

DRAFT SACRAMENTO RIVER TEMPERATURE MANAGEMENT PLAN FOR WATER YEAR 2021

INTRODUCTION

Conditions in the Central Valley are critically dry, and consequently, Shasta temperature management is limited by these dry conditions. Water Year 2020 was also a dry year. Although temperature management in Water Year 2020 resulted in low temperature dependent mortality (3-7%) for brood year (BY) 2019 Sacramento River winter-run Chinook salmon, the overall survival of juvenile winter-run Chinook salmon through the Golden Gate was low. Although water year 2021 started with higher storage than previous critical years in recent history, hydrologic conditions supporting Shasta temperature management are critically low. The Northern Sierra Precipitation 8-Station Index indicates that this year's hydrologic conditions are the driest since 1977. Shasta Reservoir's cold water pool used to protect winter-run Chinook salmon is the smallest since 1977.

This Water Year 2021 Sacramento River Temperature Management Plan (Draft Plan) reflects coordination starting in January 2021 to manage operations of Shasta Reservoir for water temperatures on the Sacramento River using conservative assumptions in modeling, taking advantage of opportunities to increase the cold water pool, and managing to real-time conditions. The Draft Plan describes how the U.S. Bureau of Reclamation (Reclamation) plans to operate Shasta Reservoir and the Temperature Control Device (TCD) on Shasta Dam consistent with the 2020 Record of Decision on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project (LTO) in compliance with:

- RPM 1.a. of the 2019 National Marine Fisheries Service (NMFS) Biological Opinion to, in coordination with the Sacramento River Temperature Task Group (SRTTG), consider technical assistance from NMFS regarding the development of an annual temperature management plan and to submit a final temperature management plan to NMFS by May 20 of each year;
- Order 90-5 to consult with the California Department of Fish and Wildlife (CDFW), U.S. Fish and Wildlife Service (USFWS), NMFS, and Western Area Power Administration on the designation of a location upstream of the Red Bluff Diversion Dam where Reclamation will meet a daily average water temperature of 56°F; and
- Order 90-5 to provide an operation plan to the State Water Resources Control Board (SWRCB), Chief of the Division of Water Rights, on Reclamation's strategy to meet the temperature requirement at a location upstream of the Red Bluff Diversion Dam.

The Draft Plan was developed in coordination with and with input from the SRTTG. It includes temperature locations and targets through October 31, modeled winter-run Chinook salmon egg mortality, estimated dates for operation of the side gates on the TCD, and the estimated end of September cold water pool. Reclamation will monitor the cold water pool, compare measured conditions to actual performance during implementation, and provide regular updates through the SRTTG throughout Plan implementation. In the event measured cold water pool conditions vary from what is projected and temperature performance appears at risk, Reclamation will reconvene the SRTTG in preparation for an adjustment of this Plan. If the adjustment impacts the temperature tier and/or other indicators warrant as discussed by the SRTTG, then a modified summer temperature release strategy will be evaluated to remain within the Tier's anticipated performance level. Reclamation will work with NMFS and the other members of the SRTTG during fall operations to conserve storage and address the potential for redd dewatering.

Based on the February 90% forecast, Reclamation identified that Water Year 2021 was likely to be a Tier 4 year and initiated interagency coordination activities regarding Shasta reservoir seasonal management. In a Tier 4 year, there is less than 2.5 MAF of total storage in Shasta Reservoir at the beginning of May, and/or Reclamation cannot meet 56°F at CCR. Conditions continue to indicate a Tier 4 temperature management season with a final determination to be made after the May 1 forecast and with modeling based on measured reservoir profiles to confirm conditions (see Attachment 1 for the April forecast).

BACKGROUND

The 2020 Record of Decision requires use of conservative forecasts through the seasonal planning process for reservoir releases (including developing initial and updated allocations) and temperature management planning, such that monthly release forecasts and associated allocations are typically based on a 90 percent exceedance inflow forecast through September. The Draft Plan manages the cold water pool at Shasta Reservoir using a tiered strategy to better manage the limited cold water resource for winter-run Chinook salmon egg survival. The tiered approach recognizes the substantial influence of hydrology on available cold water and targets a temperature of 53.5°F in the upper Sacramento River above Clear Creek from May 15 to October 31. The ROD incorporates a number of measures to improve Shasta storage and the related cold water pool for the upcoming temperature management season. Reclamation will manage water temperatures based on the following tiers, depending on the actual size of the cold water pool in a given year:

- Tier 1 – Sufficient volume of cold water to target 53.5°F or lower starting May 15 through October 31
- Tier 2 – Sufficient volume of cold water to target 53.5°F during critical egg incubation period
- Tier 3 – A volume of cold water that can target 53.5-56°F during critical egg incubation period; and consideration of intervention measures in lower Tier 3 years
- Tier 4 – Insufficient cold water to maintain 56°F or lower; and consideration of intervention measures

Reclamation's Draft Plan uses modeling and professional expertise to identify the most protective tier that can be achieved given the available cold water. Before the reservoir stratifies and the volume of cold water is known, Reclamation estimates temperature capabilities based on projections of storage.

PRE-SEASON ACTIONS

Winter-run Chinook Salmon Conservation Hatchery Production: In February 2021, a multi-agency team discussed increasing Livingston Stone National Fish Hatchery (LSNFH) winter-run Chinook salmon production targets for Water Year 2021. Typically, the USFWS would collect 60 females and 100 males out of the Keswick fish trap; however, due to poor conditions and anticipated low survival of BY2021 natural winter-run Chinook salmon, they anticipate collecting 120 females and 180 males.

Reclamation is also preparing chillers for use later in the season in the event that deliveries to the hatchery become too warm.

Shasta Critical Year: In February, Reclamation notified senior water right holders on the Sacramento River of a Shasta Critical Year and a reduction to 75% of contract totals under the Sacramento River Settlement Contract.

Water Transfers and Reduced Diversions: On April 13, 2021, Reclamation sent a letter to the SWRCB seeking support for early temperatures management actions. To effectively manage temperature in the Sacramento River this year, final decision-making and implementation was needed prior to submission of the final temperature management plan. Two actions required implementation and/or decisions in mid-April, which included shifting a portion of transfer water to be delivered in the fall and a warm-water power bypass to preserve Shasta Reservoir's cold water pool. These actions were also expected to extend the window of acceptable temperatures by an additional 2-4 weeks and increase winter-run Chinook salmon survival by 5-10%.

Shasta Warm Water Power Bypass: On April 18, 2021 Reclamation adjusted operations to bypass Shasta Dam's powerplant and temperature control device (TCD) due to the low water elevation in Shasta Reservoir. Reclamation released water from the warmer, upper layers of Shasta Reservoir directly through the dam's river outlets into the Sacramento River. The purpose of this warm water release, averaging 55° Fahrenheit, is to maintain Sacramento River flows through the spring while preserving the limited supply of colder water for later in the summer when most critical for endangered winter-run Chinook salmon. As the bypass water temperature increases later in the spring, Reclamation will revert to use of the powerplant and TCD when winter-run Chinook salmon spawn and colder waters are needed to protect their redds. If fisheries conditions show adverse effects from a warmer spring, Reclamation will coordinate with partners to further adjust temperatures during the bypass. Fishery agencies provided preliminary guidance on the maximum temperatures and Reclamation will coordinate weekly on the need for potential revisions. Monitoring for unanticipated effects includes monitoring temperatures and their impacts to hatchery winter-run Chinook salmon at LSNFH and monitoring winter-run Chinook salmon in the Sacramento River (e.g., observations of pre-spawning mortality in adults).

MODELING LIMITATIONS

Reclamation's current version of the HEC-5Q model does not have the option to model an outlet other than the outlets within the TCD. This precludes the ability to model future conditions under a power bypass using the upper river outlet gates. As a result, the model runs described below do not include the anticipated effects of a power bypass beyond the date of the temperature profile used in the modeling. By mid-May, the temperature profiles are expected to capture the majority of the effects of the power bypass and, therefore, the results of this action will be largely incorporated into the final temperature management plan.

In order to determine the potential benefits of the power bypass for the purposes of decision making for the volume of bypass, Reclamation relied upon modeling through the Sacramento River Settlement Contractors (SRSC) using the CE-QUAL-W2 Shasta Lake Model (SLM) that was jointly developed with Reclamation, the SRSC and various stakeholders. This modeling can show the potential changes in available cold water pool with and without the bypass, but this model does not include projected downstream river temperatures. A summary of the expected benefits based on changes to available cold water pool is described below; however a complete model set for this benefit, including temperature dependent mortality is not available.

Water transfers between the SRSC and South of Delta contractors have been adjusting throughout the month of April as final agreements are being developed and targeted release schedules are being developed. As with the power bypass action, Reclamation relied on modeling using the SLM CE-QUAL-W2 to estimate the benefit of both making the water available and delivering the transfer water later in the year between August and October. Reclamation expects to have final values on both the estimated water made available as well as the estimated release schedule for delivery by the final temperature management plan (Final Plan) in May. Reclamation will work with the SRSC and South of Delta contractors to incorporate this action into the updated operational outlook that will be used for the Final Plan.

Reclamation has proposed the use of NOAA-NWS Local Three-Month Temperature Outlooks (L3MTO) and historical meteorology as a means of estimating air temperature expectations for modeling purposes. In coordination with SRTTG, Reclamation has the choice of five exceedence threshold options, varying from those that serve more conservative stream temperature planning (e.g., 10% exceedence) to those that serve more aggressive planning (e.g., 90% exceedence). In past years, SRTTG has recommended the use of a conservative approach that uses the 25% exceedence L3MTO forecast. However, when Reclamation approached this process similarly this year, the combination of historical data and the 25% exceedence L3MTO forecast created data quality issues and the data was not usable. The 50% exceedence L3MTO forecasted temperatures were used in the April temperature modeling and development of the draft temperature management plan. This is a less conservative approach than was historically used. Reclamation intends to work with SRTTG to determine if a more conservative approach for the Final Plan is preferred.

TEMPERATURE STRATEGY

Preliminary temperature analyses, presented to the SRTTG in February and March 2021, included model runs with CCR target temperature at 56°F. These preliminary simulation results showed that the temperature target of 56°F could not be maintained for the entire temperature management season. These runs are characterized by end of September cold water pool volumes less than 400 TAF, early side gate use, and rising temperatures above target thresholds at the end of the simulation.

In March 2021, Reclamation estimated stage-dependent and stage-independent temperature-dependent mortalities (TDMs), End of September Cold Water Pool (EOS CWP), and side gate operations for all 358 scenarios using the Temperature Tier Selection Protocol (TTSP). However, because the TTSP tool was developed for Tier 2 and Tier 3 Year types, it did not perform well for 2021 considering this year is a Tier 4 Water Year. This assessment of scenarios suggested no temperature management scenario could meet Tier 1-3 biological objectives and facility configuration criteria to avoid loss of temperature control (exceed 56°F) throughout the duration of the temperature control period. The 358 examined TTSP scenarios achieved temperature dependent mortality ranging from 90% to 99%.

Since the TTSP approach was unable to inform target temperature criteria or duration for a Tier 4 year, Reclamation gathered input from the State Board, NOAA Fisheries, the USFWS, CDFW, Tribes, and other stakeholders on these elements of the TMP. The agencies and stakeholders provided advice on temperature criteria for the protection of salmonids.

Reclamation crafted a Draft Plan to minimize modelled temperature dependent mortality with available cold water within the following criteria and approaches:

- **Fall Certainty:** Reclamation would seek to avoid use of the side gates until September or later, if possible. Reclamation was able to develop a draft plan with scenarios that would rely on the side gates (i.e., full side gate use) by August 25 or September 1, 2021 (Table 2).
- **Life History Timing Diversity:** Reclamation would develop a temperature window to target 2 standard deviations of historical spawning, starting May 15. Reclamation was able to develop a plan that starts June 15 and extends through August.
- **Critical Egg Incubation Timing and Shoulder Temperatures:** Reclamation was able to develop a plan that targets temperatures of 53.7°F during the critical egg incubation time period and shoulder temperatures near 57°F for holding adult winter-run Chinook salmon (Table 1).
- **Spatial Diversity:** Reclamation would seek to preserve redds down to the Highway 44 Bridge.
- **Cold water efficiency:** Reclamation would operate to temperatures at SAC (Highway 44 Bridge) and respond to actual meteorological conditions.

This draft plan approach, Scenario 11, includes an initial shaping of temperatures to best meet the above goals and that would be refined through further SRTTG input on tradeoffs. The TDM results for scenario 11 ranged from 62-73% (Table 2).

Reclamation has also included a separate reference alternative that starts June 1 and operates to 56°F at CCR, as Highway 44 Bridge is not explicitly modeled (Scenario 12; Table 1). The TDM results for scenario 12 ranged from 76-93% (Table 2).

The current Warm Water Power Bypass is expected to either extend the colder window or reduce end-of-season temperatures. Water transfers may further extend the cold water window or reduce end of season temperatures. Important performance metrics (TDM, side gate operations, end –of September cold water pool volume) for each scenario are described in Table 2. Assumptions and more information for these scenarios are described in Attachments 2-5.

Table 1. Water temperature target in degrees Fahrenheit at Keswick (KWK; RKM 483) and Clear Creek (CCR; RKM 470) for proposed scenarios. HEC-5Q does not perform well after September 14. Water temperatures may be warmer than these targets and HEC-5Q results.

Month/Scenario	KWK 11	CCR 11	KWK 12	CCR 12
April	54.1	53.7	54.1	53.7
May	56.7	56.7	56.7	56.7
June	58.8	58.9	55.6	55.9
July	53.7	54.3	55.0	55.5
August	54	54.5	55.1	55.6
September	55.6	56	55.6	56.0
October	57.6	57.3	57.7	57.4
November	55.3	54.6	55.4	54.7

Table 2. TDM, Storage, and first side gate usage for different scenarios.

Metric/Scenario	11	12
USBR TDM - Anderson (%)	62	93
USBR TDM - Martin (%)	73	85
NOAA Mean TDM – Martin (%)	70	76
End of Sept CWP Storage (TAF)	170	150
First Side Gate Use	7/29/21	7/29/21
Full Side Gate	8/25/21	9/1/2021

Two additional factors were considered to evaluate a feasible scenario that reduces the risk of losing control of temperature management in the fall period. The first factor is the end-of-September cold water pool estimate. Reclamation considers a minimum of 460 TAF as a conservative buffer to achieve a temperature performance of 56°F at CCR from September 15 through October 31. None of the scenarios reflect a range of end of September cold water volumes sufficient to manage unknown factors during September and October. As shown above, scenarios 11 and 12 only result in 150-170 TAF of cold water

pool at the end of September. Therefore, the two scenarios in the Draft Plan may not be able to provide temperature management in late-September and October. The other factor is the timing of opening of the first TCD side gate. Reclamation modeling found improving temperature conditions would result in the first TCD side gate being used on July 29. Based on Reclamation's experience, the later the first side gate is deployed, the greater the likelihood to maintain temperature management control into the fall.

To implement the Draft Plan, Reclamation will monitor the cold water pool projections and compare to actual performance during implementation to ensure sufficient cold water pool throughout the Draft Plan's duration. The primary risk management criterion is defined as a cold water pool less than 49°F which is more than 10 percent less than the projected volume. In addition, ongoing modeling results will be completed for each monthly SRTTG meeting and more often as necessary. These results will be considered should they indicate increased or decreased risk to fall temperature performance, which is a concern to Reclamation based on the uncertainty in meteorology, hydrology, and real-time operation conditions unknown to Reclamation at the time of TMP selection. In the event that actual cold water pool conditions vary from what is projected and the fall temperature performance appears at risk, Reclamation will reconvene the SRTTG in preparation for an adjustment of the TMP. As in past years, Reclamation will work with NMFS and the other members of the SRTTG during fall operations to both reduce releases to conserve storage and to address the potential for Chinook salmon redd dewatering.

TECHNICAL ASSISTANCE AND CONSULTATION

December to January – Conservation of Cold Water Pool and Inactive Temperature Management Period

Reclamation provided monthly updates via e-mail to the SRTTG, outlining current river and reservoir conditions, operations, hydrology, meteorology, and long-range precipitation forecast information. No significant issues concerning temperature management arose during this period and the SRTTG was not convened. Initial discussions between NMFS, Reclamation and the Sacramento River Settlement Contractors began in January to discuss potential options should the hydrology remain dry.

February through April – Temperature Management Preparation

Reclamation convened SRTTG meetings, starting in February 2021, on a monthly basis to ensure communication and coordination among the parties in preparation for the temperature management season.

In mid-February 2021, Reclamation prepared initial projections of anticipated temperature management capability and considerations based on the 90% February hydrologic and runoff forecasts from the Department of Water Resources (DWR) and National Weather Service River Forecast Center. Reclamation's February projections showed that a Tier 4 year was likely. Reclamation initiated interagency coordination through the Drought and Dry Year activities and stakeholder coordination through the Meet and Confer activities described in the 2020 Record of Decision (ROD).

In February 2021, a multi-agency team discussed increasing LSNFH winter-run Chinook salmon production targets for Water Year 2021. Typically, the USFWS would collect 60 females and 100 males out of the Keswick fish trap; however, due to poor conditions and anticipated low survival of BY2021 natural winter-run Chinook salmon, they anticipate collecting 120 females and 180 males.

In mid-March 2021, the Sacramento River Settlement contractors initiated the meet and confer commitments under the 2020 Record of Decision and began discussions on voluntary measures for Shasta Cold Water Pool Management Dry Years, Drought Years, and Successive Dry Years. Reclamation's Proposed Action

4.12.5 describes that in Tier 3 and 4 years, Reclamation shall meet and confer with USFWS, NMFS, DWR, CDFW, and Sacramento River Settlement Contractors on voluntary measures to be considered if drought conditions continue into the following year, including measures that may be beyond Reclamation and DWR's discretion. If dry conditions continue, Reclamation will regularly meet with this group (and potentially other agencies and organizations) to evaluate current hydrologic conditions and the potential for continued dry conditions that may necessitate the need for development of a drought contingency plan (that may include actions from the toolkit) for the water year.

In mid-March 2021, Reclamation prepared updated projections of anticipated temperature management capability based on 90% March hydrologic and runoff forecasts and historical performance. These projections were provided to the SRTTG in advance of the March SRTTG meeting. In March, the projected total Shasta storage on May 1 was less than 2.5 MAF, so Reclamation continued discussions regarding Tier 4 operations.

In mid-April, Reclamation prepared updated projections of anticipated temperature management capability including considerations from updated 90% hydrologic and runoff forecasts. These updated projections were also shared with the SRTTG in advance of scheduled SRTTG meetings and served as the first assessment of candidate scenarios for the WY2021 temperature management plan.

On April 13, 2021, Reclamation sent a letter to the SWRCB seeking support for early temperature management actions. On April 15, 2021, the State Board responded to Reclamation's letter that they were supportive of early actions that improve temperature management.

October to April – Spring Pulse Flow

On October 20, 2020, a multiagency team began meeting to plan for spring pulse flow actions. During WY 2021, the Spring Pulse Flow sub-team of the Upper Sacramento River Scheduling Team developed a Spring Pulse Flow Study Plan and a WY 2021 Spring Pulse Operations Plan. The Spring Pulse Operations Plan was shared with the Upper Sacramento Scheduling Team and the Sacramento Temperature Task Group in March and April. Projected Shasta Reservoir storage for May did not meet the initial criteria for implementation of a spring pulse flow action. Therefore, a spring pulse flow will not occur on the Upper Sacramento River during WY2021 and is not included in this plan.

MONITORING AND REPORTING

CDFW, PSMFC, and USFWS started weekly carcass and redd surveys for winter-run Chinook salmon in April. Monitoring efforts by these agencies increased to twice weekly surveys in spawning reaches on May 3. This monitoring allows for observations of pre-spawn mortality or potential effects associated with spring TMP operations. These data will be shared in real-time so Reclamation and others are notified regarding pre-spawn mortality and the initiation of spawning during May. From June through October, Reclamation plans to convene SRTTG meetings each month, or more often as warranted by any changing conditions, to ensure tracking and monitoring of the temperature strategy. Temporary exceedances of the daily average temperature criteria of more than 3 consecutive days will be reported to the SRTTG. Should changes to the strategy be necessary, those changes will be developed through communication and coordination with the SRTTG, and other interested parties as warranted.

In October 2021, data collection by CDFW and communication to CVO operations will be coordinated to determine the ending date of the temperature management period: October 31, or when the SRTTG determines, based on real-time monitoring that an estimated 95 percent of Winter-run Chinook Salmon eggs have hatched, and alevin have emerged, whichever is earlier.

In November 2021, Reclamation will operate the TCD to minimize in-river thermal impacts with remaining cold water pool resources after the end of the temperature management season, if available, until seasonal changes and ambient conditions dominate river cooling downstream.

For Water Year 2021, Reclamation will complete, in coordination with SRTTG as appropriate, the following monitoring and reporting practices:

- Monthly letters to the SWRCB containing relevant data and information as identified in Order 90-5.
- Near-real-time reporting through Reclamation’s web interface of relevant information, located at the following website: <https://www.usbr.gov/mp/cvo/vungvari/sactempcpt.pdf>.
- Transmittal of pertinent data and information to the SRTTG prior to meetings or more often as conditions warrant, including applicable modeling and tracking information during the course of the temperature management season. The modeling and tracking information that support the Draft Plan are attached (Attachments 2 and 3). Meeting information can be accessed at the following website: <https://www.usbr.gov/mp/bdo/sacramento-river-temperature-task-group.html> and <https://www.usbr.gov/mp/cvo/temperature.html>
- Monitoring and communication to determine on-set of winter-Run Chinook Salmon spawning.
- Monitoring and communication to determine when an estimated 95% of winter-Run Chinook Salmon eggs have hatched and alevin have emerged.

Reclamation intends to provide temperature profile measurements for Shasta, Whiskeytown, and Trinity Reservoirs in Water Year 2021 as shown in Table 3 below:

Table 3. Frequency and detail of Northern Central Valley Project temperature profile monitoring

Reservoir	Every Month	Every 2 Weeks	Every Week	Comment
Shasta	01/01–03/01 12/1–12/31	03/01–04/01 11/15–12/01	04/01–11/15	25 ft intervals for “Every Month,” otherwise 5 ft intervals
Whiskeytown	01/01–12/31			25 ft intervals
Trinity	01/01–12/31			25 ft intervals

The time and depth intervals identified above are linked to the historical stratification and de-stratification of the lakes. When the lake is de-stratified and temperature management is inactive, a finer resolution of the thermal profile at Shasta Reservoir is not needed.

The monthly temperature profiles for Whiskeytown and Trinity are sufficient to capture the thermal dynamics; both have limited abilities to actively manage selective withdrawal and the cold-water-pool volume does not rapidly change for most of the year. Reclamation will post the corresponding isothermobaths on its website identified above as soon as the information becomes available.

Reclamation has relied on CDFW’s carcass and redd surveys to determine onset of winter-run Chinook salmon spawning and will rely on CDFW to calculate when an estimated 95% of eggs and alevin have

hatched and emerged. As in past years, Reclamation intends to use the CDFW redd dewatering survey to provide information on potential redd dewatering and stranding for informing real-time operations of Shasta and Keswick Dams during the fall transition period.

Reclamation will continue to coordinate with CDFW on river operations and flood control releases to ensure this program can be safely and effectively implemented.

Reclamation's website (<https://www.usbr.gov/mp/cvo/vungvari/sactemprpt.pdf>) and letters provide the information to meet the needs of the SWRCB and fisheries agencies for the locations currently being monitored. Should the SWRCB or fisheries agencies require the data from any of the monitoring stations outlined above in other formats or need to obtain data from other monitoring sites that Reclamation maintains or has access to, Reclamation can work with the SWRCB or fisheries agencies to provide that data.

WATER RIGHTS ORDER 90-5

Order 90-5 identified a 56°F temperature objective as “the temperature that will protect the fishery from adverse thermal effects during salmonid spawning and egg incubation.” It further recognizes that Reclamation's ability to control temperatures is dependent on the amount of water in storage at Shasta Reservoir, ambient air temperatures, tributary inflow and other factors, and that the length of the reach to be protected must be flexible and requires careful planning. Order 90-5 provides that factors beyond Reclamation's reasonable control include conditions where protection of the fishery can best be achieved by allowing a higher temperature in order to conserve cool water for a later release, and conditions where allowing a higher temperature is necessary to implement measures to conserve winter run Chinook salmon.

For water year 2021, Reclamation has determined that it cannot reasonably maintain 56°F at Clear Creek and that:

- Protection of the fishery can best be achieved by allowing a higher temperature in order to conserve cool water for later release,
- A higher temperature is necessary to implement measures to conserve winter-run Chinook salmon.

Reclamation's Draft Plan to conserve cold water for the duration of the temperature management period and operate to a higher temperature at Red Bluff Diversion Dam will best protect the fishery from adverse thermal effects during salmonid spawning and egg incubation. More specifically, Reclamation will be operating to the temperatures and compliance locations included in the Draft Plan which are upstream of Red Bluff Diversion Dam.

CONSTRAINTS

Reclamation operates the CVP to deliver water under existing agreements and contracts, including the Sacramento River Settlement (SRS) contracts, water service contracts (for irrigation and municipal and industrial purposes), refuge water supply contracts, other agreements, and other requirements such as D-1641.

The SRS contracts are settlement contracts executed with senior water right holders along the Sacramento River below Shasta Dam to address senior water rights managed by the State of California. The SRS contracts provide for the delivery of approximately 2.1 (MAF) of water. Article 5(a) of the SRS contracts provides that the Contract Total will be reduced by 25% in a Shasta Critical Year. This remains a Critical

Year, so the SRS Contract Totals were reduced by 25% for water year 2021. There are no curtailments by the State Water Board on the Sacramento Basin.

Under the Coordinated Operation Agreement (COA) (as amended in 2018), the CVP is responsible for 60% of water released from storage to meet all in-basin uses in the Sacramento River watershed under balanced conditions in Critical years. In-basin uses include all accretions and depletions within the Sacramento River watershed, which include delivery of water to SWP settlement contractors along the Feather River, among other demands. These Feather River settlement agreements provide over 1 million acre-feet of water each year and Shasta Reservoir delivers 60% of that amount. DWR has reduced contract deliveries to the Feather River Contractors this water year, and Reclamation assumed a 50% allocation for them in the analysis. The State Water Board lifted Term 91 on December 24, 2020, and reestablished it with a curtailment notice on April 29, 2021. There are no other curtailments by the State Water Board that would otherwise meet Delta outflows.

CVP water service and repayment contracts are met after satisfying senior water rights and regulatory requirements. Water service contract allocations are a product of an integrated operation of the entire Central Valley Project in coordination with the State Water Project that considers available water supply, regulatory obligations including temperature management, conveyance ability and physical capacities. North of Delta contractors were initially allocated 5% for agricultural and 55% for municipal and industrial of their Contract Total; however, the 5% agricultural allocation is no longer available. Similarly, South of Delta water service contractors were also initially allocated 5% and 55%; however, the 5% agricultural allocation is also no longer available.