

FINAL State Water Project Incidental Take Permit Risk Assessment for Winter-run and Spring-run Chinook Salmon

Section 1: Overview

Date: 3/2/2021

Life Stages Present:

Winter-run Chinook Salmon (juvenile)

Winter-run Chinook Salmon (adult)

Spring-run Chinook Salmon (juvenile)

Spring-run Chinook Salmon (adult)

Advice to the Water Operations Management Team (WOMT):

No advice is warranted.

For the week beginning 3/2/2021, D-1641 Delta Outflow X2 (7,100 cfs) is controlling exports.

Although the Salmon Monitoring Team (SaMT) projects the potential for the natural origin winter-run Chinook salmon (WR) and hatchery WR salvage to occur this week, SaMT does not anticipate Condition of Approval (COA) 8.6.1 (WR Single-year Loss Threshold) to be triggered because no natural origin WR salvage has occurred to date during water year (WY) 2021. No length-at-date (LAD) size hatchery WR were salvaged the previous week (2/22/2021- 2/28/2021). Cumulatively for WY 2021, 8 LAD size hatchery WR have been salvaged, resulting in loss of 22 fish pending correction after completion of coded wire tag (CWT) reading. Although possible, SaMT does not anticipate COA 8.6.3 (Mid- and Late-season Natural WR Daily Loss Threshold) to be triggered this week primarily due to the lack of any natural origin WR salvage and because forecasted hydrologic and export operations do not differ significantly from previous weeks. COA 8.6.4 (Daily Spring-run Chinook Salmon [SR] Hatchery Surrogate Loss Threshold) began 2/1/2021. However, no SR hatchery surrogate releases have occurred, and none are scheduled for the upcoming week.

Exports are expected to decrease this week resulting in Old and Middle River Index (OMRI) of -1,000 cfs potentially decreasing to -500 cfs depending on river inflow conditions. These OMRI values are at or more positive than what would be required if an ITP COA trigger threshold were reached this week.

Risk Assessment:

Section 1-A: Sacramento River and Confluence

Assessment of risk of entrainment into the central Delta for WR and SR in the Sacramento River: (8.1.5.1 C ii, iii, iv and 8.1.5.1 B iii)

- Exposure Risk:
 - WR: High
 - SR: Medium
- Routing Risk:
 - WR: Medium
 - SR: Medium
- Overall Entrainment Risk:

- WR: Medium
- SR: Medium
- Change in risk of entrainment into the central Delta (increased/decreased risk compared to last week):
 - WR: Exposure risk into the central Delta remains high, consistent with the previous week, based on an estimated 5-15% of the natural origin WR population yet to enter the Delta and detection of WR moving through the system at upstream sampling stations. Additionally, 75-90% of hatchery origin WR release are estimated to be upstream of the Delta and based on acoustic tag detections. Movement from upstream locations towards the Delta is expected to continue or increase over the next week. The elevation of exposure risk for WR to high is based largely on the increased exposure risk for hatchery origin WR over the next week but also for those natural origin WR still migrating into the Delta, with 75-90% estimated to be in the Delta. Routing risk for WR is similar to last week based on modeled projections of interior Delta routing, forecasted Sacramento River flows at Freeport and export operations, resulting in a medium risk level. The overall risk of routing into the Delta remains at medium based on the combination of exposure and routing risk.
 - SR: Exposure risk into the central Delta remains medium, consistent with the previous week, based on the number of SR present with 40-45% of the juvenile population estimated yet to enter the Delta, annual migration timing, and detection of SR moving through the system at upstream sampling locations. The routing risk remains the same as last week at medium level for the same rationale as for WR based on the same conditions. The overall risk of SR entrainment into the interior Delta remains at medium based on the combination of exposure and a routing risk of medium.

Section 1-B: Facilities Risk

Central Valley Project/State Water Project (CVP/SWP) facilities entrainment risk for WR and SR in the central Delta over the next week (8.1.5.1 D iii, iv, v)

- Exposure Risk:
 - WR: High
 - SR: Medium
- Reporting OMR/Export Risk: (Bins based on DSM2 scenarios for the current week)
 - Baseline OMR (-1,100 cfs)
 - WR: Medium
 - SR: Medium
 - Scenario 1 OMR (-500 cfs)
 - WR: Low
 - SR: Low
 - Scenario 2 OMR (N/A)
 - WR: N/A
 - SR: N/A
- Overall Entrainment Risk:
 - WR: Medium
 - SR: Medium

- Change in risk of entrainment into the facilities (increased/decreased risk compared to last week):
 - WR: WR facilities exposure risk remains high level, consistent with the previous week, based on the SaMT recognition that WR are beginning to transition from in-Delta rearing to actively migrating out of the Delta towards the marine environment. SaMT estimated that 75-90% of WR population remains in the Delta, a decrease from the previous week's estimates. This decrease is balanced by the increase in WR leaving the Delta, as reflected by the Chipps Island trawl data. SaMT estimated that 5-10% of WR have exited the Delta past Chipps Island, an increase over the previous week. This is also evidenced by the increase in salvage of hatchery origin salmonids, which are released at or near the smolt stage and are more actively emigrating through and out of the Delta. Overall, SaMT projects the weekly salvage to increase for salmonids including natural origin and hatchery origin WR.
 - SR: Exposure risk remains medium, consistent with the previous week, based on the increase in the estimate of juvenile SR in the Delta at 55-60%. The range of exports and OMRI forecasted over the upcoming week are the same as those described for WR. Based on the estimated SR distribution throughout the central and south Delta, overall risk of entrainment at the facilities is in the medium category.

Section 1-C: Annual Loss Threshold Risk

- Annual loss threshold risk and Alternative Actions (8.1.5.1. E I, ii, iii and 8.1.5.1 F I, ii)
 - Loss at the SWP and CVP facilities compared to the estimated remaining population in Delta and upstream of the Delta: No salvage of California Endangered Species Act (CESA)-listed Chinook salmon has occurred over the past week.
 - Define risk of hitting a threshold, 50%, or 75%, or 100%, and likelihood of exceeding a threshold:
 - Natural origin WR: 3,863 [1.17% of the final natural origin WR Juvenile Production Estimate (JPE)]
 - Current Annual Loss: 0
 - 50% Threshold based on natural WR JPE: 1,931
 - Risk of exceeding threshold: Not likely.
 - 75% Threshold based on natural WR JPE: 2,897
 - Risk of exceeding threshold: Not likely.
 - 100% Threshold based on natural WR JPE: 3,862
 - Risk of exceeding threshold: Not likely.
 - Hatchery WR: 117 (0.12% of the Final Livingston Stone National Fish Hatchery (LSNFH) hatchery release JPE)
 - Current Annual Loss: 22 pending revision after CWT reading.
 - 50% Threshold based on hatchery WR JPE: 59
 - Risk of exceeding threshold: Low but possible.
 - 75% Threshold based on hatchery WR JPE: 88
 - Risk of exceeding threshold: Low but possible.
 - 100% Threshold based on hatchery WR JPE: 117

- Risk of exceeding threshold: Low but possible.

Section 1-D: Daily Loss Threshold Risk

- Daily loss threshold risk and Alternative Actions
 - Loss at the SWP and CVP facilities compared to estimated remaining population in Delta and upstream of the Delta:
 - Daily loss thresholds hit and subsequent loss and associated operations:
 - COA 8.6.3: Mid- and Late-season Natural WR Daily Loss Threshold (defined as natural origin juvenile Chinook salmon¹):
 - January: $0.0000635 * 330,130 = 20.96$
 - February: $0.0000991 * 330,130 = 32.72$
 - March: $0.000146 * 330,130 = 48.20$
 - April: $0.0000507 * 330,130 = 16.74$
 - May: $0.000077 * 330,130 = 25.42$
 - Natural Origin Older Juvenile Chinook Salmon- Highest daily loss: 0
 - Risk of exceeding threshold: Low but possible
 - COA 8.6.4 Daily SR Hatchery Surrogate Loss Threshold.
 - Hatchery Origin YOY SR Surrogates Highest Daily Loss: N/A
 - Risk of exceeding threshold: N/A
 - Hatchery Origin YOY FR Surrogates Highest Daily Loss: N/A
 - Risk of exceeding threshold: N/A

¹ Condition applies to all older juvenile Chinook salmon is defined as any Chinook salmon that is above the minimum length for WR, according to the Delta Model length-at-date criteria used to assign individuals to race.

Section 2: Basis for Advice:

The 2020 [Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta 2081-2019-066-00](#) (SWP ITP) states that advice to Water Operations Management Team (WOMT) shall be consistent with the Project Description, COA in the ITP, and the applicable ESA authorizations. This week's advice is based on the following COAs which are currently applicable:

List relevant COA number and title based on species/life stage, time of year, etc.

8.1.4 Collaborative Approach to Real-time Risk Assessment. Beginning no later than October 1 through the end of OMR Management (see Condition of Approval 8.8) the Smelt and Salmon Monitoring Teams shall meet weekly, or more often as required, to consider survey data, salvage data, and other pertinent biotic and abiotic factors and prepare risk assessments as described in Conditions of Approval 8.1.1, 8.1.2, 8.1.5.1 and 8.1.5.2.

The Smelt and Salmon Monitoring Teams shall prepare operations advice for the WOMT as required by Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, 8.6.4, 8.7, and 8.8, including advice on operations. The Smelt and Salmon Monitoring Teams shall each prepare risk assessments and operations advice. Within each team, staff jointly develop the risk assessment and supporting documentation to accompany operations advice (see Conditions of Approval 8.1.5.1 and 8.1.5.2). DWR and CDFW Smelt and Salmon Monitoring Team staff may conclude different operations advice is warranted, in which case the difference shall be noted and elevated as described in this Condition of Approval.

The Smelt and Salmon Monitoring Teams shall communicate their advice to WOMT. The WOMT shall then confer and attempt to reach a resolution and agreed-upon Project operations. If a resolution is reached, Permittee shall operate consistent with the decision regarding Project operations from WOMT. If the WOMT does not reach a resolution, the CDFW Director may require Permittee to implement an operational recommendation provided by CDFW. CDFW will provide its operational decision to Permittee in writing. Permittee shall implement the operational decision required by CDFW. Permittee shall ensure that its proportional share (see Condition of Approval 8.10) of the OMR flow requirement as a part of the operational decision is satisfied.

8.1.5 Real-time Risk Assessments. The Smelt and Salmon Monitoring Teams (Conditions of Approval 8.1.1 and 8.1.2) shall prepare weekly risk assessments, or more often as required, and operations advice (as required by Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, 8.6.4, and 8.7) during their discussions and analyses. The Smelt and Salmon Monitoring Teams shall provide the risk assessments and pertinent supporting information to the WOMT (Condition of Approval 8.1.3) within one business day of each meeting.

8.3.2 Salmonid Presence. After January 1 each year, if Conditions of Approval 8.3.1 or 8.3.3 have not already been triggered, the OMR Management season shall begin when the Salmon Monitoring Team first estimates that 5% of the WR or SR population is in the Delta whichever is sooner. Upon initiation of the OMR Management season, Permittee shall reduce exports to achieve, and shall maintain a 14-day average OMR index no more negative than -5,000 cfs, until the OMR Management season ends (see Condition of Approval 8.8). In the event that a salmon daily or single-year loss threshold is exceeded (Conditions of Approval 8.6.1, 8.6.2, 8.6.3, or 8.6.4) prior to the start of OMR Management season the requirements in those Conditions shall control operations.

8.6.1 Winter-run Single-year Loss Threshold. In each year, Permittee shall, in coordination with Reclamation, operate the Project to avoid exceeding the following single-year loss thresholds:

- Natural WR (loss = 1.17% of natural WR JPE)*
- Hatchery WR (loss = 0.12% of hatchery WR JPE)*

The loss threshold and loss tracking for hatchery WR does not include releases into Battle Creek.

Loss of WR at the CVP and SWP salvage facilities shall be calculated based on LAD criteria for run assignment.

Annual loss of natural and hatchery WR at the CVP and SWP salvage facilities shall be counted cumulatively beginning November 1 each calendar year through June 30 the following calendar year.

WR shall be identified based on the Delta Model LAD criteria. Loss shall be calculated for the South Delta Export Facilities using the 2018 CDFW loss equation (Attachment 6).

During the water year, if cumulative loss of natural or hatchery WR exceeds 50% of the annual loss threshold, Permittee shall restrict south Delta exports to maintain a 14-day average OMR index no more negative than -3,500 cfs through the end of OMR Management (see Condition of Approval 8.8). After 14 days of operations to maintain an OMR index no more negative than -3,500 cfs, Permittee may convene the Salmon Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.1) and determine whether the risk of entrainment and loss of natural and hatchery WR is no longer present. Risks shall be measured against the potential to exceed the next single-year loss threshold. The results of this risk assessment and associated OMR advice shall be provided to WOMT according to Condition of Approval 8.1.3 and the decision-making process shall follow the process described in Condition of Approval 8.1.4.

The -3,500 cfs OMR flow operational criteria, adjusted and informed by this risk assessment, shall remain in effect until the end of OMR Management (Condition of Approval 8.8).

During the water year, if cumulative loss of natural or hatchery WR at the CVP and SWP salvage facilities exceeds 75% of the single-year loss threshold, Permittee shall restrict OMR to a 14-day moving average OMR flow index that is no more negative than -2,500 cfs through the end of OMR Management (Condition of Approval 8.7). After 14 days Permittee may convene the Salmon Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.1) and determine whether the risk of entrainment and take of natural and hatchery WR is no longer present. The results of this risk assessment and associated OMR advice shall be provided to WOMT according to Condition of Approval 8.1.3 and the decision-making process shall follow the process described in Condition of Approval 8.1.4.

The -2,500 cfs OMR flow operational criteria adjusted and informed by this risk assessment shall remain in effect until the end of OMR Management (Condition of Approval 8.8).

During the water year, if natural or hatchery WR cumulative loss at the CVP and SWP salvage facilities exceeds the single-year loss threshold, Permittee shall immediately convene the Salmon Monitoring Team to review recent fish distribution information and operations and provide advice regarding future planned Project operations to minimize subsequent loss during that year. The Salmon Monitoring Team shall report the results of this review and advice to the WOMT (see Condition of Approval 8.1.3). Operational decisions shall be made following the process described in Condition of Approval 8.1.4 (Collaborative Real Time Risk Assessment).

If the single-year loss threshold is exceeded, Permittee and Reclamation shall also convene an independent panel to review Project operations and the single-year loss threshold prior to November 1, as described in Condition of Approval 8.2. The purpose of the independent panel is to review the actions and decisions contributing to the loss trajectory that lead to an exceedance of the single-year loss threshold, and make recommendations on modifications to Project implementation, or additional actions to be conducted to stay within the single-year loss threshold in subsequent years.

Permittee shall, in coordination with Reclamation, continue monitoring and reporting salvage at the CVP and SWP salvage facilities. Permittee and Reclamation shall continue the release and monitoring of yearling Coleman National Fish Hatchery (NFH) late fall-run and yearling SR surrogates. The Salmon Monitoring Team shall use reported real-time salvage counts along with qualitative and quantitative tools to inform risk assessments (see Condition of Approval 8.1.5.1).

8.6.3 Mid- and Late-season Natural Winter-run Chinook Salmon Daily Loss Threshold. To minimize entrainment, salvage, and take of natural WR during the peak and end of their migration through the Delta. Permittee shall restrict south Delta exports for five days to achieve a five-day average OMR index no more negative than - 3,500 cfs when daily loss of natural older juveniles at the SWP and CVP salvage facilities exceeds the following thresholds based on the JPE reported in January of the same calendar year:

- January 1 – January 31: 0.00635 % of the WR JPE*
- February 1 – February 28: 0.00991 % of the WR JPE*
- March 1 – March 31: 0.0146 % of the WR JPE*
- April 1 – April 30: 0.00507 % of the WR JPE*
- May 1 – May 31: 0.0077 % of the WR JPE*

All natural older juvenile Chinook salmon juveniles shall be identified based on the Delta Model length-at-date criteria. Loss shall be calculated for the South Delta Export Facilities using the equation provided in CDFW 2018 (Attachment 6). This Condition of Approval may be modified through the process described in Condition of Approval 8.6.6 and an amendment to this ITP.

8.6.4 Daily Spring-run Chinook Salmon Hatchery Surrogate Loss Threshold. To minimize entrainment of emigrating natural juvenile CHNSR from the Sacramento River and tributaries, including the Feather and Yuba rivers into the channels of the central Delta, south Delta, CCF, and the Banks Pumping Plant, Permittee shall restrict exports based on the presence of hatchery produced CHNSR surrogate groups at the CVP and SWP salvage facilities. CHNSR surrogate groups shall consist of all in-river fall- and spring-run surrogate release groups of Chinook salmon from the Coleman National Fish Hatchery, Feather River Hatchery, and the Nimbus Fish Hatchery. Each water year between February 1 and June 30 Permittee shall reduce south Delta exports for five consecutive days to achieve a five-day average OMR index no more negative than -3,500 cfs when:

- Feather River Hatchery coded wire tagged (CWT) CHNSR surrogates (includes both spring- and fall-run hatchery release groups) cumulative loss at the at the CVP and SWP salvage facilities is greater than 0.25% for each release group, OR*

- *Coleman National Fish Hatchery and Nimbus Fish Hatchery CWT fall-run release groups cumulative loss at the at the CVP and SWP salvage facilities is greater than 0.25% of the total in-river releases for each release group.*

This Condition of Approval may be modified through the process described in Condition of Approval 8.6.6 and an amendment to this ITP.

Discussion of Conditions of Approval

Provide sentence or two addressing criteria for each Condition of Approval listed in “Basis for Advice” section. Refer to data below where appropriate.

Per Conditions of Approval 8.1.4 and 8.1.5, SaMT has provided advice and accompanying risk assessment to WOMT.

Per Conditions of Approval 8.6.1 and 8.6.3, SaMT does not project yearly or daily threshold triggers to be reached this week. Per Condition of Approval, 8.6.4 YOY SR surrogate releases have not occurred this OMR management season.

Section 3: Hydrology and Operations

Assessment of hydrologic, operational, and meteorological information. 8.1.5.1 A

Section 3-A: Water Operations C 8.1.5.1 A. i, iii:

- Antecedent Actions: *(e.g., DCC gate closure and actions such as integrated early winter pulse protection, etc.)*

DCC gates were closed 12/1/2020 and will remain closed until mid-May 2021 per Reclamation's PA description of DCC operations.

- Current Controlling Factor(s):
 - SWP: D-1641 Delta Outflow X2
 - CVP: D-1641 Delta Outflow X2
- Water Temperature:
 - Mossdale (MSD): 54.6°F on 2/28/2021
 - Number of days threshold exceeded: Not applicable until June.
 - Prisoners Point (PPT): 53.5°F on 2/28/2021
 - Number of days threshold exceeded: Not applicable until June.
- Tidal Cycle: *(Spring/Neap. Note if tidal cycle has potential to affect south Delta hydrology or X2)*
 - Not discussed
- Turbidity: Not discussed
- Salinity (X2): 81km on 3/1/2021

Hydraulic Footprint *(Provide brief description of hydrologic footprint and summary of relevant DSM2 results)*: DWR conducted DSM2 modeling runs were conducted this week. Based on discussion of the modeling, SaMT concluded:

- North Delta into Interior and Central Delta
Channels: 49 and 434
No measurable differences to flow and velocity between the modeled OMR conditions are anticipated. It is unlikely that listed salmonids would experience behavioral changes related to differences in the modeled OMR conditions this week.
- San Joaquin River and Central Delta into South Delta
Channels: 6, 21, 107, 124, and 160
There may be measurable changes to flow and velocity related to modeled OMR conditions, but they are likely to be negligible (<500 cfs). Based on recent survey data, listed salmonids are present. Hydrological changes may be detectable by fish. Cumulative net flows within the channels of the South Delta are negative in magnitude. Fish moving from the San Joaquin River mainstem would have an increased transit time towards the western Delta.
- South Delta into Facilities
Channels: 81, 94, and 148
There may be measurable changes to flow and velocity related to modeled OMR conditions, but they are likely to be negligible (<500 cfs). Based on recent survey data, listed salmonids are present. Hydrological changes may be detectable by fish. Cumulative net flows within the channels of the South Delta are negative in magnitude. Fish moving from the San Joaquin mainstem into the head of Old River would have a decreased transit time towards the fish salvage facilities.

Section 3-B: Water Operations Outlook 8.1.5.1 A. ii:

- Outages:
 - SWP: None, no reported reductions in fish salvage counts
 - CVP: None, no reported reductions in fish salvage counts. However, on Thursday morning, February 25, 2021, Tracy Fish Collection Facility had a salvage outage between 0930-1030 to inspect and adjust the Hydrolox traveling screen. No salvage occurred at this time while exports continued.
- Exports : 3/1/2021
 - SWP: 900 cfs
 - CVP: 1,000 cfs
- Meteorological Forecast: *Precipitation, wind, air temperature. Are conditions (i.e. flow, turbidity, water temp) expected to change?* As per the National Weather Service Area Forecast Discussion on 3/1/2021: *“Dry and mild weather through Friday. Rain and mountain snow return over the weekend.”* These meteorology events later in the week are not expected to result in a significant response in Delta hydrology.
- Storm Event Projection: Although rain is expected later this week, hydrological conditions are unlikely to provide an opportunity for a storm flex change in exports that allows for an OMRI more negative than -5,000 cfs.

Section 3-C: Projected Conditions 8.1.5.1 A. iii:

- DCC Gates position: Closed 12/1/2020 until mid-May 2021 per Reclamation’s PA DCC gate operations.
- Sacramento River flow at Freeport: 7,000 to 9,500 cfs
- San Joaquin River flow at Vernalis: 700 to 1,200 cfs
- QWEST: Approximately 600 cfs on 3/2/2021 and potentially reaching 1,300 cfs this week
- Old River at Bacon Island (OBI) Turbidity: *Is turbidity at Bacon Island (OBI) expected to change due to precipitation, wind, operations, or other factors?* Not discussed.
- Freeport Turbidity: *Is turbidity at Freeport (FPT) expected to change due to precipitation, wind, operations, or other factors?* Not discussed.
- Expected changes in South Delta Exports:
 - CCF: 300 to 1,500 cfs
 - Tracy: 400 to 1,000 cfs

Table 1: Comparison of OMR gauge and OMR Index (OBI Gauge was down 2/23 to 2/26 thus 5 day and 14 day average USGS OMR gauge data are not available).

| Date | Averaging Period | USGS gauges (cfs) | Index (cfs) |
|-----------|------------------|-------------------|-------------|
| 2/27/2021 | Daily | -1,500 | -1,700 |
| 2/27/2021 | 5-day | Not Available | -2,500 |
| 2/27/2021 | 14-day | Not Available | -3,700 |
| 3/1/2021 | Daily | Not Applicable | -1,500 |
| 3/1/2021 | 5-day | Not Applicable | -1,900 |
| 3/1/2021 | 14-day | Not Applicable | -3,500 |

Section 4: Distribution and Biology

8.1.5.1.B Assessment of biological information for WR and SR.

Section 4-A: WR Population Status 8.1.5.1.B i

- Adult escapement estimate:
 - Estimate from carcass counts for adults contributing to brood year (BY) 2020 is 6,195 natural origin total adults and 4,093 female spawners.
 - Adults that will contribute to BY 2021 have entered the Delta system and are appearing in the Keswick area.
- Redd distribution and fry emergence timing:
 - WR fry emergence is complete for this season. BY 2020 total passage at Red Bluff Diversion Dam through 2/25/2021 is 2,093,940 fish.
- Juvenile production estimate:
 - A final JPE has been provided by NMFS and CDFW for BY 2020 which estimates 330,130 natural-origin juvenile WR will reach the Delta. The final JPE also estimates that 97,888 LSNFH WR and 37,232 Battle Creek Jumpstart WR will reach the Delta.
- Livingston Stone National Fish Hatchery release:
 - A production release of 302,166 WR 100% marked and coded wire tagged was released on 1/30/2021 at Caldwell Boat Ramp in Redding, CA. See Appendix 3 Hatchery Release Data WY 2021 for more information.
- Distribution of natural WR:
 - % of juveniles upstream of the Delta: 5-15%
 - % of juveniles in Delta: 75-90%
 - % of juveniles past Chipps Island: 5-10%
- Distribution of Livingston Stone National Fish Hatchery Sacramento River WR and Battle Creek WR:
 - % of juveniles upstream of the Delta: 75-85%
 - % of juveniles in Delta: 15-25%
 - % of juveniles past Chipps Island: 0%
- Change in risk of entrainment into the central Delta:
 - See Section 1-A: Sacramento River and Confluence

Section 4-B: SR Population Status 8.1.5.1.B ii

- Adult escapement estimate: Not available.
 - First early adults that will contribute to BY2021 have entered the Delta system and are moving upstream.
- Redd distribution and fry emergence timing:
 - Adult SR are likely to have completed their spawning by mid-November.
 - Egg incubation and fry emergence is complete for this season. Juveniles are rearing and migrating.
- Hatchery release (in-river and downstream):
 - No SR hatchery releases have occurred in the Sacramento River system at this time. SR egg collection at the Feather River Hatchery ended on 10/2/2020. Preliminary information from the Feather River Hatchery indicates issues potentially related to thiamine deficiency in returning adults which has impacted the final production goal. In addition, reduced numbers of tagged SR

adults returned to the hatchery this fall and remained in-river to spawn which may also contribute to the low hatchery production this year.

- Distribution of natural SR:
 - % of juveniles upstream of the Delta: 40-45%
 - % of juveniles in Delta: 55-60%
 - % of juveniles past Chipps Island: 0%
- Distribution of Feather River Fish Hatchery SR:
 - % of juveniles upstream of the Delta: Not applicable. Releases have not occurred.
 - % of juveniles in Delta: Not applicable. Releases have not occurred.
 - % of juveniles past Chipps Island: Not applicable. Releases have not occurred.
- Change in risk of entrainment into the central Delta:
 - See Section 1-A: Sacramento River and Confluence

Section 4-C: Additional Data Sources to Assess Sensitivity to Entrainment into the Central and South Delta 8.1.5.1.C & D

- In-Delta distribution of WR and SR: See Section 4-A: WR population status 8.1.5.1.B i and Section 4-B SR population status 8.1.5.1.B ii.
- Acoustic telemetry: *Summary of acoustic telemetry tracking*
 - Two groups of production LFR were released from Coleman National Fish Hatchery on 1/4/2021 and 1/5/2021. A subset of each group were acoustic tagged, 460 and 141 fish respectively. The first tag detected from the first release group at Tower Bridge occurred five days later (1/9/2021). As of 3/2/2021, 85 fish have been detected at the I-80/50 Bridge and 51 have been detected at the Benicia east and west sites. One fish was detected in Old River at Quimby Island on 1/20/2021.
 - Six groups of production WR were released from LSNFH on 1/30/2021. A subset of three groups were acoustic tagged; 134, 131, and 291 fish respectively. The first tag detection occurred at I-80/50 Bridge five days after release (on 2/5/2021). As of 3/2/2021 a total of 11 fish were detected at the I-80/50 Bridge. Three fish have been detected at Georgiana Slough as of 3/2/2021 on 2/9/2021.
- Trawls: *List all relevant trawl surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
 - See Appendix 1: SaMT Monitoring Program Data
- Rotary Screw Traps: *List all relevant rotary screw trap surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
 - See Appendix 1: SaMT Monitoring Program Data
- Seines: *List all relevant seine surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
 - See Appendix 1: SaMT Monitoring Program Data
- Additional hatchery release notifications: *List all relevant hatchery release notifications.*
 - See Appendix 3 Hatchery Release Data WY 2021

- New monitoring (as required by Condition of Approval 7.5.1, 7.5.2, and 7.5.3): *Upstream monitoring results during transfer window, additional rotary screw trap monitoring updates, additional acoustic tag study results, genetic identification results, trap capture efficiency trial results, and pathology results if available and relevant*
 - Not applicable at this time.
- Anticipated emigration to continue into the Delta:
 - See Table 3.
- Flows in the Sacramento River predicted with upcoming storm events:
 - See Section 3-A: Water operations conditions 8.1.5.1 A. i, iii and the routing analysis below.
- DCC gate position:
 - Closed 12/1/2020 until mid-May 2021 per Reclamation’s PA description for DCC gate operations.
- Prediction of tidal interaction at Georgiana Slough (*Inflow to Delta from Sacramento River and the interaction of the muting of tidal effects around Georgiana Slough*):
 - See Section 3-A: Water operations conditions 8.1.5.1 A. i, iii and the routing analysis below.
- Precipitation in the forecast for the week and river flows affecting routing into central Delta:
 - See Section 3-B: Water Operations Outlook 8.1.5.1 A. ii: Storm Event Projection.
- Routing analysis:
 - STARS analysis was conducted on 2/28/2021 with results presented in Table 2 below. These results reflect the DCC gate closure through mid-May.

Table 2: STARS Model output.

| Date: 2/28/2021 | DCC | Georgiana Slough | Sacramento River | Sutter and Steamboat Sloughs |
|---------------------------|----------------|------------------|------------------|------------------------------|
| Proportion of Entrainment | Not Applicable | 31% | 44% | 24% |
| Survival | Not Applicable | 16% | 47% | 35% |
| Travel Time | Not Applicable | 18.8 days | 11.5 days | 12.0 days |

- Trend analysis: *Provide brief description of historic trends if relevant (e.g. salvage patterns, onset of spawning, etc.). Refer to data or publications as needed:*

Table 3: Historic Migration and Salvage Patterns for unclipped WR and SR as reported on SacPAS (http://www.cbr.washington.edu/sacramento/data/query_hrt.html and http://www.cbr.washington.edu/sacramento/data/query_salvage_hrt.html) with associated 95% confidence interval. These values are provided for context only.

| Date: 2/28/2021 | RBDD RST | Tisdale RST | Knights Landing RST | Sac Trawl | Chipps Island Trawl | Salvage |
|--------------------|--|---|--|--|--|------------------------|
| WR | 98.8% (98.1%,99.5%) BY:2011-2019 | 89.2% (70.1%,108.3%) BY:2011-2019 | 95.2% (90.9%,99.5%) BY:2011-2019 | 55.7% (28.3%,83.2%) BY:2011-2019 | 12.4% (-1.5%,23.3%) BY:2011-2019 | 40.9% (17.0%,64.8%) |
| SR | 25.0% (8.3%,41.7%) BY:2011-2019 | 38.4% (4.3%,72.5%) BY:2011-2019 | 28.3% (-1.5%,58.1%) BY:2011-2019 | 9.9% (-1.7%,21.5%) BY: 2011 - 2019 | 0.0% (0.0%,0.1%) BY:2011-2019 | 1.1% (-1.3%,3.4%) |

- Survival analysis (*e.g. Zeug and Cavallo CWT model*): Not available
- Tillotson entrainment model or other entrainment models as they become available: The entrainment tool estimates a median loss of 0 fish and a maximum loss of 13 fish during this week (SacPAS last updated on 2/24/21)
- Salvage trends in relation to OMRI: *Provide overview of salvage data and insert salvage table as attachment at end of document*: Not applicable as there has been no salvage of CESA listed salmon for water year 2021.
- Future export modifications: *Describe anticipated or potential changes to exports*: Not applicable at this time.

Notes: None

Appendix 1: SaMT Monitoring Program Data

Table 4: Fish monitoring data for the 2/16/2021 SaMT meeting. The following table presents fish monitoring data summarized over the past week. Unless otherwise noted, reported sizes are fork length. FR = fall-run, WR = winter-run, SR = spring-run, LFR = late-fall-run

| Location | GCID RST ¹ | Tisdale RST | Knights Landing RST ² | Beach Seines | Sacramento Trawl ³ | Chippis Is. Midwater Trawl | Mossdale Kodiak Trawl |
|-----------------------|-----------------------|-------------|----------------------------------|-----------------|-------------------------------|----------------------------|-----------------------|
| Sample Date | 2/23-3/1 | 2/22-3/1 | 2/23-3/1 | 2/22, 2/24-2/25 | 2/21-2/23, 2/25-2/26 | 2/21,2/23-2/26 | 2/21-2/22, 2/24, 2/26 |
| Fall-run Chinook | 58 juveniles | 57 | 109 | 72 | 1 | | |
| Spring-run Chinook | 2 juveniles | 3 | 4 | 5 | 1 | | |
| Winter-run Chinook | | | 2 | 1 | 1 | 4 | |
| Late Fall-run Chinook | | | | | | | |
| Chinook (ad-clip) | | 2 WR | | | | 1 | |
| Steelhead (wild) | | | | | | 1 | |
| Steelhead (ad-clip) | | | 1 | 1 | 1 | 4 | 1 |
| Green Sturgeon | | | | | | | |
| Flows (avg. cfs) | 409 | 4,959 | 5,377 | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| W. Temp. (avg. °F) | 52.5 | 51.6 | 51.5 | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| Turbidity (avg. NTU) | 3.0 | 6.5 | 9.3 | Not Applicable | Not Applicable | Not Applicable | Not Applicable |

¹ GCID RST cone sampling at 50% effort through 2/25, 100% effort 2/26-3/1.

² Knights Landing RST cones sampling at 50% effort on 2/23 and 100% the rest of the week.

³ DatCall data reported in the 2/21/21-2/27/21 DJFMP sampling summary

Table 5: Delta sturgeon tagging and monitoring.

| Date | Comments |
|-----------|---|
| 2/17/2021 | <ul style="list-style-type: none"> No new tags applied this past week. 3 juvenile GS, 0 juvenile WS, and 2 adult WS detected in the Sacramento River north of Sherman Lake. |
| 3/1/2021 | <ul style="list-style-type: none"> Tagging efforts and real time monitoring were not conducted during week ending February 27 due to inclement weather conditions and other project priorities. Tagging and monitoring efforts will resume Wednesday, March 3. |

GS = green sturgeon, WS = white sturgeon

Table 6: CDFW adult monitoring surveys.

| Location | American River Carcass Survey | Stanislaus River Carcass Survey |
|--------------|-------------------------------|---------------------------------|
| Sample Dates | Concluded for the season | Not Sampled |

Appendix 2: Salvage Data

Table 7: SWP and CVP SaMT update (2/22-2/28/2021). Trend is the current value compared to the previous week. Reduced counts are the percentage of time that routine salvage sample times were less than 30 minutes per two hours of salvage and export operations. Prepared by Geir Aasen on 3/1/2021. These are preliminary results and are subject to revision.

| Criteria | 22-Feb | 23-Feb | 24-Feb | 25-Feb | 26-Feb | 27-Feb | 28-Feb | Trend | Weekly Summary |
|------------------------------|--------|--------|--------|--------------------------|--------|--------|--------|----------------|----------------|
| Wild older juvenile CHN Loss | 0 | 0 | 0 | 0 | 0 | 0 | 0 | → | 0.00 |
| Wild Steelhead Loss | 17.32 | 0 | 0 | 0 | 0 | 0 | 0 | ↗ | 17.32 |
| SWP daily export (acre-feet) | 4,618 | 2,541 | 1,875 | 3,393 | 3,837 | 2,784 | 1,477 | ↘ | 2,932 |
| CVP daily export (acre-feet) | 5,055 | 5,064 | 5,091 | 3,240 | 1,934 | 1,933 | 1,928 | ↘ | 3,464 |
| SWP reduced counts | None | None | None | None | None | None | None | Not Applicable | Not Applicable |
| CVP reduced counts | None | None | None | Outage between 0930-1030 | None | None | None | Not Applicable | Not Applicable |

Table 8: Chinook salmon weekly salvage and loss combined for both the SWP and the CVP fish collection facilities between 2/22-2/28/2021. Race is determined by LAD on the date of capture. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 3/1/2021. These are preliminary results and are subject to revision.

| Category | Salvage | Loss | Trend |
|------------------------|---------|------|----------------|
| Wild winter-run | 0 | 0 | → |
| Wild spring-run | 0 | 0 | → |
| Wild late Fall-run | 0 | 0 | → |
| Wild fall-run | 0 | 0 | → |
| Weekly Total | 0 | 0 | Not Applicable |
| Hatchery winter-run | 0 | 0 | → |
| Hatchery spring-run | 0 | 0 | ↘ |
| Hatchery late Fall-run | 0 | 0 | ↘ |
| Hatchery fall-run | 0 | 0 | → |
| Weekly Total | 0 | 0 | Not Applicable |

Table 9: Chinook salmon cumulative salvage and loss combined for both the SWP and the CVP fish collection facilities across WY 2021. Race is determined by LAD on the date of capture. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 3/1/2021. These are preliminary results and are subject to revision.

| Category | Cumulative Salvage | Cumulative Loss | Trend |
|------------------------|--------------------|-----------------|----------------|
| Wild winter-run | 0 | 0 | → |
| Wild spring-run | 0 | 0 | → |
| Wild late Fall-run | 0 | 0 | → |
| Wild fall-run | 4 | 3 | → |
| Season Total | 4 | 3 | Not Applicable |
| Hatchery winter-run | 8 | 22 | → |
| Hatchery spring-run | 12 | 9 | ↘ |
| Hatchery late Fall-run | 44 | 65 | ↘ |
| Hatchery fall-run | 0 | 0 | → |
| Season Total | 64 | 95 | Not Applicable |

Table 10: Steelhead weekly salvage and loss combined for both the SWP and the CVP fish collection facilities for 2/22-2/28/2021. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 3/1/2021. These are preliminary results and are subject to revision.

| Category | Salvage | Loss | Trend |
|--------------------|---------|------|----------------|
| Wild steelhead | 4 | 17 | ↗ |
| Hatchery steelhead | 28 | 37 | ↗ |
| Weekly Total | 32 | 55 | Not Applicable |

Table 11: Steelhead cumulative salvage and loss combined for both the SWP and the CVP fish collection facilities across WY 2021. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 3/1/2021. These are preliminary results and are subject to revision.

| Category | Cumulative Salvage | Cumulative Loss | Trend |
|--------------------|--------------------|-----------------|----------------|
| Wild steelhead | 12 | 23 | ↗ |
| Hatchery steelhead | 90 | 79 | ↗ |
| Season Total | 102 | 102 | Not Applicable |

Appendix 3: Hatchery Salmon Release Data WY 2021

Table 12. Hatchery salmon release data for Brood Year 2020 and Water Year 2021.

| Release Date | Hatchery | Race | CWT | Marked Release Number | Total Release | Percent Marked | Release Location | Mark | Agency | Release Type |
|--------------|----------|-----------|----------|-----------------------|---------------|----------------|--|-----------------------|--------|--------------|
| 12/3/2020 | SCARF | Spring | 06-05-22 | 4,593 | 4,593 | 100% | San Joaquin River at Highway 140 | CWT and Ad-clip | CDFW | SJRRP |
| 12/3/2020 | SCARF | Spring | 06-19-66 | 501 | 501 | 100% | San Joaquin River at Highway 140 | CWT, Ad-clip, and PIT | CDFW | SJRRP |
| 1/4/2021 | CNFH | Late Fall | 05-63-47 | 67,962 | 67,962 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-48 | 67,016 | 67,016 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-49 | 57,104 | 57,104 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-50 | 62,958 | 62,958 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-51 | 74,516 | 74,516 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-52 | 67,174 | 67,174 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-53 | 67,477 | 67,477 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-54 | 58,824 | 58,824 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-55 | 57,548 | 57,548 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-56 | 52,660 | 52,660 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/4/2021 | CNFH | Late Fall | 05-63-57 | 52,555 | 52,555 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Production |
| 1/8/2021 | CNFH | Late Fall | 05-63-59 | 66,912 | 66,912 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Experimental |
| 1/22/2021 | CNFH | Late Fall | 05-63-60 | 57,357 | 57,357 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Experimental |
| 1/26/2021 | SCARF | Spring | 06-22-05 | 53,690 | 53,690 | 100% | San Joaquin River at Highway 140 | CWT and Ad-clip | CDFW | SJRRP |
| 1/29/2021 | CNFH | Late Fall | 05-63-58 | 64,807 | 64,807 | 100% | Battle Creek at CNFH | CWT and Ad-clip | USFWS | Experimental |
| 1/30/2021 | LNFH | Winter | 05-65-32 | 43,567 | 43,567 | 100% | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip | USFWS | Production |
| 1/30/2021 | LNFH | Winter | 05-65-33 | 46,697 | 46,697 | 100% | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip | USFWS | Production |
| 1/30/2021 | LNFH | Winter | 05-65-34 | 46,955 | 46,955 | 100% | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip | USFWS | Production |

| Release Date | Hatchery | Race | CWT | Marked Release Number | Total Release | Percent Marked | Release Location | Mark | Agency | Release Type |
|--------------|----------|--------|----------|-----------------------|---------------|----------------|--|---------------------------|--------|--------------|
| 1/30/2021 | LNFH | Winter | 05-65-35 | 52,202 | 52,202 | 100% | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip | USFWS | Production |
| 1/30/2021 | LNFH | Winter | 05-65-36 | 53,478 | 53,478 | 100% | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip | USFWS | Production |
| 1/30/2021 | LNFH | Winter | 05-65-37 | 59,267 | 59,267 | 100% | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip | USFWS | Production |
| 2/1/2021 | CNFH | Winter | 05-58-90 | 53,620 | 53,620 | 100% | North Fork Battle Creek at Wildcat Road Bridge, Manton, CA | CWT, Ad-clip, left pelvic | USFWS | Jumpstart |
| 3/2/2021 | SCARF | Spring | 06-18-10 | 118,041 | 118,041 | 100% | San Joaquin River at Highway 140 | CWT and Ad-clip | CDFW | SJRRP |