# Rationale for Five Agency Proposed Alternative BDCP Initial Project Operations Criteria

**May 18, 2011 Working Draft**

The following is a summary Rationale for Five Agency Alternative BDCP Initial Project Operations Criteria developed by the California Department of Water Resources (DWR); the California Department of Fish and Game (DFG); the U.S. Bureau of Reclamation (Reclamation); the U.S. Fish and Wildlife Service (FWS); and the National Marine Fisheries Service (NMFS; collectively the Five Agencies). The purpose of this document is to briefly summarize the collaborative work completed by the Five Agencies focused on identifying alternative operating criteria that could address concerns raised by State and federal regulatory agencies following their review of the August 2010 preliminary draft Effects Analysis. The alternative operating criteria are based on the BDCP Steering Committee 2010 Project Operations with modifications as described below. The Five Agencies intend to include these alternative operating criteria within a wide range of alternatives that will be evaluated through a detailed Effects Analysis for their biological effects on the covered species, natural communities, and the ecosystem.

The following list includes a brief technical background and recommendations for each of the 'Big 6 Issues' identified by SAIC during the review of the August 2010 draft Effects Analysis, plus a recommendation for an operable physical barrier at the head of Old River to improve survival of emigrating San Joaquin River juvenile salmon.

- **North Delta intake design and configuration**

  ***Concern***: Initial engineering and design efforts evaluating "in-river" intake facilities indicated there were concerns with the engineering feasibility, river channel scour, and amount of predator holding habitat with original in-river configuration

  ***Recommendation***: The Fish Facilities Technical Team (FFTT) has reconvened to review a recommendation to change to "on-bank" facilities. Revisions to the January 2010 Project Operations are pending FFTT recommendations on revised design, location and performance criteria.

- **Reduced flows in the Sacramento River downstream of the proposed North Delta intakes**

  ***Concern***: Sacramento River inflows are the largest contributor to Delta outflow and have been linked to juvenile salmon survival, habitat suitability for estuarine resident fishes and possibly as a cue for adult sturgeon spawning migrations. New North Delta diversions will reduce net Sacramento River flows near Rio Vista.

  ***Recommendation***: Although the CALSIM II modeling showed the agreed upon North Delta Diversion bypass criteria had generally been met, identified reductions in flow remain a concern and will be addressed through development of adaptive ranges. Biologists from the Five Agencies continued to provide technical input into the development of the Delta Passage Model, which will be a key tool used to evaluate effects of reduced Sacramento River flows on juvenile salmon. Results of the Effects Analysis will inform the development of an adaptive range for the bypass flow criteria and may result in changes to initial operations.



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- **San Joaquin River migratory fish survival - New operable barrier at head of Old River (HORB)**

  ***Concern***: The January 2010 Project Operations proposed a 'non-physical barrier' and habitat restoration in the south Delta. The latter was not scheduled to come online until the late long-term time frame. This was not considered adequately protective of San Joaquin River basin salmonid fishes. There was also concern over OMR flow levels during certain months.

  ***Recommendation***: Based on current best available science, the Five Agencies recommend an operable physical barrier (e.g., gate) with adult fish passage facilities. The agencies recommend that this barrier be operated in conjunction with OMR flow criteria enabled by dual conveyance to benefit San Joaquin River salmonids and their habitat. The OMR criteria also protect other covered fish species.

  The Five Agencies will continue to evaluate whether the experimental non-physical barrier can be effective. The Agencies have also committed to developing operating criteria and triggers for physical and non-physical barriers that will meet fish passage, water quality, south Delta water levels, and OMR flow objectives and standards.

  The following draft criteria have already been developed to align use of the proposed operable physical barrier with the D-1641 fall pulse flow intended to cue immigrating adult Chinook salmon into the San Joaquin River system. The proposal is to fully close the HORB and suspend south Delta diversion operations during the D-1641 flow pulse in October, and then operate it at 50 percent open for two weeks following the pulse flow. After that (sometime in November), the HORB would be fully open until at least January.

  Other supporting criteria agreed to include:
  - Agricultural barriers are assumed to be operated consistent with current practices.
  - The HORB would become operational during winter when San Joaquin River juvenile salmonids are moving out of the system (based on real time monitoring). This generally occurs when higher flow releases are being made on the San Joaquin River tributaries.
  - The HORB would be fully open whenever San Joaquin River flows are greater than 10,000 cfs at Vernalis.

- **April-May OMR Flows**

  ***Concern***: The original 'Big 6' version of this issue was that April-May OMR flows in the January 2010 Project Operations modeling were more negative than the flows modeled for the Existing Baseline Condition scenarios. The issue expanded to include OMR flow criteria during other months to take advantage of operational flexibility the CALSIM II modeling indicated would be afforded by dual conveyance. The goal was to increase San Joaquin River flow variability (improving OMR flows in the Delta and flows in the SJ River below HOR), and maximize improvements to south Delta hydrodynamics because doing so was a key piece of the conservation benefit dual conveyance was anticipated to provide. The expectation is that these revised criteria will help improve the survival of delta smelt, longfin smelt, juvenile salmonids, splittail, and sturgeon without significant water supply cost in comparison to Initial Project Operations.



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- **San Joaquin River migratory fish survival (April, May and June)**

  ***Recommendation:*** In concert with operation of an operable HORB, a set of new corresponding South Delta flow rules is recommended for the months of April, May and June. These proposed flow conditions link minimum OMR flow targets to San Joaquin River flows at Vernalis.

  These corresponding minimum OMR flow targets were focused on improving OMR flows in the Delta and flows in the SJ River below HOR to improve survival and homing of salmonids. The new proposed flows are intended to facilitate the out-migration of San Joaquin River salmonids once they pass the Old River junction. These flows would also protect out-migrating steelhead from the Calaveras and Mokelumne basins.

  For the months of April and May, when Vernalis flows are below 5,000 cfs, an average net OMR target of -2,000 cfs or the FWS RPA (whichever provides higher OMR flows) is proposed for evaluation. Based on a review of particle tracking modeling and coded-wire tag studies, operations consistent with a -2,000 cfs OMR target produce hydrodynamic conditions on the San Joaquin River that should benefit salmon and smelt compared to existing conditions.

  When Vernalis flows are above 6,000 cfs, positive average net OMR flows are proposed for evaluation. It is believed such flow conditions will further improve salmonid outmigration and reduce predation without significant water supply reductions. A review of various CALSIM II modeling output from the January 2010 Project Operations suggested that during wetter year types little or no south Delta pumping would occur.

- **Additional OMR criteria to protect all covered fish species**

  ***Recommendation***: The Five Agencies revised the December through June OMR criteria. Dual conveyance also provides some flexibility to reduce juvenile sturgeon entrainment in the summer months (**July through September**), though no changes to the Initial Project Operations have been proposed at this time to address sturgeon entrainment. The agencies will continue to consider the efficacy and possible development of sturgeon salvage-related triggers that might modify Delta flow conditions or south Delta pumping.

  Note the January 2010 Project Operations retains the FWS RPA Action 1 criteria established in the FWS Biological Opinion to protect delta smelt. In addition, to help reduce south Delta entrainment risk to winter-run Chinook salmon, it is proposed that an additional OMR criteria be set at -5,000 cfs in all year types to coincide with the north Delta "initial pulse flow" trigger. The result of these two actions would be an overall protection of out-migrating winter-run Chinook salmon during the season's initial pulse flow and protection for delta smelt.

- **Spring Delta outflow issues related to longfin smelt**

  ***Concern***: Changes in winter-spring Delta outflows correlate positively with changes in abundance of longfin smelt. A review of CALSIM II model output shows that the



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combination of new operating rules and increased conveyance capacity results in reduced net Delta outflows in the winter-spring period of wetter water years.

***Recommendation***: Although the CALSIM II modeling indicated that the D-1641 Delta outflow requirements were met, instances of reduced Spring flows, food web productivity, and other stressors remain a concern and will be addressed through development of adaptive ranges. No changes to the initial operations are proposed at this time pending the outcome of the effects analysis.

- **Fall X2**

***Concern***: The existing FWS Biological Opinion includes an RPA element that specifies X2 location in September-October of above-normal and wet water year types. The January 2010 Project Operations did not include any action to meet or mimic the fall X2 RPA component, raising concerns from FWS and others whether the project operations would meet permit issuance criteria.

***Recommendation***: While the Fall X2 action remains a subject of ongoing disagreement and litigation between DWR, FWS, and other parties, the Five Agencies agree that a range of project operations criteria, including operations that include the Fall X2 action, should be evaluated through a detailed Effects Analysis. For the purpose of evaluating alternative operations with the Fall X2 action, the Five Agencies recommend including operating criteria consistent with the Fall X2 action in the RPA in the 2008 BiOp. DWR also recommends that operations that do not include the Fall X2 action should be evaluated.



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# Summary of Proposed Alternative BDCP Initial Project Operations for Analysis
## 5-Agency Working Draft
## May18, 2011

The following is a summary of Five Agency Alternative BDCP Initial Project Operations Criteria developed by the California Department of Water Resources (DWR); the California Department of Fish and Game (DFG); the U.S. Bureau of Reclamation (Reclamation); the U.S. Fish and Wildlife Service (FWS); and the National Marine Fisheries Service (NMFS; collectively the Five Agencies). The purpose of this document is to briefly summarize the collaborative work completed by the Five Agencies focused on identifying alternative operating criteria that could address concerns raised by State and federal regulatory agencies following their review of the August 2010 preliminary draft Effects Analysis. The alternative operating criteria are based on the BDCP Steering Committee 2010 Project Operations with modifications as described below. The Five Agencies intend to include these alternative operating criteria within a wide range of alternatives that will be evaluated through a detailed Effects Analysis for their biological effects on the covered species, natural communities, and the ecosystem.

- **North Delta intake design and configuration**
  - Fish Facilities Technical Team (FFTT) is reviewing the recommendation to change to "on-bank" facilities in light of new information. In addition, revisions to the January 2010 Project Operations are pending FFTT recommendations on design, location and performance criteria.

- **Reduced flows in the Sacramento River downstream of the proposed North Delta intakes**
  - No changes to Initial Project Operations at this time
  - Results of Effects Analysis will help inform decisions and development of adaptive range and may result in changes to initial operations.

- **San Joaquin River migratory fish survival (April, May and June OMR)**
  - New South Delta flow conditions basing minimum OMR flows on Vernalis flows (see tables below)

**San Joaquin Inflow Relationship to OMR[a]**

| April and May | | June | |
|---|---|---|---|
| If San Joaquin flow at Vernalis is the following | Average OMR flows would be at least the following (interpolated linearly between values) | If San Joaquin flow at Vernalis is the following | Average OMR flows would be at least the following |
| ≤ 5,000 cfs | -2,000 cfs | ≤ 3,500 cfs | -3,500 cfs |
| 6,000 cfs | +1000 cfs | 3,501 to 10,000 cfs | 0 cfs |
| 10,000 cfs | +2000 cfs | | |
| 15,000 cfs | +3000 cfs | 10,001 to 15,000 cfs | +1000 cfs |
| >15,000 cfs | +6000 cfs | >15,000 cfs | +2000 cfs |

a. OMR values assume the proposed OMR or the RPA (as modeled in the No Action Alternative), whichever provides higher OMR. Resulting operations are expected to be more positive than depicted in this table.



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- **New operable barrier at head of Old River (HORB)**
  - A fully operable barrier with adult fish passage facilities will be constructed at the head of Old River and will be operated to benefit San Joaquin River salmonids and habitat, while not adversely affecting other covered species. The following table describes the initial operations of the barrier for the purposes of evaluating modifications to the Initial Project Operations. The 5-Agencies will continue to evaluate the effectiveness of the experimental non-physical barrier, and will continue to refine the "open/closed" operations by month.

**Head of Old River Barrier (HORB) Operations**

| MONTH | HORB[a] |
|---|---|
| Oct | 50% |
| Nov | In/Out[b] |
| Dec | Out |
| Jan | 50%[c] |
| Feb | 50% |
| Mar | 50% |
| Apr | 50% |
| May | 50% |
| Jun 1-15 | 50% |
| Jun 16-30 | Out |
| Jul | Out |
| Aug | Out |
| Sep | Out |

a. Percent of time the HORB is open. Agricultural barriers are in and operated consistent with current practices.

b. HORB would be open 100% whenever flows are greater than 10,000 cfs at Vernalis. HORB is 100% closed during the D1641 SJR fall attraction pulse and open 50% for 2 weeks following D1641 SJR fall attraction pulse, and then the HORB would be open 100% through December.

c. The HORB becomes operational at 50% when salmon fry are in the system (based on real time monitoring). This generally occurs when flood flow releases are being made.

- **Other OMR[1] criteria during other months**
  - January-March (see tables below):
    - Intended to improve lower SJ River spawning and rearing conditions for smelts and migration and rearing for salmonids and maintain benefits of dual conveyance.
    - Water year type from prior year will be carried forward until a new water year type is identified.

[1] *OMR values assume the proposed OMR or the Reasonable and Prudent Alternative(RPA)(as modeled in the No Action Alternative), whichever provides higher OMR. These numbers represent the resulting average values based on the implementation of RPA-based triggers for the "most likely" scenario. Resulting operations are expected to be more positive than depicted in this table.*



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- Water year type was used for modeling purposes, but real-time operations will be based on actual South Delta conditions.

**Proposed Criteria for OMR Flow in January, February and March**

| JANUARY | | FEBRUARY | |
|---|---|---|---|
| Water Year Type | Average OMR flows would be at least the following | Water Year Type | Average OMR flows would be at least the following |
| Wet | 0 cfs | Wet | 0 cfs |
| Above normal | -3500 cfs | Above normal | -3500 cfs |
| Below normal | -4000 cfs | Below normal | -4000 cfs |
| Dry | -5000 cfs | Dry | -4000 cfs |
| Critical | -5000 cfs | Critical | -4000 cfs |

| MARCH | |
|---|---|
| Water Year Type | Average OMR flows would be at least the following: |
| Wet | 0 cfs |
| Above normal | 0 cfs |
| Below normal | -3500 cfs |
| Dry | -3500 cfs |
| Critical | -3000 cfs |

- <u>July-September</u>:
  - No proposed changes to Initial Project Operations
  - Sturgeon trigger to be developed which could include a restricted OMR target or pumping criteria. Near term science will be used to inform decision.
- <u>October-November</u>:
  - Before the D-1641 pulse = HORB open, no OMR restrictions
  - During the D-1641 pulse = no south Delta exports (two weeks); HORB closed
  - After the D-1641 pulse = -5,000 cfs OMR (through November); HORB open 50% for 2 weeks
- <u>December</u>:
  - Develop flow trigger for sturgeon in adaptive range. Near term science will be used to inform decision.
  - OMR restriction of -5,000 cfs for Sacramento River winter-run Chinook when North Delta initial pulse flows are triggered
  - OMR restriction of -2,000 cfs for Delta smelt per FWS BO RPA trigger.

- **Spring Delta outflow issues related to longfin smelt**
  - No changes to Initial Project Operations
  - Decisions will be informed by the Effects Analysis.
  - Will identify an adaptive range for operations



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- **Position of Fall X2**
  - Implement an experimental Fall outflow/X2 (active adaptive management approach)
  - Experiment to be designed collaboratively with outside experts and stakeholders under FWS oversight
  - Basic design (to be refined further):
    - High and low expected habitat value treatments in both Wet and Above Normal years (for example, initial estimates of X2 position for high habitat value could be at 74km in Wet and 81 in Above Normal years, X2 for low habitat value could be at 85km).
    - Carefully targeted monitoring to assess outcomes
    - Will explore opportunities to minimize water costs
  - Experimental design and results will be subject to independent science review

**See Proposed Operations for Effects Analysis (Scenario 6) March 25, 2011 Working Draft Summary Table for additional modeling details.**



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## PROPOSED OPERATIONS FOR EFFECTS ANALYSIS (SCENARIO 6)
## March 25, 2011 Working Draft

### North Delta Diversion Bypass Flows

**Constant Low-Level Pumping (Dec-Jun)**

Diversions up to 6% of river flow for flows greater than 5,000 cfs. No more than 300 cfs at any one intake.

**Initial Pulse Protection**

Low level pumping maintained through the initial pulse period. For the purpose of modeling, the initiation of the pulse is defined by the following criteria: (1) Wilkins Slough flow changing by more than 45% over a five day period and (2) flow greater than 12,000 cfs. Low-level pumping continues until (1) Wilkins Slough returns to pre-pulse flows (flow on first day of 5-day increase), (2) flows decrease for 5 consecutive days, or (3) flows are greater than 20,000 cfs for 10 consecutive days. After pulse period has ended, operations will return to the bypass flow table (Sub-Table A). These parameters are for modeling purposes. Actual operations will be based on real-time monitoring of fish movement.

If the first flush begins before Dec 1, May bypass criteria must be initiated following first flush and the second pulse period will have the same protective operation.

**Post-Pulse Operations**

After initial flush(es), go to Level I post-pulse bypass rule (see Sub-Table A) until 15 total days of bypass flows above 20,000 cfs. Then go to the Level II post-pulse bypass rule until 30 total days of bypass flows above 20,000 cfs. Then go to the Level III post-pulse bypass rule.

### South Delta Channel Flows

**OMR Flows**

All OMR criteria required by the various fish protection triggers (density, calendar, and flow based triggers) described in FWS and NMFS OCAP BOs were incorporated into the modeling of the baseline and the January, 2010 proposed project, as well as these newly proposed operational criteria. Whenever those triggers would result in OMRs higher than those shown below, the higher OMR requirements would be met.

Combined Old and Middle River flows no less than values below[1] (cfs)

| Month | W | AN | BN | D | C |
|---|---|---|---|---|---|
| Jan | 0 | -3500 | -4000 | -5000 | -5000 |
| Feb | 0 | -3500 | -4000 | -4000 | -4000 |
| Mar | 0 | 0 | -3500 | -3500 | -3000 |
| Apr | varies[2] | varies[2] | varies[2] | varies varies[2] | varies varies[2] |
| May | varies[2] | varies[2] | varies[2] | varies[2] | varies[2] |
| Jun | varies[2] | varies[2] | varies[2] | varies[2] | varies[2] |
| Jul | N/A | N/A | N/A | N/A | N/A |
| Aug | N/A | N/A | N/A | N/A | N/A |
| Sep | N/A | N/A | N/A | N/A | N/A |
| Oct | varies varies[3] | varies[3] | varies[3] | varies[3] | varies[3] |
| Nov | varies varies[3] | varies[3] | varies[3] | varies[3] | varies[3] |
| Dec | -5000[4] | -5000[4] | -5000[4] | -5000[4] | -5000[4] |



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1. These numbers represent the resulting average values based on the implementation of RPA-based triggers for the "most likely" scenario. OMR values assume the proposed OMR or the Reasonable and Prudent Alternative (RPA) (as modeled in the No Action Alternative), whichever provides higher OMR. Resulting operations are expected to be more positive than depicted in this table.

2. Based on San Joaquin inflow relationship to OMR provided below in Sub-Table B.

3. Before the D-1641pulse = HORB open, no OMR restrictions
During the D-1641pulse = no south Delta exports (two weeks); HORB closed
After the D-1641 pulse = -5,000 cfs OMR (through November); HORB open 50% for 2 weeks

4. OMR restriction of -5,000 cfs for Sacramento River winter-run Chinook salmon when North Delta initial pulse flows are triggered or OMR restriction of -2,000 cfs for delta smelt when triggered.

**Head of Old River Operable Barrier (HORB) Operations/Modeling assumptions (% OPEN)**

| MONTH | HORB[1] | MONTH | HORB[1] |
|---|---|---|---|
| Oct | 50% | May | 50% |
| Nov | 100%[2] | Jun 1-15 | 50% |
| Dec | 100% | Jun 16-30 | 100% |
| Jan | 50%[3] | Jul | 100% |
| Feb | 50% | Aug | 100% |
| Mar | 50% | Sep | 100% |
| April | 50% | | |

1. Percent of time the HORB is open. Agricultural barriers are in and operated consistent with current practices. HORB would be open 100% whenever flows are greater than 10,000 cfs at Vernalis.

2. For modeling assumption only. Action proposed:
Before the D-1641 pulse = no OMR restrictions (HORB open)
During the D-1641 pulse = no south Delta exports for two weeks (HORB closed)
After the D-1641 pulse = -5,000 cfs OMR through November (HORB open 50% for 2 weeks)
Exact timing of the action will be based on hydrologic conditions

3. The HORB becomes operational at 50% when salmon fry are immigrating (based on real time monitoring). This generally occurs when flood flow releases are being made.

**Fremont Weir/Yolo Bypass**

**Weir Improvements**

Sacramento Weir - No change in operations; improve upstream fish passage facilities

Lisbon Weir - No change in operations; improve upstream fish passage facilities

Fremont Weir – Improve fish passage at existing weir elevation; construct opening and operable gates at elevation 17.5 feet with fish passage facilities; construct opening and operable gates at a smaller opening with fish passage enhancement at elevation 11.5 feet



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**Fremont Weir Gate Operations**

To provide seasonal floodplain inundation in the Yolo Bypass, the 17.5 foot and the 11.5 foot elevation gates are assumed to be opened between December 1st and March 31st. This may extend to May 15th, depending on the hydrologic conditions and the measures to minimize land use and ecological conflicts in the bypass. As a simplification for modeling, the gates are assumed opened until April 30th in all years. The gates are operated to limit maximum spill to 6,000 cfs until the Sacramento River stage reaches the existing Fremont Weir elevation. While desired inundation period is on the order of 30 to 45 days, gates are not managed to limit to this range, instead the duration of the event is governed by the Sacramento River flow conditions. To provide greater opportunity for the fish in the bypass to migrate upstream into the Sacramento River, the 11.5 foot elevation gate is assumed to be open for an extended period between September 15th and June 30th. As a simplification for modeling, the period of operation for this gate is assumed to be September 1st to June 30th. The spills through the 11.5 ft elevation gate are limited to 100 cfs to support fish passage.

## Delta Cross Channel Gate Operations

**Assumptions**

Per SRWCB D-1641 with additional days closed from Oct 1 – Jan 31 based on NMFS BO (Jun 2009) Action IV.1.2v (closed during flushing flows from Oct 1 – Dec 14 unless adverse water quality conditions).

## Rio Vista Minimum Instream Flows

**Assumptions**

Sep-Dec: Per D-1641

Jan-Aug: Minimum of 3,000 cfs

## Delta Inflow & Outflow

**Delta Outflow**

Feb-Jun: Per D-1641

Sep-Nov: Implement Fall X2 experiment (not included in modeling for Scenario 6)[1]

## Operations for Delta Water Quality and Residence Time

**Assumptions**

Jul-Sep: Prefer south delta pumping up to 3,000 cfs before diverting from north

Oct-Jun: Prefer north delta pumping (real-time operational flexibility)

## In-Delta Agricultural and Municipal & Industrial Water Quality Requirements

**Assumptions**

Existing D-1641 North and Western Delta AG and MI standards

EXCEPT move compliance point from Emmaton to Three Mile Slough juncture.

Maintain all water quality requirements contained in the NDWA/ DWR Contract and other DWR contractual obligations.

[1] Scenario 6 modeling results do not include estimates of water supply impacts for the Fall X2 experiment because a revised experimental design is not yet available.



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## Sub-Table A. Post-Pulse Operations for North Delta Diversion Bypass Flows

| Level I Post-Pulse Operations | | | Level II Post-Pulse Operations | | | Level III Post Pulse Operations | | |
|---|---|---|---|---|---|---|---|---|
| Based on the objectives stated above, it is recommended to implement the following operating criteria:<br>• Bypass flows sufficient to prevent upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to prevent upstream transport toward the proposed intakes and to prevent upstream transport into Georgiana Slough. | | | Based on the objectives stated above, it is recommended to implement the following operating criteria:<br>• Bypass flows sufficient to prevent upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to prevent upstream transport toward the proposed intakes and to prevent upstream transport into Georgiana Slough. | | | Based on the objectives stated above, it is recommended to implement the following operating criteria:<br>• Bypass flows sufficient to prevent upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to prevent upstream transport toward the proposed intakes and to prevent upstream transport into Georgiana Slough. | | |
| **Dec – Apr** | | | **Dec - Apr** | | | **Dec - Apr** | | |
| **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** | **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** | **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** |
| 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs | 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs | 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs |
| 5,000 cfs | 15,000 cfs | Flows remaining after constant low level pumping (main table) | 5,000 cfs | 11,000 cfs | Flows remaining after constant low level pumping (main table) | 5,000 cfs | 9,000 cfs | Flows remaining after constant low level pumping (main table) |
| 15,000 cfs | 17,000 cfs | 15,000 cfs plus 80% of the amount over 15,000 cfs | 11,000 cfs | 15,000 cfs | 11,000 cfs plus 60% of the amount over 11,000 cfs | 9,000 cfs | 15,000 cfs | 9,000 cfs plus 50% of the amount over 9,000 cfs |
| 17,000 cfs | 20,000 cfs | 16,600 cfs plus 60% of the amount over 17,000 cfs | 15,000 cfs | 20,000 cfs | 13,400 cfs plus 50% of the amount over 15,000 cfs | 15,000 cfs | 20,000 cfs | 12,000 cfs plus 20% of the amount over 15,000 cfs |
| 20,000 cfs | no limit | 18,400 cfs plus 30% of the amount over 20,000 cfs | 20,000 cfs | no limit | 15,900 cfs plus 20% of the amount over 20,000 cfs | 20,000 cfs | no limit | 13,000 cfs plus 0% of the amount over 20,000 cfs |
| **May** | | | **May** | | | **May** | | |
| **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** | **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** | **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** |
| 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs | 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs | 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs |
| 5,000 cfs | 15,000 cfs | Flows remaining after constant low level pumping (main table) | 5,000 cfs | 11,000 cfs | Flows remaining after constant low level pumping (main table) | 5,000 cfs | 9,000 cfs | Flows remaining after constant low level pumping (main table) |



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 15,000 cfs | 17,000 cfs | 15,000 cfs plus 70% of the amount over 15,000 cfs | 11,000 cfs | 15,000 cfs | 11,000 cfs plus 50% of the amount over 11,000 cfs | 9,000 cfs | 15,000 cfs | 9,000 cfs plus 40% of the amount over 9,000 cfs |
| 17,000 cfs | 20,000 cfs | 16,400 cfs plus 50% of the amount over 17,000 cfs | 15,000 cfs | 20,000 cfs | 13,000 cfs plus 35% of the amount over 15,000 cfs | 15,000 cfs | 20,000 cfs | 11,400 cfs plus 20% of the amount over 15,000 cfs |
| 20,000 cfs | no limit | 17,900 cfs plus 20% of the amount over 20,000 cfs | 20,000 cfs | no limit | 14,750 cfs plus 20% of the amount over 20,000 cfs | 20,000 cfs | no limit | 12,400 cfs plus 0% of the amount over 20,000 cfs |
| **Jun** | | | **Jun** | | | **Jun** | | |
| **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** | **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** | **If Sacramento River flow is over...** | **But not over...** | **The bypass is...** |
| 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs | 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs | 0 cfs | 5,000 cfs | 100% of the amount over 0 cfs |
| 5,000 cfs | 15,000 cfs | Flows remaining after constant low level pumping (main table) | 5,000 cfs | 11,000 cfs | Flows remaining after constant low level pumping (main table) | 5,000 cfs | 9,000 cfs | Flows remaining after constant low level pumping (main table) |
| 15,000 cfs | 17,000 cfs | 15,000 cfs plus 60% of the amount over 15,000 cfs | 11,000 cfs | 15,000 cfs | 11,000 cfs plus 40% of the amount over 11,000 cfs | 9,000 cfs | 15,000 cfs | 9,000 cfs plus 30% of the amount over 9,000 cfs |
| 17,000 cfs | 20,000 cfs | 16,200 cfs plus 40% of the amount over 17,000 cfs | 15,000 cfs | 20,000 cfs | 12,600 cfs plus 20% of the amount over 15,000 cfs | 15,000 cfs | 20,000 cfs | 10,800 cfs plus 20% of the amount over 15,000 cfs |
| 20,000 cfs | no limit | 17,400 cfs plus 20% of the amount over 20,000 cfs | 20,000 cfs | no limit | 13,600 cfs plus 20% of the amount over 20,000 cfs | 20,000 cfs | no limit | 11,800 cfs plus 0% of the amount over 20,000 cfs |
| Jul-Sep: 5,000 cfs<br>Oct-Nov: 7,000 cfs | | | Jul-Sep: 5,000 cfs<br>Oct-Nov: 7,000 cfs | | | Jul-Sep: 5,000 cfs<br>Oct-Nov: 7,000 cfs | | |



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| Sub-Table B. San Joaquin Inflow Relationship to OMR | | | |
|---|---|---|---|
| **April and May** | | **June** | |
| If San Joaquin flow at Vernalis is the following | Average OMR flows would be at least the following (interpolated linearly between values) | If San Joaquin flow at Vernalis is the following | Average OMR flows would be at least the following |
| ≤ 5,000 cfs | -2,000 cfs | ≤ 3,500 cfs | -3,500 cfs |
| 6,000 cfs | +1000 cfs | 3,501 to 10,000 cfs | 0 cfs |
| 10,000 cfs | +2000 cfs | | |
| 15,000 cfs | +3000 cfs | 10,001 to 15,000 cfs | +1000 cfs |
| ≥30,000 cfs | +6000 cfs | >15,000 cfs | +2000 cfs |



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