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RECLAMATION

Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project for Water Year 2021

Central Valley Project, California

California-Great Basin Region



Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project for Water Year 2021 Central Valley Project, California

Central Valley Project

California-Great Basin Region

prepared by

Bureau of Reclamation

In cooperation with

**California Department of Water Resources, U.S. Fish and Wildlife
Service, National Marine Fisheries Service, and California Department
of Fish and Wildlife**

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Introduction

This Annual Report for Water Year (WY) 2021 fulfills the annual reporting for the Long-Term Operation (LTO) of the Central Valley Project (CVP), and State Water Project (SWP) implemented through Reclamation's Record of Decision (ROD), dated February 19, 2020, and describes compliance with the Incidental Take Statements (ITS) and the Reasonable and Prudent Measures (RPMs) of the 2019 National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) Biological Opinions. The Proposed Action, adopted in the ROD, includes coordination with the California Department of Water Resources (DWR) to mitigate, protect, restore, and enhance fish and wildlife, deliver water, and generate power in the Central Valley and Bay-Delta consistent with Endangered Species Act (ESA) requirements for Delta smelt (*Hypomesus transpacificus*), Southern distinct population segment (sDPS) of North American green sturgeon (*Acipenser medirostris*), California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*), Central Valley (CV) spring-run Chinook salmon (*Oncorhynchus tshawytscha*) and Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) and their designated critical habitats (collectively, "listed species"), Southern Resident killer whale (*Orcinus orca*) as well as other fish and wildlife species.

Background

The Proposed Action included water and power operations, monitoring, habitat and facility improvements, intervention, and special studies. Bureau of Reclamation (Reclamation) and DWR incorporated conservation measures to avoid, minimize, and compensate for incidental take of listed species, as well as to contribute to the recovery and enhancement of species and their habitats. These measures would be anticipated to improve production, growth, and survival of listed species over time. Reclamation and DWR committed to review the implementation of the Proposed Action at four-year intervals (i.e., 2024 and 2028) through an independent panel of experts to review the Upper Sacramento River Performance Metrics; Old and Middle Rivers management, and measures to improve survival through the south Delta and Delta smelt Summer-Fall Habitat Actions. After coordinating with the State of California, Reclamation requested reinitiation of consultation on September 30, 2021 and NMFS and USFWS agreed on October 1. During reinitiation, Reclamation and DWR will continue to implement the ROD, as modified by applicable court orders.

Seasonal operation and tributary reports are attached to this document to provide detailed discussion on the implementation of specific components of the Proposed Action. In 2021, Reclamation, NMFS, USFWS, California Department of Fish and Wildlife (CDFW), DWR, and the State Water Resource Control Board (Water Board) worked together on the revision of flow guidance documents for assisting agency staff in implementing flow provisions that require collaboration. These "living" documents are subject to change, as necessary, in coordination with the multi-agency implementation teams. The latest final flow guidance documents are included

as attachments to seasonal reports that describe specific components of the Proposed Action. Conclusion sections in this Annual Report identify overall clarifications and recommendations to improve implementation.

Reclamation and DWR worked extensively with NMFS and USFWS to incorporate programmatic conservation measures within Reclamation's authority, appropriations, and state cost share capabilities. The Proposed Action included a science-based framework using structured decision making to prioritize actions for fish. This Annual Report describes progress in defining, planning, permitting, and implementing a number of these components during WY 2021. The WY starts October 1 and ends September 31.

Systemwide Operations Summary

The drought in 2021 required extensive additional coordination and actions by federal, state, and local entities to accommodate lower water supplies. Substantial uncertainty in future precipitation complicates implementation as managers balance uncertain risks and known impacts. A summary by month is provided below with additional discussion in seasonal reports and special drought reports. Reclamation met multiple times per week with agencies, the State Water Board, and water right holders to coordinate a response.

October 2020: WY 2021 began October 1, 2020 following a Dry hydrologic year type in 2020. Storage at the start of the WY began high for those dry conditions with Shasta at 2.2 million acre feet (MAF), Folsom at 423 thousand acre feet (TAF) and on target for planning minimum of 300 TAF, Trinity at 1.35 MAF, and New Melones at 1.5 MAF, just 400 TAF below the early flood control season limit of 1.9 MAF. Reclamation worked with the Sacramento River Settlement Contractors (SRSC) to smooth releases for their rice decomposition diversions to maintain late-spawning winter-run redds and reduce conditions that would lead to dewatering fall-run redds. Reclamation took actions at Nimbus to address water quality concerns at the Nimbus Fish Hatchery and performed a power bypass at Folsom Dam to reduce water temperatures for fisheries on the American River. Adjustments to the Incidental Take Statement permitted DWR to maintain operations at Barker Slough for diversions into the North Bay Aqueduct.

Reclamation and DWR kicked off the multi-agency drought toolkit development in terms with DWR's Incidental Take Permit (ITP) with overlap of the 2020 ROD. Federal and state agencies were asked to contribute to the toolkit. Reclamation started weekly facilitated meetings with Water Board staff to coordinate on actions including a November presentation to the Water Board on conditions. Reclamation organized and led a multi-agency workshop to discuss hydropower operations and answer questions from federal and state agencies including the Water Board.

October ended as the driest on record with no measurable precipitation recorded on the Northern Sierra Precipitation: 8-Station Index (8-Station Index), a summary of precipitation spanning Mount Shasta City in the Sacramento River Basin above Shasta Dam, to Pacific House in the American River Basin above Folsom Dam. Average precipitation in October is 2.9". The Water Board provided a "Term 91" curtailment notice to a number of diverters with water rights junior to the CVP and SWP.

November 2020: Reclamation and DWR began briefing the State Board on the dry conditions and continued work with the SRSC to smooth rice decomposition flows while minimizing redd dewatering. November was also dry – precipitation was only 3.5 in, or 56% of average across the 8-Station Index; however, the combination of October and November were now only 38% of average and in the lowest 15% of years. Of the years that had a drier precipitation by the end of November, over 70% of them were dry or critical. Reclamation presented to the Water Board and organized and conducted a forecasting workshop with Water Board staff to walk through

processes and answer questions on how Reclamation plans water operations for the system based on forecast information.

December 2020: The initial Sacramento River Unimpaired Runoff forecasts from DWR (Sacramento at Bend Bridge, Yuba, Feather, and American rivers) provided a 4-Station Index of 38% of average at 90% exceedance. DWR issued a 10% initial allocation for the SWP. December precipitation was also dry with an 8-Station Index of 3.6 in. (41% of average for the month and 38% of average cumulative for the WY). The precipitation remained in the driest 15% of historical years with similar year-to-date precipitation resulting in Dry or Critical hydrologic year-types and no years drier than 2021 resulting in a year-type of Above Normal nor Wet. The Water Board lifted Term 91 on December 24, 2020.

January 2021: January Sacramento River Unimpaired Runoff forecasts from DWR provided a 4-Station Index of 35% of average at 90% exceedance. Meet and confer discussions began with the SRSC and NMFS pursuant to the Sacramento River Settlement Contractor's Joint Resolution. The first major storm event of the year occurred at the end of the month, but January still ended below average with 7 in. of precipitation (78% of average for January) for a cumulative precipitation of 52% of average.

February 2021: February Sacramento River Unimpaired Runoff forecasts from DWR provided a 4-Station Index of 41% of average at 90% exceedance. Initial CVP allocations were made with 5% for agriculture, and 55% for Municipal and Industrial water supplies. A Shasta Critical Year was determined for Settlement Contractors and wildlife refuges (based on a threshold of 3.2 MAF). Meet and confer discussions continued with SRSC outlining several voluntary actions to support temperature management downstream of Shasta Reservoir. Reclamation and DWR requested actions from partner agencies and stakeholders to population the Drought Toolkit and consider implementation of measures in the current year. The Sacramento River Settlement Contractors identified specific actions for the Drought Contingency Plan. In the 2021 Drought Contingency Plan, CVP and SWP contractors identified actions to conserve water.

March 2021: March Sacramento River Unimpaired Runoff forecasts from DWR provided a 4-Station Index of 38% of average at 90% exceedance. Reclamation announced that south of Delta agricultural allocations were no longer available and maintained Municipal and Industrial allocations. Meet and confer discussions continued with the SRSC sharing a reduced delivery schedule and several options for shifting anticipated transfer volumes to support Shasta temperatures. Delta outflow standards required Reclamation to begin increasing releases at both Shasta and Folsom. Reclamation began evaluating a potential warm water bypass at Shasta to conserve cold water for later in the summer. Reclamation began working with the SRSC to evaluate delays in their diversions, changes to the pattern of Trinity River Basin imports, and a warm-water power bypass. Reclamation began discussing San Luis operations with DWR and developing contingency plans for meeting San Joaquin River Exchange Contractor, San Joaquin River Settlement Contractors, and Level 2 Refuge Water Supply demands south of the Delta. Reclamation's operational outlooks planned to operate Shasta primarily for Sacramento River Settlement Contracts and Delta outflow and salinity standards while protecting a minimum power, temperature, and facility function storage at Oroville. Coordination with DWR identified

a potential need for a Coordinated Operation Agreement debt for the SWP and for Reclamation to potentially borrow a volume of water in San Luis to meet CVP south of Delta deliveries.

April 2021: DWR announced a reduced Feather River Settlement Allocations to 50% and asked local agencies to conserve water. At Shasta Reservoir, the completion of an evaluation of delayed Sacramento River Settlement diversions and modification of Trinity River Basin import pattern found little benefit to temperature management and was not pursued. However, a warm water bypass and using storage in Shasta to change the timing of water transfers could preserve cold water and was planned. Beginning April 18, Reclamation began partially bypassing power generation at Shasta Dam to draw water through river outlets higher on the face of the dam than the elevation of the middle gates of the Temperature Control Device. This action ended on May 25, 2021, and preserved approximately 300 TAF of cold water for later in the year at a reduction in power value of approximately \$5 million. Expected runoff from snowmelt did not occur. The State of California provided weekly updates to the Sacramento River Runoff Forecasts with a substantial difference between the April 1 forecast and the third weekly update. Reclamation reduced releases from Folsom Reservoir to conserve storage for Public Health and Safety and informed the Water Board that portions of D-1641 would not be met in late April. The California Governor's Office issued a declaration for the Russian River Basin and Reclamation and DWR began work on a Temporary Urgency Change Petition (TUCP). The Water Board provided Term 91 curtailments on April 29.

May 2021: May Sacramento River Unimpaired Runoff forecasts from DWR provided a 4-Station Index of 34% of average for the 90% exceedance. Projected inflow to the main reservoirs decreased by approximately 680 TAF since the April 1 forecast. Reclamation and DWR submitted a TUCP for June through August; Reclamation reduced the north of Delta agricultural allocation to 0% and municipal and industrial allocation to 25% or public health and safety, whichever is greater. The California governor issued a drought proclamation that included the Central Valley, asking local agencies for a voluntary reduction in water use. Reclamation began unprecedented releases of water from New Melones for Delta outflow; however, meeting salinity standards in the north Delta limited the ability to relieve requirements on Sacramento Basin reservoirs.

June 2021: DWR installed a drought barrier in West False River. Reclamation continued releases from New Melones to support Delta standards, which began to conserve upstream storage in Shasta, Oroville, and Folsom reservoirs. To meet Delta standards under the TUCP while conserving upstream storage, Reclamation and DWR piloted "single facility operations" to reduce exports below the standard minimum of 1,500 cubic feet per second (cfs), and rely on the intertie between the Delta Mendota Canal to California Aqueduct to maintain CVP and SWP water supplies for health and safety and wildlife refuge deliveries.

July 2021: Reclamation initiated water exchanges from Friant Division contractors and began borrowing water from DWR in San Luis to meet public health and safety, wildlife refuge and senior water right demands. DWR requested 15% conservation from SWP contractors.

August 2021: Reclamation proposed an exchange of water planned for transfer to south of Delta contractors from the American River to instead be transferred from New Melones. This action

would increase protections for Municipal and Industrial deliveries that rely on lake levels in Folsom Reservoir; however, water right approval processes could not be completed in sufficient time to effectuate the exchange and the transfer was made from Folsom Reservoir. Reclamation coordinated with federal and state agencies to evaluate the potential benefits to fish from cold water power bypasses at Shasta. The temperature profile in Shasta Reservoir showed no difference and no bypass occurred. DWR worked with Feather River Settlement Contractors to conserve their contractual allocations for use in fall and winter. The Water Board issued emergency curtailments for the first time in 2021 on August 20 and then lifted them at the end of the month based on modeled return flows.

September 2021: Reclamation crews measured return flows and provided information to the Water Board staff on September 16 showing that the assumed return flows were not occurring. Reclamation and DWR presented WY 2022 drought plans to the Water Board. DWR requested minimum 2022 water demands from SWP Contractors. A cold water bypass was evaluated at Folsom Reservoir, expected to provide a benefit, and planned for later in the fall. An end of September storage target of 1.25 MAF in Shasta was not met, in part due to multi-agency coordination that decided to protect summer hydropower production by the Hyatt Power Plant on the Feather River at Lake Oroville.

WY 2021 ended with reservoir storages of Trinity at 710 TAF, Shasta at 1.1 MAF, Folsom at 230 TAF, and New Melones at 840 TAF. WY 2021 had the lowest inflow into Shasta Reservoir on record.

Upper Sacramento River

Listed species in the upper Sacramento River, from Keswick Dam to Red Bluff Diversion Dam (Figure 1) include winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, southern DPS green sturgeon, and their critical habitats.

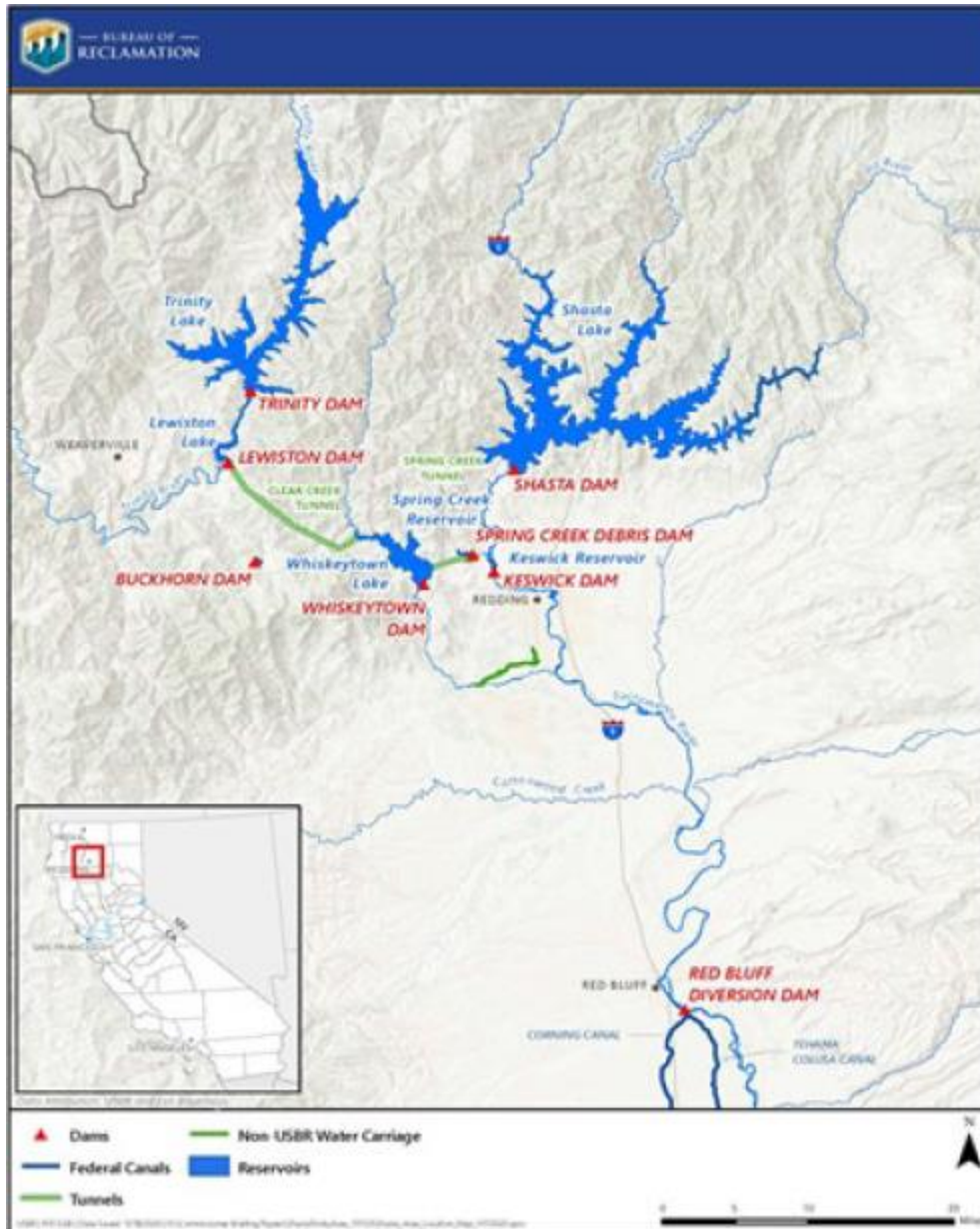


Figure 1. The Upper Sacramento River System.

Key components of the LTO include actions to rebuild storage for the upcoming water temperature management season, spring pulse flows for juvenile CV spring-run Chinook salmon

migration, and cold water pool management for winter-run Chinook salmon incubation and emergence.

Fall and Winter Refill and Redd Maintenance

Under the Fall and Winter Refill and Redd Maintenance action, Reclamation rebuilds storage and cold water pool for the subsequent year during the fall and winter while also trying to minimize the amount of winter-run Chinook salmon redd dewatering. Additional information is provided in the 2021 Seasonal Report for Shasta Lake Storage Rebuilding and Spring Pulse (Appendix A).

Redd Maintenance Performance

After discussion with the Upper Sacramento Scheduling Team (USST), the scenario labelled “Alternative 6a” was selected as the preferred flow schedule (Figure 2). Data regarding the dewatering estimates are provided in the seasonal reports (Appendix A and B).

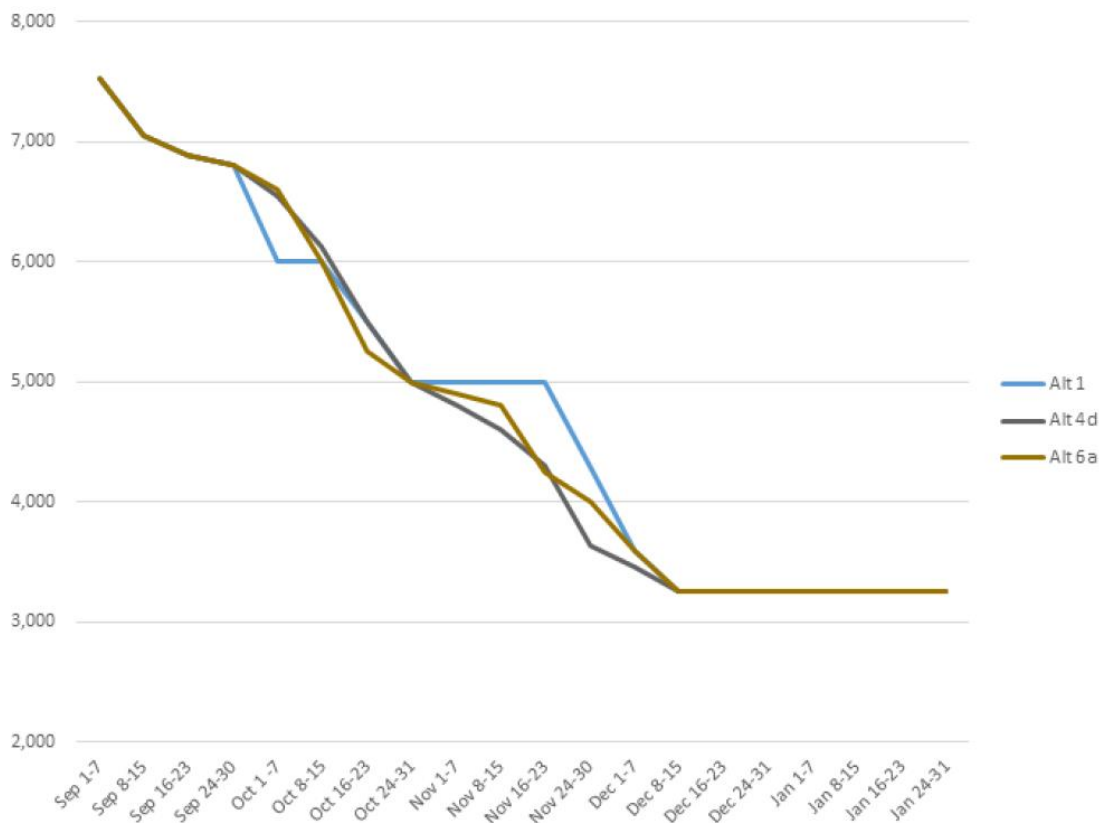


Figure 2. Flow reduction scenario comparison for Alternatives 1, 4d, and 6a.

The 2019 NMFS Biological Opinion concludes that operations are expected to result in the incidental take of juvenile listed salmonids through stranding or redd dewatering throughout the

upper Sacramento River from Keswick Dam to Red Bluff Diversion Dam. Take of Sacramento River winter-run Chinook salmon from changes in flow during the temperature management season is reasonably expected to result in egg mortality from the dewatering of up to one percent of redds. Reclamation did not exceed this take limit.

Take of CV spring-run Chinook salmon resulting from flow changes from summer releases down to 3,250 cfs is reasonably expected to result in egg mortality from the dewatering of up to three percent of redds. The anticipated level of take will be exceeded if flow decreases occur at a rate greater than the ramping rates described in the proposed action with the exception of flood control and emergency conditions.

Keswick Dam release change orders adhered to the ramping rates described in the Proposed Action adopted in the ROD and, therefore, did not exceed the established take limit of three percent for CV spring-run Chinook salmon.

February Projection of Water Operations

The majority of precipitation in California typically falls in February and March; however, the first information on the potential water year is provided at the end of January. Reclamation included in the Proposed Action and NMFS included reasonable and prudent measure (RPM) 1.e.:

In February of each year, Reclamation shall create and post a projection of water operations, as described in [Appendix C] of the biological assessment.

Reclamation provided a projection of water operations to NMFS as part of the Sacramento River Temperature Task Group (SRTTG) meetings beginning February 25, 2021.

Spring Pulse Flows

The Proposed Action states that:

Reclamation anticipates that a projected May 1 storage greater than 4 MAF provides sufficient cold water pool management for Tier 1 and may release the spring pulse if it does not impact the ability to meet project objectives. Reclamation could also determine, in coordination with the Upper Sacramento scheduling team, that while the reservoir is less than 4 MAF, there is sufficient water to do a pulse of up to 150 TAF.

NMFS included a limitation on spring pulse flows in RPM 1.b:

Reclamation shall not implement the Spring Pulse Flow if the release would cause Reclamation to drop into a lower Tier of the Shasta summer temperature management.

Due to low Shasta Lake storage and projected May 1 storage not exceeding 4 MAF, the action did not occur.

Shasta Lake Storage

The closer Shasta Reservoir is to full by the end of May, the greater the likelihood of being able to meet the winter-run Chinook salmon temperature targets throughout the entire temperature control season. The Proposed Action states in a summary that:

The PA includes several operational components that are intended to contribute to increased spring Shasta storage levels ...

By late March 2021, prior to agricultural demands/diversions, total Shasta Lake storage volume was low. May 1 storage in Shasta Lake was 2.28 MAF, approximately 58 percent of the average. Cumulative inflow (TAF) to Shasta Lake from October 1 to May 1 compared to the increase in storage (TAF) from October 1 to May 1 for a period of record of WY 2009 – WY 2021 is shown in Figure 3. Compared to the period of record, WY 2021 has the lowest cumulative inflow and lowest increase in storage.

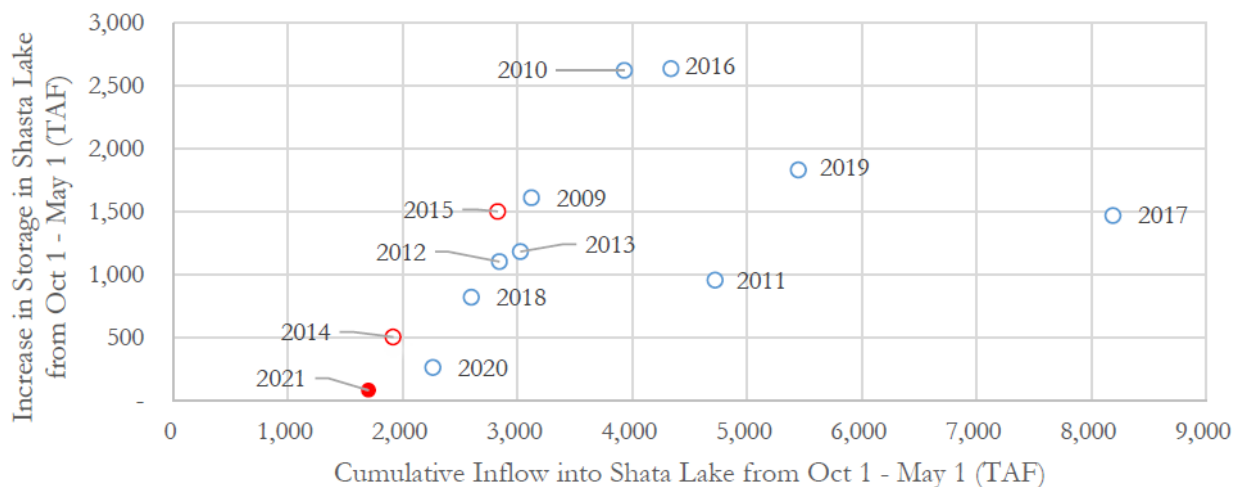


Figure 3. Shasta Lake Storage Performance from WY 2009 – WY 2021. Critically dry water year types are shown in red; all others are shown in blue.

Shasta Lake cold water pool volumes for recent critical and dry hydrologic year-types and WY 2021 are shown in Figure 3. The Temperature Control Device (TCD) on Shasta Dam selectively draws water from different elevations in the lake, allowing Reclamation to use warmer surface water earlier in the season and preserve cold water for the temperature management season later in the year while maintaining hydropower generation. The dry conditions and low reservoir storage this year prevented using the TCD upper gates which utilizes the highest elevations and warmest water in the reservoir and only the TCD middle gates were available to use in the spring. These TCD limitations resulted in using larger volumes of water from elevations of cooler temperatures than desired during the early temperature management period, when typically the upper gate are accessible to blend with these middle gate elevations. To conserve cooler waters accessible through the middle gates, between April 18 and May 25, 2021, Reclamation began partially bypassing power generation at Shasta Dam to draw water through river outlets located higher on the face of the dam than the elevation of the middle gates of the

TCD. This action preserved approximately 300 TAF of cold water for later in the year at a power value cost of approximately \$5 million. As a result of the warm water power bypass, WY 2021 had a similar cold water pool volume to previous critically dry years (WY 2014 and WY 2015).

According to the 2020 ROD,

During Tier 3 and 4 years, Reclamation shall Meet and Confer with USFWS, NMFS, DWR, CDFW, and the Sacramento River Settlement Contractors (SRSC) on voluntary measures to be considered.

Within the Meet and Confer discussion, Reclamation coordinated with buyers and sellers on the timing of when water transfers would occur. Preliminary modeling showed a Delayed Water Transfer action and the Shasta Power Bypass action would extend the window of lower temperatures by an additional 2 to 4 weeks and lower temperature dependent egg mortality of winter-run Chinook salmon by approximately 5-10 percent depending on the final Temperature Management Plan. Winter-run Chinook salmon early life stage temperature dependent egg mortality (TDM) results for the baseline scenario (i.e., without power bypass) ranged from 78-86% while the TDM results for the warm water bypass scenario ranged from 67-71%. Additional information the warm water power bypass, water transfers, and modeling assumptions are reported in the 2021 Shasta Cold Water Pool Management Seasonal Report (Appendix B). As a result of the warm water power bypass, WY 2021 had a similar cold water pool volume as previous critically dry years (WY 2014 and WY 2015), but with nearly 1 MAF less inflow.

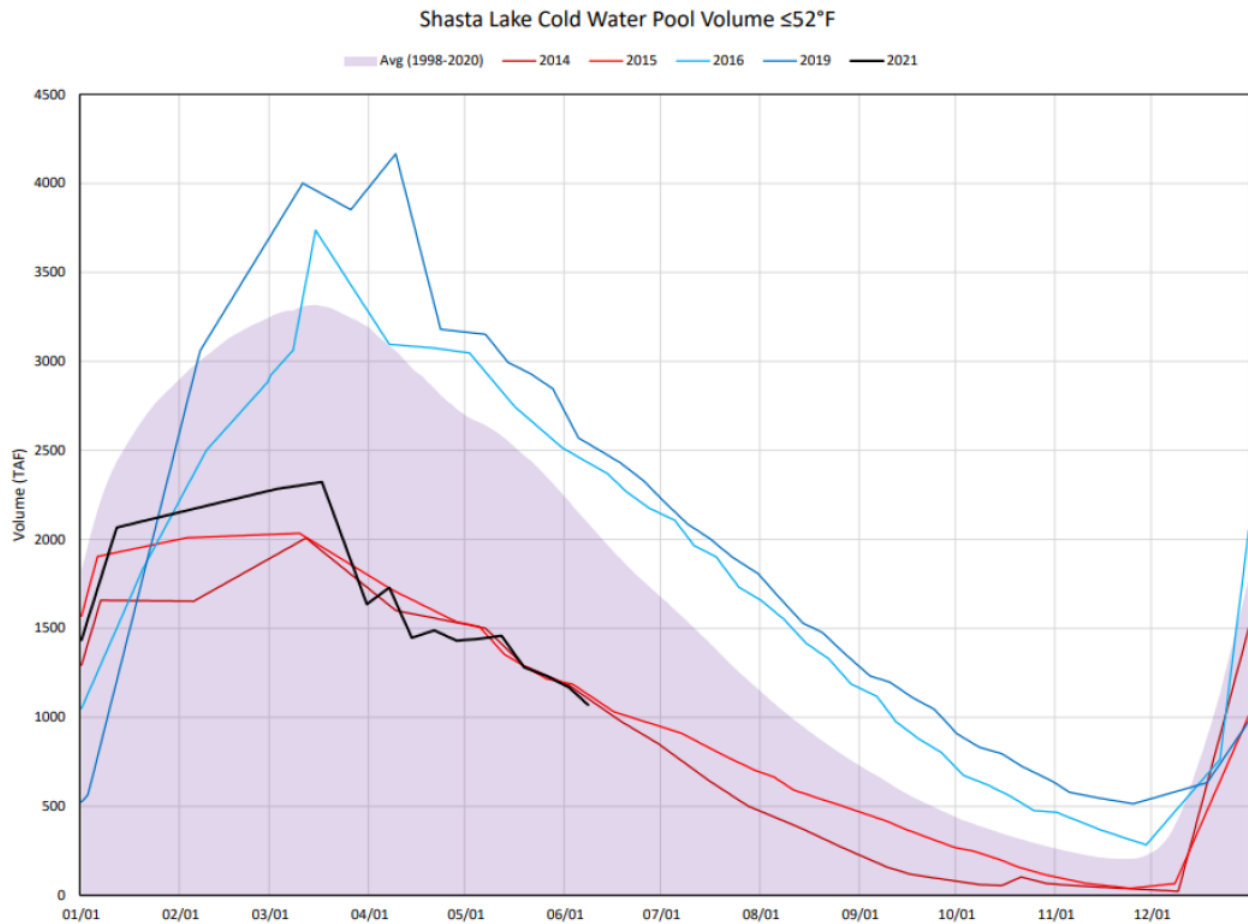


Figure 4. Shasta Lake cold water pool volumes <52 °F for critical and dry years and WY 2021.

Cold Water Pool Management

The Shasta Cold Water Pool Management Seasonal Report provides an integrated view of the system and the factors affecting the coordinated operation of the CVP and SWP and focuses on actions taken specifically by Reclamation for Shasta Lake’s cold water pool management. The NMFSITS identified the incidental take of winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead anticipated from water temperature effects and from flow management of the operation of the Upper Sacramento River (Shasta and Sacramento Division; NMFS Biological Opinion, pages 800 - 803). In a Tier 4 year, NMFS anticipates the temperature-dependent egg mortality of winter-run Chinook salmon will be 77 percent or greater. In 2021, Reclamation’s hindcast estimates for overall TDM (incidental take) was estimated to be 76-87 percent. The hindcast estimates for overall TDM were calculated using 2021 redd data and observed water temperatures.

NMFS further included as part of the incidental take statement that the anticipated level of take for winter-run Chinook salmon will be exceeded if there are two consecutive years of egg-to-fry survival of less than 15 percent followed by a third year of less than 21 percent based on fry production at Red Bluff Diversion Dam. Egg-to-fry survival in 2021 monitoring will be finalized in January of 2022 and is anticipated to fall below 15%; therefore, the agencies are facing third year conditions for 2022 and will be seeking extraordinary actions to reduce TDM and increase egg-to-fry survival.

The NMFS ITS included that the anticipated level of take for CV spring-run Chinook salmon and CCV steelhead will be exceeded if a condition for exceedance of take of winter-run Chinook salmon is met.

Commitment to Cold Water Management Tiers

The Proposed Action provides for the Tier to be determined based on May 1 storage and that, *“Once the initial tier is selected by May 15th, Reclamation will not cause a shift into a warmer tier during real-time implementation of the Shasta Cold Water Management Plan except in the event of responding to emergency and/or unforeseen conditions”* (Reclamation’s Proposed Action for Long-term Operations – Commitment to Cold Water Management Tiers 4.10.1.4.2).

Tier 4 conditions were identified in the Sacramento River Temperature Management Plan, which is provided as part of the Shasta Cold Water Pool Management Seasonal Report (Appendix B) and is posted to the SRTTG web page at <https://www.usbr.gov/mp/bdo/water-year-2021-rivertask.html>. Reclamation operated consistent with the Proposed Action.

Sacramento River Temperature Management Plan

To obtain technical assistance on the management of the cold water pool in Shasta Lake, Reclamation included collaborative development of a Temperature Management Plan in the Proposed Action, and NMFS included RPM 1.a:

a. In coordination with NMFS and the Sacramento River Temperature Task Group, Reclamation shall consider technical assistance from NMFS regarding the development of annual temperature management plans, regardless of Shasta storage or tiered temperature management stratum. Reclamation shall submit the final temperature management plan to NMFS by May 20 of each year.

Reclamation coordinated with NMFS through the SRTTG and completed the Sacramento River Temperature Management Plan in 2021. It is provided as part of Appendix B.

Upper Sacramento Performance Metrics

The Upper Sacramento Performance Metrics are included in the Shasta Cold Water Pool Management Seasonal Report in Appendix B. The objectives of the annual and multi-year hindcast evaluations are to:

- Meet performance metrics objectives and expectations. Identify if results reflect the modeled and analyzed results and show a tendency towards performing as least as well as modeled;
- Evaluate whether either the total egg-to-fry survival or the temperature-dependent egg mortality exceeded the Tier objective; and
- Contribute to determining whether an independent review of the year is required. (Biological Assessment page 4-37)

NMFS required as RPM 1.d.:

By February of each year, Reclamation shall provide a hindcast report of temperature-dependent mortality for winter-run Chinook salmon based on realized temperature management.

Additionally, the Proposed Action describes how these metrics will be updated:

Prior to the initial Four Year Review independent panel, Reclamation shall refine performance objectives for temperature dependent mortality and the total survival of winter-run Chinook salmon from egg incubation to juvenile migration at Red Bluff Diversion Dam. Reclamation expects to participate in an effort by NMFS to establish early life stage survival rates that are required for a positive cohort replacement rate.

Tier 4 years have no specific performance criteria for TDM or egg-to-fry survival and rely on interagency coordination to achieve the best negotiated outcome. Reclamation's Hindcast TDM estimate using the SacPAS stage dependent mortality model is 87% and using the stage independent model is 76%. A final estimate for egg-to-fry survival to Red Bluff Diversion Dam is not available at this time. However, Reclamation used the publicly accessible SacPAS web tool to obtain a preliminary estimate of egg-to-fry survival for WY 2021 of 3-6%. Refer to the Shasta Cold Water Pool Seasonal Report for more information on recent preliminary and historical estimates of winter-run Chinook salmon early life stage survival and mortality.

Conservation Measures

The Proposed Action included conservation measures to avoid and minimize or compensate for CVP and SWP project effects, including take, on listed species as well as contribute to the recovery and enhancement of species and their habitats. These measures may also improve production, growth, and survival of listed species. The following provides the status of each conservation measure at the end of WY 2021.

- **Rice Decomposition Smoothing:** SRSC and Reclamation coordinated on contract delivery modifications and finalized plans for depletions in October 2020 (initial month of WY 2021). Information can be found in the WY 2021 Shasta Storage Rebuilding and Spring Pulse Seasonal Report.

- **Spring Management of Spawning Locations:** During WY 2021, a guidance document was developed, and the technical team started meeting in July 2021. A draft study plan has been developed and includes potential new and ongoing evaluations of spring temperature management and its effect on the spawning timing, location and reproductive success of winter-run Chinook salmon.
- **Temperature Modeling Platform:** The Proposed Action included: a collaborative model development effort to develop a new temperature model for the upper Sacramento River (Shasta and Keswick reservoirs).

NMFS included as RPM 1.c.:

...Reclamation shall develop a stratification model for Shasta Reservoir and evaluate this model for implementation as part of the development of annual temperature management plans. The initial stratification model shall be available for pilot application and evaluation no later than January 1, 2022, unless NMFS and Reclamation agree to extend the date. At the end of the three-year period starting once the stratification model is available, Reclamation and NMFS shall submit the model to the Four-Year Review Panel for advice on the model's accuracy and utility as a forecasting tool, and Reclamation will decide whether implementation is appropriate.

As part of the Water Temperature Modeling Platform (WTMP) effort, reservoir models should have sufficient vertical resolution to represent seasonal stratification under various thermal regimes. For seasonally stratified reservoirs, geometric representation will include sufficient spatial resolution to capture isothermal conditions, onset of stratification, persistent seasonal stratification, and fall breakdown of stratification. Models representing the larger reservoirs that hold considerable cold water will represent detailed stratification.

In WY 2021, the modeling technical committee held its first meeting on July 1, 2021, to kick off the start of the community/stakeholder coordination through meetings and workshops.

- **Shasta Temperature Control Device Performance Evaluation:** The charter was completed on January 28, 2021. A technical team has been established and is working towards identifying whether there are problems or limitations with the function of the TCD under low storage conditions.
- **Lower Intakes near Wilkins Slough:** In WY 2021 a charter was completed on December 10, 2020. The goal of the charter is to enable operation of pumps in the vicinity of Wilkins Slough to operate at flows below the current regulatory limit of 5,000 cfs, for planning purposes as low as 3,000 cfs.

The first action under this charter is the Meridian Farms Pump Replacement, Phase II. The Meridian Farms Pump Replacement grant was awarded in September 2021.

New applications for lowering other pumps in the affected area are solicited as part of Notice of Funding Opportunity (NOFO) for Habitat & Facilities Improvement. NOFO closes November 30, 2021; Awards by September 30, 2022; Completion within five years of award.

- **Spawning & Rearing Habitat Restoration:** Reclamation partnered with USFWS, Chico State University, Sacramento River Forum, SRSC, Yurok Tribe, River Partners, NMFS, and CDFW to complete the Anderson River Park side channels, the Nur Pon (South Cypress) Open Space side channel and the first construction phases of the East Sand Slough side channel and floodplain habitat projects along the Sacramento River. Information on these projects is at <https://www.sacramentoriver.org/forum/index.php?id=channels>
- **Small Screen Program:** Under the Small Screen Program, Reclamation and DWR work together within existing authorities to screen small diversions throughout the Central Valley, CVP and SWP streams, and the Delta. A Small Screen Program Project Charter was developed and completed on January 14, 2021. Applications solicited as part of NOFO - Habitat & Facilities Improvement. NOFO closed on November 30, 2021. Awards of projects are expected by September 30, 2022, with a completion date requirement within five years of award. Project Management teams are forming in parallel with NOFO.

Tier 4 Intervention Measures: In WY 2021, there was increased production of winter-run Chinook salmon at Livingston Stone National Fish Hatchery (LSNFH) to mitigate for the anticipated temperature related mortality for eggs naturally spawned in the river. In addition, three 525 ton semi-trailer sized electric powered water chillers were rented to cool the water coming into LSNFH and reduce temperatures to more optimal levels (close to 53° F) for egg-to-fry survival. The system used two running chiller units with one on standby for outages. The system successfully produced acceptable survival despite intermittent chiller outages. 5.79 cfs were chilled at peak production. The 2021 brood year production included the winter-run Chinook salmon eggs from the Keswick trapped adults, winter-run Chinook salmon captive broodstock reared at LSNFH, and Battle Creek winter-run Chinook salmon adult returns trucked to LSNFH for egg collection and incubation.

Additional intervention measures also included a warm-water power bypass and water transfers. Refer to the Shasta Cold Water Pool Management Seasonal Report (Appendix B) for more information or the SRTTG webpage at <https://www.usbr.gov/mp/bdo/water-year-2021-rivertask.html>.

Battle Creek Salmon and Steelhead Restoration Project and Battle Creek Reintroduction Plan: NMFS required as RPM 1.f.:

Reclamation shall work with NMFS, USFWS, and CDFW to complete a Battle Creek Acceleration Plan by December 31, 2020. The plan shall address the Battle Creek Salmon and Steelhead Restoration Program and the Battle Creek Winter-run Chinook Salmon Reintroduction Plan, and work with USFWS to identify Livingston Stone National Fish

Hatchery facility improvements necessary to support the Battle Creek Winter-run Chinook Salmon Reintroduction Plan.

The Phase 2 contract to remove South Diversion Dam, South Canal, Soap Creek Feeder Diversion Dam and Lower Ripley Creek Feeder Diversion Dam is planned to be awarded in November 2022. The Battle Creek Salmon and Steelhead Restoration Project November 2020 update is included as Appendix C.

The Battle Creek winter-run reintroduction group identified monitoring activities to improve the reintroduction process. Reclamation entered into an interagency agreement with USFWS to monitor winter-run Chinook salmon reintroduction activities in Battle Creek. The monitoring activities are:

1. On the ground surveys for adult winter-run Chinook salmon during the spawning period, including adult, redd, and carcass surveys, and collecting water temperature data from 43 locations in the watershed;
2. Track movements of adult winter-run Chinook salmon in and around Battle Creek using radio and/or acoustic telemetry to identify holding locations, potential barriers, and straying;
3. Assess movement and survival of emigrating juvenile winter-run Chinook salmon from Battle Creek with acoustic telemetry; and
4. Develop a monitoring plan for Eagle Canyon Diversion Dam canal gate that will enable acceptance by Pacific Gas and Electric Company (PG&E) of the Eagle Canyon Dam fish ladder so that it can be operated for fish passage, and
5. Evaluate genetic diversity and life history strategies in upper Sacramento River (below Keswick Dam) and tributary Chinook salmon and steelhead, including Battle Creek, using both genetics and otoliths.

Reclamation conducted a value engineering study of the Coleman National Fish Hatchery fish trap and sorter design. A new fish trap and sorter would allow accurate sorting and distribution of species at the Coleman National Fish Hatchery ladder and reduce handling stress from the current situation. Decisions on the roughly \$12 million project may be made in FY 2022, subject to appropriations.

- **Winter-Run Chinook Salmon Conservation Hatchery Production:** Due to the drought conditions in WY 2021, the Livingston Stone National Fish Hatchery increased their production of winter-run Chinook salmon. The additional fish would help mitigate for lost in-river production. The adult collection and egg take goals were effectively doubled. The USFWS, who operates Livingston Stone National Fish Hatchery, spawned 118 female salmon and 129 male salmon to produce approximately 590,000 eyed eggs. Due to the warm and fluctuating water temperatures from Shasta Lake, Reclamation rented water chillers to maintain satisfactory water quality for hatchery operations. Refer to the

Shasta Cold Water Pool Management Seasonal Report (Appendix B) for more information.

- **Non-Flow Projects for Salmonids:** For details on completed projects, see the WY 2020 Annual Report and its appendices. Updates on activities in WY 2021 include the following:
 - **Knights Landing Outfall Gates:** Knights Landing Outfall Gates is a positive fish barrier to prevent migrating salmon from entering into and getting trapped in the Colusa Basin Drain. The Knights Landing Outfall Gates fish screen project is starting the construction phase. Reclamation District (RD) 108 awarded the construction contract to Auburn Construction, and work commenced in September 2021, and will be complete in the late fall of the same year.

Conclusion

Reclamation and DWR are in compliance with the 2019 NMFS ITS for the upper Sacramento River.

During WY 2021, the SRTTG followed the Shasta Cold Water Pool Management Guidance Document and met regularly to discuss planning, implementation, and performance of the Temperature Management Plan. Given the water and fish operations challenges presented by the Tier 4 management conditions of WY 2021, a number of issues came up for further clarification, including:

- Presentation and availability of modeling results and the ability for third parties to review source code and calibration.
- The use of multiple models to inform temperature management
- Coordination between the Upper Sacramento Scheduling Team, SRTTG, and Water Operation Management Team (WOMT)

Guidance Document Updates

- Shasta Cold Water Pool Management Plan
- Sacramento River Spring Pulse Flow Guidance Document

Seasonal Reports

- Shasta Storage Rebuilding and Spring Pulse Seasonal Report
- Shasta Cold Water Pool Seasonal Report

Clear Creek

Clear Creek, from Whiskeytown Reservoir to its confluence with the Sacramento River, includes CV spring-run Chinook salmon and CCV steelhead and their critical habitats. WY 2021 was a critically dry water year. Clear Creek management in a critically dry water year includes: one spring pulse flow, anticipated difficulties in meeting water temperature criteria, and the possibility for flows below normal base flow minimums. This document includes the background and description of Clear Creek management in WY 2021, including minimum base flows, spring attraction flows, fish habitat restoration and management, water temperature management, and fisheries monitoring. For additional information on Clear Creek management, see Appendix C for the Clear Creek Technical Team's Summary of Activities for WY 2021.

Water Temperature Management

During the adult CV spring-run Chinook salmon holding period (June 1 – September 15), mean daily water temperatures at Igo gage remained below the temperature criterion of 60 °F for 100 percent of the period. The mean daily temperature daily temperatures were generally maintained 1-3° F below the 60° F (maximum) threshold for most of this timeframe. These water temperatures were delivered via a 50:50 mix of water from Whiskeytown Dam's upper and lower guard gates. The mean daily water temperature criterion transitioned from 60 °F to 56 °F for the spawning/egg incubation period, which started on September 16. This temperature criterion period runs from September 16 through October 31. A Whiskeytown Dam gate adjustment was made on September 15 to withdraw 100 percent of the release from the lower guard gate to provide the coldest possible water from Whiskeytown Reservoir. Following the gate adjustment water temperatures decreased, but did not drop below the 56 °F (maximum) criterion. To further reduce water temperatures, flows from Whiskeytown Dam were increased from 150 to 200 cfs on September 21. Mean daily temperatures at Igo were maintained below 56 °F for 36 of the 46-day spawning/egg incubation period in WY 2021 (and 37 of 46 days in calendar year 2021). Figure 5 shows water temperatures at the Igo gage.

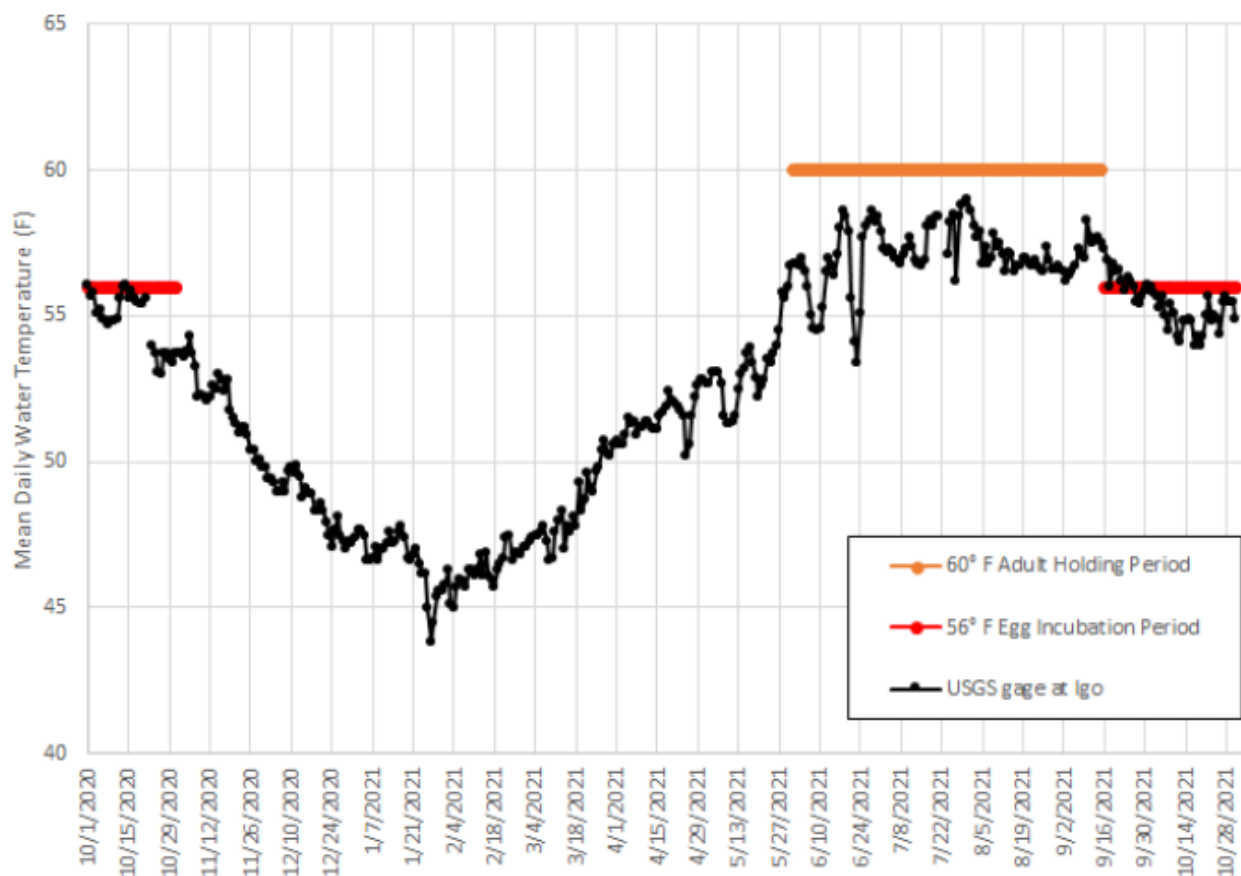


Figure 5. Mean daily water temperature on Clear Creek at the Igo gaging station in 2021 compared to the mean daily temperature criteria for CV spring-run Chinook salmon holding (60 °F June 1 to September 15) and spawning and egg incubation (56 °F September 16 to October 31) periods. These data span water years.

WY 2021 was a “critically dry” year, under which Reclamation proposed to operate to the target water temperatures to the extent possible. The extent of take is measured by the appropriate life stage habitat between Whiskeytown Dam and the Igo gauge exposed to water temperatures that exceed the proposed water temperature management target (2019 NMFS Biological Opinion, page 804). The level of incidental take anticipated from water temperature effects described in the 2019 NMFS Biological Opinion would be exceeded if 1) “the daily average temperature at the Igo gauge exceeds 60°F from June 1 through September 14 for longer than seven consecutive days or exceeds 61°F for any single day” and 2) “if the average daily water temperature [between September 16 through October 31] exceeds 59°F for longer than seven consecutive days [at the Igo gage],” for those years when Trinity Reservoir end-of-April storage is below 1.5 million acre-feet (such as WY 2021). As these water temperature criteria were not exceeded in WY 2021, the anticipated level of take was not exceeded in Clear Creek.

The NMFS Biological Opinion's included as RPM 2 states the following:

a. To minimize incidental take under 60° F daily average water temperature criteria for adult CV spring-run Chinook salmon holding, and 56° F daily average water temperature criteria for CV spring-run Chinook salmon egg incubation, Reclamation shall, consistent with the proposed action and in consideration of Shasta Cold Pool Management:

i. Continue maintenance of temperature control curtains (Oak Bottom and Spring Creek) in Whiskeytown Reservoir.

ii. Through coordination with the Clear Creek Technical Team, consider real-time species information when making decisions regarding operational adjustments.

iii. In critical years, Reclamation shall coordinate with NMFS through Clear Creek Technical Team and/or the Sacramento River Temperature Task Group on the timing, frequency, duration and magnitude of flows below 150 cfs.

The Oak Bottom and Spring Creek Temperature Control Curtains remained in place and operational during WY 2021.

Flow Management

Through the Clear Creek Technical Team (CCTT) the USFWS, CDFW, and Reclamation provided real-time fish data (e.g., weir passage, spawning sightings) to evaluate options when making operational adjustments at Whiskeytown Dam.

Flow scheduling in WY 2021 was coordinated through the CCTT. These coordinated flow management actions included Minimum Base Flows, Water Temperature Management, and Spring Pulse Flows. Channel Maintenance Flows were discussed but not implemented, as it was a critical dry year.

During a critical year, the anticipated level of take associated with base flows in Clear Creek identified that flows may go below 150 cfs depending on available water supply.

- **Base Flow Management:** In WY 2021, Clear Creek's minimum base flows were met for most of the year, except for a purposeful reduction during an emergency drought-related action. The operations plan for Clear Creek has provisions for deviating from base flow minimums during critically dry water years, such as WY 2021.

Additional flows were needed to meet temperature criteria in the fall of 2020. From the beginning of WY 2021 (October 1, 2020) through October 8, 2020, Whiskeytown Dam releases to Clear Creek were elevated, running at approximately 225 cfs. These flows were a continuation from the adjustments needed to meet water temperature criteria in WY 2020 that started on September 28, 2020. The flows were returned to the normal base flow of 200 cfs on October 9, 2020. As water temperatures again exceeded the

temperature criteria, the flows were increased to 215 cfs on October 15, 2020. These elevated flows were maintained through February 27, 2021. Flows were reduced to 200 cfs on February 28, 2021, where they remained until the spring attraction pulse.

The CCTT developed an emergency action that reduced base flows below normal base flows to ‘bank’ water for an emergency pulse flow (see below for explanation of this action). The emergency action was initiated on May 27, 2021, with a base flow reduction (from 200 cfs to 125 cfs). These reduced flows (125 cfs) occurred both before and after the emergency pulse (from May 27-June 20, and June 25-July 1). The emergency pulse occurred from June 21-24, with a 500 cfs peak. This emergency action was initiated to encourage upstream migration of the record number of CV spring-run Chinook salmon in Clear Creek.

As previously stated, water temperature management required increased base flows from September 21 through September 30, 2021. Flows were increased from 150 cfs to 200 cfs to try to obtain a mean daily water temperature at Igo below 56° F.

- **Spring Attraction Pulse Flow:** Reclamation proposed to implement one spring pulse flow during critically dry water years, such as WY 2021. The CCTT with CVO designed a pulse flow for implementation in early May of 2021. These flow releases begin on May 7 and reach a peak of 840 cfs May 8 to 11. Flow rates quickly dropped to 200 cfs by May 16, following the approved ramping rate. The original CCTT pulse flow design had proposed a 900 cfs peak release, but this high of a flow would have caused significant operational problems for the Clear Creek Community Service District’s infrastructure, so the peak flows were reduced to 840 cfs.

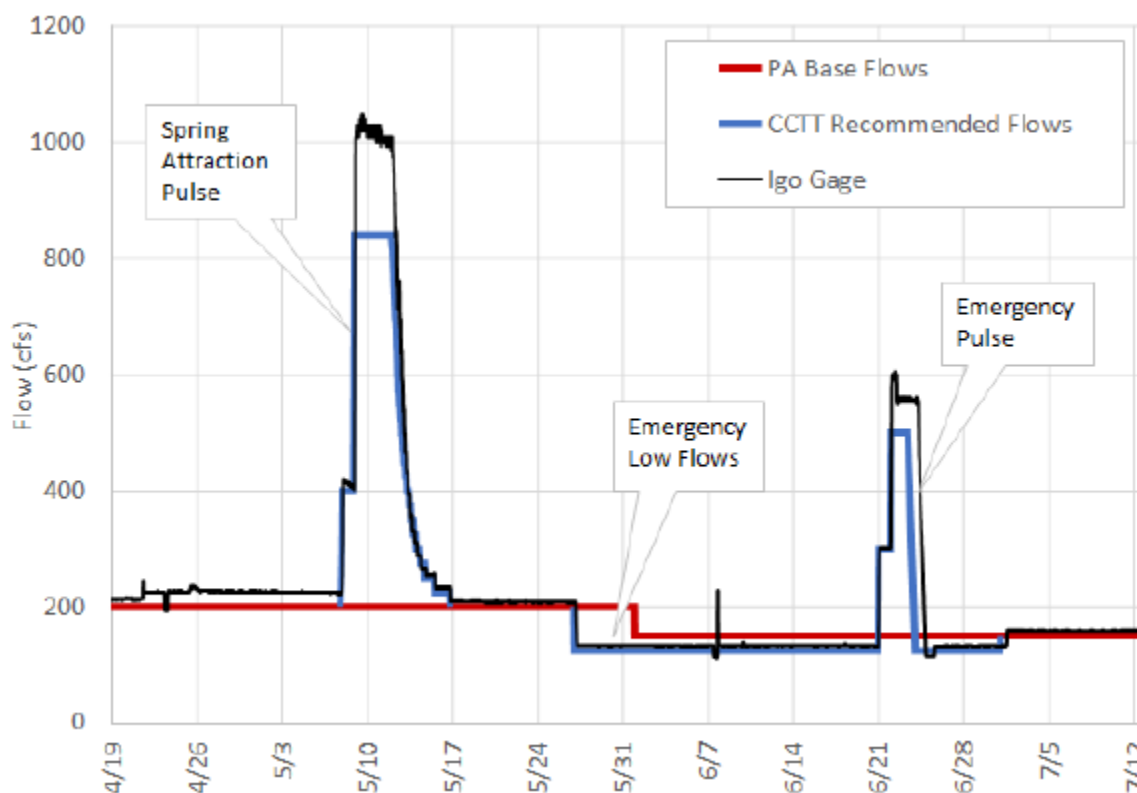


Figure 6. The Clear Creek Technical Team-proposed release schedule for the 2021 spring attraction pulse and emergency pulse (including the low flow period) flows from Whiskeytown Dam. The flow measured at the USGS Igo gage is shown for reference.

- Emergency Pulse Flow and Low Flow Period:** Following the single planned spring attraction pulse flow, a record number of CV spring-run Chinook salmon were discovered to be occupying the lower reaches of Clear Creek, where they would be subjected to warmer holding temperature and increased poaching concerns. An ad hoc CCTT meeting was convened to discuss the possibility of an emergency action informed by real-time species distribution information and desire to improve decisions regarding fishery operational adjustments. The CCTT developed a proposal (Figure 6) that would not utilize additional water, but would lower base flows below normal operations commensurate with the pulse flow volume (i.e., volume neutral). This action was incorporated into Reclamation’s drought toolkit. The proposed plan was initiated on May 27, with a base flow reduction. These reduced flows (125 cfs) occurred both before and after the emergency pulse (from May 27-June 20, and June 25-July 1). The emergency pulse occurred from June 21-24, with a 500 cfs peak.

The combination of reduced base flows and an additional pulse flow appears to have been successful in encouraging many CV spring-run Chinook salmon to move upstream into colder water refugia (Figure 7). The USFWS conducted several snorkel surveys in 2021 to count and determine the distribution of CV spring-run Chinook salmon in Clear Creek.

These data showed that the distribution of CV spring-run Chinook salmon continually moved upstream following each flow action.



Figure 7. CV spring-run Chinook salmon in Clear Creek during the summer of 2021. Holding habitat for these fish, such as this deep pool, improves as they migrate upstream. Photo Credit: Derek Rupert, Bureau of Reclamation.

- Channel Maintenance Flows: No Channel Maintenance Flows were released in 2021, as it was designated a critical dry water year type. There were also no Gloryhole spills in WY 2021.

a. NMFS included as RPM 2.d.: To minimize the adverse effects of flow fluctuations associated with CVP-controlled water operations on all life stages of listed anadromous fish species in Clear Creek, Reclamation shall:

i. Coordinate flow release schedules with NMFS, USFWS, and CDFW via Clear Creek Technical Team or a comparable inter-agency fish monitoring group.

Reclamation worked with the CCTT to coordinate flow releases in WY 2021. Reclamation and the CCTT worked to produce flow management actions that improved the habitat for listed

species in Clear Creek and that reduced adverse conditions associated with flow management actions.

Fish Habitat Restoration and Management

Fish habitat restoration efforts continued on Clear Creek in WY 2021.

- **Lower Clear Creek Anadromous Fish Habitat Restoration and Management Project (“Gravel Augmentations”)**: The gravel augmentation program on Clear Creek continues to enhance the spawning habitat available for salmon and steelhead. In WY 2021, a total of 5,011 tons of coarse sediment (e.g., gravel) were injected at three sites on Clear Creek (Figure 8). The WY 2021 augmentations increased the total amount of coarse sediment placed into Clear Creek to 196,605 tons (1996-2021).



Figure 8. Implementation of the gravel augmentation project at the Below Dog Gulch site on Clear Creek. Photo credit: Derek Rupert, Bureau of Reclamation.

- **Lower Clear Creek Floodway Rehabilitation Project – Phase 3C**: In 2020, major construction was completed for the Lower Clear Creek Floodway Rehabilitation Project (LCCFRP) – Phase 3C. The Yurok Tribe helped develop the site's design and completed all the construction for the Phase 3C project on public lands administered by the Bureau of Land Management.

In WY 2021, the Yurok Tribe completed their efforts to revegetate areas disturbed during construction (Figure 9). A diversified revegetation strategy was implemented to improve the ecological function, habitat potential, and esthetics of the construction area. Irrigation of planted trees and plants continued through the summer of 2021. Additional irrigation

will occur in 2022. Once irrigation ceases, and the materials are removed, the Phase 3C project will be considered complete.



Figure 9. Clear Creek flowing through the Phase 3C stream channel restoration project area. Spring plant growth reveals that the revegetation efforts were successful on the newly created river bars. Photo credit: Derek Rupert, Bureau of Reclamation.

Segregation Weir

NMFS additionally required as RPM 2.c.:

Reclamation shall continue implementation of a weir annually to separate CV spring-run Chinook salmon and fall-run Chinook salmon during spawning to minimize the effects of redd superimposition and hybridization.

The segregation weir was installed and operated beginning on August 31, 2021 to separate CV spring-run Chinook salmon and fall-run Chinook salmon during spawning. The segregation weir was installed at the Reading Bar location. On October 22, 2021, the weir was blown out due to high flows during a large storm event. The weir was not replaced since it is typically removed sometime in November each year.

Temperature Modeling Platform

NMFS additionally required as RPM 2.b.:

Reclamation shall ensure that the proposed temperature modeling platform for the Sacramento River will consider Clear Creek system, including Whiskeytown Reservoir, to enable better temperature forecasting and planning in Clear Creek. Reclamation shall undertake a study to collect and analyze temperature data in Whiskeytown Reservoir and Clear Creek to determine the magnitude and potential impact on temperatures from power peaking and flat loading of hydropower production. The data collected shall be analyzed and shared with NMFS and considered for implementation in the temperature model.

The Temperature Model Platform for the CVP is discussed in the Upper Sacramento River section under Conservation Measures.

Conclusion

This report and the seasonal reports, guidance documents, and other documentation indicate that Reclamation and DWR are in compliance with the 2019 NMFS Biological Opinion ITS and the Proposed Action adopted in the 2020 Reclamation ROD in Clear Creek.

WY 2021 was a critically dry year coupled with hot and dry environmental conditions making water temperature management difficult. Considering these difficulties, water temperatures during the temperature management season (June 1-October 31) were below or near the criteria, with overall conditions generally suitable when compared to past years.

One spring attraction pulse flow and one emergency pulse flow were provided from Whiskeytown Dam. Channel maintenance flows were not implemented in WY 2021, as it was a critically dry year. Fish habitat restoration actions continued with the final stages of the Phase 3C restoration project and implementation of the gravel augmentation program.

For WY 2021, recommendations were not identified to improve implementation of the Biological Opinions and the Proposed Action adopted in the ROD in the Clear Creek watershed.

Guidance Documents Updates during WY 2021:

- Clear Creek Minimum Flows and Cold-Water Pool Management Plan (Reclamation authored document)

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Feather River

The Oroville Facilities (Oroville Dam and related facilities, including the Feather River Fish Hatchery) are part of the SWP. DWR has been operating the Oroville Facilities under a Federal Energy Regulatory Commission (FERC) license and is currently undergoing a relicensing process (FERC Project No. 2100-134). USFWS and NMFS completed section 7 consultations and issued biological opinions to FERC regarding the effects of relicensing the Oroville Facilities for 50 years on April 9, 2007, and December 5, 2016, respectively. Because the effects of the operations of the Oroville Facilities were considered in these consultations with FERC, the Relicensing of the Oroville Facilities Hydroelectric Project Biological Opinions are incorporated into the LTO consultation by reference, only, to satisfy the ESA section 7(a)(2) responsibility as a component of ongoing operations of the CVP and SWP, and operations of the Oroville Facilities are not included in this report.

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American River

The lower American River extends approximately 30 river miles from Folsom Reservoir through Lake Natoma downstream to its confluence with the Sacramento River. CCV steelhead and its critical habitat, and also critical habitat for CV spring-run Chinook salmon, are present in the lower American River. There is also evidence for non-natal rearing of winter-run Chinook salmon in the lower American River.

Folsom Reservoir and Lake Natoma seasonal operations follow a set of objectives. During winter, Reclamation operates for flood control and building storage, considering both the channel capacity within the lower American River and Folsom Reservoir flood conservation space. In January to May, Reclamation provides redd dewatering protective adjustments. During spring, Folsom Reservoir continues to build additional storage until flows are needed to support instream demands on the lower American River, Delta requirements, and other CVP needs. During spring, this may include a spring pulse flow to provide juvenile salmonid emigration cues. Summer operations are focused around water temperature control, Delta outflows, and exports. Fall operations are guided by water temperature control and fish spawning habitat. Throughout the entire year, there are minimum flows adopted from the 2017 Flow Management Standard intended to improve cold water pool and habitat conditions for CCV steelhead and fall-run Chinook salmon. The American River Group (ARG) Annual Summary of Activities report is presented in Appendix E.

Water Temperature Management

In the fall of 2020, Reclamation approved a power bypass at Folsom to provide cooler water temperatures for CCV steelhead (rearing juveniles) and fall-run Chinook salmon (adult holding and spawning; egg incubation). Another power bypass for the same purposes was planned during WY 2021, for implementation beginning in October 2021 of WY 2022. Both power bypasses are summarized in the Conservation Measures section under the Drought Temperature Management measure.

The 2021 Temperature Management Plan (TMP) for the lower American River (LAR) was developed according to the Proposed Action adopted in the 2020 ROD.

Given the hydrology and Folsom Reservoir storage conditions for WY 2021, water temperatures were expected to exceed 68°F at Hazel Avenue for most of the summer. These higher water temperatures will further impact oversummering juvenile CCV steelhead in the lower American River below Nimbus Dam.

After reviewing the current hydrological conditions, operations forecast, Folsom Reservoir temperature profile, and temperature modeling, Reclamation targeted 71°F at Hazel Avenue from June 6, 2021, throughout the remainder of WY 2021.

The 2019 NMFS Biological Opinion specifies that

In a critical year, or year following critical year, Reclamation will meet with NMFS, FWS, CDFW, and the SWRCB to discuss and determine the best use of the limited cold water pool for that year. (2019 NMFS, p 806).

The TMP temperature target of 71°F at Hazel is consistent with discussions with the ARG including at the June 3, 2021 ARG ad hoc meeting, which included NMFS, USFWS, CDFW, and the Water Board, given the conditions this year.

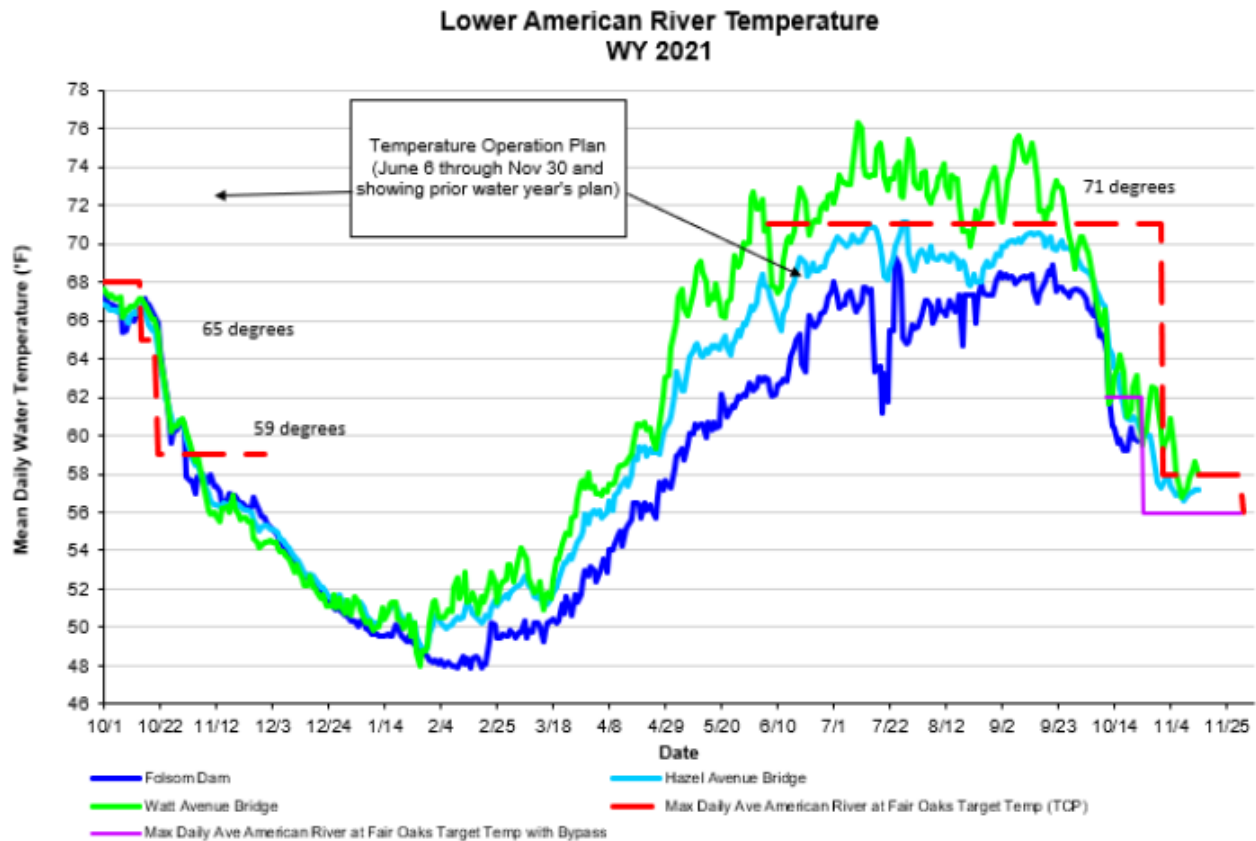


Figure 10. Summary of WY 2021 Water Temperatures in the Lower American River

Conservation Measures

Reclamation included conservation measures in the Proposed Action that were adopted in the ROD to avoid and minimize or compensate for CVP and SWP project effects, including incidental take, on listed species. These measures may also improve production, growth, and survival of listed species.

- Spawning and Rearing Habitat Restoration:** In WY 2021 one spawning and rearing habitat restoration project was completed in the American River. Reclamation partnered with the Sacramento Water Forum to complete the Ancil Hoffman Habitat Restoration Project (Figure 11). The Ancil Hoffman Habitat Restoration Project recreated spawning and rearing areas by laying approximately 15,800 cubic yards of clean gravel into the flowing river and carving a new alcove in the existing gravel bar parallel to the river.

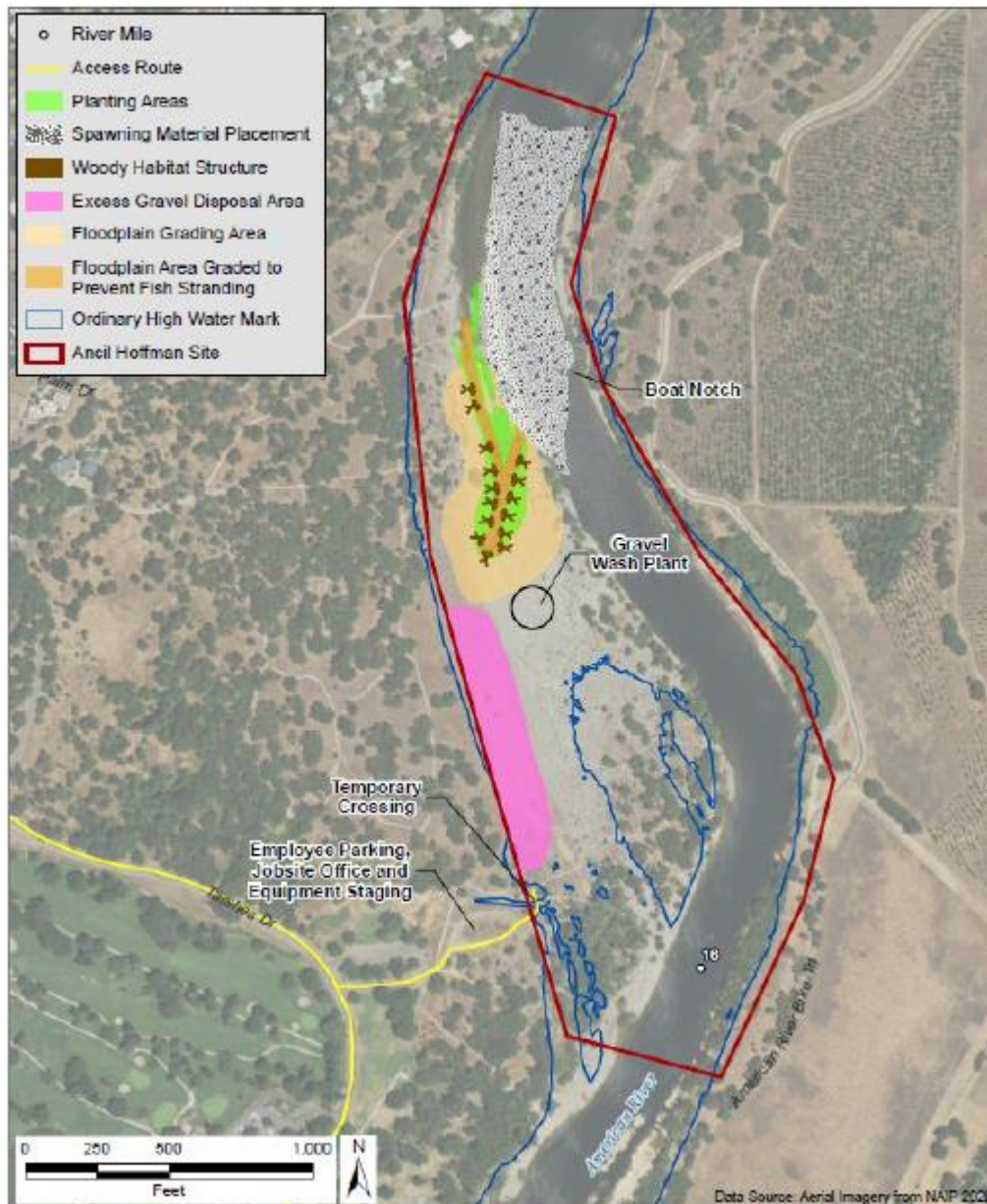


Figure 11. Ancil Hoffman Habitat Restoration Project in the American River.

- Nimbus Fish Hatchery:** A Nimbus Fish Hatchery – Hatchery and Genetics Management Plan (HGMP) Project Management Plan (PMP) document was completed in June 2021.

The PMP establishes the objectives, scope, proposed schedule, project team roles and responsibilities, and QA/QC protocols for the upcoming development of Chinook salmon and CCV steelhead HGMPs. A Performance Work Statement (PWS) was drafted and submitted to Acquisitions in August 2021 for procurement of a contractor to oversee HGMP development. Construction of the Nimbus Fish Ladder Project was completed in summer 2021 and is being used for returning hatchery fish during the fall.

- **Drought Temperature Management:** WY 2021 was classified as Critical, as defined by the Sacramento Valley 40-30-30 index WY hydrologic classification (SWRCB D-1641). For drought temperature management, Reclamation committed to degang the middle and bottom shutters of the TCD in order to provide flexibility in temperature blending of releases at Folsom Dam. Reclamation also supported water temperature management during the recent dry conditions through the use of power bypass operations at Folsom Dam. When temperature operations exhaust the reservoir's cold water pool at the lowest shutter locations, Reclamation has the operational ability to release the coolest water from the river outlets at the lowest elevation outfall in Folsom Dam in effort to achieve targeted temperatures in the LAR to the extent physically controllable. Releases from the river outlets cannot be used to generate power and thus this operation is referred to as a "power bypass".

In WY 2021, a power bypass commenced during October and continued into November as summarized below.

- **October-November 2020 Folsom Power Bypass:** The ARG submitted a Power Bypass proposal to the Regional Director on October 20, 2020, and it was approved the same day. Temperature operations under this plan began on October 21, 2020. On October 21 all lower shutters were lifted, and the LAR could become as cool as this release would allow. On October 28 Reclamation began ramping up to a 500 cfs power bypass through the lower outlet tubes with a goal of reaching 56°F at Hazel Ave by November 1, 2020. This power bypass was planned to continue for up to 28 days if needed to maintain 56°F at Hazel Ave. The targeted temperature of 56°F was achieved on November 25, the last day of the bypass.
- Planned in WY 2021, but implemented in WY 2022 at the tail end of the summer-fall water temperature management season, another power bypass was implemented as summarized below:
 - The power bypass commenced on October 11 with 50 cfs and followed by an addition of approximately 50 cfs per day for three days up to approximately 150 cfs (to avoid cold water shock to fish in Lake Natoma) with the goal of reaching a LAR daily average water temperature of 62° F measured at Hazel Avenue to limit pre-spawn mortality and limit induction of early spawning. Around October 25 the bypass was increased to no more than 350 cfs to target 56° F LAR daily average water temperature measured at Hazel Avenue (via approximately 100 cfs/day increments) by November 1.

Incidental Take Statement

Reclamation's proposed action in the American River Division will create circumstances of water temperature and flow that are reasonably expected to result in the take of CCV steelhead (NMFS Biological Opinion, page 805).

Water Temperature

The 2019 NMFS Biological Opinion ITS describes take for CCV Steelhead egg-to-fry life stage on the American River as:

“The extent of take associated with suboptimal water temperatures is all redds exposed to temperatures above 54° F in the vicinity of Watt Avenue December 1 through May 31. The anticipated level of take of CCV steelhead during the egg-to-fry life stage during these months is expected to be minimal because of the small proportion of eggs or alevins still incubating in the month of May.”

Conditions during WY 2021: WY 2021 was a Critical year. Temperature maintained below 54° F starting in December until mid-March when temperature rose above 54° F into May 31 (Figure 10).

The 2019 NMFS Biological Opinion ITS describes take for CCV Steelhead juveniles on the American River as:

“The ecological surrogate to define the amount or extent of take of CCV steelhead juvenile life stage is daily average temperature at Watt Avenue May 15 to October 31. The anticipated level of take will be exceeded if temperatures at Watt Avenue exceed 68°F from May 15 to October 31 for more than seven consecutive days unless it is a critical year based on the Sacramento Valley index or a year following one or more critical years. In critical years, and years immediately after a critical year, anticipated level of take is exceeded if water temperature exceeds 68°F at Hazel Avenue.”

WY 2021 was a Critical year, so water temperature was tracked at Hazel Avenue. For the period May 15 to October 31, water temperatures exceeded 68°F at Hazel Avenue from June until September (see Figure 10). As noted previously, the Temperature Management Plan for WY 2021 included a Hazel Avenue temperature target of 71° F. Water temperatures during the water temperature management season (June 6-October 31 [historically, starting in May, but delayed due to uncertainties related to drought actions]) were at the agreed upon temperature management thresholds of 71° F for most of the summer (see Figure 10). The water temperature threshold of 68°F identified in the Biological Opinion was exceeded in 2021.

Flow Changes

In WY 2021, the minimum flows of the Proposed Action Flow Management Standard were met in most months. However, during the month of February 2021, Reclamation operated to a lower minimum flow standard in order to provide potential benefits for cold water pool and

temperature management at Folsom Reservoir later in the season (Figure 12). This was discussed with NMFS and other ARG stakeholders during the month of February.

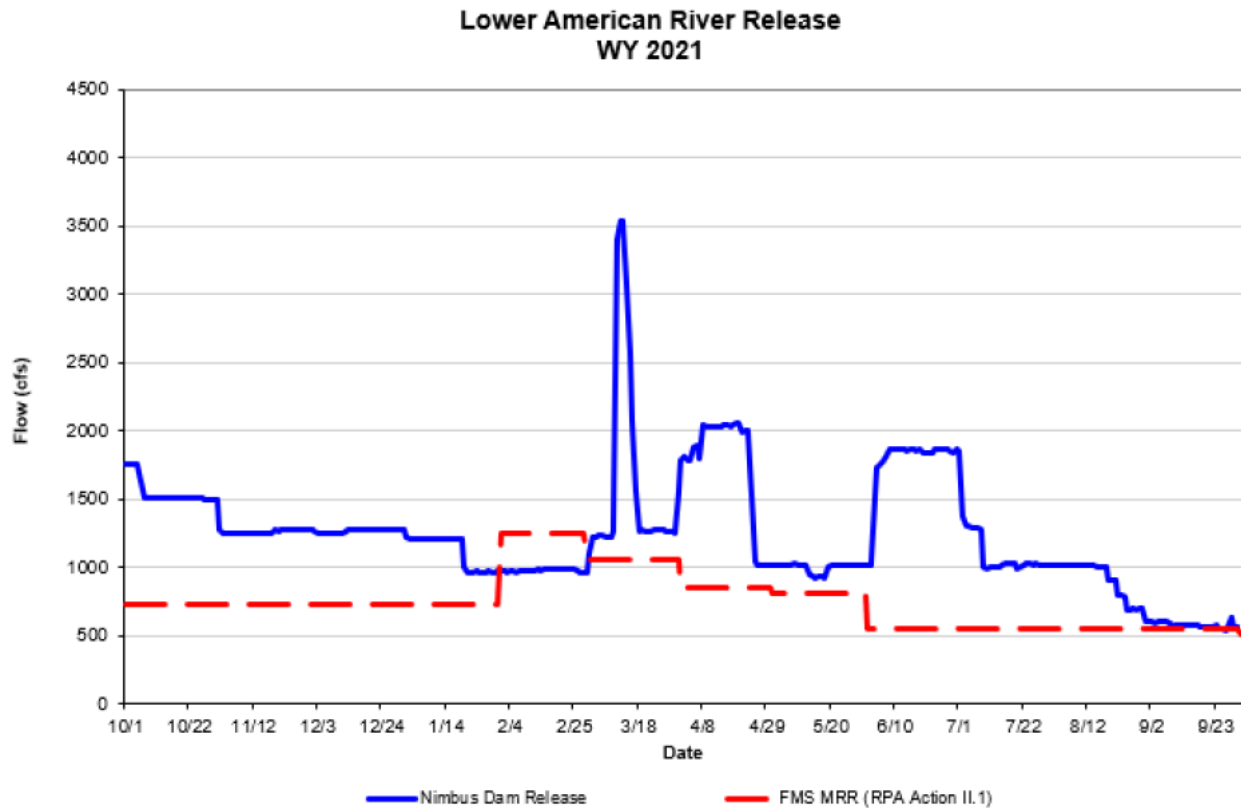


Figure 12. Summary of WY 2021 Nimbus Dam Releases to the Lower American River Releases.

Reasonable and Prudent Measures

This section of the WY 2021 Annual Report describes compliance with the RPMs of the 2019 NMFS Biological Opinion. The 2019 USFWS Biological Opinion did not include RPMs for the American River. The 2019 NMFS Biological Opinion included the following RPM (and associated Terms and Conditions) to minimize impacts of incidental take of the listed fish species in the American River:

RPM 3: Reclamation shall minimize the impact of the amount or extent of incidental take of listed species during operations of the American Division.

a. Seasonal operational decisions that affect water temperature and river flows shall be coordinated through the American River Group.

Operational decisions made by Reclamation concerning lower American River temperature management, flow schedule development, and implementation and pulse flow development were communicated and coordinated with the ARG throughout this reporting period. NMFS, CDFW, Reclamation, and other ARG stakeholders provided real-time fish data to evaluate options when making operational adjustments at Folsom Dam.

Spring Pulse Flow: Spring pulse flow, as defined in the Proposed Action and adopted in the ROD, was not required during WY 2021.

Water Temperature Management: The summer of 2021 was unusually hot, and as a result, Reclamation made multiple adjustments to in-river temperature operations throughout these exceedance periods to not exceed the 71°F objective at Hazel Avenue. The extent of the incidental take was minimized in accordance with RPM 3.

Monthly ARG Meeting: Monthly ARG meetings typically take place on the third Thursday of each month, and the ARG is a venue for various stakeholders to provide input on hydrologic, operational, biological, and water temperature management, as well as provide fisheries monitoring information. Reclamation takes this input into consideration when making operational decisions. Monthly ARG meeting notes are taken and posted to the ARG webpage. <https://www.usbr.gov/mp/bdo/american-river-group.html>

Fisheries Management Discussions: Periodic discussions took place outside of ARG monthly meetings between Reclamation, the fisheries agencies, and other ARG stakeholders. The purpose of these meetings was to discuss lower American River fisheries management concerns and constraints with an emphasis on improving interagency communication and cooperation. Discussions took place on 1/28, 4/15, 5/27, and 6/3/2021. Reclamation presented discussion summaries from these discussions to ARG, and they can be found on the ARG webpage. <https://www.usbr.gov/mp/bdo/american-river-group.html>

Conclusion

This report and the seasonal reports, guidance documents, and other documentation indicate that Reclamation did not meet the temperatures in the 2019 NMFS Biological Opinion and the Proposed Action adopted in the 2020 Reclamation ROD on the lower American River. WY 2021 was a critical year. In accordance with the 2019 NMFS Biological Opinion and the Proposed Action adopted in the 2020 Reclamation ROD on the lower American River, Reclamation met with NMFS, USFWS, CDFW, and the SWRCB to discuss and determine the best use of the limited cold water pool for that year. The TMP temperature target of 71°F at Hazel Avenue was decided to be the best use of the limited cold water and is consistent with discussions with the ARG, where NMFS supported the TMP target given the WY 2021 conditions. Reclamation and DWR complied with NMFS's requirements to discuss and determine the best use of the limited cold water pool for that year.

For WY 2021, there were no clarifications that were necessary or recommendations identified to improve implementation of the NMFS Biological Opinion and the Proposed Action adopted in the ROD in the American River watershed.

Guidance Documents Revisions for WY 2021:

- American River Water Temperature Management Plan (draft as of January 2022.)
- American River 2017 FMS Guidance Document (draft as of January 2022.)

Delta

Federally listed species in the Delta include Delta smelt, winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS North American green sturgeon. Operations involve the Delta Cross Channel (DCC) gates, Suisun Marsh Salinity Control Gates (SMSCG), diversion facilities (Jones Pumping Plant and Banks Pumping Plant, Barker Slough, North Bay Aqueduct, Contra Costa CVP facilities), and the South Delta agricultural barriers (Figure 13).

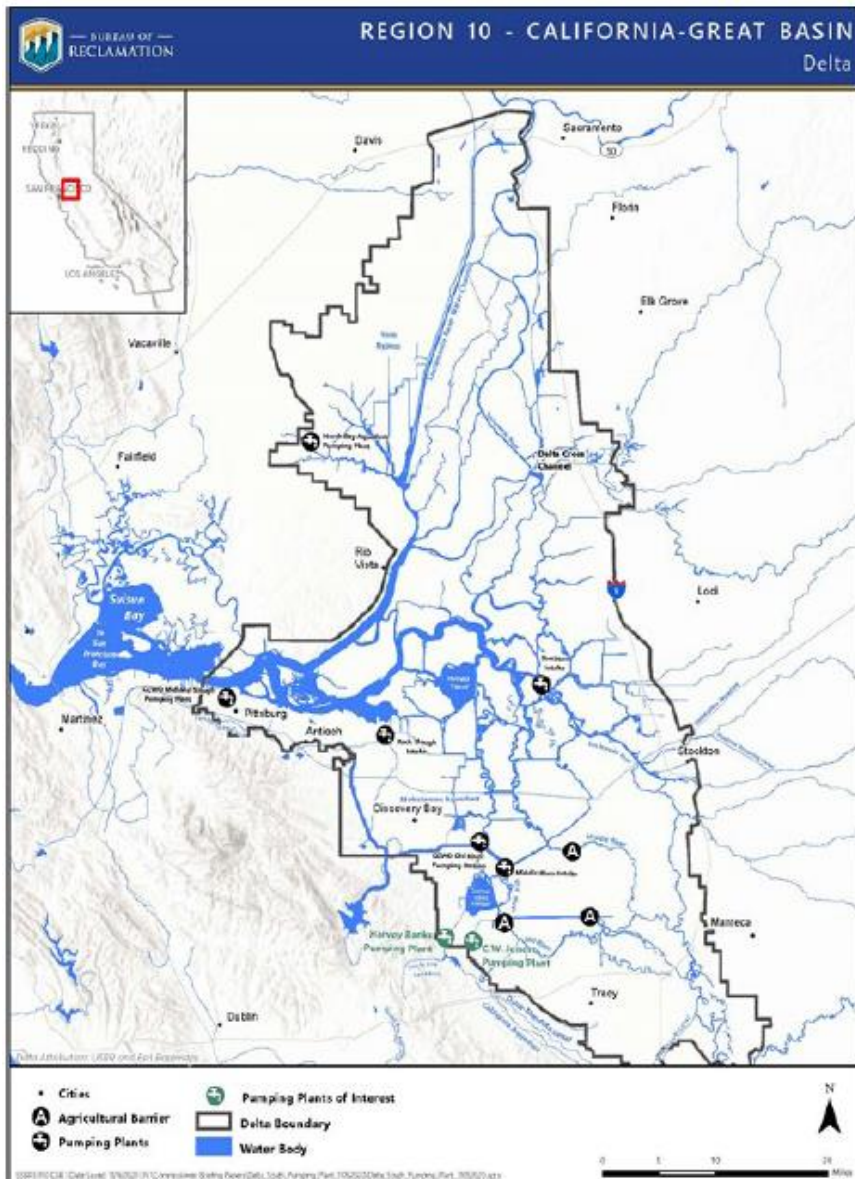


Figure 13. Map of the Delta with CVP and SWP Infrastructure.

Key operational components of the Proposed Action include the closure of the DCC gates, export reductions to manage Old and Middle River (OMR) reverse flows, and the Delta smelt Summer and Fall Habitat Action.

Delta Cross Channel

The OMR Flow Management Seasonal Report (Appendix E) describes DCC Operations during WY 2021. The Proposed Action described closures by calendar date and action triggers from the Knights Landing Catch Index (KLCI) and the Sacramento Catch Index (SCI). The anticipated level of take will be exceeded if the number or duration of openings exceed those described in the Proposed Action (NMFS Biological Opinion, page 809).

Reclamation included in the Proposed Action (page 4-56):

i. Action Triggers – Water quality criteria per D-1641 are met, and either the Knights Landing Catch Index or Sacramento Catch Index is greater than five fish per day. Action Responses – Within 48 hours, close the Delta Cross Channel gates and keep closed until the catch index is less than three fish per day at both the Knights Landing and Sacramento monitoring sites (NMFS Biological Opinion, page 417).

ii. Action Trigger – Water quality criteria are met per D-1641 and either the Knights Landing Catch Index or Sacramento Catch Index is greater than 3.0 fish per day but less than or equal to 5 five fish per day. Action Responses – Within 48 hours, close the Delta Cross Channel gates and keep closed for 3 days.

NMFS required that normal rounding rules to the tenths place be used to streamline implementation of the DCC gate triggers (RPM 5.d.i. page 819 of the NMFS Biological Opinion).

The DCC gate operations were consistent with the schedule described in the Proposed Action, including the D-1641 operations requirement except for required maintenance. During WY 2021, the scheduled maintenance required construction actions and testing (i.e., opening) of the DCC gates during periods when the gates were required to be closed, which were short in duration and the DCC gate operations during WY 2021 were evaluated as part of weekly assessments by the Salmon Monitoring Team (SaMT). During WY 2021 the DCC gates were open for testing for a short period on February 16, February 17, and May 5, 2021. WY 2021 weekly assessments generated through the SaMT were posted online (<https://www.usbr.gov/mp/bdo/water-year-2021.html>). The testing of the DCC resulted in an insignificant hydrological alteration that would have exposed present federally listed fish species to stressors identified in the NMFS 2019 Biological Opinion. The gates were in the open position for a few hours during testing which would have exposed listed fish to the Delta interior during this brief period.

OMR Management

The OMR Guidance Document describes the implementation guidance in coordination with DWR, NMFS, USFWS, and CDFW. The WY 2021 OMR Flow Management Seasonal Report (Appendix F) describes operations during WY 2021 and includes the Guidance Document. The Incidental Take Report is included as Appendix I. Reclamation and DWR operate to an OMR index (OMRI) computed using an equation as opposed to the United States Geological Survey (USGS) Tidally Filtered Method to calculate OMR flow. Each year the two methods are compared.

For the period of 12/1/2020 through 6/30/2021, the OMRI averaged 37 cfs more positive than the USGS calculation on a 14-day average. The USGS 14-day average could only be calculated for 49% (103 days) of the days in that period due to missing data. Some of the missing data were a result of vegetation fouling the Middle River gauge. The OMRI could be calculated for the entire 212-day period. Figure 14 below illustrates the data.



Figure 14: USGS OMR and OMR Index

Note that USGS gauges are not always working and thus lead to gaps in data.

In WY 2021, salmonid entrainment levels did not trigger OMR reverse flow reductions and salmonid loss at the CVP and SWP facilities did not exceed thresholds.

NMFS required as RPM 9:

Reclamation and DWR shall implement a program to accelerate steelhead research and monitoring to develop juvenile population abundance estimates and consider using these estimates to develop revised incidental take levels and scale juvenile steelhead salvage and loss to a population abundance estimate.

a. Phase 1 (Beginning October 2020):

i. Consistent with the proposed action, implement steelhead research and monitoring actions to develop a juvenile production estimate for steelhead-producing tributaries with CVP or SWP facilities.

ii. Reclamation and DWR will coordinate with NMFS, CDFW, USFWS, CSAMP, and others as necessary, regarding juvenile production estimates on non-project tributaries.

iii. Develop an initial report for consideration of the four-year panel review (2024).

iv. Prepare summary report of population abundance estimates by September 2025.

See section on “Steelhead Lifecycle Monitoring Program” and “San Joaquin Basin Steelhead Collaborative” below.

NMFS required as RPM 10:

Within 5 years, Reclamation and DWR shall assess a potential Delta Performance Objective for young-of-year CV spring-run Chinook salmon

a. Reclamation and DWR shall conduct a set of CWT-tagged juvenile Chinook salmon releases during winter and spring to provide increased information on presence and loss of Sacramento basin natural and hatchery spring run Chinook salmon through recovery in fishery and fish collection facility monitoring surveys. b. Develop an initial report for consideration of the four-year panel review (2024).

c. Prepare summary report of findings by September 2025.

d. Consider and revise incidental take estimate, based on new information.

Reclamation in collaboration with DWR, NMFS, CDFW, and USFWS prepared a charter document (Spring-Run Chinook Salmon Population Assessment and Delta Performance Measure Development Charter) to develop the most suitable measure, or set of measures, to assess CV spring-run Chinook salmon populations consistent with the requirements of the NMFS Biological Opinion (RPM 10). The project will support development of Delta Performance Objective for young-of-the-year CV spring-run Chinook salmon. The project will track progress towards implementation of RPM 10 through technical teams.

In WY 2021, OMR flows did not exceed those described in the Proposed Action and addressed in the ITS in the 2019 NMFS Biological Opinion. Single-year and cumulative loss thresholds were not exceeded. As flows and levels of incidental take were not exceeded, there was not a need for an independent panel review for WY 2021.

USFWS required under RPM 1.3:

If it is determined that an independent panel is necessary to determine the efficacy of the proposed OMR Management actions, Reclamation shall seek technical assistance from the Service on development of the charter for that panel.

USFWS required under RPM 1.4:

If Reclamation or DWR determine that a Turbidity Bridge Avoidance action is not necessary because the event is not believed to be related to an actual turbidity bridge, they will provide the supporting information, including the reason why the action is not warranted, within 24 hours, and the Service will respond within 24 hours. The action will be initiated until Reclamation, DWR, and the Service are in agreement that an action is not necessary.

The CVP and SWP export facilities operated to the Turbidity Bridge Avoidance action from February 1, 2021, to April 1, 2021. Incidental take under the Proposed Action was zero Delta smelt for WY 2021. For more information, see the OMR Flow Management Seasonal Report (Appendix F). Daily turbidity levels in Old River at Bacon Island did not exceed the 12 NTU (turbidity) threshold (read as FNU) during the action period in WY 2021.

USFWS required under RPM 1.5:

Reclamation and DWR shall monitor OMR flow and turbidity levels (the surrogate parameter identified in the Amount or Extent of Anticipated Take section) at locations identified in the PA on a real-time basis. Reclamation and DWR shall ensure monitoring stations have appropriate redundancy to reduce the likelihood of data collection failure due to malfunction. This information shall be made available to the Service on a real-time basis to document the management of the system. This can be done through Bay Delta Live or a similar system. If the Service determines that conditions have led to the exceedance of anticipated take, reinitiation would be required.

The required monitoring was in place for WY 2021, with the required redundancy, and information provided to the Service via Bay Delta Live, SacPas and Proposed Action Assessments produced weekly, so Reclamation and DWR were in compliance.

USFWS required under RPM 1.6:

Reclamation and DWR shall use Service life cycle models or other Service-approved models when available for the purposes of estimating proportion of the population affected by entrainment.

Reclamation and DWR were in compliance with this RPM as informed by the Delta smelt Life Cycle Entrainment Model (CGB-1000 2.2.4.21 dated March 13, 2020) in WY 2021.

USFWS required under RPM 1.7:

Reclamation shall seek technical assistance from the Service on the development of the charter for the independent panel for the proposed Four-Year Review of the “OMR management and measures to improve survival through the south Delta”.

Development of the Independent Panel charter will include USFWS technical assistance; Reclamation is in compliance.

Tracy Fish Collection Facility and John E. Skinner Delta Fish Protective Facility

Reclamation screens fish from the inlet channel leading to the Jones Pumping Plant at its confluence with Old River with the Tracy Fish Collection Facility (TFCF).

NMFS required RPM 5.b.

i. Reclamation and DWR shall monitor and calculate salvage and loss for winter-run Chinook salmon, CV spring-run Chinook salmon, CV fall-run Chinook salmon, CV late fall-run Chinook salmon, CCV steelhead, and salvage of sDPS green sturgeon at the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility.

a. Reclamation and DWR shall prepare and submit to NMFS daily reports from October 1 through June 30 of each water year (or provide data online) regarding the observations of both salmonids and sDPS green sturgeon in the fish salvage facilities. Daily salvage sheets and the operational information needed to calculate salvage and loss shall be provided to NMFS (to a list of recipients updated each water year) or made available online. If, during the period from July 1 to September 30, salmonids and/or sDPS green sturgeon are observed in salvage, Reclamation and/or DWR shall notify NMFS through electronic mail and include the daily salvage sheets and operational information, or direct NMFS to where this information is available online.

b. During the October through June period of each water year, DWR and Reclamation shall prepare and submit to NMFS, Delta operations for salmonids and sturgeon and other relevant technical teams weekly reports summarizing salvage and loss over the previous week and for the water year to date (or provide data online).

c. No later than December 31, Reclamation and DWR shall submit to NMFS an annual report summarizing salvage and loss over the previous water year (October 1 to September 30).

ii. Reclamation and DWR shall undertake tissue sampling programs from natural origin salmonids, and coded wire tag samples from adipose fin-clipped juvenile winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead and CV late-fall run Chinook salmon at the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility, for genetic analysis or tag removal/reading pursuant to appropriate sampling protocols and statistical power analyses.

a. Reclamation and DWR shall submit incidental take reports from Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility by December 31 of each year, to include the genetic results of the tissue samples.

b. Reclamation and DWR shall develop and submit for review and concurrence by NMFS a plan for tissue and whole fish or head processing and storage by December 31, 2020.

The TFCF staff distributes daily salvage sheets and operational information needed to calculate salvage and loss to a distribution list that includes NMFS recipients. The Technical Service Center (TSC) currently enters TFCF salvage and operational data into a database and makes these data/information available online through the Reclamation Information Sharing Environment (RISE) website (<https://data.usbr.gov/catalog/4494>). The TSC also prepares and submits daily/weekly reports that summarize observations of salmonids and sDPS green sturgeon (Appendix G). DWR and Reclamation have also completed the 2020/2021 Salmonid and Green Sturgeon Incidental Take and Monitoring Report (Appendix H).

The Standard Operating Procedures (SOP) for Fish Handling Related to the Collection, Sampling, Transport, and Release of Salvaged Fish at the CVP's TFCF was developed and submitted to NMFS and USFWS on October 23, 2020. This SOP describes protocols for tissue processing/coded wire tag sampling to meet RPM 5.b.ii.b.

The SOP for the Skinner Delta Fish Protective Facility was developed and submitted to NMFS and USFWS on May 8, 2020.

NMFS additionally required RPM 5.c.

Reclamation and DWR shall minimize incidental take through the application of best management practices at the fish salvage facilities by developing coordinated protocols within 18 months of the effective date of this Opinion for the following three topics. By the effective date of the Opinion, Reclamation and DWR shall provide the protocols currently being used.

i. Protocols for fish sampling and handling (from salvage through release), including a description of training procedures and the process for quality assurance and quality control of data.

ii. Protocols for daily estimation of salvage or loss for each ESA-listed anadromous fish that include relevant calculations and identify the data and information sources necessary to perform the relevant calculations used to estimate fish salvage or loss. Each facility shall include in their protocol a process to provide to NMFS, FWS, CDFW, DWR, and Reclamation staff the relevant data and information necessary to calculate fish salvage or loss. The protocol should specify whether and how pumping will be restricted during any salvage disruption, and whether and how salvage disruptions will be reflected in the estimation of salvage or loss. The protocol should include procedures used to implement the single year and cumulative loss thresholds for Delta operations.

iii. Procedures for reporting salvage and loss for each ESA-listed anadromous fish (or relevant surrogate), including a description of the general content, frequency, and distribution of reports. Salvage and loss shall be reported daily (excepting weekends and holidays) from October 1 through June 30 and DWR and Reclamation shall submit to NMFS an annual report summarizing salvage and loss over the previous water year no later than December 31 of each year.

Reclamation submitted to NMFS an annual report summarizing salvage and loss over the previous water year on December 12, 2021 in order to be in compliance with RPM 5.c.iii.. DWR and Reclamation have also completed the 2020/2021 Salmonid and Green Sturgeon Incidental Take and Monitoring Report (Appendix H).

The Proposed Action included and USFWS subsequently required as RPM 1.1 in its Biological Opinion:

Reclamation and DWR shall ensure the frequency of sampling for the south Delta export facilities (Banks and Jones) will be at least 25% of the time the export facilities are in operation. If this cannot be achieved, the Service shall be notified on a real-time basis.

USFWS required as RPM 1.2 in its Biological Opinion:

Reclamation and DWR shall update and provide fish salvage protocols for Skinner Fish Facility and the Tracy Fish Collection Facility to the Service within 1 year of the issuance of this biological opinion. Annual reports of salvage activities will be submitted to the Service documenting the operation and monitoring activities of the fish salvage facilities.

Reclamation submitted to USFWS an annual report summarizing salvage operation and monitoring activities of the TFCF on January 26, 2022.

Results are reported in the Incidental Take Report (Appendix I). Data were provided on CDFW's FTP site, for the smelt Monitoring Team, and on the SacPAS website:
<http://www.cbr.washington.edu/sacramento/>.

Sampling is documented through the smelt Monitoring Team here:
<https://www.usbr.gov/mp/bdo/water-year-2020-rivertask.html>

Annual report of salvage activities documenting the operation and monitoring of the fish salvage facilities (Appendix G)

A charter for the TFCF on Improvements and Operations of the facility per the 2019 Long Term Operations of the CVP and SWP Proposed Action was drafted on March 1, 2021 and is currently under Reclamation review.

A charter for the Skinner Delta Fish Protective Facility Operations for WY 21 was completed on January 6, 2021.

In WY 2021, Reclamation and DWR were in compliance with the requirements of the Proposed Action and Biological Opinions for operations in the Delta.

Delta smelt Summer-Fall Habitat

WY 2021 was classified as Critically Dry, as defined by the Sacramento Valley 40-30-30 index WY hydrologic classification (SWRCB D-1641, and Reclamation and DWR did not implement any Delta smelt Summer-Fall Habitat Actions beyond baseline monitoring. Reclamation, DWR, USFWS, NMFS, and CDFW developed the WY 2021 Delta smelt Summer Fall Habitat Seasonal Report (Appendix J) that provides habitat and monitoring information on this year.

NMFS additionally required RPM 5.i in its Biological Opinion.:

Reclamation and DWR shall coordinate with NMFS through the Sacramento River Temperature Task Group temperature planning processes and the coordination group for the Delta smelt Summer-Fall Habitat action regarding approaches to for using storage releases for the Delta smelt Summer-Fall Habitat action.

In WY 2021, the Summer-Fall habitat action was not implemented.

USFWS included as RPM 2 in its Biological Opinion:

Minimize the adverse effects of habitat degradation in summer and fall by studying the effectiveness of the Summer-Fall Habitat Action implementation. As appropriate, representatives from Reclamation, DWR, CDFW, NMFS, and the Service will participate in the Delta Coordination Group as part of this planning process.

1. Reclamation and DWR, in coordination with the Service and Delta Coordination Group, will define specific parameters for implementation of the Summer-Fall Habitat Action. Additionally, mutually agreeable methods for determining parameters for successful recruitment of delta smelt will be developed. These parameters shall include habitat acreages and population trends. This method shall be in place prior to implementation of the Summer-Fall Habitat Action.

2. Reclamation and DWR shall provide annual reports documenting the planning, implementation, and monitoring of the Summer-Fall Habitat Action. In years that an action will be implemented, Reclamation shall provide a draft of the implementation plan to the Service by May 1 and a final report of the action by May 1 of the following year.

3. Reclamation and DWR shall develop a monitoring plan to assess the efficacy of implementing the Summer-Fall Habitat Action. The plan shall be vetted by the Delta Coordination Group and included in the annual implementation plan. A full report of results shall be provided within one year of the completion of the action.

4. Reclamation shall seek technical assistance from the Service on the development of the charter for the independent panel for the proposed Four-Year Review of “Delta smelt Summer and Fall Habitat Actions.”

5. Reclamation and DWR will comply with all monitoring and reporting requirements as identified in the Reporting Requirements section.

Reclamation and DWR, with review by the Delta Coordination Group, developed the Delta smelt Summer-Fall Habitat Action Monitoring and Science Plan.

Details are provided in the WY 2021 Delta smelt Summer Fall Habitat Seasonal Report (Appendix J). See above for more information on the Delta smelt Summer-Fall Habitat action. Reclamation will work with the USFWS on the charter for the independent panel Four Year Review of Delta smelt Summer and Fall Habitat Actions, which will be documented in the appropriate annual report. For WY 2021, Reclamation and DWR were in compliance.

Suisun Marsh Preservation Agreement and Salinity Control Gates

Reclamation and DWR continued to implement the Suisun Marsh Preservation Agreement in WY 2021 to meet water quality standards in accordance with D-1641. WY 2021 was classified as critically dry, as defined by the Sacramento Valley 40-30-30 index WY hydrologic classification (SWRCB D-1641). DWR operated the SMSCG to meet Table 3 salinity standards of SWRCB D-1641 for Suisun Marsh in a Critically Dry Year. Also, since it was a Critically Dry Year, Reclamation and DWR did not implement increased SMSCG operations, included in the Delta smelt Summer-Fall Habitat Action. The SMSCG operations were operated in a manner

consistent with the Proposed Action and the ROD; therefore, the anticipated level of take of listed salmonids and sDPS green sturgeon was not exceeded.

The Roaring River Distribution System (RRDS) and the Morrow Island Distribution System (MIDS) are used to deliver fresh water flowing into Montezuma and Suisun sloughs to adjacent wetlands and to drain water from these wetlands. The use of these distribution systems entrains fish. The entrainment of Delta smelt is based on the ecological conditions (i.e., fish screen approach velocities). The approach velocities at the RRDS fish screen are calculated using the stage information behind and in front of the fish screens. The flows are calculated automatically by the program controls, and the RRDS operators move the gates based on the calculated velocities. The approach velocity at the fish screens did not exceed the proposed maximum approach velocity of 0.2 ft/second and 0.7 ft/second during mid- September – mid October fall flood up operations. The amount or extent of the anticipated level of take in the 2019 USFWS Biological Opinion is not considered to be exceeded. For WY 2021, Reclamation and DWR were in compliance.

Agricultural Barriers

DWR installed three agricultural barriers to maintain water levels in the South Delta to support local non-project diversions. NMFS required RPM 5.h.

i. DWR shall send notice of intent to construct the barriers to NMFS at least 14 days prior to start of construction. This information shall include anticipated start dates and completion dates for each of the barriers. In the fall, DWR shall provide NMFS with the anticipated schedule for removal of the barriers, and notification when the removal has been completed.

ii. DWR shall provide documentation to NMFS indicating the anticipated schedule for culvert operations, including potential early closures and water elevation conditions, by the completion of barrier installation each season. Updates to barrier operations shall be provided to NMFS on a weekly basis until mid-June.

With construction starting as early as May 1, 2021, the agricultural barriers (Middle River, Old River near Tracy, and Grant Line Canal) were all closed by May 27, 2021. To provide passage for adult salmon as described in the Proposed Action for the agricultural barriers, the Middle River, and Old River Tracy Barriers were notched on September 13. Flashboards at the Grant Line Canal structure were also adjusted on September 13.

Removal of the Middle and Old River Barriers was completed on November 12 and 20, respectively. Removal of the Grant Line Canal Barrier was completed on November 30. DWR operated the Temporary Barriers Project in compliance with all applicable federal and state permits, including the Temporary Barriers Project Biological Opinions and as described in the Biological Assessment Appendix A, Section A.5-2 Temporary Agricultural Barriers. Specific dates for implementation of the South Delta Temporary Barriers Project are described in the

Biological Assessment Appendix A Table A.5-3 (page A-96). For WY 2021, Reclamation and DWR were in compliance.

Water Transfers

WY 2021 was a Critically Dry year; therefore, the Proposed Action provided for up to 600 TAF water transfers through CVP and SWP facilities from July 1 through November 30. For WY 2021, the transfer amount released for exports by Reclamation and DWR was approximately 296 TAF through November.

Contra Costa Water District Operations – Rock Slough Intake Infrastructure and Operations

Reclamation included all diversions at the Rock Slough Intake (350 cfs capacity for the maximum annual diversion of 195 TAF) as part of the Proposed Action. Contra Costa Water District's (CCWD) operations in the Proposed Action are consistent with the separate biological opinions and remain unchanged from the current operations scenario. In WY 2021, maximum daily average pumping from the Rock Slough Intake was 74 cfs permitted by the 2019 NMFS and USFWS Biological Opinions; the total diversions from Rock Slough Intake were 18 TAF below the 195 TAF diversion limit permitted by the 2019 NMFS and USFWS Biological Opinions. For WY 2021, Reclamation was in compliance.

North Bay Aqueduct and Barker Slough Pumping Plant

The North Bay Aqueduct (NBA) serves communities in Napa County, Vallejo, Benicia, and Travis Air Force Base. NBA diversions are through Barker Slough Pumping Plant (BSPP). The Proposed Action described an annual maximum diversion of 125 TAF. WY 2021 annual diversions were 51 TAF. NMFS incidental take uses an ecological surrogate of the maximum diversion rate of 175 cfs (NMFS Biological Opinion, page 811), and the maximum diversion for WY 2021 was 130 cfs (on 7/31/2021). USFWS incidental take used an environmental surrogate of 30 TAF for the months of March, April, and May (USFWS Biological Opinion, page 397). WY 2021 diversions for March through May was 11 TAF. Table 1 shows the monthly average diversions.

Table 1. BSPP monthly average diversions during WY 2021.

Month	Monthly Volume (TAF)	Monthly average (cfs)
October 2020	4.9	80
November 2020	5.4	91
December 2020	4.4	71
January 2021	3.2	52
February 2021	1.9	35
March 2021	0.7	12
April 2021	4.9	82
May 2021	5.7	93
June 2021	5.6	93
July 2021	5.1	82
August 2021	5.1	84
September 2021	3.9	65

i. Cleaning of sediment from in front of the fish screens shall occur during the summer in-water work window of July 1 through October 31 or if ambient water temperature is greater than 77° F.

ii. Observers shall be present during sediment cleaning to look for entrained fish in the dredge material discharge as it is pumped into the dredge spoils pit. Any observed fish shall be collected and identified to species. If the species is a salmonid, total body length shall be measured and assigned to race by length at date using the Delta model. Tissue samples shall be collected all natural origin salmonids, and coded-wire tag (CWT) samples from adipose fin-clipped juvenile winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead, for genetic analysis or tag removal/reading pursuant to appropriate sampling protocols. All observed sDPS green sturgeon shall be collected. Any living specimens shall be resuscitated if possible, and released away from the Barker Slough Pumping Plant facilities. All dead specimens shall be retained, frozen, and NMFS notified for final disposition.

iii. Cleaning of aquatic weeds from in front of the fish screens shall occur during the in-water work window of July 1 through October 31 or when ambient water temperatures are greater than 25oC.

iv. Observers shall look for any salmonids or sDPS green sturgeon entangled in the weed mass as it is placed in the trucks and as it is dumped in the disposal site area. Any observed fish shall be collected and identified to species. If it is a salmonid, total body length shall be measured and assigned to race by length at date using the Delta model. All observed sDPS green sturgeon shall be collected. Any living specimens shall be resuscitated if

possible, and released away from the Barker Slough Pumping Plant facilities. All dead specimens shall be retained and NMFS notified for final disposition.

v. An annual report shall be sent to NMFS-California Central Valley Office by December 31 of each year for the previous water year's operations. The report shall contain information regarding the dates of sediment removal or vegetation cleaning, the number of observed fish, including the number of salmonids and sDPS green sturgeon, if any, and the final disposition of the fish. If salmonids are observed, the report shall include the body lengths and run assignments for each fish.

Sub-paragraph iii. limits cleaning of aquatic weeds to the in-water work window of July 1 – October 31; however, the communities require water year-round. In WY 2020, significant aquatic weed infestations required a temporary modification granting cleaning operations to continue beyond October 31 while NMFS considered a permanent change. On September 30 of 2021, Reclamation sent NMFS a letter confirming the current understanding between the two agencies, as well as DWR, that weed removal is no longer constrained just to the window of time listed in RPM 5.e but is now authorized to take place, “as needed”, regardless of the time of year.

Aquatic weeds were removed from the BSPP fish screens 59 times, with weeds loads ranging from none to moderate. Weed removal occurred year-round (October 2020 through September 2021 – see Table 2 below). A biological monitor was present during the weed removal events and no listed fish species were found in the removed aquatic weeds. In November 2020, two nonnative fish (one warmouth and one bluegill) were salvaged from the removed weeds and returned to the water. All work occurred immediately in front of the fish screens and on top of the concrete apron that extends out into the BSPP Forebay. No weed removal activities occurred outside of the embayment created by the floating booms.

No sediment removal activities occurred during the reporting period.

Table 2: Weed Removal Events

Month	Number of Weed Removal Events	Number of ESA-listed Species (Fish) Observed	Number of Other Species Observed
October 2020	5	0	0
November 2020	9	0	2
December 2020	10	0	0
January 2021	10	0	0
February 2021	4	0	0
March 2021	2	0	0
April 2021	3	0	0
May 2021	4	0	0
June 2021	3	0	0
July 2021	3	0	0
August 2021	4	0	0
September 2021	2	0	0

USFWS included as RPM 4.1. Minimize the adverse effects of the operation of the North Bay Aqueduct.

DWR shall ensure that regular fish screen maintenance is performed at the North Bay Aqueduct. This maintenance is necessary to avoid incidental take of juvenile and adult delta smelt and to avoid exceeding the incidental take of larvae. DWR shall annually report to the Service with details on fish screen maintenance at these facilities.

On December 9, 2021, DWR provided USFWS maintenance and inspection reports for the fish screens at the NBA. The reports include maintenance and inspection logs, fish screen cleaning logs, and an underwater inspection of the intake at BSPP.

Clifton Court Aquatic Weed and Algal Bloom Management

DWR controls aquatic weeds and algal blooms in Clifton Court Forebay to avoid degrading drinking water quality through production of taste and odor compounds and algal toxins, and prevent pump cavitation at Banks Pumping Plant to reduce the mortality of ESA listed fish species. The Proposed Action identified a normal timeframe and magnitude of application. Beyond the commitments incorporated into the Proposed Action, NMFS additionally required RPM 5.g.:

i. DWR shall provide notification of intent to conduct aquatic weed removal activities to NMFS at least two weeks prior to starting, including the types of herbicides intended to be used for that application and the areas that will be treated.

ii. DWR shall send copies of the water quality monitoring results for the concentration of herbicides in the Clifton Court Forebay following treatment to NMFS within 10 business days of DWR's receipt of the results.

iii. DWR shall report to NMFS any fish observed exhibiting unusual behavior or found dead or moribund following herbicide treatment within 10 business days of the incident. All dead specimens shall be retained and NMFS notified for final disposition.

The normal timeframe for herbicide treatment as part of the Clifton Court Aquatic Weed and Algal Bloom Management action, as described in the Proposed Action and adopted in the ROD, is June 28 to August 31. DWR conducted herbicide treatment in CCF once during the normal timeframe in WY 2021, on June 29, 2021.

In addition, following the procedure also described in the Proposed Action and adopted in the ROD, DWR, through Reclamation, notified and conferred with USFWS and NMFS on October 30, 2020, for another herbicide treatment in CCF, outside of the normal timeframe. In response to the notification and DWR's assessment of the effects to listed species of the herbicide treatment, both USFWS and NMFS sent emails agreeing that ESA listed fish species are not anticipated to be present nor at risk from the proposed treatment, so the herbicide treatment proceeded on November 3, 2020.

Additional Conservation Measures

Reclamation included additional conservation measures in the Proposed Action that were adopted in the ROD to avoid and minimize or compensate for CVP and SWP project effects on listed species as well as contribute to the recovery and enhancement of species and their habitats. These measures may also improve production, growth, and survival of listed species.

- **San Joaquin Basin Steelhead Telemetry Study:** During WY 2021, three release groups of hatchery steelhead were released in March (400 fish), April (500 fish), and May (600 fish). Each release group consisted of fish released at three locations (Durham Ferry, Stockton, and Head of Old River), and the combined (across locations) minimum survival estimate to Benicia Bridge was 3% for March and May releases and 5% for April releases. The SaMT used real-time detection information from these releases to inform distribution estimates of San Joaquin Basin study steelhead within the Delta during the WY 2021 OMR Management Season.
- **Steelhead Lifecycle Monitoring Program:** Implementation of Stanislaus River steelhead life-cycle monitoring started in September 2020. Early implementation phases included the development of research and monitoring plans for target life stages and the acquisition of state and federal biological permits to support field monitoring. Juvenile

steelhead life-cycle monitoring started in late spring 2021 and included installation and operation of stationary Passive Integrated Transponder (PIT) tag antennas, biological sample collection (i.e., fin tissue and scales), and implementation of genetic-based mark-recapture field study. Adult spawner surveys started in spring 2021, with adult migration monitoring scheduled to start in September 2021 via resistance board weir and Vaki Riverwatcher. Additional special studies targeting earlier life stages (e.g., egg-to-fry survival) are scheduled to begin winter/spring of 2022.

Discussion focused on the location of the Sacramento River tributary for the second life-cycle monitoring program started in spring 2021. State and federal partners identified in the non-flow action steelhead charter will be participating in this discussion. Initial discussion focused on opportunities to enhance or support ongoing Sacramento Basin steelhead monitoring while identifying efficient ways to permit additional life-cycle monitoring activities. Candidate tributaries will include CVP watersheds and tributaries with existing monitoring infrastructure.

- **San Joaquin Basin Steelhead Collaborative:** Reclamation worked with the Delta Stewardship Council to assemble a CCV steelhead collaborative workshop steering committee composed of state, federal, and stakeholder partners. The steelhead collaborative workshop was held virtually on February 17-19, 2021. During the spring and summer, an interagency writing team has been meeting to draft the San Joaquin River steelhead monitoring plan. The writing team is using information produced and presented during the workshop.
- **San Joaquin River Scour Hole Predation Reduction:** This project will implement measures to reduce the predation intensity on juvenile salmonids and sturgeon, entering the Delta from the San Joaquin River at the Head of Old River Scour Hole, through modifications to the channel geometry and associated habitats. An interagency charter for the San Joaquin River Scour Hole Predation Reduction (Head of Old River Scour Hole) was finalized in April 2020. A contract for the project is anticipated in 2021.
- **Tidal Habitat Restoration:** A levee breach planned for 2021 will complete the Dutch Slough Tidal Habitat Restoration project. More details on tidal habitat restoration projects, including previously completed projects are provided in Appendix J and the WY 2020 Annual Report.
- **Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project:** Construction of the Fremont Weir is anticipated to be completed by the end of 2022. Construction for the supplemental fish passage structure is scheduled for 2023.

NMFS included as RPM 1.g.:

In order to minimize project related impacts to fish growth and survival on the lower Sacramento River, Reclamation shall complete construction of the Fremont Weir component of the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project by 2022.

Reclamation and DWR are currently working on design and permitting to construct the gated notch structure at Fremont Weir in 2022. Funding for construction was provided in FY 2019. In August 2020, Reclamation conducted a Value Engineering Study on the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project. Reclamation and DWR currently hold monthly agency coordination meetings, including NMFS, USFWS, CDFW, U.S. Army Corps of Engineers (USACE), Central Valley Flood Protection Board, and State Water Resources Control Board. The solicitation for construction will be submitted for bid in early 2022.

- **Predator Hot Spot Removal:** Reclamation would coordinate with water users to minimize lighting at fish screen and bridges and possible remove abandoned structures. NMFS required as RPM 5.a.

Develop and implement a predator management experiment to reduce the mortality of emigrating juvenile salmonids at “hot spots” in the Bay-Delta.

A charter is currently being drafted. The purpose of this effort is to develop a process working toward implementation of Delta Predator Hot Spot Removal activities as consistent with the Proposed Action as adopted in the ROD.

- **Delta Cross-Channel Gate Improvements:** Reclamation is currently working on evaluating improvements to automating and streamlining operation of the DCC gates. Reclamation’s goal is to modernize DCC’s gate materials and mechanics to include adding industrial control systems, increasing additional staff time, and improve physical and biological monitoring associated with the DCC daily and/or tidal operations as necessary to maximize water supply deliveries. Reclamation has identified technical team membership, previous studies/efforts that may be leveraged in the alternative development process and completed the initial investigations of the gate mechanics. The DCC gates Guidance Document was revised and completed in July 2021.
- **Tracy Fish Collection Facility Improvements:** A report on the TFCF Operations Improvement is in progress, and the first review is scheduled for January 2021.
- A report describing operational and structural changes to the TFCF is posted to: <https://www.usbr.gov/mp/TFFIP/docs/1a-tr93-history-of-the-tfcf-final508.pdf>
- As part of the Tracy Fish Facility Improvement Program (TFFIP), the proposal package for FY 2021 is posted on Reclamation’s website here:
- <https://www.usbr.gov/mp/TFFIP/docs/study-plan/3-tffip-fy21proposalpackage-final508.pdf>
- The Tracy Technical Advisory Team (TTAT) has developed a process and deadlines for research proposals, including scientific and technical review and selection for FY 2022.
- **Clifton Court Forebay Mortality Reduction:** The first field season for the Enhanced Predatory Fish Removal and Relocation Study (EPFRRS) was conducted from March through May of 2021. The study was delayed by two months due to a surge in COVID

cases in early 2021. In addition, there was a two-week hiatus during the month of April, due to a self-imposed quarantine period following two confirmed COVID cases among contracted staff approximately a week apart. While these cases were not directly tied to the project, the decision was made to err on the side of caution to prevent an outbreak. Low flows through the CCF and high ambient air and water temperatures led to an early close of the field season. Specifically, there were exceedances of the 18°C electrofishing threshold and 21°C threshold for all other gear types, as specified in the Scientific Collecting Permit obtained from California Department of Fish and Wildlife. As a result, electrofishing was halted on April 29, 2021, and the rest of the gears were halted May 12, 2021.

- NMFS included as RPM 5.f.:

The initial “run” of Chinook salmon shall be determined based on length at date criteria if the fish is actually capture and handled prior to release.

- The 2021 field season incorporated methodologies tested in previous predator removal efforts to maximize predatory fish capture. The four methods employed included electrofishing, hoop traps, beach seine, and hook-and-line. Target fish taxa included black bass, Striped Bass, and catfish, with opportunistic removal of sunfish. Over the 26.5 field days in 2021, a total of 15,675 fish from the target fish species were transported and 16,009 total fish were transported. Based on predatory fish lengths and length-weight relationships established in prior removal studies, estimated biomass removed was 4,693.2 lbs. Listed individuals were caught in all gear types except hook and line. There was a total of 30 listed fish captured and four observed during EPFRRS. Of the eight Chinook salmon and 20 CCV steelhead captured, two and one, respectively, had intact adipose fins. The one CCV steelhead that had an intact adipose fin turned out to be a tagged DWR CCV steelhead where the adipose fin was not clipped prior to release. The other was designated a winter run by length-at-date, and was submitted to CDFW for genetic analysis and archiving. Genetic testing confirmed that the salmon was actually a spring-run instead. Two green sturgeon were captured in the beach seine and were immediately released back into CCF to minimize handling stress. There were no mortalities of any listed individuals, and all were released back into CCF.
- **Salvage Release Sites:** In September 2020, Reclamation finalized the Antioch Fish Release Site Replacement Physical Hydraulic Model (Hydraulic Laboratory Report HL-2020-03). The report is posted on the TFFIP website here: <https://www.usbr.gov/mp/TFFIP/docs/hl-2020-03-antiochfishreleasesite-hydraulicmodel-final508.pdf>

The model determined that the proposed operating procedure adequately cleared debris from the release pipe for all debris except for large amounts of small floating debris. In these cases, small floating debris was difficult to pass.

Construction of the replacement fish release site at Antioch began January 2021. Completion is expected by April 2022. The fish release site will be ready for immediate use upon completion.

- **Small Screen Program:** Under the Small Screen Program, Reclamation and DWR work together within existing authorities to screen small diversions throughout the Central Valley, CVP/SWP streams, and the Delta. A Small Screen Program Charter was completed in January 2021.
- **Supplementation Efforts for Delta smelt:** USFWS finalized and delivered a Delta smelt Supplementation Strategy on October 21, 2020, completing the first phase proposed by Reclamation as steps toward supplementation of Delta smelt. In addition, the agencies met monthly through the Culture and Supplementation of smelt (CASS) which facilitated research and progress on cultured Delta smelt. Experimental release anticipated in winter 2021-2022. In 2021, the Fish Conservation and Culture Laboratory (FCCL) increased production of Delta smelt to roughly 40,000 for supplementation. As called for by the Supplementation Strategy, increases in production methods are being refined to reflect best practices in both genetic management of Delta smelt and increasing production.

USFWS included as RPM 3.1.

Reclamation shall ensure development of a supplementation strategy for the FCCL supplementation program as described in the PA. This strategy will be in place one year from the issuance of the Biological Opinion.

The FCCL has begun increasing production of Delta smelt to reach maximum production capacity in two more years as part of Phase 2. As called for by the supplementation strategy, increases in production methods are being refined to reflect best practices in both genetic management of Delta smelt and increasing production.

- **Delta Fish Species Conservation Hatchery:** The need for expanded production capacity is closely tied to the successful Delta smelt supplementation by both USFWS and CDFW. Discussions between Reclamation, DWR, USFWS, and CDFW are ongoing with regard to production goals and necessary research to support supplementation decisions.
- **Sediment Supplementation Feasibility Study:** There is no update on the status of the Sediment Supplementation Feasibility Study for WY 2021.

Conclusion

This report and the seasonal reports, guidance documents, and other documentation indicate that for WY 2021, Reclamation and DWR were in compliance with the 2019 NMFS and USFWS Biological Opinions and the Proposed Action adopted in the 2020 Reclamation ROD.

The WY 2020 Annual Report clarified the operational dates in the 2019 NMFS and USFWS Biological Opinions and the Proposed Action adopted in the 2020 Reclamation ROD for the agricultural barriers and should be consistent with the dates in the Temporary Barriers Project Biological Opinions and as described in the Biological Assessment Appendix A, Section A.5-2 Temporary Agricultural Barriers (Biological Assessment Appendix A Table A.5-3 [page A-96]).

Since WY 2021 was Critically Dry, Reclamation and DWR did not implement increased SMSCG operations or X2 management associated with the Delta smelt Summer-Fall Habitat Action. As described in the seasonal report, Delta smelt habitat in WY 2021 was limited due to salinity conditions in the late summer and fall.

The CVP and SWP did not exceed the amount or extent of incidental take specified in the incidental take statement of listed fish species described in the 2019 NMFS and USFWS Biological Opinions. Exports at the CVP and SWP export facilities and operations of the DCC gates were consistent with the Proposed Action adopted in the ROD and within the effects anticipated by the 2019 NMFS and USFWS Biological Opinions. As detailed above, salmonid losses were below thresholds established in the Proposed Action, and there were no OMR reverse flow reductions based on exceedances of the thresholds described in the PA. Many other factors controlled the operation and reductions in exports and were not necessarily due to OMR flow management.

OMR flows did not exceed those described in the Proposed Action and addressed in the ITS in the 2019 USFWS Biological Opinion. Exceedance of a single-year threshold or 50 percent of the cumulative loss threshold for listed salmonids did not occur. As flows and levels of incidental take were not exceeded, there was no need identified for an independent panel review for WY 2021.

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Stanislaus River

The Stanislaus River is 60 river miles, from New Melones Reservoir to its confluence with the San Joaquin River (Figure 15). New Melones Reservoir seasonal operations follow a set of objectives. During winter, Reclamation operates for flood control and building storage, considering both the channel capacity within the Stanislaus River and New Melones Reservoir flood conservation space. During spring, New Melones Reservoir continues to build additional storage until flows are needed to support downstream regulatory demands. Summer operations are focused on water deliveries into the canals at Goodwin Dam. During the summer, Reclamation also maintains applicable dissolved oxygen standards (applicable year-round, but requiring operational changes primarily during the summer) on the lower Stanislaus River for species protection and releases from the Stanislaus River also support salinity standards on the San Joaquin River. Throughout the year, Reclamation operates the minimum flow schedule in the Stepped Release Plan (SRP), which provides base flows and key ecological flow features for fish.



Figure 15. Stanislaus River Watershed

Flow Management

Reclamation operates New Melones Reservoir (as measured at Goodwin Dam) in accordance with a SRP that varies by hydrologic condition and WY type. In WY 2021, with feedback from the Stanislaus Watershed Team (SWT), Reclamation implemented reshaped flows in the fall, winter, and spring to optimize biological benefits. The reshaped fall pulse flows helped improve instream conditions and provided an attraction cue for adult salmonids returning to spawn in the Stanislaus River. The winter instability flows allowed for short-term inundation of shallow water habitat which provided benefits to rearing salmonids such as: temporary spatial refuges from large predators, increased temperatures that may allow short-term increases in growth rate, and increased capture of terrestrial food and nutrients within the main channel. The spring pulse flows cued anadromy and improved migratory conditions in both the Stanislaus River and in the mainstem San Joaquin River and southern delta. In the Stanislaus River, higher flows were expected to reduce water temperature (or at least buffer daily maximum water temperature) and inundate some shallow water habitat which may provide juvenile salmonids with short-term growth benefits as well as potential refuge from predation. In the mainstem San Joaquin River and south delta, higher flows from the Stanislaus River (and other San Joaquin tributaries) were expected to convey out-migrating salmonids more rapidly along their migratory pathway, which could improve outmigration success. The Stanislaus River Summary of Activities for WY 2021 report is included as Appendix K.

Table 3. WY 21 New Melones Seasonal Operations Summary

Seasonal Operations	Flow Quantity/Description	SRP	Operations Outline
Fall 2020 Pulse Flow (October 13 – December 31)	The Alt-1 schedule had the same total volume (62,373 AF, including base flows) for the October 13 -December 31 period as the default SRP Dry schedule	SRP Dry Schedule	For WY 2021, Reclamation implemented a reshaped fall pulse flow according to the flow schedule described in Alternative 1.
Winter Instability Flows (January)	Reshaping the sub-daily flow pattern to increase the peak flow to over 700 cfs for part of the first day of the pulse helped in	SRP schedule for the Critical water year type (793 AF). but were reshaped to include higher peak flows and variability.	On January 7 and 8, 2021, Reclamation implemented a January 2021 WIF with peaks of 750 cfs on the first day and 550 cfs on the second day.
Winter Instability Flows (February)	Reshaping the sub-daily flow pattern to increase the peak flow to over 700 cfs for part of the first day of the pulse Flow	default SRP schedule for the Critical water year type (793 AF, not including the base flow of 200 cfs).	Reclamation implemented a February 2021 WIF that was: (a) reshaped according to the "Alternative" flow schedule for the water year type in effect (critical), and (b) shifted in time to (i) the second half of February, and

Seasonal Operations	Flow Quantity/Description	SRP	Operations Outline
			(ii) to coincide with the timing of a storm event.
Spring Pulse Flows (March 16 – June 30)	Reshaping the single pulse identified in the default SRP schedule into an extended five-peak pulse period increased flow variability within the season	default SRP Critical schedule for the March 16-June 30 period had the same total volume (67,240 AF, including base flows)	For WY 2021, Reclamation implemented a reshaped spring pulse flow according to the flow schedule described in Alt-Critical-1

Conservation Measures

Reclamation included conservation measures in the Proposed Action that were adopted in the ROD, to avoid and minimize or compensate for CVP project effects in the Stanislaus River, including take, on listed species. These measures may also improve production, growth, and survival of listed species.

- Spawning and Rearing Habitat Restoration:** In August and September 2021, Reclamation placed 4,700 tons of gravel in the Float Tube Pool and 2,500 tons in the Cable Crossing Area below Goodwin Dam on the Stanislaus River. Reclamation has exceeded the annual average goal of 4,500 since implementation of the 2020 ROD (Section 4.10.6.2 of Proposed Action). Currently, Reclamation is two years ahead of schedule in implementing gravel placement projects on the Stanislaus River.

During WY 2021, a charter was developed for Stanislaus Habitat Restoration. Reclamation made progress towards restoring rearing habitat on the Stanislaus River by implementing the Stanislaus Habitat Restoration Charter and forming a technical team to coordinate and plan habitat restoration actions on the Stanislaus River. The technical team has identified several prospective sites along the Stanislaus River to pursue for rearing and spawning habitat restoration projects. No additional rearing habitat acreage was restored during WY 2021.

- Water Temperature Management Study:** Reclamation will study approaches to improve water temperature for listed species on the lower Stanislaus River, including the evaluation of the utility of conducting water temperature measurements/profiles in New Melones Reservoir. Reclamation is currently working on a Central Valley Project Water Temperature Modeling Platform project. The objectives of this project to develop a set of physically based tools within a modeling platform capable of providing recommendations for short and long-term temperature prediction to assist resource managers of major CVP reservoirs (Sacramento River, American River and Stanislaus River) to have better understanding of balancing operations and water resources for downstream and temperature needs.

Incidental Take Statement

The 2019 NMFS Biological Opinion found the action is reasonably expected to create the stressors of water temperature and flow conditions resulting in take of CCV steelhead in the Stanislaus River.

Water Temperature

CCV steelhead egg-to-fry lifestage: The extent of take is all redds exposed to temperatures above 54° F in the vicinity of Orange Blossom Bridge (OBB) December 1 through May 31. Water temperatures at OBB exceeded 54° F during 73 days in the period between December - May 2021 (Figure 16), with exceedances beginning in mid-March. However, few steelhead eggs were expected to be incubating during the times when the 54° F water temperatures were exceeded. Every year operations have exceeded water temperatures of 54° F with the exception of WYs 2006 and 2019 (2001-2020; Figure 17). Temperature management capabilities are limited on the Stanislaus River. New Melones Dam does not have a temperature control device.

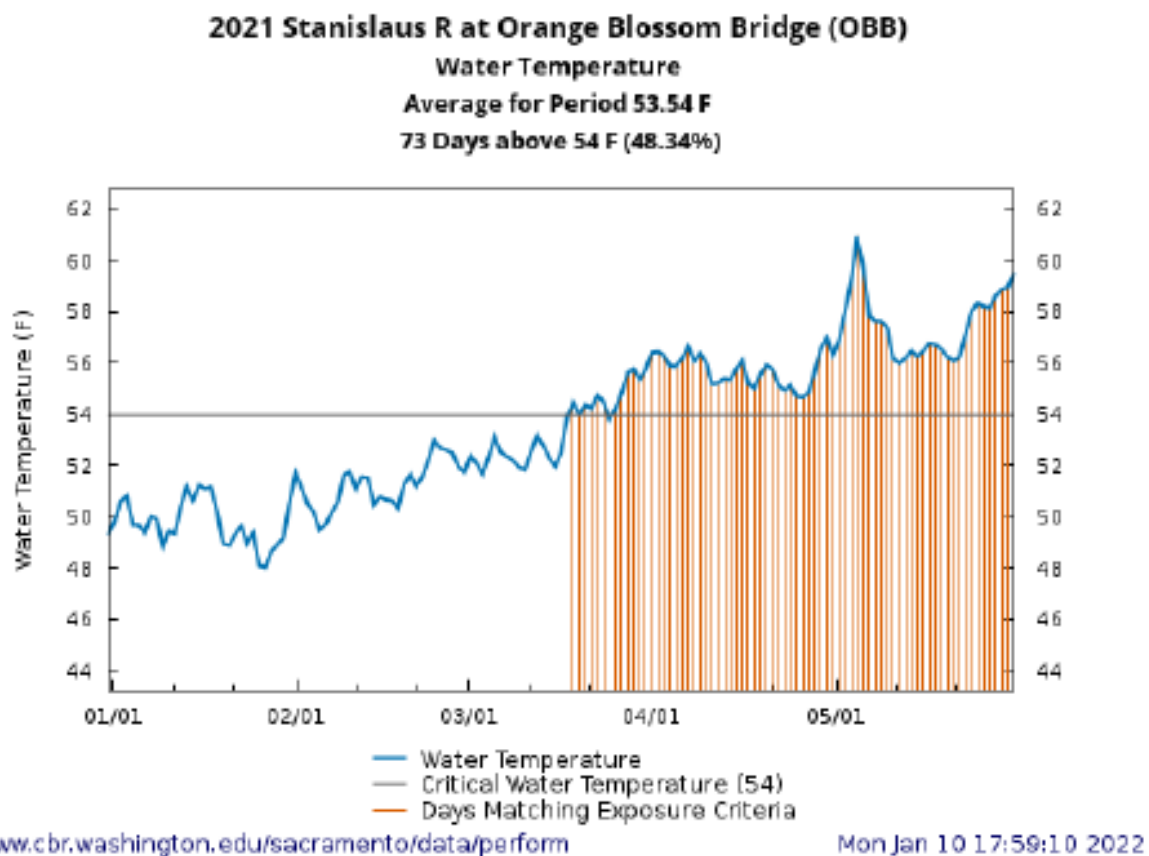


Figure 16. Water Temperatures at Orange Blossom Bridge between January–June 2021

WY 2001-2022 OBB Stanislaus R at Orange Blossom Bridge
 Daily Average Water Temperature (F)
 Observed Range 36.30-73.10
 Threshold Value 54.0

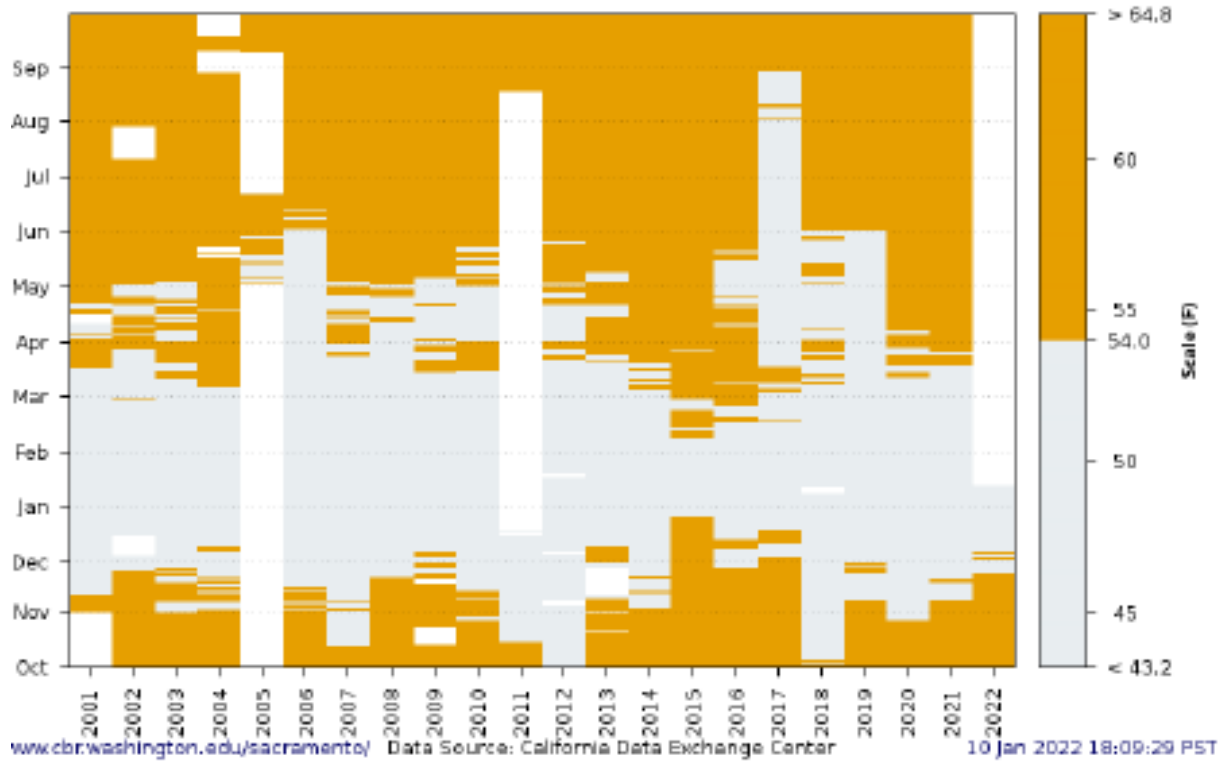


Figure 17. WY 2001-2022 Daily Average Water Temperatures at Orange Blossom Bridge

CCV steelhead juveniles: The anticipated level of take will be exceeded if temperatures at OBB exceed 68° F between May 15 to October 31 for more than seven consecutive days unless Reclamation and NMFS agree that it is an acceptable exceedance given the hydrologic and meteorological conditions for that year. From May 15 to October 31, daily average temperatures at Orange Blossom Bridge did not exceed 68° F for more than seven consecutive days.

Flow

As described in the NMFS Biological Opinion (page 807), with regard to flow, take will be exceeded if flow releases to the Stanislaus River measured at Goodwin Dam decrease to levels lower than the SRP, or those scheduled by the SWT. In WY 2021, flow releases were consistent with flows described in the SRP or those scheduled by the SWT. For more information, see Appendix K.

Reasonable and Prudent Measures

The 2019 NMFS Biological Opinion included the following RPM (and associated Terms and Conditions) to minimize impacts of incidental take of the listed fish species in the Stanislaus River):

RPM 4: Reclamation shall minimize the impact of the amount or extent of incidental take of listed species during operations of the Eastside Division.

a. The shift in compliance location for dissolved oxygen from Ripon to Orange Blossom Bridge from June 1 to September 30 shall not go into effect until NMFS confirms that Reclamation has satisfied both of the following conditions:

- i. Provide confirmation that a dissolved oxygen gauge has been installed, and*
- ii. Consistently providing accurate dissolved oxygen data at Orange Blossom Bridge.*

b. Reclamation shall complete the Final Temperature Management Study by December 31, 2025.

No changes have yet been made regarding the shift in compliance location for dissolved oxygen. The Temperature Model Platform for the CVP is discussed above in the Upper Sacramento River section under Conservation Measures.

c. Reclamation shall provide to NMFS an annual water temperature data set and will provide summary statistics.

See above under the Stanislaus River ITS section.

d. Reclamation shall provide to NMFS an annual report of incidental take associated with monthly temperatures and provide an assessment of temperature conditions over the year including monthly average data at Orange Blossom Bridge.

See above under the Stanislaus River ITS section.

Conclusion

This report and the seasonal reports, guidance documents, and other documentation indicate that for operations on the Stanislaus River during WY 2021, Reclamation was in compliance with the 2019 NMFS Biological Opinion ITS and the 2020 Reclamation ROD.

For WY 2021, there was a one-year agreement to calculate year type for SRP implementation based on the 60-20-20 Index using the 75% exceedance forecast, as used for implementation of D-1641. During revision of the guidance document for SRP flows, the group recommended

capturing explicitly the water accounting procedures used by SWT to clarify implementation of the Biological Opinion in the Stanislaus River watershed.

Guidance Documents Revisions in WY 2021.

- Stanislaus River Step Release Plan Guidance Document.

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San Joaquin River

The San Joaquin River, from the confluence of the Stanislaus River downstream to and including the Sacramento–San Joaquin Delta



Figure 18. San Joaquin River (Photo credit: USFWS)

Conservation Measures

Reclamation included conservation measures in the Proposed Action to avoid and minimize or compensate for CVP and SWP project effects, including take, on listed species. These measures may also improve production, growth, and survival of listed species.

Lower San Joaquin River Rearing Habitat: Reclamation is implementing this effort as part of the conservation measure described in the NMFS 2019 Biological Opinion, consistent with the Collaborative Planning action. This would involve a large-scale floodplain habitat restoration effort in the Lower San Joaquin River. This effort did not occur during WY 2021.

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Additional Actions and RPMs

The Proposed Action and ITSs include programmatic CVP-wide measures that do not fall within the watersheds.

Collaborative Planning

The Proposed Action identified that Reclamation would pursue and implement certain actions through collaborative planning with the goal of continuing to identify and undertake actions that benefit listed species. Collaborative planning will make use of the CSAMP, CVPIA, Interagency Ecological Program, and Delta Plan Interagency Implementation Committee, successors to the forums, or complementary forums, e.g., Voluntary Agreement forums.

NMFS included as RPM 8.a.:

Reclamation and DWR shall convene an annual Director's meeting through CSAMP to review the past year's collaborative planning actions and coordinate on future year priorities.

A Directors' meeting is being coordinated through CSAMP. CSAMP, SRSP, and SIT are comparing science priorities between the organizations to avoid duplication of science-based monitoring and studies and focus resources on mutual science priorities. Habitat and facility improvements are summarized under the CVPIA.

Reporting on Incidental Take

NMFS required RPM 7:

Reclamation and DWR shall monitor and report the amount and extent of incidental take described in Section 2.1 as necessary to implement this Opinion.

a. Reclamation and DWR shall monitor the amount and extent of incidental take through the continued use of programs and processes described in [Appendix C]. Reclamation and DWR also shall annually maintain and update [Appendix C] as appropriate to describe the intended monitoring programs and how they will be used to monitor the amount and extent of take, how they will be applied to CVP and SWP water operation decision making and how they will be used for validation and effectiveness monitoring of Collaborative Planning actions.

USFWS required RPM 1.8.:

Reclamation and DWR will comply with all monitoring and reporting requirements as identified in the Reporting Requirements section.

Through the development of Seasonal Reports, and this Annual Report for WY 2021, Reclamation and DWR have satisfied reporting requirements in WY 2021.

Accommodation of Research

NMFS required RPM 7:

Reclamation and DWR shall monitor and report the amount and extent of incidental take described in Section 2.1 as necessary to implement this Opinion.

b. Reclamation and DWR shall coordinate with the Interagency Ecological Program Biotelemetry Project Work Team to accommodate research that requires special handling of salvaged fish, release of adipose fin-clipped sutured fish; checking for acoustic tags which furthers minimizes take of listed fish, unless not practicable.

Reclamation and DWR coordinated with the Interagency Ecological Program's Biotelemetry Project Work Team by providing information on ITAG [Interagency Telemetry Advisory Group] annual work plan for tagging, array, and reporting), and accommodated research, as necessary, for WY 2021. Reclamation provided support for training for acoustic telemetry tagging, handling, and release at Coleman National Fish Hatchery. The annual ITAG report describing activities will be posted to CalFish Track: Central Valley Enhanced Acoustic Telemetry Project CalFishTrack (noaa.gov).

Western Yellow-billed Cuckoo

Reclamation and USFWS have been coordinating to improve baseline survey data of Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) (YBCU) in the project area to further the understanding of potential areas of impact to YBCU. This effort may also provide baseline survey data to other related projects. Ultimately this information may be useful in the conservation of the species, including a potential ecological surrogate model. Reclamation and USFWS have developed a YBCU Surveys LTO Implementation Charter.

Efforts to date include developing protocols, estimating costs, and creating options for implementation. In WY 2021, Reclamation was in compliance.

Southern Resident Killer Whale

NMFS anticipated the proposed action would result in incidental take in the form of harm to Southern Resident Killer Whale (SRKW) individuals in the K and L pods by reducing prey availability and impairing feeding behavior when SRKWs forage for longer periods without success, migrate to alternate locations to seek prey, and experience nutritional stress and related health effects (NMFS Biological Opinion, page 813).

The 2019 NMFS Biological Opinion relied on surrogates in the form of effects to Chinook salmon populations and the measures of surrogates used for the DCC Gates and for CVP and SWP Pumping Facilities. Therefore, actions that result in adverse effects or protections for winter-run Chinook salmon would result in adverse effects or protections for spring-run Chinook salmon and fall-run Chinook salmon. Exceedance of take related to these surrogates would be viewed as an exceedance of the anticipated take of SRKW as well.

Reclamation and DWR did not exceed take related to Chinook salmon populations related to the DCC Gates and for CVP and SWP Pumping Facilities. Therefore, actions did not result in the exceedance of the anticipated take of SRKW.

NMFS included RPM 6:

Reclamation shall minimize the impact of the amount or extent of incidental take of Southern Resident killer whales during operations.

a. Reclamation shall continue to support the USFWS' study of alternative release sites for Coleman National Fish Hatchery produced fall-run Chinook salmon for the next two years to determine if trucking to an alternative release site can increase juvenile survival to the ocean and adult returns to the Sacramento River.

USFWS trucked fall-run Chinook salmon to the alternative release sites in 2021. This should result in more adult Chinook salmon available to SRKWs than would otherwise occur. Reclamation funded CDFW, USFWS, and Pacific States Marine Fisheries Commission to tag fish and compile data.