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

Section 1: Overview

Date: 3/9/2021

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 3/9/2021, D-1641 Delta Outflow X2 (7,100 cfs) is controlling exports.

Combined exports are projected to range from 700 cfs to 4,000 cfs resulting in projected Old and Middle River Index (OMRI) of -500 cfs to -3,500 cfs. The projected ranges in OMRI are largely due to uncertainty in forecasting the potential rainfall this week.

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 only one natural origin WR by length-at-date (LAD) has been detected (3/8/2021) during water year (WY) 2021. This specimen is not included in the salvage report which covers 3/1-3/7/2021. Note that expansion of salvage and loss based on this specimen has not yet been tabulated, but it is mentioned here for informational purposes. Cumulatively, for WY 2021, 4 LAD size hatchery WR have been salvaged resulting in loss of 4 fish. No LAD-size hatchery WR were salvaged the previous week (3/1/2021- 3/7/2021). 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 low natural origin WR salvage to date. COA 8.6.4 (Daily Spring-run Chinook Salmon [SR] Hatchery Surrogate Loss Threshold) began 2/1/2021. The first surrogate release of fall-run Chinook salmon (FR) is scheduled for 3/10/2021. This release will total 1,290,150 FR of which 322,538 FR are marked with an adipose fin clip and CWT. These marked fish will be utilized as release group one for implementing COA 8.6.4.

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: High
- Routing Risk:
  - WR: Medium

    - SR: Medium
- Overall Entrainment Risk:
    - WR: High
    - SR: High
- 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's estimate, based on an estimated 5-10% of the natural origin WR population yet to enter the Delta and detection of WR moving through the system at upstream sampling stations. Additionally, 60-80% 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 75-85% estimated to be in the Delta. Routing risk for WR is difficult to evaluate based on variable 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 is high based on the combination of exposure and routing risks.

    - SR: Exposure risk into the central Delta is elevated to high this week from medium the previous week. This elevation in exposure risk is based on projections of increased flow and turbidity in the Sacramento River watershed, which may stimulate increased SR migration. SaMT estimated 35-40%of the juvenile population is yet to enter the Delta, due to increased flows and turbidity, annual migration timing, and the 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 is elevated to high this week from a medium level last week based on the combination of exposure and routing risks.

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 (-3,300 cfs)
        - WR: High
        - 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: High
    - SR: Medium
- Change in risk of entrainment into the facilities (increased/decreased risk compared to last week):
    - WR: WR facilities exposure risk remains at a high level, consistent with the previous week's estimate, 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 75-85% of WR population remains in the Delta, a decrease from the previous week's estimates. SaMT estimated that 10-15% of WR have exited the Delta past Chipps Island, an increase over the previous week. Overall, SaMT projects the weekly salvage to increase for salmonids, including natural origin and hatchery origin WR. Note that with salvage and loss expansion, particularly at the SWP, a relatively small number of WR detected could trigger the COA 8.6.1 (WR Single-year Loss Threshold) for hatchery WR which is 59 fish at the 50% threshold or the COA 8.6.3 (Mid- and Late-season Natural WR Daily Loss Threshold) for older juvenile Chinook salmon which is 48.2 fish. While SaMT does not expect these thresholds to be reached the possibility should not be discounted. The overall facilities entrainment risk has been elevated to high based on the SaMT evaluation that WR are present in the south Delta and vulnerable to entrainment, projections of increased flow are likely to stimulate migration, which increases vulnerability to entrainment. Furthermore, the large release of hatchery FR from the Coleman National Fish Hatchery is likely to stimulate migration via the 'pied piper' effect.

    - SR: Exposure risk remains medium, consistent with the previous week's estimate, which is based on the increase in the estimate of juvenile SR in the Delta at 60-65%. 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 and rearing life history life stage 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: 4
        - 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 salmon[1]):
                - 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 Young-of-Year (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: First release is scheduled to occur on 3/10/2021. Given travel time to the export facilities and potential salvage the likelihood of reaching an export trigger threshold is low.

[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 will provide advice and an 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 but does not discount the possibility. Per Condition of Approval 8.6.4, the first YOY SR hatchery surrogate release is scheduled for 3/10/2021, but the potential of reaching a threshold trigger is low.

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): 58.2°F on 3/9/2021
    - Number of days threshold exceeded: Not applicable until June.
  - Prisoners Point (PPT): 55.5°F on 3/9/2021
    - 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 3/9/2021
- 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
    Slight measurable changes to flow and velocity related to modeled OMR conditions are anticipated. It is unlikely that listed salmonids would experience behavioral changes related to modeled OMR conditions this week. Despite low exports the zone of influence has expanded further south due to the dry hydrologic conditions.

  - San Joaquin River and Central Delta into South Delta
    Channels: 6, 21, 107, 124, and 160
    There will be measurable changes to flow and velocity related to modeled OMR conditions. 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 would have an increased transit time towards the western Delta. Despite low exports the zone of influence has expanded further north due to the dry hydrologic conditions.

  - South Delta into Facilities
    Channels: 81, 94, and 148
    There will be measurable changes to flow and velocity related to modeled OMR conditions. 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: The CVP did not export or salvage during 3/4/2021 from 1200 to 2400, 3/5/2021 from 0100 to 1200, 3/6/2021 from 1200-2400, and 3/7/2021 from 0100-1200.
- Exports : 3/9/2021
  - SWP: 500 cfs
  - CVP: 800 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 3/9/2021: "*Winter storm to bring mountain and foothill snow, Valley rain, and thunderstorms through Wednesday. Dry and milder weather expected to return by the end of the week*." These meteorology events are expected to result in uncertain responses in Delta hydrology.
- Storm Event Projection: Although rain is expected 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: 6,500 to 9,500 cfs
- San Joaquin River flow at Vernalis: 800 to 1,200 cfs
- QWEST: Approximately 1,300 cfs on 3/9/2021 with an uncertain response depending on meteorology, hydrology, and water operations 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 3,500 cfs
  - Tracy: 400 to 1,800 cfs

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

Date	Averaging Period	USGS gauges (cfs)	Index (cfs)
3/6/2021	Daily	-100	-500
3/6/2021	5-day	-1,000	-600
3/6/2021	14-day	Not Available	-1,900
3/8/2021	Daily	Not Applicable	-1,100
3/8/2021	5-day	Not Applicable	-600
3/8/2021	14-day	Not Applicable	-1,400

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: 5-10%
    - % of juveniles in Delta: 75-85%
    - % of juveniles past Chipps Island: 10-15%
- Distribution of Livingston Stone National Fish Hatchery Sacramento River WR and Battle Creek WR:
    - % of juveniles upstream of the Delta: 60-80%
    - % of juveniles in Delta: 20-30%
    - % of juveniles past Chipps Island: 0-10%
- 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 completed 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: 35-40%
    - % of juveniles in Delta: 60-65%
    - % 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 3/10/2021, 85 fish have been detected at the I-80/50 Bridge with the last arrival detected on 2/3/2021 and 51 have been detected at the Benicia east and west sites with the last arrival detected on 2/7/2021. 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 (2/5/2021). As of 3/10/2021 a total of 30 fish were detected at the I-80/50 Bridge. Four fish have been detected at Georgiana Slough, and 2 fish at Benicia as of 3/10/2021
- 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 3/8/2021 with results presented in Table 2 below. These results reflect the DCC gate closure through mid-May.

Table 2: STARS Model output.

Date: 3/8/2021	DCC	Georgiana Slough	Sacramento River	Sutter and Steamboat Sloughs
Proportion of Entrainment	Not Applicable	31%	44%	24%
Survival	Not Applicable	16%	48%	35%
Travel Time	Not Applicable	18.25 days	11.57 days	12.02 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: 3/7/2021	RBDD RST	Tisdale RST	Knights Landing RST	Sac Trawl	Chipps Island Trawl	Salvage
WR	98.9% (98.2%,99.6%) BY: 2011 - 2019	95.9% (91.9%,99.9%) BY: 2011 - 2019	96.7% (93.8%,99.7%) BY: 2011 - 2019	58.6% (30.4%,86.8%) BY: 2011 - 2019	19.2% (5.6%,32.9%) BY: 2011 - 2019	48.2% (27.3%,69.0%)
SR	26.2% (9.0%,43.3%) BY: 2011 - 2019	42.6% (10.1%,75.2%) BY: 2011 - 2019	29.0% (-0.4%,58.4%) BY: 2011 - 2019	12.2% (0.0%,24.4%) BY: 2011 - 2019	0.1% (-0.0%,0.2%) 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 WR entrainment tool estimates a median loss of 0 fish and a maximum loss of 4 fish during this week (SacPAS last updated on 3/3/21).
- Salvage trends in relation to OMRI: *Provide overview of salvage data and insert salvage table as attachment at end of document*: See Appendix 2.
- Future export modifications: *Describe anticipated or potential changes to exports*: Export operations are uncertain at this time with the previously stated ranges dependent on meteorology and associated hydrology.

Notes: None

Appendix 1: SaMT Monitoring Program Data

Table 4: Fish monitoring data for the 3/9/2021 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]	Chipps Is. Midwater Trawl	Mossdale Kodiak Trawl
Sample Date	3/2-3/7	3/2-3/7	3/2-3/8	3/2, 3/4-3/5	2/28-3/1, 3/3-3/4	2/28-3/2, 3/4	3/1
Adult Chinook						1	
Fall-run Chinook	70 juveniles	10	5	193			
Spring-run Chinook				6			
Winter-run Chinook						2	
Late Fall-run Chinook							
Chinook (ad-clip)		2 WR				1	
Steelhead (wild)							
Steelhead (ad-clip)			1		1	9	
Green Sturgeon							
Flows (avg. cfs)	672	4,443	4,743	Not Applicable	Not Applicable	Not Applicable	Not Applicable
W. Temp. (avg. °F)	53.9	54.0	54.1	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Turbidity (avg. NTU)	3.3	5.4	6.9	Not Applicable	Not Applicable	Not Applicable	Not Applicable

[1] GCID RST cone sampling at 100% effort this week. *Flow was not recorded on 3/6-3/7.

[2] Knights Landing RST cones sampling at 100% this week.

[3] DatCall data reported in the 2/28/21-3/6/21 DJFMP sampling summary.

Table 5: Delta sturgeon tagging and monitoring.

Date	Comments
3/3-3/4/2021	• No new tags applied this past week. • 11 juvenile GS, 0 juvenile WS, and 2 adult WS detected in the Sacramento River north of Sherman Lake.

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 (3/1-3/7/2021). 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 3/8/2021. These are preliminary results and are subject to revision.

Criteria	1-Mar	2-Mar	3-Mar	4-Mar	5-Mar	6-Mar	7-Mar	Trend	Weekly Summary
Wild older juvenile CHN Loss	0	0	0	0	0	0	0	→	0.00
Wild Steelhead Loss	0	0	0	0	0	0	0	→	1.24
SWP daily export (acre-feet)	1,691	815	805	0	578	0	1,046	↘	705
CVP daily export (acre-feet)	1,926	1,617	1,623	817	794	851	804	↘	1,205
SWP reduced counts	None	None	None	Outage all day	None	Outage all day	None	NA	NA
CVP reduced counts	None	None	None	Outage between 1200-2400	Outage between 0100-1200	Outage 1200-2400	Outage between 0100-1200	NA	NA

Table 8: Chinook salmon weekly salvage and loss combined for both the SWP and the CVP fish collection facilities between 3/1-3/7/2021. 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 3/8/2021. 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	4	4	↗
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 3/8/2021. 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	4	4	→
Hatchery spring-run	16	27	→
Hatchery late Fall-run	48	69	↗
Hatchery fall-run	0	0	→
Season Total	68	99	Not Applicable

Table 10: Steelhead weekly salvage and loss combined for both the SWP and the CVP fish collection facilities for 3/1-3/7/2021. 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 3/8/2021. These are preliminary results and are subject to revision.

Category	Salvage	Loss	Trend
Wild steelhead	0	0	↘
Hatchery steelhead	2	9	↘
Weekly Total	2	9	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 3/8/2021. These are preliminary results and are subject to revision.

Category	Cumulative Salvage	Cumulative Loss	Trend
Wild steelhead	12	23	↘
Hatchery steelhead	92	88	↘
Season Total	104	111	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
3/8/2021	CNFH	Winter	05-57-79	79,024	79,024	100%	North Fork Battle Creek at Wildcat Road Bridge, Manton, CA	CWT, Ad-clip, left pelvic	USFWS	Jumpstart
3/10/2021	CNFH	Winter	05-65-39	44,105	44,105	100%	North Fork Battle Creek at Wildcat Road Bridge, Manton, CA	CWT, Ad-clip, left pelvic	USFWS	Jumpstart
3/10/2021	CNFH	Fall	05-65-42	102,854	411,417	25%	Battle Creek at CNFH	CWT and Ad-clip	USFWS	Production
3/10/2021	CNFH	Fall	05-65-43	106,001	424,003	25%	Battle Creek at CNFH	CWT and Ad-clip	USFWS	Production
3/10/2021	CNFH	Fall	05-65-46	113,683	454,730	25%	Battle Creek at CNFH	CWT and Ad-clip	USFWS	Production