can result in an increase in the loss of nests; repeated nest failures may cause cuckoos to abandon suitable habitat.

Climate change also poses threats to the cuckoo through changes in the availability and distribution of suitable habitat. In the cuckoo's range, climate change is generally predicted to result in an overall warmer, drier climate, with periodic episodic precipitation events. California has a recurring drought cycle that can result in loss of riparian trees from reduced river flows and lowering water tables. The most recent drought is suspected to be a major contributing factor to the decline of the Kern River Valley cuckoo population (USFWS 2019).

Long-term climate trends are likely to have an overall negative effect on the available habitat throughout the breeding range of the cuckoo (79 FR 48547). However, there is a potential that future conditions in the major riparian corridors of California may result in better habitat suitability for cuckoo than future conditions in the species' current stronghold in the Southwest (USFWS 2019; Point Reyes Bird Observatory 2012). In 2012, the Point Reyes Bird Observatory (now called Point Blue Conservation Science) produced distributional models for potential habitat for riparian birds, including cuckoo, under current conditions and two different climate scenarios (Figure 12-1). Despite potential changes in the frequency, timing, and severity of storm events in the future, the model predicted an increase in potential habitat for cuckoo. The models are coarse estimates of potential habitat availability and do not represent potential occupied habitat under potential future climate scenarios (USFWS 2019).



Notes: Variables in order of importance for yellow-billed cuckoo: 1. Precipitation seasonality, 2. Vegetation, 3. Precipitation of driest quarter, 4. Annual precipitation, 5. Distance to stream, 6. Mean temperature of the warmest quarter, 7. Temperature seasonality, 8. Annual mean temperature, 9. Mean diurnal range, 10. Isothermality.

Source: California Avian Data Center, Point Reyes Bird Observatory 2012.

Figure 12-1. Modeled Western Yellow-billed Cuckoo Distribution Responses to Climate Change.

In the arid southwest, models based on projected climate change predict that saltcedar will become more dominant in this region over the next 100 years (79 FR 48547). In degraded habitat with saltcedar the threat of fire may be greater. Saltcedar ignites quickly, further increasing the incidence of periodic fires. Wildfires are likely to become more common with climate change, further exacerbating the saltcedar problem in cuckoo habitat in places such as New Mexico and Arizona (79 FR 48547).

12.1.9 Distribution

The cuckoo formerly bred in California, Arizona, New Mexico, Oregon, Washington, western Colorado, western Wyoming, Idaho, Nevada, Utah, northwestern Mexico, and probably southern British Columbia, Canada (Figure 12-2). The species is now absent through much of the western range, including British Columbia, Oregon, and Washington (Hughes 2015). Very few incidental sightings have occurred in the Pacific Northwest over the last 30 years (Toochin and Cecile 2014; USFWS 2019). The possibility of a vestigial breeding population in Washington exists (Wahl et al. 2005); however, if cuckoos still breed in the state, their numbers are extremely low, with pairs numbering in the single digits (USFWS 2015).

The species' current confirmed breeding range reaches its northwestern limit in the Sacramento Valley, California (although a small, potentially breeding population exists in coastal northern California on the Eel River). The northeastern portion of the breeding range is in southeastern Idaho on the Snake River. They breed at several sites in California, Arizona, New Mexico, and Mexico. Arizona, New Mexico, and northwestern Mexico, where some cuckoo populations are stable or growing, are recognized as the current core breeding areas for the cuckoo (USFWS 2019). While California historically hosted a large portion of the breeding population and the species nested at numerous sites primarily in coastal areas from San Diego to Sonoma County, the Central Valley from Kern County to Shasta County, and the lower Colorado River, the California population has decreased to less than 1% of its estimated historical size (78 FR 61622). Today, there are only three regions in California with confirmed breeding populations: the Sacramento River between Red Bluff and Colusa, the Kern River immediately upstream of Lake Isabella, and the Lower Colorado River along the border between Arizona and California (78 FR 61622). The Lower Colorado River breeding population is relatively stable (McNeil et al. 2013; Parametrix and Southern Sierra Research Station 2018). The Kern River population is experiencing a drastic decline and the area may not currently support a viable breeding population (Southern Sierra Research Station 2017). While cuckoo still occupy the Sacramento River Valley, the population has declined by at least 80 percent over the last 40 years, with a major continuing decline in the most recent 10 years (78 FR 61622). In 2013, the Sacramento River Valley population was found to be between 27 and 28 breeding pairs (Dettling et al. 2015a).

Source: Bureau of Reclamation 2018. Lower Rio Grande Yellow-billed Cuckoo Survey Results 2017.

Notes: This figure depicts the most recently published map of the western yellow-billed cuckoo breeding range, but that map is based on 1987 data. Current data for New Mexico confirm a cuckoo population on the Lower Rio Grande that is not depicted on this map.

Figure 12-2. Current Breeding Range of the Western Yellow-billed Cuckoo.

The metapopulation dynamics of the cuckoo are largely unknown at this time. Given the limited scope of banding and geolocator studies for cuckoo, it is unknown if the exchange of individuals among geographically separated populations is common, or if there is a core population from which individuals may disperse out into other populations.

The available information on the winter range of the western DPS of the cuckoo comes from two studies: Sechrist et al. 2012 and McNeil et al. 2015. A single cuckoo from the breeding population on the middle Rio Grande River in New Mexico wintered in eastern Bolivia, southwestern Brazil, Paraguay, and northeastern Argentina, spending 5 months from late November through late April moving around an area 1,243 miles in length and 373 miles in width (Sechrist et al. 2012). Another study documented a similar loop migration route in another cuckoo breeding in the lower Colorado River in Arizona, but reversed in direction from the New Mexico bird. During fall migration the bird flew ~5,903-5,959 miles (~9,500–9,900 km), passing through the Caribbean region. It wintered from mid-November to late April in the Gran Chaco of central South America, around the junction of Paraguay, Bolivia, and Argentina. The more direct spring route back to the breeding grounds passed through Peru and Central America (McNeil et al. 2015).

12.2 Environmental Baseline

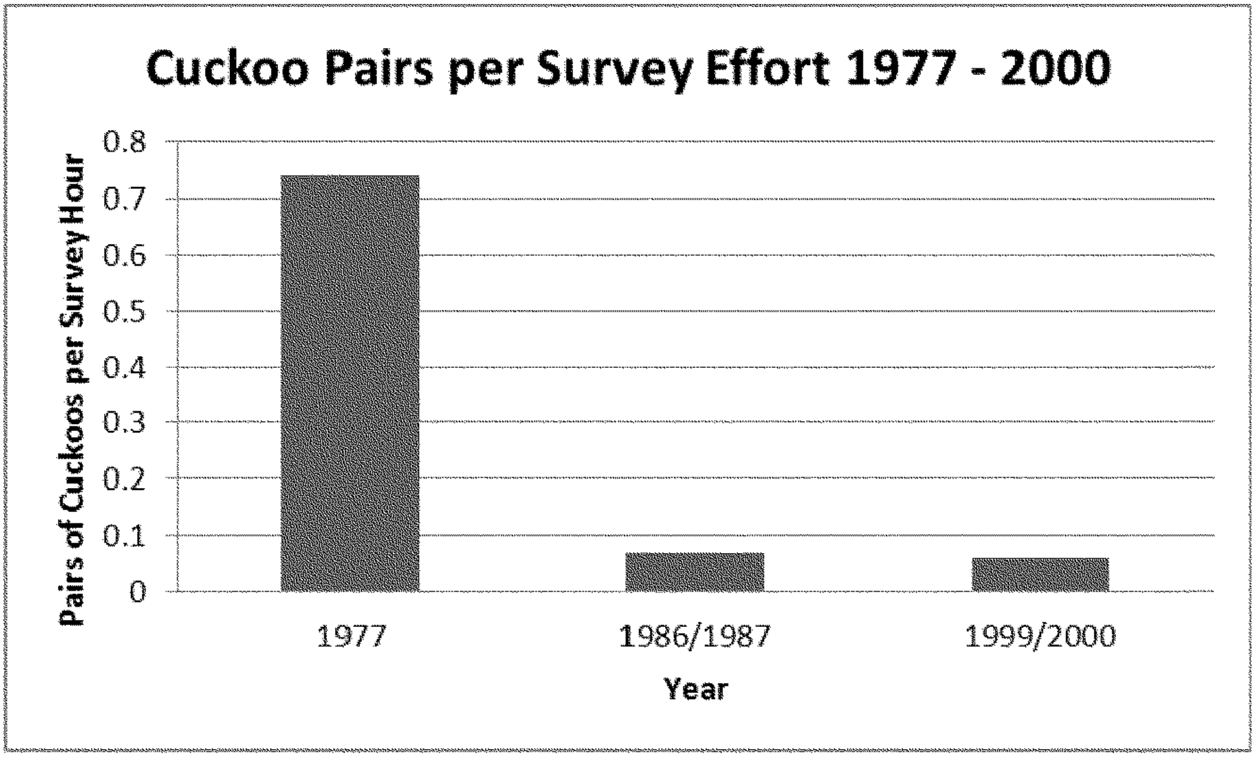
The cuckoo is known to have been historically common in riparian habitat throughout the Central Valley, from Kern County north to Redding (Laymon 1998). While the species has been detected in multiple watersheds throughout the Action Area, only the Sacramento River Valley is believed to currently sustain breeding populations at isolated sites along the Sacramento River and Sutter Bypass between Red Bluff and Colusa (Laymon and Halterman 1989; Laymon 1998; Halterman 2001; Hammond 2011; Dettling et al. 2014; Stanek 2014; Parametrix and Southern Sierra Research Station 2015). Table 12-2 contains a summary of occurrences at locations throughout the Action Area from the 1960s to 2019. No surveys for cuckoo were conducted for this Biological Assessment.

Table 12-2. Watersheds Occupied by Western Yellow-billed Cuckoo.

Location	Dates	Notes	Source
Sacramento River (between Red Bluff and Colusa)	through 2018	Believed to be the only active breeding location within the Central Valley. No large-scale surveying efforts since 2013.	CDFW 2023, eBird 2023, Dettling et al. 2015
Sutter Bypass and East Canal (Sacramento River Valley)	1992, 1999, 2000, 2008, 2010, 2015, 2016, 2018	Six pairs detected by Sutter National Wildlife Refuge staff in 2000.	CDFW 2023, eBird 2023, USFWS 2019
Feather River	1976, 1977, 1985, 1986, 1987, 2016	Occurrences near Yuba City and Lake of the Woods State Wildlife Area. Point Reyes Bird Observatory	CDFW 2023, eBird 2023

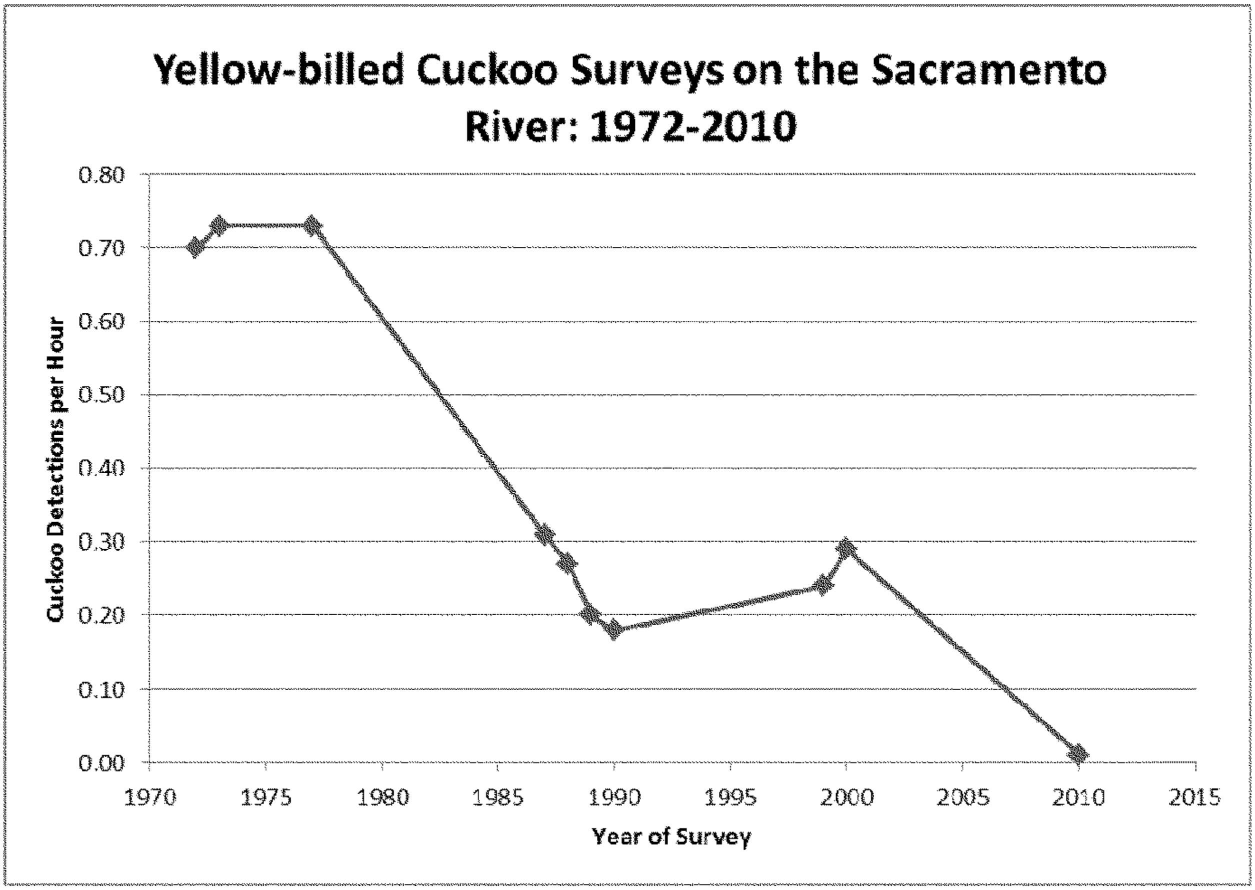
Location	Dates	Notes	Source
		surveys 2012 and 2013 detected no individuals in the watershed.	
American River (between Nimbus Dam and convergence with Sacramento River)	August 2013, August 2015	Two reports in 2013 of a single bird; one report in 2015 of a single bird.	eBird 2023
Stanislaus River (between Ripon and convergence with the San Joaquin River)	1962, 1965, June 1973, July 1982, July 2018	Numerous observations near the mouth of the Stanislaus River from 1962-1973.	CDFW 2023, eBird 2023
San Joaquin River- Old River	June 2012	Water Treatment Plant	eBird 2023
Bay-Delta (Lower Sacramento River)	July 2009, August 2010	Snodgrass Slough	CDFW 2023
Bay-Delta (Lower San Joaquin River)	June 2005	Dow Wetlands Preserve	eBird 2023

The cuckoo population within the Action Area has been in decline since the time when the first phases of the CVP were implemented, and likely prior to that time given the extensive loss of riparian habitat since the Gold Rush. The steep decline in the cuckoo population in the Sacramento Valley was first noted by Grinnell and Miller in 1944, who concluded that the loss of large areas of riparian forest was the cause of the decline. By the 1980s, 95% of riparian forest in California's Central Valley had been lost (Katibah 1984). The breeding cuckoo population throughout California was estimated to be approximately 15,000 pairs before extensive development (Hughes 2015). The USFWS estimates between 40 and 50 breeding pairs remain in California, down from approximately 280 pairs in 1977 (78 FR 61622). Approximately half of the statewide population in 2013 is within the Sacramento River Valley area. The most recent estimate of the breeding population within the Action Area is no more than 28 pairs in 2013 (Dettling et al. 2015). Since 1977, the number of cuckoos detected per survey hour has been declining (Figure 12-3 and Figure 12-4). Detections per survey hour are an indication of the density of individual birds occupying a particular area. Trends in the detection rate of a species are indicative of the general trend in the species' population, supporting the conclusion that the population in the Sacramento River Valley continues to decline (see Figure 12-4).



Source: 78 FR 61622.

Figure 12-3. Yellow-billed Cuckoo Pairs per Survey Effort on California Statewide Surveys, 1977–2000.



Source: 78 FR 61622.

Figure 12-4. Yellow-billed Cuckoo Detections during Surveys on the Sacramento River on 10 Separate Years, 1972–2010.

Cuckoo detections have occurred most frequently in the upper Sacramento River where levees are setback from the river or do not exist, allowing for larger patches of active floodplain riparian habitat. Additionally, the last 20 years has seen a large amount of riparian restoration occur in the upper Sacramento River (Golet et al. 2008). The Sacramento River from Red Bluff to Colusa has a highly dynamic mosaic of habitat patches of varying ages that form, disappear, and re-form in response to active river channel processes that operate over decades (USFWS 2019). Although this section of the Sacramento River is affected by altered hydrology, it is far enough below Shasta Dam and below several major undammed tributaries, such as Cottonwood Creek and Battle Creek, that it still has flood events every few years that help support riparian habitat processes (USFWS 2019). The river provides habitat characteristics that Laymon (1998) indicated were important for the cuckoo in California, such as a meandering system with young riparian habitat that, compared to mature woodlands, provides preferred nesting sites, high productivity of invertebrate prey, and reduced predator abundance (Laymon 1998).

Most other riparian habitat in the Action Area tends to be more narrow and linear than in the mainstem Sacramento River between Red Bluff and Colusa. The American River has a wider floodplain due to levees being setback from the channel. There are some patches large enough to support nesting cuckoos, though cuckoos have not been observed nesting along the American River. In 2013, there were two unconfirmed audible occurrences along the American River Parkway approximately five miles from the Action Area. These two occurrences were less than five miles apart along the river and heard on the same day (eBird 2023). In 2015, there was a confirmed visual sighting along the American River located in proximity to both the 2013 occurrences and approximately five miles from the Action Area (eBird 2023). Insufficient prey base from extensive application of insecticides to control mosquitoes and disturbance from recreational activities and homeless encampments along the American River may deter cuckoos from nesting. Based on these sightings, cuckoos likely use locations throughout the Action Area as stop-over habitat for feeding, resting, and sheltering during their migration from Mexico to the Upper Sacramento River. These stop-over areas also include the Stanislaus River, San Joaquin River, the Delta, Yolo Bypass, and Sutter Bypass.

A habitat model developed by Gaines (1974) for the cuckoo in the Sacramento Valley includes the following elements: patch size of at least 25 acres, at least 330 feet wide and 990 feet long, within 330 feet of surface water, and dominated by cottonwood/willow gallery forest with a high-humidity microclimate. Laymon and Halterman (1989) further refined the model by classifying habitat patch sizes for suitability. A willow-cottonwood forest patch greater than 1,980 feet wide and greater than 200 acres (81 hectares) is classified as optimum habitat; a patch 660 to 1,980 feet wide and 102.5 to 200 acres (41.5 to 81 hectares) is suitable; a patch 330 to 660 feet wide and 50 to 100 acres (20 to 40 hectares) is marginal, and smaller patches are unsuitable. Most riparian corridors in the Action Area do not support sufficiently large riparian patches or the natural, geomorphic processes that provide suitable cuckoo breeding habitat (Greco 2013).

Largely due to restoration efforts, there is currently estimated to be a total of 20,100 acres (8,134 hectares) of potential cuckoo habitat along the Sacramento River and 5,070 acres (2,052 hectares) along the Feather River, for a total of 25,170 acres (10,186 hectares) in the species current breeding area in the Central Valley (Dettling et al. 2015). Despite the restoration efforts in the Sacramento River Valley, the amount of forest restored so far may not be enough to slow the decline of the species that was already in motion (Dettling et al. 2015). Dybala et al. (2017) determined an additional 8,377 acres (3,390 hectares) of riparian vegetation in the Sacramento River Valley would need to be restored within the next 10 years to stop the trend of steep population decline for cuckoo. A total of 151,670 acres (61,379) hectares would have to be restored within the next 100 years to make the cuckoo population resilient (Dybala et al. 2017).

The decline of the cuckoo is primarily the result of the loss and degradation of riparian habitat within its breeding range (Gaines and Laymon 1984). The first major human disturbance to riparian habitat historically used by cuckoo within the Action Area came from hydraulic mining in the mid- 1800s. The bed of the Sacramento River returned to its original elevation after the end of hydraulic mining in 1884. However, the plan view of the river was permanently altered. Before the river established a new pattern of stability, dams and levees were built to control floods and restricted the river’s natural hydraulic processes. Levee construction and reclamation of levee lands further destroyed large amounts of riparian vegetation and began the conversion of riparian lands to croplands which continued through the 1980s (Scott and Marquiss 1984). The few remaining riparian areas used for breeding by the cuckoo within the Action Area were included in the proposed critical habitat rule (79 FR 48547).

12.2.1 Factors Affecting Western Yellow-Billed Cuckoo Within the Action Area

Many factors have contributed to the current status of the cuckoo in the Action Area. Agriculture, construction of flood control infrastructure, levee construction, and riprapping have contributed to historic loss of riparian and floodplain habitat, and which constrain or prevent ecosystem function to allow for riparian habitat regeneration in the Action Area. Flood control efforts in the Sacramento Valley have a history dating back to the Gold Rush, and resulted in a fragmented system of levees and other structures (James and Singer 2008). Long-term operations of the CVP and SWP have been occurring for many decades and have contributed to the current condition of the species in the Action Area, along with the other factors listed above.

The operation of large dams have significant downstream hydrologic and geomorphic effects on rivers (Graf 1999, 2006), and recent studies have modeled the effects of dams and diversions on the Sacramento River (Fremier et al. 2014; USFWS 2019). The changes in channel dynamics resulting from the operation of water storage and conveyance facilities in the Sacramento River are major factors in the reduction of suitable cuckoo habitat (Greco 2013). Multiple models have been developed to explain how water operations have changed hydrogeomorphic processes in the Sacramento River since the implementation of the CVP (Greco 1999, 2013; Greco et al. 2007).

Continued shifts in vegetation community composition in terms of dominant species, age, canopy height, and patch sizes (Greco et al. 2007; Greco 2013) and changes in channel morphology (USFWS 2019) have been documented in recent decades. The effects of dam-induced reduction of mean annual peak discharge flow (CALFED Bay-Delta Program 2000), reduction of flood discharge volume (Greco 2013), reduction in stream power (Fremier 2003), sediment starvation (USFWS 2019), and reduced bank erosion rates and overbank deposition (Buer et al. 1989) all contribute to changes in successional riparian forest ecosystems. As the ability of the river channel to migrate laterally is restricted (Larsen et al. 2006) and the quantity of new land production reduces, the amount of new pioneer riparian forests is subsequently decreased (Greco et al. 2007).

In addition to the management of riparian habitat within the USFWS' wildlife refuges within the Action Area, there are restoration projects that have occurred or are planned to occur. Substantial riparian restoration and floodplain reestablishment through levee setbacks are occurring on the Sacramento and San Joaquin Rivers, and some major tributaries.

As of 2019, the USFWS had formally consulted on 32 projects within the Action Area. These include projects such as bridge replacements, riverbank protection, channel rehabilitation, habitat restoration, USACE flood control manual updates, and transmission line installation. A consultation with the USACE was completed in 2018 for the Folsom Dam Water Control Manual Update. In this consultation, it was found that flood flows were expected to result in a reduction in the amount of habitat, or lowering of the quality of the remaining habitat, but this reduction was deemed to be of insufficient duration, intensity, and severity to adversely affect the cuckoo. Another notable consultation is with the USACE on the construction of the Hamilton City Flood Damage Reduction and Ecosystem Restoration Project to setback the levee along the Sacramento River near Hamilton City, Glenn County. This project is expected to result in temporary adverse effects to cuckoo during construction, but will improve riparian habitat quality long-term. Once completed, the setback levee will allow for the return of dynamic riverine processes to 1,415 acres on the landside of the existing levee that will be reconnected to the active floodplain, and restoration of 420 acres of riparian forest suitable for cuckoo breeding.

12.3 Effects of the Proposed Action

As noted in the *Environmental Baseline* section above, the effects of the Proposed Action will be against a backdrop of a highly degraded, constrained riparian system. The following description of the effects of the Proposed Action is broken out by watershed and Proposed Action element.

12.3.1 Sacramento River

12.3.1.1 Seasonal Operations

Periodic flooding and erosion are important to maintaining successional riparian ecosystems. The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the Sacramento River (Figure 6-1). Seasonal operations under the Proposed Action may reduce natural variability beyond major flood events (Figure 6-2). Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. It is assumed that seasonal operations under the Proposed Action will on average maintain current vegetation. It is expected that implementation of the Proposed Action will result in similar habitat conditions currently being experienced by yellow billed cuckoo. The proposed changes are unlikely to produce measurable changes in quantity or quality of western yellow billed cuckoo habitat in the upper Sacramento watershed, and there is no apparent mechanism by which these changes could result in harm to individual western yellow-billed cuckoos.

12.3.1.2 Spring Pulse Flows

The spring pulse flows in the Proposed Action may benefit cuckoo by supporting the recruitment of important riparian tree species, primarily willows but is likely discountable. The spring pulse flows may result in floodplain activation that could lead to the regeneration of riparian vegetation. The Proposed Action does not include the incorporation of flow recession during the germination and seedling establishment for riparian over-story species (particularly Fremont cottonwood).

12.3.2 American River

12.3.2.1 Seasonal Operations

The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the American River (Figure 9-1). Similar to the Sacramento River, it can be assumed that seasonal operations will on average maintain current vegetation, with limited floodplain activation to stimulate regeneration. Seasonal operations under the Proposed Action may reduce natural variability beyond major flood events (Figure 9-2). Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, it can be expected that implementation of the Proposed Action will result in similar habitat conditions that those currently experienced by western yellow-billed cuckoo.

12.3.3 Stanislaus River

12.3.3.1 Seasonal Operations

The frequency and intensity of flood events is a result of hydrology, and of USACE conservation pool requirements and the existence and maintenance of levees which are not part of this Proposed Action. The Proposed Action includes proposed flow changes in the Stanislaus River (Figure 6-3). Seasonal operations under the Proposed Action may reduce natural variability beyond major flood events (Figure 6-4). Similar to the Sacramento River, it can be assumed that seasonal operations under the Proposed Action will on average maintain current vegetation, resulting in habitat similar to the current condition with limited floodplain activation to stimulate regeneration and will likely result in flows being generally more stable, which will reduce riparian over-story tree regeneration. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, it can be expected that implementation of the Proposed Action will result in similar habitat conditions that those currently experienced by western yellow-billed cuckoo.

12.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Additional future activities that are reasonably certain to occur in the Action Area include creation of recreation trails and conversion of riparian habitat to agriculture. Recreational trails can disturb or harass cuckoos when trails are located adjacent or within cuckoo breeding habitat. Construction equipment that is used for creation of the trail has the potential to disrupt nesting cuckoos. Any future agriculture conversions that occur adjacent to riparian habitat that could be used by the cuckoo has the potential to affect the cuckoo and its habitat through the use of pesticides and drift of pesticides damaging both the riparian vegetation as well as the prey base of the cuckoo.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the western yellow-billed cuckoo and are reasonably certain to occur in the Action Area.

12.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" the western yellow-billed cuckoo. The seasonal operations in the Sacramento River, American River, and the Stanislaus River and the potentially beneficial impacts associated with the spring pulse flows will have a discountable impact to the existing riparian vegetation. Additionally, elevated water flows are not anticipated to rise to the level that would cause impacts to nesting western yellow-billed cuckoos. The overall impacts on the species would not result in the incidental take of individuals of this species.

12.6 Critical Habitat

12.6.1 Status of Western Yellow-billed Cuckoo Critical Habitat

The USFWS designated critical habitat for western yellow-billed cuckoo on April 21, 2021. The PBFs essential for western yellow-billed cuckoo were derived from its biological needs. Based on current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, the USFWS determined that the PBF's essential to the conservation of the western yellow-billed cuckoo are:

1. **Range wide breeding habitat (including areas in the Southwest) –** Riparian woodlands across the DPS; Southwestern breeding habitat, primarily in Arizona and New Mexico: Drainages with varying combinations of riparian, xeroriparian, and/or nonriparian trees and large shrubs. This PBF includes breeding habitat found throughout the DPS range as well as additional breeding habitat characteristics unique to the Southwest.

    2. **Adequate prey base –** Presence of prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies, moth larvae, spiders), lizards, and frogs for adults and young in breeding areas during the nesting season and in post breeding dispersal areas.

    3. **Hydrological processes –** The movement of water and sediment in natural or altered systems that maintains and regenerates breeding habitat. This PBF includes

hydrologic processes found in range wide breeding habitat as well as additional hydrologic processes unique to the Southwest in southwestern breeding habitat

Sixty-three units have been designated as critical habitats for the western yellow-billed cuckoo. The areas designated as critical habitat are located in Arizona, California, Colorado, Idaho, New Mexico, Texas, and Utah. Figure 12-5 presents the range of critical habitat within the project area.

12.6.2 Western Yellow-Billed Cuckoo Environmental Baseline

One critical habitat units identified for western yellow-billed cuckoo occur in the Action Area. Unit 63: CA-1 Sacramento River; Colusa, Glenn, Butte, and Tehama Counties, California (Figure 12-5).

Critical habitat unit CA-1 is 34,201 ac (13,841 ha) in extent and is a 69-mi (111-km)-long continuous segment of the Sacramento River starting 5 mi (8 km) southeast of the city of Red Bluff in Tehama County, California, to the downstream boundary of the Colusa-Sacramento River State Recreation Area next to the town of Colusa in Colusa County, California. Approximately 2,123 ac (859 ha) is in Federal ownership; 485 ac (196 ha) is in State ownership; and 31,593 ac (12,785 ha) is in other ownership. The unit is considered to have been occupied at the time of listing. This site has been a significant nesting area (nearly 100 nesting pairs in early 1970s) for the western yellow-billed cuckoo in the past but has been in decline (Dettling et al. 2015, p. 2). This unit is part of the area outside the Southwest portion of the DPS that provides breeding habitat for the western yellow-billed cuckoo that is in a different ecological setting as identified in our conservation strategy. The unit provides the habitat component provided in PBF 1 and the prey component in PBF 2. Hydrologic processes, in natural or altered systems, that provide for maintaining and regenerating breeding habitat as identified in PBF 3 occur within this unit but depend on river flows and flood timing. Survey efforts in the early 1970s detected approximately 3 western yellow-billed cuckoo detections per day (60-96 nesting pairs). In the late 1980s this number dropped to less than 1.5 per day (35 nesting pairs) and in 2012 the survey efforts identified one to less than one sighting per day (28 nesting pairs) (Dettling et al. 2015, pp. 11-13). It is an important area to maintain for occupancy to promote species recovery.

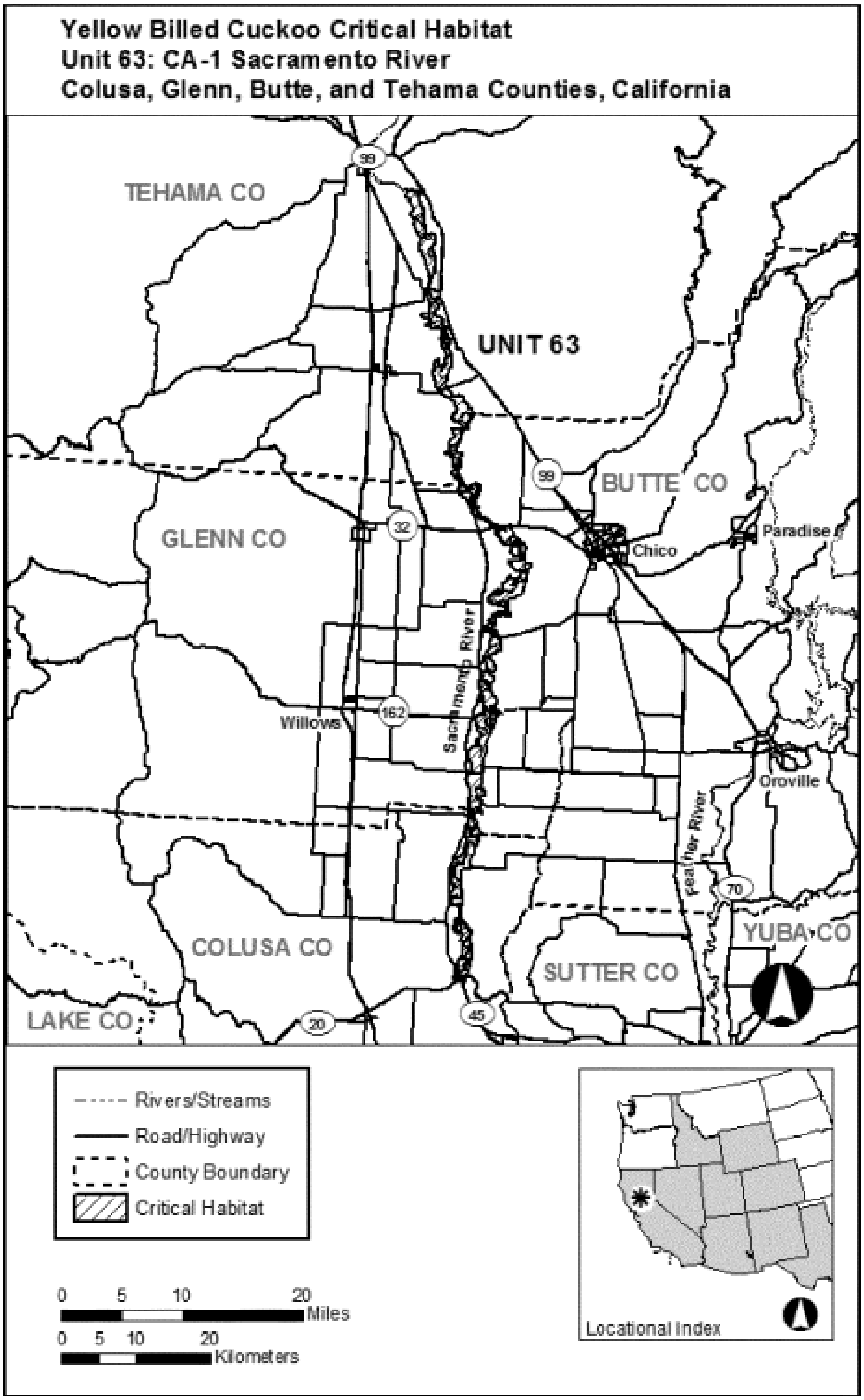


Figure 12-5. Unit 63 Western Yellow-billed Cuckoo Critical Habitat.

12.6.3 Previous Consultations in the Action Area

According to the ECOSphere – Section 7 Consultation Issued Biological Opinions there is one known project "*Formal Consultation on the Kopta Slough Multi-Benefit Project, Tehama County, California (2022-0075813-S7-001)*" that occurred within the relevant Critical Habitat unit for this species.

12.6.4 Effects of the Proposed Action on Western Yellow-billed Cuckoo Critical Habitat

12.6.4.1 Seasonal Operations

The Proposed Action includes proposed flow changes in the Sacramento River (Figure 6-1). The proposed changes are unlikely to produce measurable change in quantity or quality of western yellow billed cuckoo habitat in the upper Sacramento watershed, and there is no apparent mechanism by which these changes could result in harm to individual western yellow billed cuckoos. The impacts on each PBF are detailed below:

- PBF 1 (range wide breeding habitat) – This factor is unlikely to be significantly altered as the current hydrological regime is not being modified in a substantial manner under the Proposed Action. The current hydrological regime does not preclude the presence of breeding habitat however the water flow releases as part of seasonal operations is generally not conducive to inundating additional floodplain habitat or encouraging succession that is required to maintain suitable riparian breeding habitat over the long term. The status of this PBF is effectively unchanged by the seasonal operations on the Sacramento River.
- PBF 2 (adequate prey base) – This factor is primarily driven by surrounding habitat uses and application of insecticides. The Proposed Action will not have measurable impacts on the prey base within the critical habitat area.
- PBF 3 (hydrological processes) – The existing dams and regulated water releases prevents the needed sediment deposition, erosion of the banks and inundation of floodplain habitat. Periodic flooding and erosion are important to maintaining successional riparian ecosystems. Seasonal operations under the Proposed Action will on average maintain current vegetation, resulting in habitat similar to the current condition with limited floodplain activation to stimulate regeneration.

12.6.4.2 Spring Pulse Flows

The spring pulse flows in the Proposed Action may benefit cuckoo by supporting the recruitment of important riparian tree species, primarily willows.

- **PBF 1 (range wide breeding habitat) –** Impact for the spring pulse flows are potentially beneficial to this PBF as the higher water flows may lead to increased stream meandering, sediment transport, inundation of floodplains and create new areas to facilitate successional regeneration of riparian vegetation that is essential to the continued value of the area as viable breeding habitat.

- **PBF 2 (adequate prey base) –** This factor is primarily driven by surrounding habitat uses and application of insecticides. The Proposed Action will not have any measurable impact on the prey base within the critical habitat area.
- **PBF 3 (hydrological processes) –** The spring pulse flows are potentially beneficial to this PBF as the higher water flows may lead to increased stream meandering, sediment transport, inundation of floodplains and create new areas to facilitate successional regeneration of riparian vegetation.

  The incorporation of a spring pulse flow may lead to more of the natural hydrology and stream effects that were typical prior to the modification of the hydrological regime by the installation and operation of dams.

12.6.5 Cumulative Effects for Western Yellow-billed Cuckoo Critical Habitat

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Additional future activities that are reasonably certain to occur in the Action Area include creation of recreation trails and conversion of riparian habitat to agriculture. Recreational trails can disturb or harass cuckoos when trails are located adjacent or within cuckoo breeding habitat. Construction equipment that is used for creation of the trail has the potential to disrupt nesting cuckoos. Any future agriculture conversions that occur adjacent to riparian habitat that could be used by the cuckoo has the potential to affect the cuckoo and its habitat through the use of pesticides and drift of pesticides damaging both the riparian vegetation as well as the prey base of the cuckoo.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the western yellow-billed cuckoo's critical habitat and are reasonably certain to occur in the Action Area.

12.6.6 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" critical habitat for western yellow-billed cuckoo. The effects from the proposed flow changes through the Sacramento River seasonal operations and the spring pulse flow are presumed discountable to western yellow-billed cuckoo critical habitat, as the riparian vegetation of the surrounding habitat would not be substantially altered. Thus, the PBFs will remain intact, contributing to the high conservation value of each critical habitat unit and critical habitat as a whole, and sustaining this unit's role in the conservation and recovery of western yellow-billed cuckoo.

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Chapter 13 Western Snowy Plover

13.1 Status of the Species

13.1.1 Legal Status

The USFWS listed the Pacific coast population DPS of western snowy plover as threatened on March 5, 1993 (58 FR 12864).

13.1.2 Critical Habitat

Critical habitat was designated for western snowy plover on December 7, 1999 (64 FR 68508 68544), revised on September 29, 2005 (70 FR 56970 57119), and again revised on June 19, 2012 (77 FR 36727 36869). Final critical habitat within California as of the 2012 rule consists of 47 units across Del Norte, Humboldt, Mendocino, Marin, Napa, Alameda, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego counties. Critical habitat for western snowy plover does not occur within the Action Area; therefore, it will not be addressed further in this Biological Assessment.

13.1.3 Recovery Plan

The USFWS issued a recovery plan for the species in 2007 and identified six recovery units – one for Washington-Oregon, and five within California (U.S. Fish and Wildlife Service 2007). The primary goal of the recovery plan is to delist the Pacific coast DPS of western snowy plover by increasing population size throughout the DPS's range, managing the species and its habitat in perpetuity, and monitoring the population and threats to determine success of recovery action and adaptive management needs (U.S. Fish and Wildlife Service 2007). Criteria for delisting that are applicable to California recovery units include maintaining an average of 2,750 breeding adults among five recovery units in California for 10 years with a yearly average productivity of at least one (1.0) fledged chick per male maintained in each recovery unit in the last 5 years prior to delisting, and developing and implementing mechanisms to insure long-term protection and management of breeding, wintering, and migration areas (U.S. Fish and Wildlife Service 2007).

13.1.4 Five-Year Review

The USFWS completed a five-year review of the status of the Pacific coast population DPS of western snowy plover in 2019 and concluded that the DPS remained threatened (U.S. Fish and Wildlife Service 2019). The document is incorporated by reference to provide additional information relevant to the status of the species.

13.1.5 Natural History/Biology

A detailed account of the taxonomy, ecology, and biology of the Pacific coast population DPS of western snowy plover is presented in the recovery plan for this species (U.S. Fish and Wildlife Service 2007).

Western snowy plover feed on various immature and mature life stages of aquatic and terrestrial invertebrates. Foraging occurs within the intertidal zone, above the high tide line, on salt pans and spoil sites, and along salt marsh, salt pond, and lagoon edges. Prey species consumed vary throughout the range of the western snowy plover. In San Diego, rove beetles (*Staphylinidae*), long-legged flies (*Dolichopodidae*), shore flies (*Ephydridae*), water bugs (*Saldidae*), hymenopterans (Braconidae), and unidentified insect larvae were found in plover feces during the breeding season. In San Francisco Bay salt evaporation ponds, western snowy plover were recorded feeding on brine flies (*Ephydra cinerea*), beetles (*Tanarthrus occidentalis, Bembidion* sp.), moths (*Perizoma custodiata*), and lepidopteran caterpillars. Within saline habitats such as salt ponds, ponds of low and medium salinities provide the highest density of vertebrates (U.S. Fish and Wildlife Service 2007).

Western snowy plovers either migrate or remain resident year-round at coastal breeding locations. Coastal populations that migrate generally depart their California breeding grounds in late June to late October for wintering grounds in coastal areas from southern Washington to Central America. Western snowy plovers that reside inland during the breeding season will migrate within California to the coast as early as July, creating mixed flocks along the coastline from a few up to 300 birds. Overwintering habitat includes both breeding and non-breeding beach habitat, in addition to human-made salt ponds, sandy areas of estuaries, and mud flats. Western snowy plovers display high site fidelity at overwintering locations (U.S. Fish and Wildlife Service 2007).

Breeding habitat for the Pacific coast population DPS of western snowy plover primarily consists of sand spits, dunes with sparse vegetation, beaches backed by dunes and at the mouths of creeks and rivers, and salt pans at lagoons and estuaries. Nesting habitat can also include beaches backed by bluffs, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars. Birds that migrate for the winter can arrive to breeding grounds in California as early as January, with most arriving between early March and late April; arrivals can continue through June however for birds that breed at multiple sites throughout the nesting season (U.S. Fish and Wildlife Service 2007). Breeding occurs from mid-February or early March until almost the end of July. Nests are built on the ground in shallow natural or scraped depressions in sandy or saline substrates. Vegetation and other ground cover elements (e.g., driftwood) are sparse or absent from the surrounding area. Nests are usually located within 328 feet of water, but may be farther away if vegetation is not present to obstruct nestlings' access to the shore (U.S. Fish and Wildlife Service 2007).

Western snowy plover. Source: Baird 2007.

13.1.6 Range-wide Status and Distribution

For the most recent comprehensive assessment of the species' range-wide status and distribution, refer to the 2019 five-year review (U.S. Fish and Wildlife Service 2019).

The Pacific coast population DPS of western snowy plover overwinters from southern Washington south to Central America. Within California, the main coastal overwintering population occurs from Bodega Bay in Sonoma County, south. Up to 2,500 birds are believed to overwinter along the mainland portion of the coast, with additional hundreds located within the San Francisco Bay and Channel Islands. The Pacific coast DPS of western snowy plover breeds from Midway Beach in Washington south to Bahia Magdalena in Baja California Sur, Mexico. The majority of the breeding population nests in California, although breeding populations in coastal areas of Oregon and Washington are increasing. Within California, breeding populations, particularly those in the southern part of the state, have declined significantly (U.S. Fish and Wildlife Service 2007). Counts of breeding adults along the coast declined between the 1970s and 2000, but between then and 2007 increased overall until four out of the five California recovery units experienced large decreases in breeding adults (U.S. Fish and Wildlife Service 2007, 2019). Overall, since 2007 the coastal California breeding population has increased, although not enough to meet delisting criteria. In 2019, the population estimate across all California recovery units was 1,738 breeding adults (U.S. Fish and Wildlife Service 2019).

13.1.7 Threats

The main ongoing threat that the Pacific coast population DPS of western snowy plover faces throughout its range is habitat degradation and destruction. Contributing factors include human disturbance (e.g., recreation), urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations (U.S. Fish and Wildlife Service 2007, 2019). Climate and sea level changes are additional sources of impact both directly to nest and overwintering population survival, and to roosting and nesting habitat.

13.2 Environmental Baseline

Occurrence records within the California Natural Diversity Database are limited within the San Francisco Bay area, and include less than 10 records within the Action Area that are all located around the San Francisco Bay; no records are currently noted within the Suisun Marsh (CDFW, 2023). Citizen scientists have reported observations of nestlings in the Montezuma Wetlands area as recently as 2023, although the vast majority of sightings are concentrated around the San Francisco Bay, followed by the San Pablo Bay (eBird 2023). Since 2005, the San Francisco Bay Recovery Unit, Unit 3, experienced a decline in population in 2006, 2008, 2011, 2012, 2014, and 2015. Overall however, between 2005-2018 the population has increased from 124 breeding adults to 235 adults despite these fluctuations (U.S. Fish and Wildlife Service 2019). The population remains under the 500-bird recovery threshold however, and faces ongoing threats of nest predation and depredation by domesticated species, competition and aggression between plovers due to limitations of the species' altered habitat, conflicting habitat management priorities with those of other listed species, and variations in nesting habitat availability (U.S. Fish and Wildlife Service 2019).

During the 2021 breeding season, 263 adults were recorded in the San Francisco Bay through combined survey efforts of the San Francisco Bay Bird Observatory, USFWS, CDFW, and other stakeholders. Of the total 214 nests monitored, 207 were found in the South Bay, two were found in the San Pablo Bay, three were found at the Hayward Shoreline, and two were found at Montezuma Wetlands in Suisun Bay. Almost half (48%) of all nests were depredated, with slightly fewer (45%) successfully hatching at least one egg. Results of the remaining nests were either abandoned, unknown, flooded, or failed to hatch (San Francisco Bay Bird Observatory 2022).

The USFWS has formally consulted on two projects within the Action Area that may affect the plover; the Bay Area Mosquito Source Reduction Project in Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties (File No 2022-0048737), and the Montezuma Wetlands Project in Solano County (File No. 2022-0074267).

13.2.1 Tidal Habitat Restoration

Across the tidal habitat restoration projects in the Delta and Suisun Marsh listed in Table 4-1, approximately 3,170.42 acres of tidal habitat has been restored, approximately 3,781 acres are in construction, and approximately 1,600 acres are in planning. The total acreage of all stages of tidal habitat restoration is approximately 8,551.42 acres.

The overall primary purpose of these restoration projects is to protect, restore and enhance intertidal and associated subtidal habitat to benefit listed fishes. Restoration projects result in short term construction related effects and permanent habitat loss for upland terrestrial species. However, as the restored areas evolve over time into a functioning tidal marsh, restoration projects are expected to provide benefits through increased exports of nutrients and food to adjacent open water, and potentially provide potential physical delta smelt rearing habitat.

The SMP is a comprehensive plan designed to address the various conflicts regarding use of Marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and managed wetland activities. The SMP is intended to guide near-term and future actions related to restoration of tidal wetlands and managed wetland activities.

The following Biological Opinion documents the impacts to federally listed terrestrial species, including Pacific coast population DPS of western snowy plover:

- USFWS 2013 Biological Opinion (File No. 0SESMF00-2012-F-0602) – Transmittal of Final Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California

The USFWS SMP Biological Opinion described the tidal wetland restoration actions, specifically levee breaching, initially would result in the establishment of tidal open water habitat. Tidal wetland vegetation would establish as sediment accrues over time. Effects of tidal marsh restoration will be dispersed in space and time. As the restored area evolves into a functioning, vegetated tidal wetland, it is expected to provide permanent suitable and sustainable habitat for federally listed species in Suisun Marsh. Specifically, as the restored area evolves into a functioning tidal marsh, it is expected to provide indirect benefits to fish species through increased exports of nutrients and food to adjacent open water areas. SMP Restoration activities would benefit the actual or available primary productivity of Suisun Marsh as a whole by increasing nutrient exchange and nutrient turnover rates. Restoration activities would include the construction of habitat levees that include benches or berms, which would provide opportunities for the establishment of high marsh/upland transition habitat. Ground disturbing activities, such as levees maintenance and dredging, may result in the harassment, harm, injury, or death of federally listed species within Suisun Marsh. Also, there could be a temporary loss of foraging habitat as a result of construction-related activities throughout the Marsh.

13.3 Effects of the Proposed Action

13.3.1 Suisun Marsh Salinity Control Gates (Proposed Flow Changes)

The SMSCG are being proposed to direct more fresh water in the Suisun Marsh to improve habitat conditions for Delta smelt in the region. Depending on the timing of the proposed operations (up to 120 days between June 1st and December 1st), SMSCG operations may overlap with the western snowy plover late breeding season and potential foraging in the Suisun Marsh.

The western snowy plover breeding occurs from mid-February or early March until almost the end of July. Temporary decreases in salinity from operation of the SMSCG (example of change in salinity for below normal year is shown in Figure 4-2 through Figure 4-7) may cause a potential shift in prey availability within the Marsh, although this potential shift is presumed discountable due to the availability of typical prey species (see Section 13.1, *Status of the Species*) and similar invertebrate prey to tolerate variations in salinity. However, the distribution and abundance of these prey species could be influenced by large changes in salinity over an extended period of time. In addition, this decrease in salinity may be beneficial to western snowy plover due to increased abundance of invertebrates in foraging habitat such as salt ponds with low and medium salinities (U.S. Fish and Wildlife Service 2007). Thus, adverse effects to western snowy plovers are not expected to occur as a result of the Proposed Action.

13.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

The anticipated cumulative effects within the Action Area include additional future urban and commercial development in the Bay-Delta watershed, and the increased stormwater runoff, road building, and changes to contaminant loading that accompany these land use changes. Future urbanization may also result in increased recreational uses in the form of water-based activities and hunting. The amount of anticipated change to the regional climate expected in the near term is lower than it is for the latter half of the century. Therefore, it is less certain that any measurable change from current conditions will occur in the next approximately 10 years than by the latter half of the century.

Future effects from increased urbanization, any new agricultural developments and/or practices, increased recreation, and greenhouse gas emissions within the Action Area will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the western snowy plover and are reasonably certain to occur in the Action Area.

13.5 Effect Determination

The Proposed Action "may affect, but is not likely to adversely affect" western snowy plover as the proposed flow changes to the SMSCG are likely to result in a discountable or potentially beneficial effect on plover prey availability within the Suisun Marsh, and potential effects are not expected to result in the incidental take of any individuals of this species.

13.6 References

California Department of Fish and Wildlife. 2023. *California Natural Diversity Database*. RareFind version 5. Natural Heritage Division. Sacramento, CA. Available: https://wildlife.ca.gov/Data/CNDDB/Maps-and-Data.

eBird. 2023. *eBird: An online database of bird distribution and abundance* [web application]. eBird, Cornell Lab of Ornithology, Ithaca, NY. Available: http://www.ebird.org. Accessed: September 7, 2023.

Baird, M. 2007. *Western Snowy Plover (bird) south of Villa Creek, Estero Bluffs, a few miles north of Cayucos, CA, Feb. 14, 2007* (CC BY 2.0). Available: https://www.flickr.com/photos/72825507@N00/390629863/. Accessed: November 14, 2023.

San Francisco Bay Bird Observatory. 2022. *Western Snowy Plover Monitoring in the San Francisco Bay Annual Report 2021*. Prepared for staff at Don Edwards San Francisco Bay National Wildlife Refuge, California Department of Fish and Wildlife, California State Coastal Conservancy, California Wildlife Foundation, and Ducks Unlimited. Milpitas, CA.

U.S. Fish and Wildlife Service. 2007. *Recovery Plan for the Pacific Coast Population of the Western Snowy Plover* (Charadrius alexandrines nivosus). California/Nevada Operations Office, U.S. Fish and Wildlife Service, Sacramento, CA.

U.S. Fish and Wildlife Service. 2019. *5-Year Review: Western Snowy Plover [Pacific Coast population Distinct Population Segment]* (Charadrius nivosus nivosus). Arcata Fish and Wildlife Office, U.S. Fish and Wildlife Service, Arcata, CA.

Chapter 14 Foothill Yellow-legged Frog

14.1 Status of the Species

14.1.1 Legal Status

The USFWS listed the foothill yellow-legged frog South Sierra DPS as endangered on September 28, 2023 (88 FR 59698).

14.1.2 Critical Habitat

Critical habitat has not been designated for the foothill yellow-legged frog.

14.1.3 Recovery Plan

A recovery plan has not yet been developed for this species.

14.1.4 Five-Year Review

A five-year review has not been conducted for this species.

14.1.5 Natural History/Biology

A detailed description of the taxonomy, ecology, and biology of foothill yellow-legged frog is presented in the species status assessment (U.S. Fish and Wildlife Service 2023). Foothill yellow-legged frog is a stream-obligate species that occurs in a wide variety of vegetation types, including valley-foothill hardwood, valley-foothill riparian, mixed chaparral, and wet meadow (U.S. Fish and Wildlife Service 2023). Adults are found in or along the edges of streams and feed on terrestrial and aquatic invertebrates including snails, moths, water striders, beetles, spiders, and ants (U.S. Fish and Wildlife Service 2023). Tadpoles consume algae, diatoms, and detritus (U.S. Fish and Wildlife Service 2023).

Foothill yellow-legged frog. Source: Golden Gate National Parks Conservancy 2022.

The species breeds along mainstem water channels and overwinters in smaller tributaries which provide refuge from high winter flows, although some individuals may overwinter in breeding locations if conditions are suitable. Foothill yellow-legged frog requires loose, rocky substrate that is not embedded in sediment and has interstitial spaces, low stream velocities for oviposition and early life stages (eggs, tadpoles, metamorphs), and natural hydrological conditions that maintain habitat and provide cues for breeding and provide appropriate water depth and temperature for early life stages. Foothill yellow-legged frog adults require upland and tributary habitat, and migration and dispersal routes (U.S. Fish and Wildlife Service 2023).

14.1.6 Reproduction

Foothill yellow-legged frogs breed between March and July during the transition from wet season to dry season with decreasing water velocity and increasing temperature.

14.1.7 Numbers

No range wide surveys have been conducted for foothill yellow-legged frog, with different analysis units receiving differing levels of survey coverage. In the absence of extensive abundance data, the USFWS assessed changes in species occupancy using available presence data (U.S. Fish and Wildlife Service 2023).

Foothill yellow-legged frog occupancy varies widely among analysis units and all units have experienced large declines in occupancy throughout the species' range. The North Sierra, North Coast, and North Feather units have the greatest proportion of occupied stream segments, and the South Coast, Central Coast, and South Sierra units had the lowest occupancy (U.S. Fish and Wildlife Service 2023). Available abundance data indicates that the species abundance is also highest in the northern portions of its range, particularly in the North Coast analysis unit (U.S. Fish and Wildlife Service 2023).

14.1.8 Distribution

The historical distribution of the foothill yellow-legged frog extended from the Willamette River drainage in Oregon south to at least the Upper San Gabriel River in Los Angeles County, California, occupying foothill and mountain streams between the Pacific coast and the Sierra-Cascade crest, from sea level to approximately 1,524 meters (m) (5,000 feet (ft)) (U.S. Fish and Wildlife Service 2023).

The current distribution of the foothill yellow-legged frog generally follows the historical distribution of the species except with range contractions in the southern and, to a lesser extent, northern parts of the species' range. Within areas currently occupied, foothill yellow-legged frog distribution is currently in a declining trend in several parts of the species' range with the species having disappeared from more than half of its historically-occupied locations (U.S. Fish and Wildlife Service 2023).

14.1.9 Threats

The Species Status Assessment contains a detailed description of the threats influencing foothill yellow-legged frog populations (U.S. Fish and Wildlife Service 2023). The primary threats identified include altered hydrology due to dams, pulse flows, water diversions, and channel modification; nonnative species; disease and parasites, including chytridiomycosis; agriculture; recreation; mining; urbanization; drought; high-severity wildfire; extreme flood events; and climate change (U.S. Fish and Wildlife Service 2023).

14.2 Environmental Baseline

The Action Area overlaps with the South Sierra and Central Coast DPS; however, the Proposed Action would not affect the Central Coast DPS, as there would be no actions that affect suitable habitat. The Proposed Action would also not affect the South Sierra DPS in the American River and San Joaquin River watersheds or upstream of New Melones Reservoir on the Stanislaus River, as there would be no actions that affect suitable habitat. Therefore, effects are analyzed only for the South Sierra DPS on the Stanislaus River downstream of the New Melones Dam.

There are no California Natural Diversity Database occurrences of the South Sierra DPS foothill yellow-legged frog in the Action Area (CDFW 2023). The Species Status Assessment reported several occurrences along the Stanislaus River and American River; however, in recent years (since 2010) no occurrences in the Action Area along the American River and three occurrences along the Stanislaus River upstream of New Melones Reservoir (U.S. Fish and Wildlife Service 2023). Breeding has also been reported on the Stanislaus River downstream of New Melones Reservoir (Hayes et al. 2016).

The South Sierra DPS has experienced large declines in occupancy. Currently less than half of all known occurrences are presumed to be occupied and a low proportion of stream segments are presumed occupied, relative to potential stream segments. Data on foothill yellow-legged frog abundance are extremely limited for the South Sierra DPS, but abundance appears to be smaller relative to northern populations following extreme flood events in the 1960s and 1970s (U.S. Fish and Wildlife Service 2023).

14.3 Effects of the Proposed Action

14.3.1 Stanislaus River

14.3.1.1 Seasonal Operations

While there are no currently documented South Sierra DPS foothill yellow-legged frog populations along the Stanislaus River below New Melones Reservoir, suitable breeding habitat exists along the river, and the absence of foothill yellow-legged frog cannot be confirmed as survey data is lacking in this area for the species. Hayes et al. (2016) reports that breeding can take place on the Stanislaus River below New Melones Reservoir as late as July, indicating presence of the species, but does not go into further detail about the current population. Given the best available data, Reclamation is assuming presence of this species for all relevant life stages in the action area but the species presence has not been definitively proven in the action area.

The Proposed Action includes proposed flow changes on the lower Stanislaus River (Figure 6-3). Compared to the overall seasonal operations Reclamation has a relatively small amount of discretionary contract water delivery on the Stanislaus from New Melones Dam when compared to the much larger non-discretionary senior water rights. Changes in flows, may dislodge, isolate, or kill egg masses, and strand and/or kill tadpoles and metamorphs. Higher flows and resulting increases in velocity and water levels may kill adults feeding or residing (e.g., for breeding or overwintering) in the Stanislaus River, and may lead to sedimentation of cobbled substrates. Cobbled substrates are used for oviposition and tadpole and metamorph development; thus, sedimentation would decrease the suitability and availability of habitat for these three life stages. High flows in the summer will decrease water temperatures, which can preclude breeding, slow development of eggs, tadpoles, and metamorphs and make these life stages more vulnerable to predation and changing habitat conditions, and may make tadpoles and metamorphs more susceptible to pathogens (U.S. Fish and Wildlife Service 2023). Seasonal operations under the Proposed Action may reduce natural variability in water releases, beyond major flood events, which will create more stable conditions (i.e., more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and increase sedimentation) and provide some potential benefits for foothill yellow-legged frogs.

Ultimately the limited discretion on flow releases from New Melones reservoir into the Stanislaus River will result in a limited version of the impacts described above on the relevant life stages for this species. Those limited impacts may result in take for all the applicable life stages for the foothill yellow legged frog associated with lower water temperatures in the summer, high pulse flow water releases during developmental periods and a minor increase in sedimentation of cobbled substrates.

14.4 Cumulative Effects

Cumulative effects are those effects of future State, tribal, local, or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation (50 Code of Federal Regulations [CFR] 402.02) that the USFWS use in conducting a jeopardy analysis.

Future effects from any new agricultural developments and/or practices will remain throughout the life of the Proposed Action and would be very difficult to quantify or predict the nature that they will take throughout the life of the Proposed Action. Beyond these future activities, Reclamation is unaware of any specific future State, Tribal, local, or private actions that may affect the foothill yellow-legged frog and are reasonably certain to occur in the Action Area.

14.5 Effect Determination

The Proposed Action “may affect, is likely to adversely affect” foothill yellow-legged frog as the proposed seasonal operations in the Stanislaus River. Majority of water releases from New Melones Reservoir are non-discretionary, the discretionary water operations will result in pulse flow water releases, cold water temperatures, and increases cobble sedimentation that may directly endanger all life stages of the species.

14.6 References

California Department of Fish and Wildlife (CDFW). 2023. *California Natural Diversity Database*. RareFind version 5. Natural Heritage Division. Sacramento, CA. Available at: https://wildlife.ca.gov/Data/CNDDB/Maps-and-Data.

Hayes, M. P., C. A. Wheeler, A. J. Lind, G. A. Green, and D. C. Macfarlane (Technical Coordinators). 2016. *Foothill yellow-legged frog conservation assessment in California*. Gen. Tech. Rep. PSW-GTR-248. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 193 p.

Golden Gate National Parks Conservancy. 2022. *Foothill Yellow-legged Frog*. Available at: https://www.onetam.org/peak-health/foothill-yellow-legged-frog. Accessed: November 14, 2023.

U.S. Fish and Wildlife Service. 2023. *Species Status Assessment Report for the Foothill Yellow-legged Frog* (Rana boylii). Version 2.11. Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, CA.

Chapter 15 Summary of Effects Determination

Population and critical habitat analyses are included in this Biological Assessment to assist the USFWS in making the determination of whether the Proposed Action would reasonably be expected "directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." 50 C.F.R. § 402.02; 16 U.S.C. § 1536(a)(2). Three possible determinations can be included in a Biological Assessment regarding a Proposed Action's effects on listed species:

- **"No effect"** is the appropriate conclusion when it is determined that the Proposed Action will not affect a listed species or designated critical habitat.
- **"May affect, but is not likely to adversely affect"** is the appropriate conclusion when effects to listed species or critical habitat are expected to be discountable (extremely unlikely to occur), insignificant (never resulting in take), or completely beneficial (positive effects without adverse effects)
- **"May affect, likely to adversely affect"** is the appropriate conclusion if any adverse effect may occur to listed species or critical habitat as a direct result of the Proposed Action, and the effect is not discountable, insignificant, or beneficial. If incidental take is anticipated to occur as a result of the Proposed Action, an "is likely to adversely affect" determination is made.

This section presents a summary of the effects for listed species (Table 15-1) and their designated critical habitat (Table 15-2).

Table 15-1. Species Effect Determinations

Species	**Status**	**Effect Determination**
California Clapper Rail (*Rallus longirostris obsoletus)*	Endangered	May affect, but is not likely to adversely affect
California Least Tern (*Sterna antillarum browni*)	Endangered	May affect, but is not likely to adversely affect
Least Bell's Vireo (*Vireo bellii pusillus*)	Endangered	May affect, but is not likely to adversely affect
Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*)	Endangered	May affect, but is not likely to adversely affect
Suisun Thistle (*Cirsium hydrophilum var. hydrophilum*)	Endangered	May affect, but is not likely to adversely affect
Soft Bird's-beak (*Cordylanthus mollis ssp. Mollis*)	Endangered	May affect, but is not likely to adversely affect
Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)	Threatened	May affect, but is not likely to adversely affect

Species	Status	Effect Determination
Riparian Brush Rabbit (*Sylvilagus bachmani riparius*)	Endangered	May affect, but is not likely to adversely affect
Riparian Woodrat (*Neotoma fuscipes riparia*)	Endangered	May affect, but is not likely to adversely affect
Western Yellow-billed Cuckoo (*Coccyzus americanus*)	Threatened	May affect, but is not likely to adversely affect
Western Snowy Plover (*Charadrius nivosus nivosus*)	Threatened	May affect, but is not likely to adversely affect
Foothill Yellow-legged Frog, South Sierra DPS (*Rana boylii*)	Endangered	May affect, likely to adversely affect

Table 15-2. Critical Habitat Effect Determinations

Species	Critical Habitat	Effect Determination
Suisun Thistle (*Cirsium hydrophilum* var. *hydrophilum*)	Designated in action area	May affect, but is not likely to adversely affect
Soft Bird's-beak (*Cordylanthus mollis* ssp. *Mollis*)	Designated in action area	May affect, but is not likely to adversely affect
Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)	Designated in action area	May affect, but is not likely to adversely affect
Western Yellow-billed Cuckoo (*Coccyzus americanus*)	Designated in action area	May affect, but is not likely to adversely affect